

ARKANSAS RIVER CORRIDOR

Appendix I: Correspondence

ARKANSAS RIVER CORRIDOR, TULSA COUNTY, OKLAHOMA

Introduction

The Arkansas River is a water resource serving numerous nationally significant purposes. The river has historically served as a nationally significant resource for aquatic and terrestrial habitat of the nation's wildlife that live, breed, and migrate through the Arkansas River ecosystem. This includes federally endangered Interior Least Tern (Least Tern, *Sterna antillarum*), a nationally significant resource, and one federally threatened bird species, the Piping Plover (*Charadrius melodus*) as well as a plethora of native species and migratory waterfowl that support a healthy and functional riverine ecosystem. Keystone Lake and its dam located along the Arkansas River play vital roles in supporting the continued provision for these species, as well as many other purposes. In particular, the lake and dam provide flood risk management benefits, contribute to the eleven reservoir system operation of the McClellan-Kerr Arkansas River Navigation System, provide clean and efficient power through the associated hydropower plant, and provide a source of water for municipal and industrial uses. However, construction, operation, and maintenance of the Keystone Dam, lake, associated hydropower operations and other multi-purposes have significantly degraded the riverine ecosystem structure, function, and dynamic processes below Keystone Dam on the Arkansas River within Tulsa County, Oklahoma.

Purpose

This study is in response to the Section 3132 authorization of the 2007 WRDA. The purpose of this study is to evaluate the aquatic ecosystem restoration components of the October 2005 Arkansas River Corridor Master Plan (ARC Master Plan) and determine if there is a Federal Interest that aligns with the Corps of Engineers' ecosystem restoration mission.

Study Authority

The Arkansas River Corridor study is authorized in the Water Resources Development Act (WRDA) of 2007, Section 3132.

Section 3132. Arkansas River Corridor.

- (a) IN GENERAL. – The Secretary is authorized to participate in the ecosystem restoration, recreation, and flood damage reduction components of the Arkansas River Corridor Master Plan dated October 2005. The Secretary shall coordinate with appropriate representatives in the vicinity of Tulsa, Oklahoma, including representatives of Tulsa County and surrounding communities and the Indian Nations Council of Governments.
- (b) AUTHORIZATION OF APPROPRIATIONS. – There is authorized to be appropriated \$50,000,000 to carry out this section.

Non-Federal Sponsor

Tulsa County is the non-federal sponsor for the Arkansas River Corridor feasibility study. An amended feasibility cost-sharing agreement was executed in May 2015.

Recommended Plan

Alternative 5 is the National Ecosystem Restoration (NER) Plan and includes construction of a pool structure at River Mile 530 to regulate flow in the Arkansas River, a rock riffle feature associated wetland plantings at Prattville Creek, and construction of a sandbar island near Broken Arrow, OK. With the implementation of the NER plan, more natural river flow would return to 42 river miles of the Arkansas River within the study area. The NER plan would provide approximately 2,144 acres of additional riverine habitat, nearly doubling the amount of currently available habitat under low flow conditions. Also five acres of restored wetlands, and three acres of reliable sandbar island habitat where none currently succeed, would be restored as part of the NER plan. Shoreline, river, backwater, slackwater, wetland, and sandbar island habitat quality would all be improved generating an overall increase in the ecosystem quality and carrying capacity of the corridor. Current operation of Keystone Dam would not be changed. Additional water and flow would remain within the existing banks of the river and would not increase the flood elevation, nor downstream or backwater flooding.

ARKANSAS RIVER CORRIDOR, TULSA COUNTY, OKLAHOMA

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DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P. O. BOX 17300
FORT WORTH, TEXAS 76102-0300

August 26, 2016

Public Notice
Arkansas River Ecosystem Restoration Study, Tulsa County, Oklahoma

The U.S. Army Corps of Engineers, Tulsa District (Corps), in partnership with Tulsa County, is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the Arkansas River Ecosystem Restoration Study (Study) in Tulsa County, Oklahoma. Authorized by Congress in Section 3132 of the Water Resources Development Act of 2007, the study seeks to identify and evaluate measures to restore riverine and riparian ecological functions in the Arkansas River Corridor below Keystone Dam as identified in the 2005 Arkansas River Corridor Master Plan. Enclosed is a map of the study area.

Widely fluctuating flows associated with hydropower releases from Keystone dam have resulted in inadequate, inconsistent flows, scouring and lack of deposition contributing to the overall degradation of the Arkansas River below the dam. Several structural and non-structural ecosystem restoration measures are currently being considered as part of the on-going study. These measures include, but are not limited to, a low water dam / pooling structure, rock riffle structures, riparian plantings, and least tern islands. An EA, pursuant to Section 102 of the National Environmental Policy Act (NEPA) as implemented by the regulations promulgated by the Council on Environmental Quality (40 Code of Federal Regulations Parts 1500-1508 and USACE Engineering Regulation 200-2-2), will be prepared to describe the project alternatives and the affected environment, as well as analyze the potential direct, indirect, and cumulative environmental effects of the action alternatives.

Our office would like to solicit any input you may have within the proposed study area to assist us as we progress through the NEPA process. We look forward to receiving your comments as we move forward. Please address any comments to Mr. Charles McGregor, Jr., Chief, Inland & Reimbursable Section, Regional Planning and Environmental Center, P.O. Box 17300, Fort Worth, Texas 76102-0300 or Charles.McGregor@usace.army.mil. Thank you for your interest and cooperation.

Sincerely,

A handwritten signature in black ink, appearing to read "D. Sims".

Douglas Sims
Chief, Environmental Compliance Branch
Regional Planning and Environmental Center

Enclosure



U.S. Department
of Transportation
**Federal Aviation
Administration**

Southwest Region, Airports Division
Arkansas/Oklahoma Airports District Office

FAA-ASW-630E
10101 Hillwood Parkway
Fort Worth, TX 76177-4298

September 8, 2016

Mr. Charles McGregor, Jr.
Chief, Inland & Reimbursable Section
Regional Planning and Environmental Center
P.O. Box 17300
Fort Worth, TX 76102-0300

VIA EMAIL

Re: Arkansas River Ecosystem Restoration Study, Tulsa County, OK

Dear Mr. McGregor,

The Federal Aviation Administration (FAA) reviewed the public notice submitted by the United States Army Corps of Engineers (USACE) for the proposed Arkansas River Ecosystem Restoration Study in Tulsa County, OK. The stated purpose of the study is to identify and evaluate measures to restore riverine and riparian ecological functions in the Arkansas River Corridor below Keystone Dam.

Four sites being evaluated are stated in an email to me from David Gade, (David.Gade@usace.army.mil) dated August 25, 2016 including the following:

- 1) A pool structure in the Arkansas River channel at one of two locations, either just upstream of, or downstream of the Highway 97 Bridge over the Arkansas River near Sand Springs, OK
- 2) Wetland development at the Prattville Creek confluence with the Arkansas River
- 3) Wetland and slackwater development just upstream of the I-44 Bridge over the Arkansas River on the left bank of the river
- 4) A newly developed Least Tern island nesting habitat within the Arkansas River channel just south of the Indian Springs Sports Complex, Broken Arrow, OK.

Three airports within the National Plan of Integrated Airport Systems (NPIAS) are located in the Tulsa Metropolitan Area. They are William R. Pogue Municipal Airport (OWP) in Sand Springs, Tulsa International Airport (TUL) and Richard Lloyd Jones Jr. Airport (RVS) also known as Riverside Airport. FAA has reviewed each site listed above and their proximity to the three NPIAS airports in the Tulsa Metropolitan Area.

SITE 1: Vicinity of Highway 97 Bridge over the Arkansas River

The centerpoint of the Highway 97 bridge is approximately 4.0 miles from the centerpoint of Runway 17/35 at OWP. Either side of the bridge is located within Perimeter C, as defined in Advisory Circular (AC) 150/5200-33B, *Hazardous Wildlife Attractants On or Near Airports*. Perimeter C includes the air operations area (AOA) between 10,000 feet and 5 miles within which hazardous wildlife attractants should be avoided, eliminated or mitigated to protect approach, departure and circling airspace.

The centerpoint of the Highway 97 bridge is approximately 13.2 miles from the centerpoint of Runway 36L/18R at TUL. This is outside Perimeter C as defined in AC 150/5200-33B.

The centerpoint of the Highway 97 bridge is approximately 9.4 miles from the centerpoint of Runway 1L/19R at RVS. This is outside Perimeter C as defined in AC 150/5200-33B.

SITE 2: Confluence of Prattville Creek with the Arkansas River

The confluence of Prattville Creek and the Arkansas River is approximately 4.4 miles from the centerpoint of Runway 17/35 at OWP. This is located within Perimeter C, as defined in AC 150/5200-33B. Perimeter C includes the AOA between 10,000 feet and 5 miles within which hazardous wildlife attractants should be avoided, eliminated or mitigated to protect approach, departure and circling airspace.

The confluence of Prattville Creek and the Arkansas River is approximately 12.8 miles from the centerpoint of Runway 36L/18R at TUL. This is outside Perimeter C as defined in AC 150/5200-33B.

The confluence of Prattville Creek and the Arkansas River is approximately 8.9 miles from the centerpoint of Runway 1L/19R at RVS. This is outside Perimeter C as defined in AC 150/5200-33B.

SITE 3: Left bank of the Arkansas River upstream of the Interstate 44 Bridge

The left bank of the Arkansas River upstream of the Interstate 44 Bridge is approximately 10.6 miles from the centerpoint of Runway 17/35 at OWP. This is outside Perimeter C as defined in AC 150/5200-33B.

The left bank of the Arkansas River upstream of the Interstate 44 Bridge is approximately 8.9 miles from the centerpoint of Runway 36L/18R at TUL. This is outside Perimeter C as defined in AC 150/5200-33B.

The left bank of the Arkansas River upstream of the Interstate 44 Bridge is approximately 3.6 miles from the centerpoint of Runway 1L/19R at RVS. This is located within Perimeter C, as defined in AC 150/5200-33B. Perimeter C includes the AOA between 10,000 feet and 5 miles within which hazardous wildlife attractants should be avoided, eliminated or mitigated to protect approach, departure and circling airspace.

SITE 4: Arkansas River channel south of Indian Springs Sports Complex, Broken Arrow, OK

The Arkansas River channel south of Indian Springs Sports Complex is approximately 24.2 miles from the centerpoint of Runway 17/35 at OWP. This is outside Perimeter C as defined in AC 150/5200-33B.

The Arkansas River channel south of Indian Springs Sports Complex is approximately 16.9 miles from the centerpoint of Runway 36R/18L at TUL. This is outside Perimeter C as defined in AC 150/5200-33B.

The Arkansas River channel south of Indian Springs Sports Complex is approximately 11.2 miles from the centerpoint of Runway 1R/19L at RVS. This is outside Perimeter C as defined in AC 150/5200-33B.

After reviewing the notice and maps, FAA determines that the project as described should not increase aviation wildlife strikes at OWP, RVS or TUL. However, we ask that you contact the airports so as they can make a determination of effect. If you have any questions, concerns or need additional information on this determination, please contact me at (817) 222-5359 or by email at Roberto.Ramos@faa.gov.

Sincerely,



Robb Ramos
Environmental Protection Specialist
Arkansas/Oklahoma Airports District Office ASW-630E
FAA Southwest Region

From: [Stubbs, Kevin](#)
To: [Wadlington, Brandon SWF](#)
Cc: [Daniel Fenner](#); [David Martinez](#)
Subject: [EXTERNAL] Re: Arkansas River Corridor Project
Date: Thursday, August 18, 2016 4:09:24 PM

Brandon, Yes we would support designing a structure that provides releases to enhance downstream flows and minimize the hydropower fluctuations, while still allowing sediment transport, fish passage, and maintains riverine conditions upstream. We look forward to working with you on potential designs.

Kevin Stubbs
Fish and Wildlife Biologist
US Fish and Wildlife Service
Oklahoma Ecological Services Field Office
9014 East 21st Street
Tulsa, Oklahoma 74129-1428
918-382-4516

On Fri, Aug 12, 2016 at 3:29 PM, Wadlington, Brandon SWF <Brandon.Wadlington@usace.army.mil> <<mailto:Brandon.Wadlington@usace.army.mil>> > wrote:

Hi Kevin

Thanks again for taking the time to discuss our restoration efforts on the Arkansas River Corridor Project.

Our objective is to restore and enhance riverine, wetland, and riparian habitat while avoiding any adverse impacts. As we develop our restoration measures, part of our planning process entails identifying and quantifying restoration measure benefits.

An option being considered to improve river flow is the construction of a structure that pools releases from Keystone Dam and release that water at a lower flow rate to extend the period of flow in the river, minimizing the occurrence of low or no river flow conditions.

The challenge with this option is avoiding the creation of a disconnected lacustrine pool above the structure, which cannot be counted as a restoration benefit.

If the design of that structure allowed the upstream pool to function as a riverine pool through sediment transport, fish passage, and connected river flow through the upstream pool would you support USACE capturing the upstream pool area as beneficial riverine habitat?

As part of our ongoing coordination, we'll seek you're input regarding the structure design details to ensure restorative objectives are met.

Brandon Wadlington
Biologist
Coastal Section- Environmental Compliance Branch
Regional Planning and Environmental Center
US Army Corps of Engineers
Office: 817-886-1720
Brandon.Wadlington@usace.army.mil <<mailto:Brandon.Wadlington@usace.army.mil>>

From: [Josh Johnston](#)
To: [Wadlington, Brandon SWF](#)
Subject: Re: [EXTERNAL] Re: Arkansas River Corridor Project
Date: Tuesday, August 16, 2016 3:58:31 PM

Haha, yes, keystone. I guess I had Tenkiller on my mind.

Sent from my iPhone

> On Aug 16, 2016, at 1:55 PM, Wadlington, Brandon SWF <Brandon.Wadlington@usace.army.mil> wrote:

>

> Thanks for support Josh.

>

> To clarify, did you mean Keystone Dam instead of Tenkiller Dam?

>

> Brandon

>

>

> -----Original Message-----

> From: Josh Johnston [<mailto:josh.johnston@odwc.ok.gov>]

> Sent: Sunday, August 14, 2016 10:00 PM

> To: Wadlington, Brandon SWF <Brandon.Wadlington@usace.army.mil>

> Subject: [EXTERNAL] Re: Arkansas River Corridor Project

>

> Brandon,

>

> Thanks for calling on Friday to update me on progress, and explain the approach. We (Odwc) had hoped for a way of using Tenkiller dam to meet flow regime needs, but understand that the reality of that is not likely. That being said, we will fully support a structure that provides downstream flows closer to that of the natural flow regime, while maintaining a somewhat riverine habitat above it. I am always happy to help if needed, so call if you need anything.

>

> Thanks,

>

> Josh Johnston

>

> Sent from my iPhone

>

>> On Aug 12, 2016, at 3:57 PM, Wadlington, Brandon SWF <Brandon.Wadlington@usace.army.mil> wrote:

>>

>> Hi Josh

>>

>> Thanks again for taking the time to discuss our restoration efforts on the Arkansas River Corridor Project.

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>>

>> Brandon Wadlington

>> Biologist

>> Coastal Section- Environmental Compliance Branch

>> Regional Planning and Environmental Center

>> US Army Corps of Engineers

>> Office: 817-886-1720

>> Brandon.Wadlington@usace.army.mil

>

>

Arkansas River Corridor Feasibility Investigation: Coordination meeting between U.S. FWS (Kevin Stubbs USFWS-OK Ecological Services), **ODWC** (Josh Johnston), **and U.S. ACE** (Gene Lilly PEC-PF, Michael Ware SWT-RO, and David Gade PEC-TN).

July 21, 2015 10:00-12:00

Oklahoma Ecological Services Office
9014 E 21st Street, Tulsa

Lilly briefed the group over the status of the project including schedule, authority, 2013 Charette summary, and Future Without (Corps) Project Conditions, assuming locally constructed Low Water Dams (LWDs) at Sand Springs, Jenks/South Tulsa, Bixby, Zink Dam rehabilitation, development of the Gathering Place for Tulsa, and Creek Nation riverfront development.

Lilly indicated present USACE consideration of cooperation in Flood Risk Management (FRM) (Tulsa/West Tulsa levee rehabilitation/H&H Modeling/Evacuation Plan/Warning System/Buy-Out) for inclusion under the current funding authority, awaiting legal opinion and levee assessment conclusions, in addition to Ecosystem Restoration (ER) and Recreation (REC) opportunities.

Given probable future conditions including LWDs, USACE is assessing potential ER/REC measures associated with LWD sites including Interior Least Tern (ILT) islands/habitat, wetlands, stream bank restoration/stabilization, flood plain/riparian zone restoration, trails, and signage. These would be planned/designed to provide ER benefits beyond required mitigation associated with construction of LWDs.

Considering competition for funding of USACE ER efforts, demonstrating national significance is a priority. ILT habitat development/enhancement, as a federally listed endangered species, is envisioned to support national significance. Inclusion of FRM into study with 'high risk' levee status could enhance demonstration of significance.

Both ODWC and USFWS suggested ideal ER would address 'mitigation' of the short/long-term effects of the Keystone Dam operation/power generation on stream flow and sediment transport below the dam. From a native fisheries perspective, LWDs and river lakes "doom" native aquatic habitats. With consideration of LWD design including fish passage, while passage may support adult migration upstream, necessary flow-induced distribution of eggs and non-motile fry back downstream for viability would be inhibited by LWD pooling in multiple locations. If LWDs are operated for benefit of native aquatic species, pools may not be available for desired recreational uses during spawning periods (March – June). Logistics and planning for centralized and coordinated O&M of proposed LWDs was questioned. LWD induced pools would represent 'biological wastelands' relative to native fish species, and would not provide foraging habitat for ILT. Proposed ILT islands with potential to provide benefits likely restricted to upper (Sand Springs LWD - with potential forage upstream including Keystone Lake) and extreme lower (Bixby LWD - with forage zone including open river below the LWD) sites.

Riparian zone restoration is likely to be minimally effective due to sediment-starved flow (bank armoring required) and marginal existing habitat. 'Best Use' of riparian areas may be as flood zone 'park' land without extensive development. With respect to Bald Eagle nesting sites, riparian zone protection and enhancement could provide some benefit. Benefits of wetlands creation adjacent to river not likely to exceed losses incurred from LWD pool construction. Offsite wetlands creation may be necessary to adequately compensate losses.

From the resource agency perspective, the critical element providing ecosystem benefit, given proposed LWD development, would be minimum flow releases (> 100 cfs) from Keystone Dam obtained through allocation from unclaimed storage within the Keystone/Kaw Lake pool(s), alteration of current hydropower generation regime, or retrofitting Keystone Dam with 'miniature' power generation units (=< 1000 cfs). Absent consideration of altered flow release regime from Keystone Dam, critical components to enhance aquatic habitat include reregulation (flow smoothing) potential of a Sand Springs LWD, and refurbishment of Zink Dam for fish passage.

Arkansas River Corridor Feasibility Investigation: Coordination meeting between U.S. FWS (Kevin Stubbs USFWS-OK Ecological Services), **ODWC** (Josh Johnston), **and U.S. ACE** (Gene Lilly, David Gade, Kelly Burks-Copes, Brandon Wadlington, Danny Allen)

May 23, 2016 09:00 – 11:30

Tulsa District Office
1645 S. 101st East Ave.

Lilly reviewed information presented to USFWS and ODWC on Jan. 28, 2016 describing draft final array of alternatives, current project schedule, and a description of information requirements (including environmental benefits analysis) for CE/ICA analysis.

Burks-Copes presented a description and overview of HEP models and application, emphasizing selected HEP species models must match habitat created in the restoration effort.

Burks-Copes led a discussion identifying specific approved HEP species models for application to habitat types proposed to be restored in the Arkansas River Corridor study. Species models previously under consideration included Interior Least Tern, Common Shiner, Paddlefish, and Gizzard Shad. Discussions focused on tern island habitat within the river channel identified the Interior Least Tern (ILT) HEP model as appropriate for use (Stubbs, USFWS).

Discussions of models applicable to aquatic habitat restored through providing some level of minimum flow progressed. Gade indicated initial efforts to select species models attempted to identify 'guilds' representing small (ILT forage) and larger fish. Because the Common Shiner does not occur in the Arkansas River system in OK, the Common Shiner HEP model was eliminated. While Gizzard Shad do occur in the system, HEP model limitations to lacustrine systems for the Gizzard Shad HEP model eliminated this model. The previously identified Paddlefish HEP model was accepted as appropriate for the system. Johnston (ODWC) identified the Walleye HEP model as potentially applicable. After a review of variables included in the riverine model, the Walleye HEP model was accepted as appropriate. Discussions to identify another species, potentially representing habitats occupied by smaller fish species, eventually focused on the Bigmouth Buffalo (Johnston, ODWC). A review of riverine model variables, including water level fluctuation, led to acceptance of the Bigmouth Buffalo HEP model for the system.

A discussion of species models appropriate for evaluation of wetland creation (Prattville Creek) and riparian plantings (Prattville Creek, Cherry Creek mouth, and adjacent to I-44 wing deflectors) identified the Slider Turtle and Red-Winged Blackbird HEP models as applicable for use.

In a general discussion of USACE ecosystem restoration efforts in the Arkansas River Corridor, the word 'mitigation' was mentioned. Lilly and Burks-Copes clearly indicated that USACE ecosystem restoration efforts do not involve mitigation. Both Resource Agency representatives concurred that restoration of some level of minimum flow, through any of the proposed water source alternatives, would provide net benefit to fish and wildlife resources in the Arkansas River Corridor in Tulsa County.

Planned application of the selected HEP models (ILT, Paddlefish, Walleye, Bigmouth Buffalo, Slider Turtle, Red-Winged Blackbird) will require continued interaction with Resource Agency representatives.

From: [Gade, David SWT](#)
To: Roberto.ramos@faa.gov
Subject: Arkansas River Corridor Ecosystem Restoration (Tulsa County, OK)
Date: Thursday, August 25, 2016 4:01:54 PM
Attachments: [FAA MOA 2003.pdf](#)
[Proposed ARC measure locations \(for FAA\).pdf](#)

Roberto,

In compliance with the Memorandum of Agreement between the FAA, USAF, US Army (USACE), USEPA, USFWS, & USDA to address aircraft-wildlife strikes (attached as 'FAA_MOA_2003.pdf'), we wish to coordinate with you with respect to an ecosystem restoration project proposed for the Arkansas River Corridor in Tulsa County Oklahoma. The project area includes the 42-mile Arkansas River Corridor from the Keystone Lake Dam down to the Tulsa/Wagoner County boundary.

At present, measures being evaluated include:

- 1) A pool structure in the Arkansas River channel at one of two potential locations, either just upstream of, or downstream of the Hwy 97 Bridge over the Arkansas River near Sand Springs, OK. The structure will be designed to capture and slowly release peaking hydropower releases from the Keystone Dam. Design features will be incorporated such that the structure will smooth hydropower releases and provide a reasonably consistent minimum discharge (~1,000 cfs) during periods when releases from Keystone Dam are only from hydropower production. The structure will also incorporate features to allow for fish and sediment passage. The structure will pass flood pool releases from the Keystone Dam.
- 2) Wetland development at the Prattville Creek confluence with the Arkansas River. Prattville Creek is a right-bank tributary to the Arkansas River downstream of the Highway 97 Bridge at Sand Springs, Oklahoma. A proposed rock riffle at the current mouth of Prattville Creek would create a 5.34-acre wetland adjacent to the Arkansas River. Additional proposed features include wetland and riparian plantings in a 10 to 15 meter zone around the periphery of the ponded area. Development of this measure would periodically restore some flow to the 'old' Prattville Creek channel which parallels the Arkansas River for about a mile downstream of the current mouth.
- 3) Wetland and slackwater development just upstream of the I-44 Bridge over the Arkansas River on the left bank of the river. Proposed restoration measures include two rock riffles at the mouth of stormwater outfalls to create small wetlands (0.22 and 0.33 acres) adjacent to the Arkansas River, wing deflectors in the Arkansas River to protect the created wetland pools and generate slackwater areas, and restoration plantings around the periphery of the wetland areas.
- 4) A newly developed Least Tern island nesting habitat within the Arkansas River channel just south of the Indian Springs Sports Complex near Broken Arrow, OK. Using placed rock chevrons, an island of up to 5-acres will develop during high, sediment moving flows in the Arkansas River.

Attached is a pdf with simple graphics identifying locations of the features identified/described above.

If you need additional information, please let me know.

Your comments are welcomed and desired.

Thank you.

David Gade
Limnologist
Environmental Compliance Branch
USACE Regional Planning & Environmental Center
Office: 918.669.7579

FARMLAND CONVERSION IMPACT RATING

PART I (To be completed by Federal Agency)		Date Of Land Evaluation Request			
Name of Project		Federal Agency Involved			
Proposed Land Use		County and State			
PART II (To be completed by NRCS)		Date Request Received By NRCS		Person Completing Form:	
Does the site contain Prime, Unique, Statewide or Local Important Farmland? <i>(If no, the FPPA does not apply - do not complete additional parts of this form)</i>		YES <input type="checkbox"/>	NO <input type="checkbox"/>	Acres Irrigated	Average Farm Size
Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %		Amount of Farmland As Defined in FPPA Acres: %		
Name of Land Evaluation System Used	Name of State or Local Site Assessment System		Date Land Evaluation Returned by NRCS		
PART III (To be completed by Federal Agency)		Alternative Site Rating			
		Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly					
B. Total Acres To Be Converted Indirectly					
C. Total Acres In Site					
PART IV (To be completed by NRCS) Land Evaluation Information					
A. Total Acres Prime And Unique Farmland					
B. Total Acres Statewide Important or Local Important Farmland					
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted					
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value					
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)					
PART VI (To be completed by Federal Agency) Site Assessment Criteria <i>(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)</i>		Maximum Points	Site A	Site B	Site C
1. Area In Non-urban Use		(15)			
2. Perimeter In Non-urban Use		(10)			
3. Percent Of Site Being Farmed		(20)			
4. Protection Provided By State and Local Government		(20)			
5. Distance From Urban Built-up Area		(15)			
6. Distance To Urban Support Services		(15)			
7. Size Of Present Farm Unit Compared To Average		(10)			
8. Creation Of Non-farmable Farmland		(10)			
9. Availability Of Farm Support Services		(5)			
10. On-Farm Investments		(20)			
11. Effects Of Conversion On Farm Support Services		(10)			
12. Compatibility With Existing Agricultural Use		(10)			
TOTAL SITE ASSESSMENT POINTS		160			
PART VII (To be completed by Federal Agency)					
Relative Value Of Farmland (From Part V)		100			
Total Site Assessment (From Part VI above or local site assessment)		160			
TOTAL POINTS (Total of above 2 lines)		260			
Site Selected:		Date Of Selection		Was A Local Site Assessment Used? YES <input type="checkbox"/> NO <input type="checkbox"/>	
Reason For Selection:					
Name of Federal agency representative completing this form:					Date:

(See Instructions on reverse side)

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

- Step 1 - Federal agencies (or Federally funded projects) involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form. For Corridor type projects, the Federal agency shall use form NRCS-CPA-106 in place of form AD-1006. The Land Evaluation and Site Assessment (LESA) process may also be accessed by visiting the FPPA website, <http://fppa.nrcs.usda.gov/lesa/>.
- Step 2 - Originator (Federal Agency) will send one original copy of the form together with appropriate scaled maps indicating location(s) of project site(s), to the Natural Resources Conservation Service (NRCS) local Field Office or USDA Service Center and retain a copy for their files. (NRCS has offices in most counties in the U.S. The USDA Office Information Locator may be found at http://offices.usda.gov/scripts/ndISAPI.dll/oip_public/USA_map, or the offices can usually be found in the Phone Book under U.S. Government, Department of Agriculture. A list of field offices is available from the NRCS State Conservationist and State Office in each State.)
- Step 3 - NRCS will, within 10 working days after receipt of the completed form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland. (When a site visit or land evaluation system design is needed, NRCS will respond within 30 working days.
- Step 4 - For sites where farmland covered by the FPPA will be converted by the proposed project, NRCS will complete Parts II, IV and V of the form.
- Step 5 - NRCS will return the original copy of the form to the Federal agency involved in the project, and retain a file copy for NRCS records.
- Step 6 - The Federal agency involved in the proposed project will complete Parts VI and VII of the form and return the form with the final selected site to the servicing NRCS office.
- Step 7 - The Federal agency providing financial or technical assistance to the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

(For Federal Agency)

Part I: When completing the "County and State" questions, list all the local governments that are responsible for local land use controls where site(s) are to be evaluated.

Part III: When completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them or other major change in the ability to use the land for agriculture.
2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities planned build out capacity) that will cause a direct conversion.

Part VI: Do not complete Part VI using the standard format if a State or Local site assessment is used. With local and NRCS assistance, use the local Land Evaluation and Site Assessment (LESA).

1. Assign the maximum points for each site assessment criterion as shown in § 658.5(b) of CFR. In cases of corridor-type project such as transportation, power line and flood control, criteria #5 and #6 will not apply and will, be weighted zero, however, criterion #8 will be weighed a maximum of 25 points and criterion #11 a maximum of 25 points.
2. Federal agencies may assign relative weights among the 12 site assessment criteria other than those shown on the FPPA rule after submitting individual agency FPPA policy for review and comment to NRCS. In all cases where other weights are assigned, relative adjustments must be made to maintain the maximum total points at 160. For project sites where the total points equal or exceed 160, consider alternative actions, as appropriate, that could reduce adverse impacts (e.g. Alternative Sites, Modifications or Mitigation).

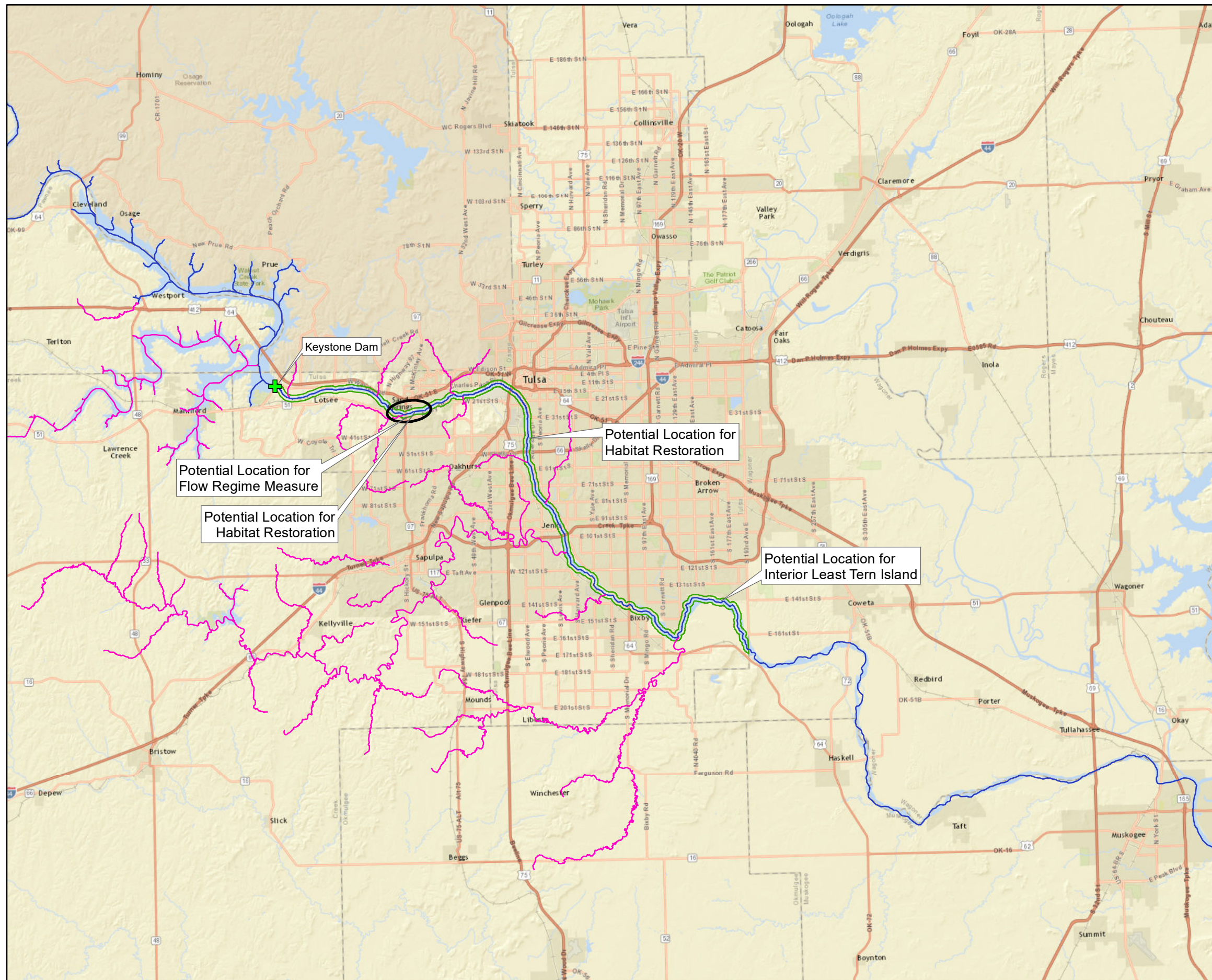
Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, convert the site assessment points to a base of 160.

Example: if the Site Assessment maximum is 200 points, and the alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \times 160 = 144 \text{ points for Site A}$$

For assistance in completing this form or FPPA process, contact the local NRCS Field Office or USDA Service Center.

NRCS employees, consult the FPPA Manual and/or policy for additional instructions to complete the AD-1006 form.



- LEGEND**
- Potential Location for Flow Regime Measure
 - ⊕ Keystone Dam
 - Arkansas River
 - Named Tributaries
 - ▭ Study Area

Notes:
 1. The Study Area (in green) is a preliminary project boundary that will be adjusted once the effects of the project are better understood.

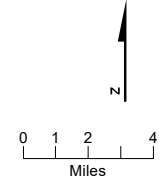


FIGURE 1
Study Area
 Arkansas River Corridor Feasibility Study Environmental Assessment – Cultural and Archeological Resources Report



Sand Springs

ASARCO Trust Formerly Federated Metals



Sand Springs PetroChemical Complex



Compass Industries Landfill

91

84

97

OK-51

W 31st St S

W 6th St

E 6th St

E Pecan St

E Morrow Rd

W Morrow Rd

Pecan St

Oak St

S Main St

S 61st West Ave

S 61st West

Avery Ln

Arkansas

Industrial Ave

N Grant Ave

N B

County 5

S River City Park Rd

Long St

River City Park

d St S

W 31st St S

LIST OF RECIPIENTS- **draft working copy** August 23, 2016

Agency/Entity	Address	Contact	Status/Notes
U.S. Fish and Wildlife Service Oklahoma Ecological Services Field Office	9014 E. 21 st St. Tulsa, OK74129-1428	Ms. Jonna Polk, Team Leader	
Oklahoma Historical Society Oklahoma History Center	800 Nazih Zuhdi Drive Oklahoma City, OK 73105	Dr. Bob Blackburn State Historic Preservation Officer	
Office of Environmental Justice and Tribal Affairs	US EPA Region 6 Mailcode 6RA-DA 1445 Ross Ave Dallas, TX 75202	Dr. Sharon Osowski Morgan Ecologist/Environmental Scientist	
U.S. Environmental Protection Agency	1445 Ross Ave., Suite 1200 Dallas, TX 75202	Mr. Ron Curry Federal Region VI Administrator	
Federal Aviation Administration	Arkansas / Oklahoma Airport District Office 10101 Hillwood Parkway Fort Worth, TX 76117	Mr. Roberto Ramos	
USDA, Natural Resources Conservation Service	100 USDA, Suite 206 Stillwater, OK 74074 2655	Mr. Gary O'Neill State Conservationist	
Oklahoma Department of Wildlife Conservation	1801 N. Lincoln Blvd. Oklahoma City, OK 73105	Mr. Richard Hatcher Director	
Oklahoma Department of Environmental Quality	P.O. Box 1677 Oklahoma City, OK 73101- 1677	Mr. Scott Thompson Executive Director	
ODEQ Water Quality Division	P.O. Box 1677 Oklahoma City, OK 73101- 1677	Ms. Kristi Roy	
ODEQ Water Quality Division	P.O. Box 1677 Oklahoma City, OK 73101- 1677	Ms. Elena Jigoulina	
Oklahoma Water Resources Board	3800 N. Classen Boulevard Oklahoma City, OK 73118	Mr. J.D. Strong Executive Director	
Oklahoma Water Resources Board	3800 N. Classen Boulevard Oklahoma City, OK 73118	Mr. Derek Smithee Chief, Water Quality	
Oklahoma Conservation Commission	2800 N. Lincoln Blvd., Suite 160, Oklahoma City, OK 73105	Mr. Trey Lamb Executive Director	
Oklahoma Conservation Commission	2800 N. Lincoln Blvd., Suite 160 Oklahoma City, OK 73105	Ms. Shanon Phillips Director Water Quality Programs	
Oklahoma Biological Survey	111 E. Chesapeake Street Norman, OK 73019-0575	Mr. Ian H. Butler Oklahoma Natural Heritage Inventory	
University of Oklahoma	111 E. Chesapeake Street Norman, OK 73019-0575	Dr. Amanda Regnier	

Oklahoma Archeological Survey			
Oklahoma Department of Transportation Environmental Programs Division	200 N.E. 21 st Street, Room 3D2a Oklahoma City OK 73105	Mr. Tim Vermillion NEPA Project Manager, Division 4	
Oklahoma Tourism and Recreation Department	120 N. Robinson, 6 th Floor Oklahoma City OK 73102	Ms. Deby Snodgrass Executive Director	
City of Mannford	300 Coonrod Cleveland OK 74020	Mr. Mike Nunneley City Administrator	Applicable?
City of Cleveland	201 N. Broadway Street Cleveland OK 74020	Mr. Elizabeth Smith City Manager	Applicable?
City of Sand Springs	P.O. Box 338 Sand Springs, OK 74063	Ms. Elizabeth Gray City Manager	
City of Oilton	101 West Main Street Oilton, OK 74052	Mr. Patrick Kennedy Mayor	Applicable?
City of Jenks	211 North Elm St. P.O. Box 2007 Jenks, OK 74037	Mike Tinker, City Manager	
City of Tulsa	175 E 2nd St # 15, Tulsa, OK 74103	Mayor's Office	New Mayor elect start Jan. 2017
Alabama Quassarte Tribal Town, Oklahoma	P.O. Box 187 Wetumka, OK 74883	Chief Tarpie Yargee	
City of Bixby	116 W. Needles P.O. Box 70 Bixby, OK 74008	Jared Cottle, City Manager Or John Easton, Mayor	
City of Broken Arrow	220 South First Street Broken Arrow, OK 74012	Michael Spurgeon, City Manager	
Tulsa County Board of Commissioners			
Tulsa Chamber of Commerce			
Kialegee Tribal Town, Oklahoma	P.O. Box 332 Wetumka, OK 74883	Mekko Jermiah Hobia	
Caddo Nation of Oklahoma	P.O. Box 487 Binger, OK 73009	Kim Penrod	
Cherokee Nation	P.O. Box 948 Tahlequah, OK 74465	Principal Chief Bill Baker	
Kialegee Tribal Town	P.O. Box 332 Wetumka, OK 74883	Jeremiah Hobia	
Muscogee (Creek) Nation, Oklahoma	P.O. Box 580 Okmulgee, OK 74447	Principal Chief George Tigerg	
Osage Nation, Oklahoma	P.O. Box 779 Pawhuska, OK 74056	Principal Chief Geoffrey Standing Bear	
Pawnee Nation Of Oklahoma	P.O. Box 470 Pawnee, OK 74058	President W. Bruce Pratt	
Sac & Fox Nation, Oklahoma	Route 2 Box 246 Stroud, OK 74079	Principal Chief Kay Rhoads	
Seminole Nation Of Oklahoma	P.O. Box 1498 Wewoka, OK 74884	Principal Chief Leonard Harjo	

Thlopthlocco Tribal Town, Oklahoma	P.O. Box 188 Okemah, OK 74859	Charles Coleman	
Wichita and Affiliated Tribes of Oklahoma	P.O. Box 729 Anadarko, OK 73005	President Terri Parton	
United Keetoowak Bank of Cherokees	P.O. Box 746, Tahlequah, OK 74465	Chief Joe Bunch	
Cross Timbers The Harbor Marina	1989 Cross Timbers Lane Mannford, OK 74044		
Keyport Marina	1200 S. Keyport Road Mannford, OK 74044		
Pier 51 Marina	1926 S. Hwy 151 Sand Springs, OK 74063		
Westport Marina	Rt. 3, Box 3-4 Cleveland, OK 74020		
Southwestern Power Administration	One West Third Street Tulsa, OK 74103-3502	Mr. Scott Carpenter Administrator	
Southwestern Power Administration	One West Third Street Tulsa, OK 74103-3502	Ms. Frieda Olsen	
George Kaiser Family Foundation	7030 S. Yale Avenue, Suite 600, Tulsa, OK 74136		
Mr. Clark Miller	109 Craven Dr. Mannford, OK 74044	Mr. Clark Miller	
Mr. Tyler Buttram	130 Birch Mannford, OK 74044	Mr. Tyler Buttram	
Bell Timmons	P.O. Box 1967 Mannford, OK 74044	Bell Timmons	
Mr. Larry Chasteen	P.O. Box 1116 Mannford, OK 74044	Mr. Larry Chasteen	
Mr. William E. Barrett	168 Glendale Circle Mannford, OK 74044	Mr. William E. Barrett	
Willard Walbridge	P.O. Box 521 Oilton, OK 74052	Willard Walbridge	
River Parks Authority	2424 E. 21 st Street, Suite 300, Tulsa OK 74114	Mr. Matt Meyer	
Jimmie D. Copeland	1606 Lakeview Drive Mannford, OK 74044	Jimmie D. Copeland	
Jearld McAfee	308 W. 49 th Street Sand Springs, OK 74063	Jearld McAfee	
Jim Selzen	P.O. Box 952 Jenks, OK 74037	Jim Selzen	
USGS	202 NW 66 th St., Bldg 7, OK 73136	Mr. William Andrews	
INCOG	2 West Second Street, Suite 800, Tulsa, OK 74103	Mr. Vernon Seaman	
INCOG	2 West Second Street, Suite 800, Tulsa, OK 74103	Mr. Rich Brierre	
Sand Spring Home	P.O. Box 278, Sand Springs, OK 74063	Mr. Ron Weese, Trustee	
Levee District #12	1202 East Pecan St., Sand Springs, Oklahoma 74063	Mr. Todd Kilpatrick	



Board of County Commissioners

Tulsa County Administration Bldg.
500 South Denver
Tulsa, Oklahoma 74103-3832
918.596.5015

KAREN KEITH
DISTRICT 2

February 3, 2017

U.S. Army Corps of Engineers, Tulsa District
Attention: Cynthia Kitchens
1645 South 101 East Avenue
Tulsa, Oklahoma 74128

RE: Support of Arkansas River Corridor Feasibility Study Report

Dear Ms. Kitchens,

As you know, Tulsa County has been the non-federal/local sponsor in partnership with the U.S. Army Corps of Engineers (USACE) since the beginning of the Feasibility Study. We have been an active participant in the development of the Feasibility Study and the draft Report currently under review.

We agree with the findings of the Report that confirm the degrading condition of the Arkansas River ecosystem in Tulsa County, primarily due to the operation of Keystone Dam for hydropower and flood control. Tulsa County supports retaining clean hydropower generation at Keystone Dam and certainly supports and commends the USACE for its flood control operations, as it has protected us in Tulsa County for several decades. We also support the recommendations in the Report which propose to improve the daily low flow regime of the river and implement other needed ecosystem restoration measures. We support the implementation of the Recommended Plan as presented in the Report.

Tulsa County and local stakeholders will continue to be involved with the implementation of the Feasibility Study projects and will endeavor to secure the necessary funds for the subsequent phase of implementation. Funding from both the Federal government and local sponsor will be essential for future implementation and the continuance of the projects implementation.

We are excited about the progress being made in the Feasibility Study and how it is consistent with our earlier findings and proposed projects contained in the Arkansas River Corridor Master Plan. We look forward to and support the next phases of this important project.

Sincerely,

Karen Keith, Commissioner
Tulsa County Board of County Commissioners



Tulsa County

Board of County Commissioners

Tulsa County Administration Bldg. • 500 South Denver

Tulsa, Oklahoma 74103-3832 • (918) 596-5015

KAREN KEITH

DISTRICT 2

July 1, 2010

Colonel Teague
District Commander
U.S. Army Corps of Engineers
1645 South 101st East Avenue
Tulsa, OK 74128-4609

Dear Colonel Teague:

RE: Arkansas River Corridor Feasibility Study, Tulsa County, Oklahoma

The Tulsa County Board of County Commissioners (BOCC) is interested in participating as the non-federal sponsor in a feasibility study on the Arkansas River in Tulsa County. Initial reconnaissance studies identified that a feasibility study should be conducted to address problems and opportunities related to flood risk reduction, ecosystem restoration, recreation, and water quality measures identified in the 2005 Arkansas River Corridor Master Plan.

I understand that the Corps of Engineers can conduct a cost-shared feasibility study under the General Investigations Program. I understand that Tulsa County's cost-sharing responsibility during the feasibility phase would be 50 percent, which can be provided in cash and/or as in-kind services and products. I also understand that the preconstruction engineering and design and construction for measures would be cost-shared the appropriate amount for each authority. The local sponsor provides all the lands, easements, rights-of-way, relocations and disposal areas needed for the project as part of their share of the project.

The purpose of this letter is to express the intent of the Tulsa County BOCC to enter into negotiations for the feasibility phase. The Project Management Plan developed during the negotiations will describe the study activities, proposed schedule, and cost of the study. I understand that this letter is not a contractual obligation on the part of either the Corps or Tulsa County BOCC, and either party may discontinue the project development process at any time.

If you have any questions concerning this matter, please contact Mr. Gaylon Pinc, P.E. at Program Management Group at your convenience.

Sincerely,

A handwritten signature in black ink, appearing to read 'Karen Keith', written over a large, stylized circular flourish.

Karen Keith
Chair, Tulsa County BOCC



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Oklahoma Ecological Services Field Office
9014 East 21st Street
Tulsa, OK 74129-1428
Phone: (918) 581-7458 Fax: (918) 581-7467
<http://www.fws.gov/southwest/es/Oklahoma/>

In Reply Refer To:

December 10, 2017

Consultation Code: 02EKOK00-2018-SLI-0461

Event Code: 02EKOK00-2018-E-01067

Project Name: Arkansas River Corridor Ecosystem Restoration Feasibility Study

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the

human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Non-federal entities conducting activities that may result in take of listed species should consider seeking coverage under section 10 of the ESA, either through development of a Habitat Conservation Plan (HCP) or, by becoming a signatory to the General Conservation Plan (GCP) currently under development for the American burying beetle. Each of these mechanisms provides the means for obtaining a permit and coverage for incidental take of listed species during otherwise lawful activities.

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>; <http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit through our Project Review step-wise process <http://www.fws.gov/southwest/es/oklahoma/OKESFO%20Permit%20Home.htm>.

Attachment(s):

- Official Species List
-

- USFWS National Wildlife Refuges and Fish Hatcheries
 - Migratory Birds
 - Wetlands
-

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Oklahoma Ecological Services Field Office

9014 East 21st Street

Tulsa, OK 74129-1428

(918) 581-7458

Project Summary

Consultation Code: 02EKOK00-2018-SLI-0461

Event Code: 02EKOK00-2018-E-01067

Project Name: Arkansas River Corridor Ecosystem Restoration Feasibility Study

Project Type: LAND - RESTORATION / ENHANCEMENT

Project Description: The U.S. Army Corps of Engineers, Tulsa District (USACE) and Tulsa County, the non-federal sponsor, are conducting a Civil Works feasibility study, Arkansas River Corridor (ARC) Ecosystem Restoration Feasibility Study, evaluating aquatic ecosystem restoration opportunities within the ARC between Keystone Dam and the Tulsa/Wagoner County line. The proposed project purpose is to address aquatic ecosystem degradation in the greater Tulsa, Oklahoma area. The study area spans nearly 42 river miles within the existing channel of the Arkansas River in Tulsa County, Oklahoma. The key constraint of the study is outlined in Water Resources Development Act 2005, Section 3132, which limits ecosystem restoration measure consideration to only those found in Indian Nations Council of Governments' 2005 Arkansas River Corridor Master Plan.

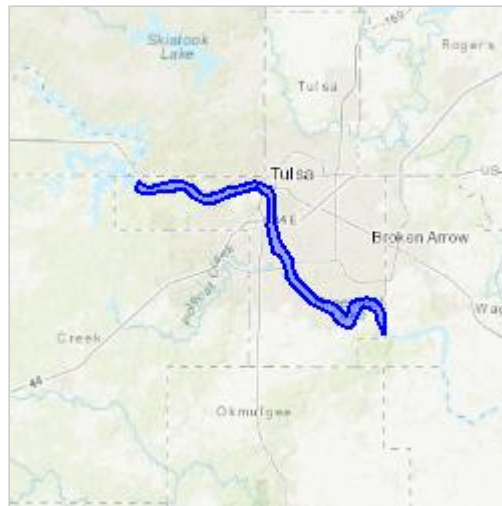
. The proposed project includes constructing an instream pool structure at river mile 530 that would operate to temporarily capture portions of water releases from Keystone Dam and associated hydropower generation, and rerelease the water during periods of little to no flow from Keystone Dam. The target release flow rate to increase minimum river flow, but not increase river flow or depth downstream during larger releases from Keystone Dam, throughout the study area is 1,000 cubic feet per second (cfs). The 1,000 cfs target was identified by U.S. Fish and Wildlife Service (USFWS) and Oklahoma Department of Wildlife Conservation (ODWC) staff as having tangible aquatic ecosystem benefits and a significant improvement over the little to no flow conditions that reoccur in the ARC. The pool structure can sustain the 1,000 cfs for up to approximately three and half days without additional releases from Keystone Dam to refill the pool. The design of the structure would allow water, fish, fish egg, and sediment passage through a combination of adjustable full and partial height gates in order to maintain riverine conditions up and downstream of the structure. In addition, 5.34 acres of wetland restoration, entailing rock riffle placement and native wetland plantings, is proposed at the confluence of the Arkansas River and Prattville Creek as well as three acres of sandbar island creation near Broken Arrow, Oklahoma using placed rock chevrons. Activities,

including heavy construction and hauling of materials, would occur outside of the Interior Least Tern breeding season (April through August) in areas with Interior Least Tern activity.

Project Location:

Approximate location of the project can be viewed in Google Maps:

<https://www.google.com/maps/place/36.03245355019266N95.96004087081215W>



Counties: Tulsa, OK

Endangered Species Act Species

There is a total of 5 threatened, endangered, or candidate species on this species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

Mammals

NAME	STATUS
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Birds

NAME	STATUS
Least Tern <i>Sterna antillarum</i> Population: interior pop. No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8505	Endangered
Piping Plover <i>Charadrius melodus</i> Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot <i>Calidris canutus rufa</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened

Insects

NAME	STATUS
American Burying Beetle <i>Nicrophorus americanus</i> Population: Wherever found, except where listed as an experimental population No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/66	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act¹ and the Bald and Golden Eagle Protection Act².

Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service³. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured. Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures, as described [below](#).

-
1. The [Migratory Birds Treaty Act](#) of 1918.
 2. The [Bald and Golden Eagle Protection Act](#) of 1940.
 3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern](#) (BCC) list or are known to have particular vulnerabilities in your project location. To learn more about the levels of concern for birds on your list, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your specific project area. To see maps of where birders and the general public have sighted birds in and around your project area, visit E-bird tools such as the [E-bird data mapping tool](#) (search for the scientific name of a bird on your list to see specific locations where that bird has been reported to occur within your project area over a certain time-frame) and the [E-bird Explore Data Tool](#) (perform a query to see a list of all birds sighted in your county or region and within a certain time-frame). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list can be found [below](#).

NAME	BREEDING SEASON
<p>American Bittern <i>Botaurus lentiginosus</i></p> <p>This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA</p> <p>https://ecos.fws.gov/ecp/species/6582</p>	<p>Breeds Apr 1 to Aug 31</p>
<p>American Golden-plover <i>Pluvialis dominica</i></p> <p>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	<p>Breeds elsewhere</p>
<p>Bald Eagle <i>Haliaeetus leucocephalus</i></p> <p>This is not a Bird of Conservation Concern (BCC), but is of concern in this area either because of the Eagle Act, or for potential susceptibilities in offshore areas from certain types of development</p>	<p>Breeds Mar 20 to Sep 15</p>

or activities.

<https://ecos.fws.gov/ecp/species/1626>

Black-billed Cuckoo <i>Coccyzus erythrophthalmus</i>	Breeds May 15 to Oct 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	
Bobolink <i>Dolichonyx oryzivorus</i>	Breeds May 20 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Eastern Whip-poor-will <i>Antrostomus vociferus</i>	Breeds May 1 to Aug 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Harris's Sparrow <i>Zonotrichia querula</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Hudsonian Godwit <i>Limosa haemastica</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
King Rail <i>Rallus elegans</i>	Breeds May 1 to Sep 5
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8936	
Long-billed Curlew <i>Numenius americanus</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5511	
Least Bittern <i>Ixobrychus exilis</i>	Breeds Aug 16 to Oct 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/6175	
Lesser Yellowlegs <i>Tringa flavipes</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	
Marbled Godwit <i>Limosa fedoa</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9481	
Prothonotary Warbler <i>Protonotaria citrea</i>	Breeds Apr 1 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and	

Alaska.

Red-headed Woodpecker <i>Melanerpes erythrocephalus</i>	Breeds May 10 to Sep 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Rusty Blackbird <i>Euphagus carolinus</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Short-billed Dowitcher <i>Limnodromus griseus</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480	
Semipalmated Sandpiper <i>Calidris pusilla</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Smith's Longspur <i>Calcarius pictus</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	
Sprague's Pipit <i>Anthus spragueii</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8964	
Swallow-tailed Kite <i>Elanoides forficatus</i>	Breeds Mar 10 to Jun 30
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8938	
Willet <i>Tringa semipalmata</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Wood Thrush <i>Hylocichla mustelina</i>	Breeds May 10 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	

Additional information can be found using the following links:

- Birds of Conservation Concern <http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php>
 - Measures for avoiding and minimizing impacts to birds
<http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
 - Nationwide conservation measures for birds
<http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeas>
-

Wetlands

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

FRESHWATER EMERGENT WETLAND

- [PEM1A](#)
- [PEM1C](#)
- [PEM1F](#)
- [PEM1Fx](#)
- [PEM1Ax](#)
- [PEM1Cx](#)

FRESHWATER FORESTED/SHRUB WETLAND

- [PFO1A](#)
- [PFO1/EM1C](#)
- [PFO1/SS1A](#)
- [PSS1C](#)
- [PFO1C](#)
- [PSS1A](#)
- [PSS1/EM1A](#)
- [PSS1/EM1C](#)
- [PSS2A](#)
- [PFO1/EM1A](#)
- [PSS1F](#)

FRESHWATER POND

- [PUBHh](#)
- [PUBHx](#)
- [PUSC_x](#)
- [PUBF_x](#)
- [PUBH](#)
- [PUBF_h](#)

LAKE

- [L2UBF_x](#)
-

RIVERINE

- [R2USC](#)
 - [R2UBF](#)
 - [R2USA](#)
 - [R4SBC](#)
 - [R2UBHx](#)
 - [R2UBH](#)
-

IPaC

U.S. Fish & Wildlife Service

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

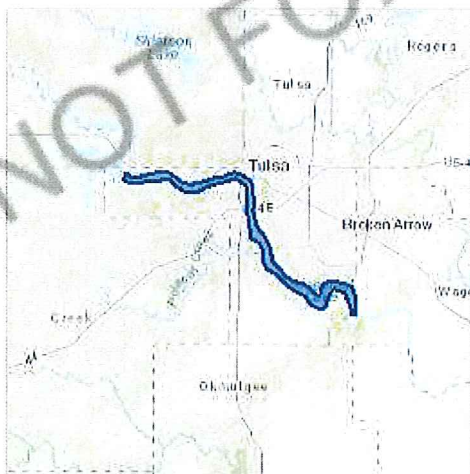
Project information

NAME

Arkansas River Corridor Ecosystem Restoration Feasibility Study

LOCATION

Tulsa County, Oklahoma

**DESCRIPTION**

The U.S. Army Corps of Engineers, Tulsa District (USACE) and Tulsa County, the non-federal sponsor, are conducting a Civil Works feasibility study, Arkansas River Corridor (ARC) Ecosystem Restoration Feasibility Study, evaluating aquatic ecosystem restoration opportunities within the ARC between Keystone Dam and the

Tulsa/Wagoner County line. The proposed project purpose is to address aquatic ecosystem degradation in the greater Tulsa, Oklahoma area. The study area spans nearly 42 river miles within the existing channel of the Arkansas River in Tulsa County, Oklahoma. The key constraint of the study is outlined in Water Resources Development Act 2005, Section 3132, which limits ecosystem restoration measure consideration to only those found in Indian Nations Council of Governments' 2005 Arkansas River Corridor Master Plan. . The proposed project includes constructing an instream pool structure at river mile 530 that would operate to temporarily capture portions of water releases from Keystone Dam and associated hydropower generation, and rerelease the water during periods of little to no flow from Keystone Dam. The target release flow rate to increase minimum river flow, but not increase river flow or depth downstream during larger releases from Keystone Dam, throughout the study area is 1,000 cubic feet per second (cfs). The 1,000 cfs target was identified by U.S. Fish and Wildlife Service (USFWS) and Oklahoma Department of Wildlife Conservation (ODWC) staff as having tangible aquatic ecosystem benefits and a significant improvement over the little to no flow conditions that reoccur in the ARC. The pool structure can sustain the 1,000 cfs for up to approximately three and half days without additional releases from Keystone Dam to refill the pool. The design of the structure would allow water, fish, fish egg, and sediment passage through a combination of adjustable full and partial height gates in order to maintain riverine conditions up and downstream of the structure. In addition, 5.34 acres of wetland restoration, entailing rock riffle placement and native wetland plantings, is proposed at the confluence of the Arkansas River and Prattville Creek as well as three acres of sandbar island creation near Broken Arrow, Oklahoma using placed rock chevrons. Activities, including heavy construction and hauling of materials, would occur outside of the Interior Least Tern breeding season (April through August) in areas with Interior Least Tern activity.

Local office

Oklahoma Ecological Services Field Office

(918) 581-7458

(918) 581-7467

9014 East 21st Street
Tulsa, OK 74129-1428

<http://www.fws.gov/southwest/es/Oklahoma/>

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Log in to IPaC.
2. Go to your My Projects list.
3. Click PROJECT HOME for this project.
4. Click REQUEST SPECIES LIST.

Listed species

are managed by the [Ecological Services Program](#) of the U.S. Fish and Wildlife Service.

1. Species listed under the [Endangered Species Act](#) are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the [listing status page](#) for more information.

The following species are potentially affected by activities in this location:

Mammals

NAME

STATUS

Northern Long-eared Bat *Myotis septentrionalis*

Threatened

No critical habitat has been designated for this species.

<https://ecos.fws.gov/ecp/species/9045>

Birds

NAME	STATUS
Least Tern <i>Sterna antillarum</i> No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8505	Endangered
Piping Plover <i>Charadrius melodus</i> There is final critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot <i>Calidris canutus rufa</i> No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1864	Threatened

Insects

NAME	STATUS
American Burying Beetle <i>Nicrophorus americanus</i> No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/66	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act

¹ and the Bald and Golden Eagle Protection Act².

Any activity that results in the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service

³. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured. Any person or organization who plans or conducts activities that may result in the take of

migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures, as described [below](#).

1. The [Migratory Birds Treaty Act](#) of 1918.
2. The [Bald and Golden Eagle Protection Act](#) of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern <http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php>
- Measures for avoiding and minimizing impacts to birds <http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
- Nationwide conservation measures for birds <http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf>

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern](#) (BCC) list or are known to have particular vulnerabilities in your project location. To learn more about the levels of concern for birds on your list, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your specific project area. To see maps of where birders and the general public have sighted birds in and around your project area, visit E-bird tools such as the [E-bird data mapping tool](#) (search for the scientific name of a bird on your list to see specific locations where that bird has been reported to occur within your project area over a certain time-frame) and the [E-bird Explore Data Tool](#) (perform a query to see a list of all birds sighted in your county or region and within a certain time-frame). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list can be found [below](#).

NAME	BREEDING SEASON
American Bittern <i>Botaurus lentiginosus</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/6582	Breeds Apr 1 to Aug 31
American Golden-plover <i>Pluvialis dominica</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere

Bald Eagle <i>Haliaeetus leucocephalus</i>	Breeds Mar 20 to Sep 15
This is not a Bird of Conservation Concern (BCC), but is of concern in this area either because of the Eagle Act, or for potential susceptibilities in offshore areas from certain types of development or activities.	
https://ecos.fws.gov/ecp/species/1626	
Black-billed Cuckoo <i>Coccyzus erythrophthalmus</i>	Breeds May 15 to Oct 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
https://ecos.fws.gov/ecp/species/9399	
Bobolink <i>Dolichonyx oryzivorus</i>	Breeds May 20 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Eastern Whip-poor-will <i>Antrostomus vociferus</i>	Breeds May 1 to Aug 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Harris's Sparrow <i>Zonotrichia querula</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Hudsonian Godwit <i>Limosa haemastica</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
King Rail <i>Rallus elegans</i>	Breeds May 1 to Sep 5
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
https://ecos.fws.gov/ecp/species/8936	
Least Bittern <i>Ixobrychus exilis</i>	Breeds Aug 16 to Oct 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	
https://ecos.fws.gov/ecp/species/6175	
Lesser Yellowlegs <i>Tringa flavipes</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
https://ecos.fws.gov/ecp/species/9679	

Long-billed Curlew <i>Numenius americanus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5511	Breeds elsewhere
Marbled Godwit <i>Limosa fedoa</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9481	Breeds elsewhere
Prothonotary Warbler <i>Protonotaria citrea</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker <i>Melanerpes erythrocephalus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rusty Blackbird <i>Euphagus carolinus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Semipalmated Sandpiper <i>Calidris pusilla</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Short-billed Dowitcher <i>Limnodromus griseus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480	Breeds elsewhere
Smith's Longspur <i>Calcarius pictus</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Sprague's Pipit <i>Anthus spragueii</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8964	Breeds elsewhere

Swallow-tailed Kite *Elanoides forficatus*

Breeds Mar 10 to Jun 30

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

<https://ecos.fws.gov/ecp/species/8938>

Willet *Tringa semipalmata*

Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wood Thrush *Hylocichla mustelina*

Breeds May 10 to Aug 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in your project's counties during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is $0.25/0.25 = 1$; at week 20 it is $0.05/0.25 = 0.2$.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (l)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the counties of your project area. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (-)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information.



Black-billed Cuckoo

BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Bobolink

BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Eastern Whip-poor-will

BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Harris's Sparrow

BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Hudsonian Godwit

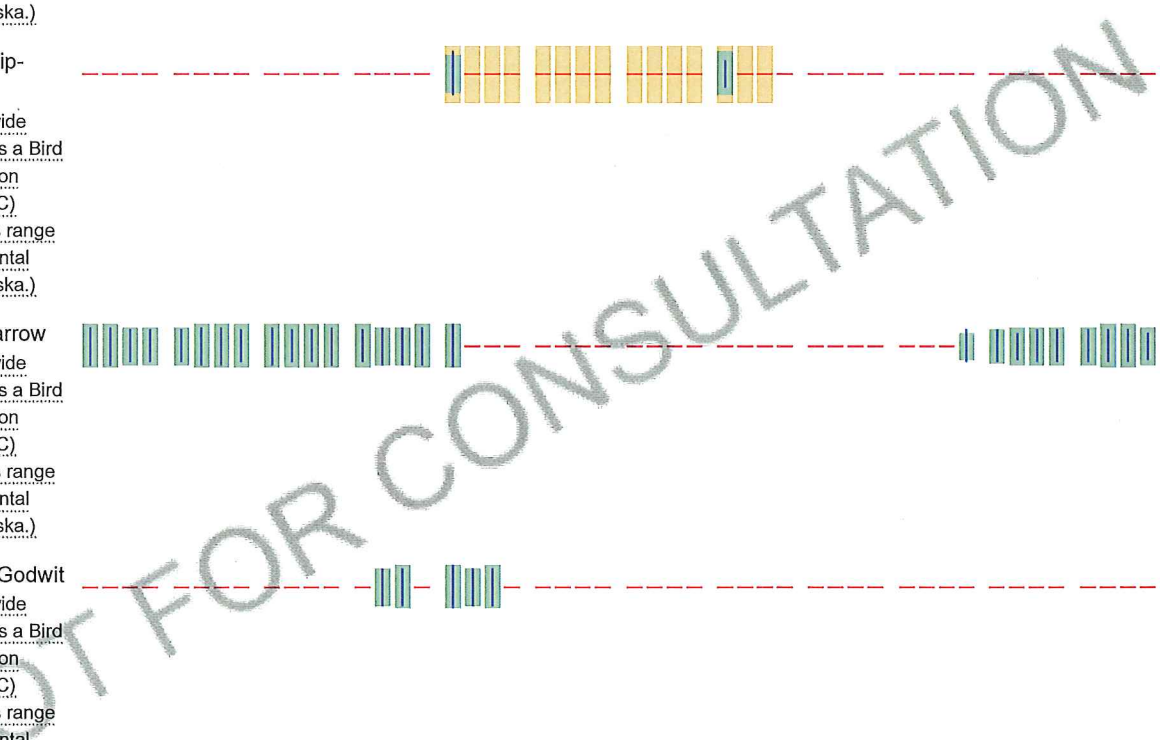
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

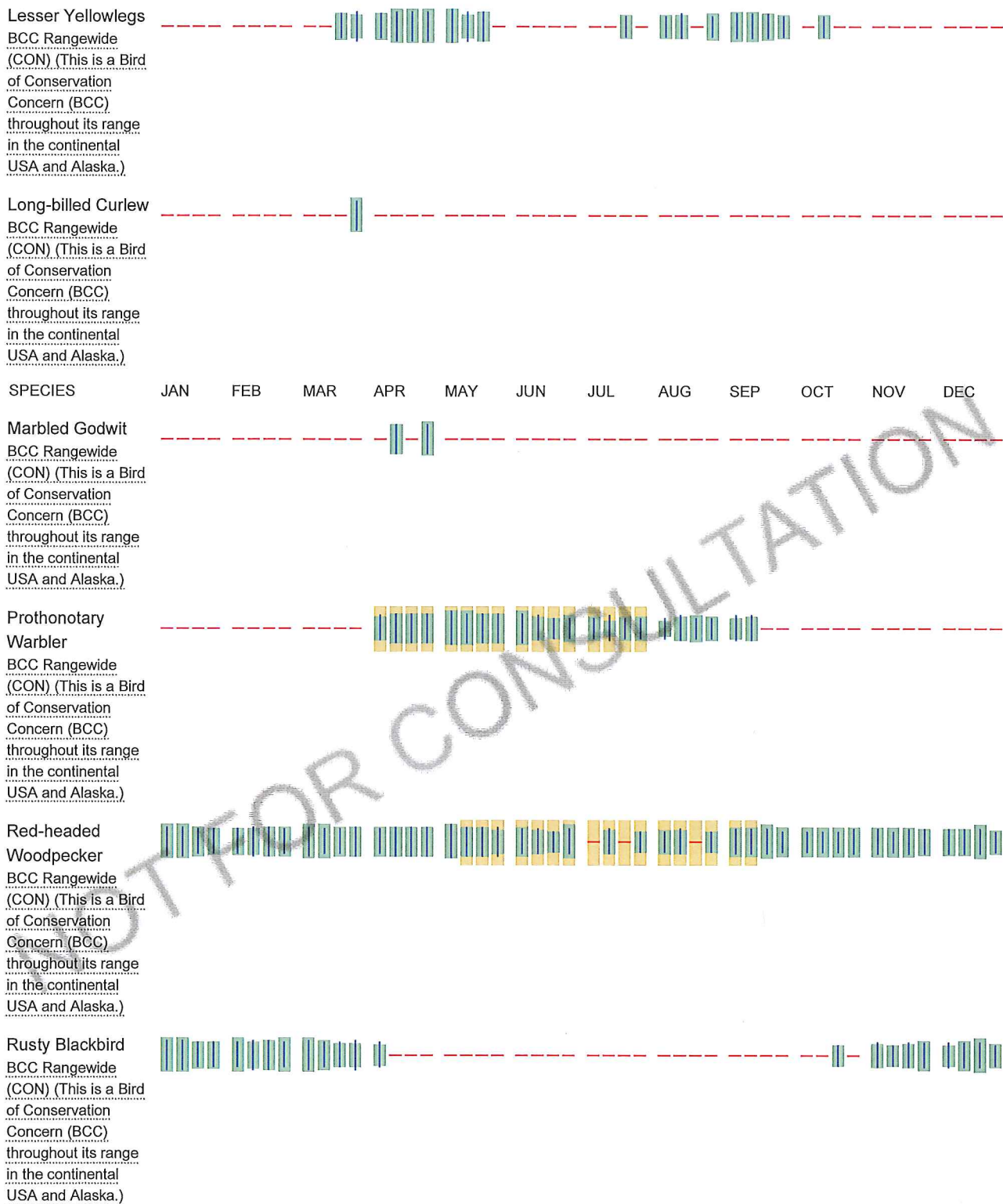
King Rail

BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Least Bittern

BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)





Semipalmated Sandpiper

BCC Rangewide
(CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Short-billed Dowitcher

BCC Rangewide
(CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Smith's Longspur

BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)



Sprague's Pipit

BCC Rangewide
(CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Swallow-tailed Kite

BCC Rangewide
(CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



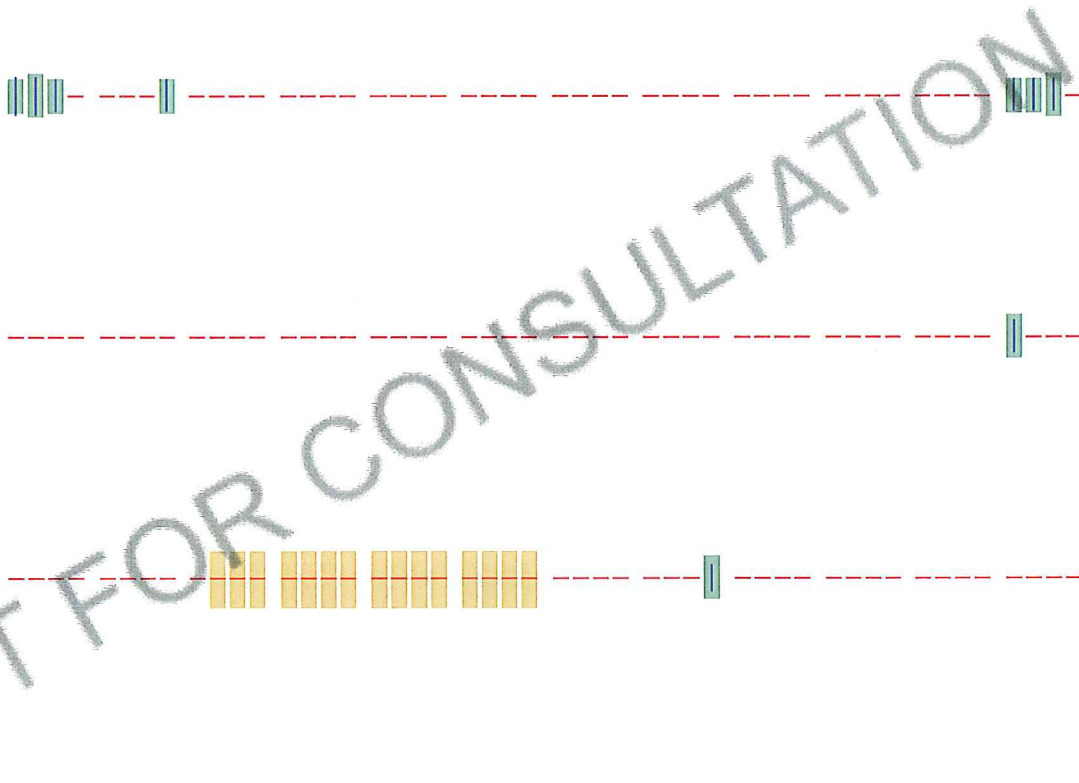
Willet

BCC Rangewide
(CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Wood Thrush

BCC Rangewide
(CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Such measures are particularly important when birds are most likely to occur in the project area. To see when birds are most likely to occur in your project area, view the Probability of Presence Summary. Special attention should be made to look for nests and avoid nest destruction during the breeding season. The best information about when birds are breeding can be found in [Birds of North America \(BNA\) Online](#) under the "Breeding Phenology" section of each species profile. Note that accessing this information may require a [subscription](#). [Additional measures](#) and/or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) that might be affected by activities in your project location. These birds are of priority concern because it has been determined that without additional conservation actions, they are likely to become candidates for listing under the [Endangered Species Act \(ESA\)](#).

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#). The AKN list represents all birds reported to be occurring at some level throughout the year in the counties in which your project lies. That list is then narrowed to only the Birds of Conservation Concern for your project area.

Again, the Migratory Bird Resource list only includes species of particular priority concern, and is not representative of all birds that may occur in your project area. Although it is important to try to avoid and minimize impacts to all birds, special attention should be made to avoid and minimize impacts to birds of priority concern. To get a list of all birds potentially present in your project area, please visit the [E-bird Explore Data Tool](#).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The [The Cornell Lab of Ornithology All About Birds Bird Guide](#), or (if you are unsuccessful in locating the bird of interest there), the [Cornell Lab of Ornithology Neotropical Birds guide](#). If a bird entry on your migratory bird species list indicates a breeding season, it is probable the bird breeds in your project's counties at some point within the time-frame specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

[Avoidance and minimization measures](#) should be implemented to reduce impacts to birds on your list, and all other birds that may occur in your project area. Nationwide Standard Conservation Measures can be applied for any project, regardless of project type or location.

If measures exist that are specific to your activity or to any of the species on your list that are confirmed to exist at your project area, these should also be considered for implementation in addition to the Nationwide Standard Conservation Measures. Implementation of avoidance and minimization measures is particularly important for BCC birds of rangewide concern.

If your project has the potential to disturb or kill eagles, you will need to [obtain a permit](#) to avoid violating the BGEPA should such impacts occur.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

[PEM1A](#)
[PEM1F](#)
[PEM1C](#)
[PEM1Fx](#)
[PEM1Ax](#)
[PEM1Cx](#)

FRESHWATER FORESTED/SHRUB WETLAND

[PFO1A](#)
[PFO1C](#)
[PFO1/SS1A](#)
[PSS1/EM1C](#)
[PSS1C](#)
[PSS1/EM1A](#)
[PSS1A](#)
[PFO1/EM1A](#)
[PFO1/EM1C](#)
[PSS2A](#)
[PSS1F](#)

FRESHWATER POND

[PUBHx](#)
[PUSCx](#)
[PUBFx](#)
[PUBH](#)
[PUBHh](#)
[PUBFh](#)

LAKE

[L2UBFx](#)

RIVERINE

[R2UBH](#)[R2USC](#)[R2USA](#)[R2UBHx](#)[R2UBF](#)[R4SBC](#)

A full description for each wetland code can be found at the National Wetlands Inventory website:

<https://ecos.fws.gov/ipac/wetlands/decoder>

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance-level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

[L2UBFx](#)

RIVERINE

[R2UBH](#)[R2USC](#)[R2USA](#)[R2UBHx](#)[R2UBF](#)[R4SBC](#)

A full description for each wetland code can be found at the National Wetlands Inventory website:

<https://ecos.fws.gov/ipac/wetlands/decoder>

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance-level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

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OBS Ref. 2016-392-FED-ARM

Dear Mr. Sims,

Sep. 6, 2016

We have reviewed occurrence information on federal and state threatened, endangered or candidate species, as well as non-regulatory rare species and ecological systems of importance currently in the Oklahoma Natural Heritage Inventory database for the following location you provided:

Multiple locations along Arkansas River in Tulsa County

We found 122 occurrence(s) of relevant species within the vicinity of the project location as described.

See table on page 2

Additionally, absence from our database does not preclude such species from occurring in the area.

If you have any questions about this response, please send me an email, or call us at the number given below.

Although not specific to your project, you may find the following links helpful.

ONHI, guide to ranking codes for endangered and threatened species:
http://vmpincol.ou.edu/heritage/ranking_guide.html

Information regarding the Oklahoma Natural Areas Registry:
http://www.oknaturalheritage.ou.edu/registry_faq.htm

Todd Fagin
Oklahoma Natural Heritage Inventory
(405) 325-4700
tfagin@ou.edu

Table 1. Listed and protected species in site location.

Species Name	Common Name	Federal Status	County	TRS
Anthus spragueii	Sprague's Pipit	Candidate for Listing	Tulsa	Sec. 1-T19N-R12E
Anthus spragueii	Sprague's Pipit	Candidate for Listing	Tulsa	Sec. 1-T19N-R12E
Anthus spragueii	Sprague's Pipit	Candidate for Listing	Tulsa	Sec. 36-T20N-R13E
Anthus spragueii	Sprague's Pipit	Candidate for Listing	Tulsa	Sec. 8-T17N-R14E
Anthus spragueii	Sprague's Pipit	Candidate for Listing	Tulsa	UNKNOWN
Anthus spragueii	Sprague's Pipit	Candidate for Listing	Tulsa	UNKNOWN
Haliaeetus leucocephalus	Bald Eagle	Protected	Rogers	Sec. 32-T20N-R16E
Haliaeetus leucocephalus	Bald Eagle	Protected	Rogers	Sec. 32-T20N-R16E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 1-T18N-R12E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 10-T19N-R11E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 10-T19N-R11E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 11-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 11-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T18N-R12E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T18N-R12E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 13-T17N-R13E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 13-T19N-R11E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 13-T19N-R11E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 13-T19N-R11E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 14-T17N-R13E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 14-T17N-R13E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 14-T19N-R12E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 14-T19N-R12E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 16-T17N-R14E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 18-T18N-R13E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 18-T18N-R13E

Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	Sec. 29-T17N-R14E
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	Sec. 36-T19N-R12E
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	Sec. 7-T17N-R13E
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Wagoner	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Wagoner	UNKNOWN



Oklahoma Historical Society

Founded May 27, 1893

State Historic Preservation Office

Oklahoma History Center • 800 Nazih Zuhdi Drive • Oklahoma City, OK 73105-7917
(405) 521-6249 • Fax (405) 522-0816 • www.okhistory.org/shpo/shpom.htm

September 20, 2016

Mr. Douglas Sims
Corps of Engineers
P.O. Box 17300
Fort Worth, TX 76102-0300

RE: File #2410-16; Arkansas River Ecosystem Restoration Study

Dear Mr. Sims:

We have received the documentation submitted concerning the referenced project in Tulsa County.

We are unable to process your request for review at this time and ask that you supply a completed Historic Preservation Resource Identification Form and appropriate photographs for each of the structures to be affected by the project, OR a letter indicating that there are no structures on the site and that none have been removed in the recent past, in anticipation of this project.

NOTE: If properties within the area of potential affect are less than 45 years old, Historic Preservation Resource Identification Forms and photos are not required. However, your review request must include the address and date of construction of each property.

If properties within the area of potential affect are 45 years old or older, and you have not received Historic Preservation Resource Identification Forms and the Review & Compliance Manual which is necessary to complete the forms, you may call or write to request hard copies from our office, or go online at www.okhistory.org and select "State Historic Preservation Office," then "Programs," then "Section 106," then click on "*Review & Compliance (Section 106 Process) Manual*" which includes instructions and the form.

If you have any questions regarding this request, you may reach me at 405/521-6381. Your response must reference the above underlined file number. Thank you.

Sincerely,

Catharine M. Wood
Historical Archaeologist

CMW:jr

From: [Theodore Isham](#)
To: [Wadlington, Brandon E CIV USARMY CESWF \(US\)](#)
Subject: [EXTERNAL] Feasibility Report for Arkansas River Corridor Ecosystem Restoration Study
Date: Wednesday, March 08, 2017 11:46:28 AM

The Seminole Nation of Oklahoma wishes to comment on the Feasibility Report for Arkansas River Corridor Ecosystem Restoration Study by stating this tribal entity would like to have Traditional/ Medicinal plants replanted within the ecosystem. The Cherokee 7 medicinal plants plus the river cane are sufficient.

Theodore Isham

Seminole Nation of Oklahoma

Historic Preservation Officer

PO Box 1498

Seminole, Ok 74868

Phone: 405-234-5218

e-mail: isham.t@sno-nsn.gov <<mailto:isham.t@sno-nsn.gov>>



TRIBAL HISTORIC PRESERVATION OFFICE

Date: March 22, 2017

File: 1617-1945OK-2

RE: USACE, Fort Worth District, Arkansas River Corridor Ecosystem Restoration Study, Tulsa County, Oklahoma

Fort Worth District
Brandon Wadlington
819 Taylor Street, Room 3A12
Fort Worth, TX 76102

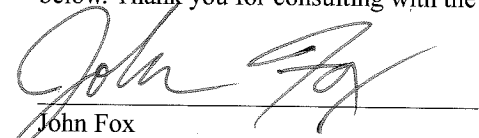
Dear Mr. Wadlington,

The Osage Nation Historic Preservation Office has received notification and accompanying information for the proposed project listed as USACE, Fort Worth District, Arkansas River Corridor Ecosystem Restoration Study, Tulsa County, Oklahoma. **The Osage Nation requests that a cultural resources survey be conducted for this project.**

In accordance with the National Historic Preservation Act, (NHPA) [54 U.S.C. § 300101 et seq.] 1966, undertakings subject to the review process are referred to in 54 U.S.C. § 302706 (a), which clarifies that historic properties may have religious and cultural significance to Indian tribes. Additionally, Section 106 of NHPA requires Federal agencies to consider the effects of their actions on historic properties (36 CFR Part 800) as does the National Environmental Policy Act (43 U.S.C. 4321 and 4331-35 and 40 CFR 1501.7(a) of 1969).

The Osage Nation has a vital interest in protecting its historic and ancestral cultural resources. **The Osage Nation anticipates reviewing and commenting on the planned Phase I cultural resources survey report for the proposed USACE, Fort Worth District, Arkansas River Corridor Ecosystem Restoration Study, Tulsa County, Oklahoma.**

Should you have any questions or need any additional information please feel free to contact me at the number listed below. Thank you for consulting with the Osage Nation on this matter.


John Fox
Archaeologist



Oklahoma Historical Society

Founded May 27, 1893

State Historic Preservation Office

Oklahoma History Center • 800 Nazih Zuhdi Drive • Oklahoma City, OK 73105-7917
(405) 521-6249 • Fax (405) 522-0816 • www.okhistory.org/shpo/shpom.htm

February 27, 2017

Mr. Brandon Wadlington
Environmental Compliance Branch
Fort Worth District Corps of Engineers
P.O. Box 17300
Fort Worth, TX 76102

RE: File #0806-17 [Former File #2410-16]; Arkansas River Corridor Ecosystem Restoration Study,
Tulsa, Tulsa County, Oklahoma

Dear Mr. Wadlington:

We are in receipt of the U.S. Army Corps of Engineers (COE), Fort Worth, Texas District, Notice of Availability for the *Draft Feasibility Report with Integrated Environmental Assessment for the Arkansas River Corridor Ecosystem Restoration Study, Tulsa County, Oklahoma*.

Based upon the nature and amount of ground disturbing activities proposed for the project, we assume that the COE will be consulting with our office per Section 106 of the National Historic Preservation Act (NHPA) as appropriate regarding the proposed project.

If you have any questions, please contact Catharine M. Wood, Historical Archaeologist, at (405) 521-6381. Please reference the above underlined file number when responding. Thank you.

Sincerely,

Melvena Heisch
Deputy State Historic
Preservation Officer

MH:pm

cc: ✓ Mr. Douglas C. Sims, COE, Fort Worth District
Mr. Andrew Commer, COE, Tulsa District
Dr. Kary Stackelbeck, OAS



DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

August 18, 2017

Dr. Kary L. Stackelbeck
State Archaeologist
Oklahoma Archeological Survey
University of Oklahoma
111 E. Chesapeake Street
Norman, OK 73019-5111

Dear Dr. Stackelbeck:

The U.S. Army Corps of Engineers, Tulsa District (USACE) and Tulsa County are continuing the Arkansas River Corridor Feasibility Study in Tulsa County, Oklahoma. Because effects on historic properties cannot be fully determined prior to approval of the undertaking, we find it necessary to address identification and evaluation of historic properties programmatically, pursuant to 36 CFR 800.14, in the design phase of the study to meet the agency's Section 106 obligations.

The enclosed draft Programmatic Agreement (PA) provides a definition of the area of potential effect (APE), the study authorization and purpose, as well as a description of proposed restoration measures and preliminary maps. The APE will be finalized in consultation with the signatories of the PA. Previously recorded historic properties and cultural resource surveys within the study area are also discussed in the draft PA.

In accordance with 36 CFR 800 and the cooperative agreement between the State Historic Preservation Officer and the Oklahoma Archeological Survey, we request your review and comment on the enclosed draft PA. We are also inviting the Oklahoma State Historic Preservation Officer, the non-Federal sponsor, Tulsa County, the Advisory Council on Historic Preservation, and appropriate federally recognized Tribes to consult as signatories to the PA.

Thank you for your cooperation in this review process. If you have any questions concerning this project or if we can be of further assistance, please contact Leslie Crippen at 817-886-1470 or via email at Leslie.Crippen@usace.army.mil.

Sincerely,

A handwritten signature in black ink, appearing to read "D. C. Sims", with a small upward-pointing arrow above the final flourish.

Douglas C. Sims, RPA
Chief, Environmental Compliance Branch
Regional Planning and Environmental Center

Enclosure



DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

August 18, 2017

Dr. Bob L. Blackburn
State Historic Preservation Officer
Oklahoma Historical Society
Oklahoma History Center
800 Nazih Zundi Drive
Oklahoma City, OK 73105-7917

Dear Dr. Blackburn:

The U.S. Army Corps of Engineers, Tulsa District (USACE) and Tulsa County are continuing the Arkansas River Corridor Feasibility Study in Tulsa County, Oklahoma. Because effects on historic properties cannot be fully determined prior to approval of the undertaking, we find it necessary to address identification and evaluation of historic properties programmatically, pursuant to 36 CFR 800.14, in the design phase of the study to meet the agency's Section 106 obligations.

The enclosed draft Programmatic Agreement (PA) (Enclosure 1) provides a definition of the area of potential effect (APE), the study authorization and purpose, as well as a description of proposed restoration measures and preliminary maps. The APE will be finalized in consultation with the signatories to the PA. Previously recorded historic properties and cultural resource surveys within the study area are also discussed in the draft PA.

In accordance with 36 CFR 800 and your 27 February 2017 comment letter (Enclosure 2), we request your review and comment on the enclosed draft PA. We are also inviting the Oklahoma Archaeological Survey, the non-Federal sponsor, Tulsa County, the Advisory Council on Historic Preservation, and appropriate federally recognized Tribes to consult as signatories to the PA.

Thank you for your cooperation in this review process. If you have any questions concerning this project or if we can be of further assistance, please contact Leslie Crippen at 817-886-1470 or via email at Leslie.Crippen@usace.army.mil.

Sincerely,

A handwritten signature in black ink, appearing to read "D. Sims", with a stylized flourish at the end.

Douglas C. Sims, RPA
Chief, Environmental Compliance Branch
Regional Planning and Environmental Center

Enclosures



DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P. O. BOX 17300
FORT WORTH, TEXAS 76102-0300

August 28, 2017

Principal Chief Geoffrey Standing Bear
The Osage Nation
627 Grandview Avenue
Pawhuska, OK 74355

Dear Chief Standing Bear,

The Tulsa District of the US Army Corps of Engineers (USACE) and Tulsa County are continuing the Arkansas River corridor Feasibility Study in Tulsa County, Oklahoma. Because effects on historic properties cannot be fully determined prior to approval of the undertaking, we find it necessary to address identification and evaluation of historic properties programmatically, pursuant to 36 CFR 800.14, in the design phase of the study to meet the agency's Section 106 obligations.

The USACE thanks you and Mr. John Fox for the 22 March 2017 comments regarding the draft Feasibility Study and Integrated Environmental Assessment. We are seeking your comments on the enclosed draft PA and invite the Osage Nation to participate as a concurring party to the agreement.

If interested, please respond by email to Leslie.Crippen@usace.army.mil within 30 calendar days, once received. If no response is received within 30 calendar days, USACE will assume your Tribal Government does not wish to participate in the development of the PA. If you have any questions or require further information, Ms. Crippen can be reached by telephone at (817) 886-1470.

Sincerely,

A handwritten signature in black ink, appearing to read "D. Sims", with a stylized flourish at the end.

Douglas C. Sims, RPA
Chief, Environmental Compliance Branch
Regional Planning and Environmental Center

Enclosure



DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P. O. BOX 17300
FORT WORTH, TEXAS 76102-0300

August 28, 2017

Chief Leonard Harjo
The Seminole Nation of Oklahoma
PO Box 1498
Wewoka, OK 74884

Dear Chief Harjo:

The Tulsa District of the US Army Corps of Engineers (USACE) and Tulsa County are continuing the Arkansas River corridor Feasibility Study in Tulsa County, Oklahoma. Because effects on historic properties cannot be fully determined prior to approval of the undertaking, we find it necessary to address identification and evaluation of historic properties programmatically, pursuant to 36 CFR 800.14, in the design phase of the study to meet the agency's Section 106 obligations.

The USACE thanks you and Mr. Theodore Isham for the 8 March 2017 comments regarding the draft Feasibility Study and Integrated Environmental Assessment. We are seeking your comments on the enclosed draft PA and invite the Seminole Nation of Oklahoma to participate as a concurring party to the agreement.

If interested, please respond by email to Leslie.Crippen@usace.army.mil within 30 calendar days, once received. If no response is received within 30 calendar days, USACE will assume your Tribal Government does not wish to participate in the development of the PA. If you have any questions or require further information, Ms. Crippen can be reached by telephone at (817) 886-1470.

Sincerely,

A handwritten signature in black ink, appearing to read "D. C. Sims", with a stylized flourish at the end.

Douglas C. Sims, RPA
Chief, Environmental Compliance Branch
Regional Planning and Environmental Center

Enclosure

From: Crippen, Leslie A CIV (US)
To: ["esham.t@sno-nsn.gov"](mailto:esham.t@sno-nsn.gov)
Subject: Arkansas River Corridor Ecosystem Restoration (UNCLASSIFIED)
Date: Thursday, July 06, 2017 1:19:00 PM

CLASSIFICATION: UNCLASSIFIED

Mr. Isham,

I have been working with the USACE for about four months and am getting caught up with the Arkansas River Ecosystem Restoration Project and the consultations that have occurred thus far. I see a communication from you dated March 8, 2017 stating that the Seminole Nation of Oklahoma would like to have river cane and the Cherokee 7 medicinal plants incorporated into the proposed restoration. I would like to give a list of these seven plants to our biologists, so that they can incorporate these species as much as possible into their design. I've been researching medicinal plants used by local tribes, but being from the Pacific Northwest, could really use your guidance.

I'm available by phone most anytime and would be happy for the chance to say hello. Please feel free to email or call, as works for you.

Leslie Crippen
Archaeologist, US Army Corps of Engineers
Regional Planning & Environmental Center
819 Taylor Street
Fort Worth, TX 76102
Direct: (817) 886-1470

CLASSIFICATION: UNCLASSIFIED



Preserving America's Heritage

September 29, 2017

Ms. Leslie Crippen
Archaeologist
U.S. Army Corps of Engineers
819 Taylor Street
Fort Worth, TX 76102

Ref: *Proposed Arkansas River Corridor Ecosystem Restoration Feasibility Study
City of Tulsa, County, Oklahoma*

Dear Ms. Crippen:

The Advisory Council on Historic Preservation (ACHP) has received your notification and supporting documentation regarding the adverse effects of the referenced undertaking on a property or properties listed or eligible for listing in the National Register of Historic Places. Based upon the information you provided, we have concluded that Appendix A, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, of our regulations, "Protection of Historic Properties" (36 CFR Part 800), does not apply to this undertaking. Accordingly, we do not believe that our participation in the consultation to resolve adverse effects is needed. However, if we receive a request for participation from the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer, affected Indian tribe, a consulting party, or other party, we may reconsider this decision. Additionally, should circumstances change, and you determine that our participation is needed to conclude the consultation process, please notify us.

Pursuant to 36 CFR §800.6(b)(1)(iv), you will need to file the final Programmatic Agreement (PA), developed in consultation with the Oklahoma State Historic Preservation Office's (SHPO's) and any other consulting parties, and related documentation with the ACHP at the conclusion of the consultation process. The filing of the PA and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the National Historic Preservation Act.

Thank you for providing us with your notification of adverse effect. If you have any questions or require further assistance, please contact Christopher Daniel at 202 517-0223 or via e-mail at cdaniel@achp.gov.

Sincerely,

Artisha Thompson
Historic Preservation Technician
Office of Federal Agency Programs

ADVISORY COUNCIL ON HISTORIC PRESERVATION

401 F Street NW, Suite 308 • Washington, DC 20001-2637
Phone: 202-517-0200 • Fax: 202-517-6381 • achp@achp.gov • www.achp.gov



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Division of Ecological Services 9014 East 21st Street
Tulsa, Oklahoma 74129
918/581-7458 / (FAX) 918/581-7467

August 2015



Monday, December 18th 2017

Online Project Review Concurrence Letter

To: Douglas C. Sims, RPA
Environmental Compliance Branch, Chief
Regional Planning and Environmental Center
U.S. Army Corps of Engineers
P.O. Box 17300, Room 3A12
Fort Worth, Texas 76102-0300

Project Name: Arkansas River Corridor (ARC) Ecosystem Restoration Feasibility Study

Consultation Code: 02EKOK00-2018-SLI-0461

Dear Applicant:

Thank you for using the U.S. Fish and Wildlife Service (Service) Oklahoma Ecological Services Field Office (ESFO) online project review process. By providing this letter in conjunction with your complete project review package, you are certifying that you have accurately completed the online project review process for the referenced project in accordance with all instructions provided, using the best available information to reach your conclusions. Concurrence with “not likely to adversely affect” determinations does not provide any exemption for violations of section 9 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA) or “take” of federally-listed species. The Federal action agency is ultimately responsible for ensuring compliance with the ESA and any take that occurs due to your proposed action would be considered a violation under section 9 of the ESA.

This letter and the enclosed project review package complete the review of your project in accordance with the ESA. This letter also provides information for your project review under the National Environmental Policy Act (National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C.4321-4347, 83 Stat. 852), as amended.

A copy of this letter and the project review package must be emailed to **okprojectreview@fws.gov** for this certification to be valid. This letter and the project review package will be maintained in Service records. **Please allow the Oklahoma ESFO 45 days to review your information. If the Oklahoma ESFO determines that the package is not complete, or that additional coordination is necessary, we will contact your office. If, after days from the date of your email submittal of your project review package, the Oklahoma ESFO has not contacted your office, consider your section 7 consultation complete.**

The proposed action consists of:

The proposed project includes constructing an instream pool structure at river mile (RM) 530 to increase minimum river flow, but not increase river flow or depth downstream during larger releases from Keystone Dam, throughout the study. 5.34 acres of wetland restoration, entailing rock riffle placement and native wetland plantings, is proposed at the confluence of the Arkansas River and Prattville Creek as well as three acres of sandbar island creation near Broken Arrow, Oklahoma using placed rock chevrons.

In total, 3 acres of riverine/wetland habitat would be lost due to the footprint of constructed features, however, an additional 2,144 acres of riverine habitat, 5 acres of wetland habitat, and 3 acres of sandbar island habitat would be restored. Existing roads and disturbed areas would be used for access and construction areas to the maximum extent practicable to avoid adverse impacts.

The enclosed ARC T&E evaluation report contains maps and descriptions of restoration measures and impacted areas.

Project start and completion dates:

Feasibility Phase Ends August 2018. The next phase, Pre-construction Engineering and Design, would start when Congressionally appropriated funds are received.

Federal agency or federal program providing a permit, funding, grant, authorization, loan, etc. associated with the proposed project and how that agency is associated with your project:

U.S. Army Corps of Engineers, Tulsa District, and the non-federal partner, Tulsa County, are studying ecosystem restoration measures in the ARC as authorized by the Water Resources Development Act 2007, Section 3132.

Federal agency or federal program providing a permit, funding, grant, authorization, loan, etc. associated with the proposed project and how that agency is associated with your project:

U.S. Army Corps of Engineers, Tulsa District, and the non-federal partner, Tulsa County, are studying ecosystem restoration measures in the ARC as authorized by the Water Resources Development Act 2007, Section 3132.

Federal Agency/Program Point of contact (Name, phone, and email address):

Brandon Wadlington, Biologist, USACE- Regional Planning and Environmental Center.
Office: 817-886-1720

Brandon.Wadlington@usace.army.mil

The species conclusions table in the enclosed project review package summarizes your ESA conclusions. These conclusions resulted in “not likely to adversely affect/modify” determinations for listed species and critical habitat in relation to potential effects of your proposed project. We certify that the use of the online project review process in strict accordance with the instructions provided as documented in the enclosed project review package results in reaching the appropriate

determinations. Therefore, we concur with determinations of “not likely to adversely affect” for listed species and critical habitat reached by proper use of this process. For projects where this particular determination is reached, additional coordination with this office is not needed.

Candidate species are not legally protected pursuant to the ESA. However, the Service encourages efforts to avoid or minimize adverse impacts to them from project effects. Some federal agencies have standing policies that grant limited protections to candidate species. Conservation of candidate species now may preclude future needs to federally list them as endangered or threatened, at which point their legal protection would become required. Please contact this office for additional coordination if your project action area contains candidate species.

Should project plans change or if additional information on the distribution of listed species or critical habitat becomes available, this determination may be reconsidered. You should re-visit the Service's Information, Planning, and Conservation (IPaC) website at <http://ecos/fws.gov/ipac/> within 90 days of project initiation to ensure species information is correct. If new species or critical habitat is identified, this letter is no longer valid and a new project package should be submitted to the Oklahoma ESFO.

Information about the online project review process including instructions and use, species information, and other information regarding project reviews within Oklahoma is available at our website: <<http://www.fws.gov/southwest/es/oklahoma/>>. If you have any questions, please call 918-581-7458 or send an email message to OKProjectReview@fws.gov.

Sincerely,
/s/ Jonna Polk
Field Supervisor
Oklahoma Ecological Services Field Office

Enclosures:

1) ENTIRE PROJECT REVIEW

- PACKAGE: Species Conclusion Table
- IPaC Species List and Action Area map
- This letter (Online Concurrence Letter)
- (Optional) Additional maps

2) Other relevant project data/documents

The attached ARC Threatened and Endangered Evaluation Report, and associated appendices, contains the Species Conclusion Table, IPaC Species List, Action Area Maps, and additional project info including nearly several years of least tern nest locations in the Action Area.



DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P. O. BOX 17300
FORT WORTH, TEXAS 76102-0300

December 18, 2017

Ms. Jonna Polk
Field Supervisor
U.S. Fish and Wildlife Service
9014 East 21st Street
Tulsa, Oklahoma 74129

Dear Ms. Polk:

The U.S. Army Corps of Engineers, Tulsa District (USACE), and Tulsa County, the non-federal sponsor, are conducting a Civil Works feasibility study, Arkansas River Corridor (ARC) Ecosystem Restoration Feasibility Study, evaluating aquatic ecosystem restoration opportunities within the ARC between Keystone Dam and the Tulsa/Wagoner County line. The proposed project purpose is to address aquatic ecosystem degradation in the greater Tulsa, Oklahoma area. The study area spans nearly 42 river miles within the existing channel of the Arkansas River in Tulsa County, Oklahoma. The key constraint of the study is outlined in the Water Resources Development Act 2007, Section 3132, which limits ecosystem restoration measure opportunities to only those identified in the 2005 Arkansas River Corridor Master Plan.

The ARC is within the Interior Least Tern (*Sternula antillarum*) breeding range with known annual nesting activity occurring, particularly in the downstream reaches of the study area. The proposed project includes constructing an instream pool structure at river mile 530 that would temporarily capture portions of water releases from Keystone Dam and associated hydropower generation, and re-release the water during periods of little to no flow from Keystone Dam. The target release rate, to increase minimum river flow, would be 1,000 cubic feet per second (cfs) throughout the study area. This release would not increase river flow or depth downstream during larger releases from Keystone Dam. The 1,000 cfs target was identified by U.S. Fish and Wildlife Service (USFWS) and Oklahoma Department of Wildlife Conservation (ODWC) staff as having tangible aquatic ecosystem benefits providing significant improvement over the little to no flow conditions that regularly occur in the ARC. The pool structure can sustain the 1,000 cfs for approximately three and half days without additional releases from Keystone Dam. The design of the structure would allow water, fish, fish eggs, and sediment passage through a combination of adjustable full and partial height gates in order to maintain riverine conditions up and downstream of the structure. In addition, 5.34 acres of wetland restoration, entailing rock riffle placement and native wetland plantings, is proposed at the confluence of the Arkansas River and Prattville Creek, as well as three acres of sandbar island creation near Broken Arrow using placed rock chevrons. Activities, including heavy construction and hauling of materials, would occur outside of the Interior Least Tern breeding season (April through August) in areas with Interior Least Tern activity.

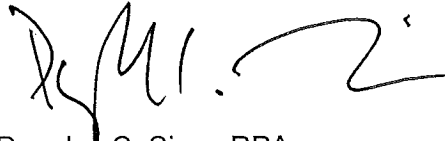
On September 11, 2017 a 1,000 cfs test release from Keystone Dam, made possible by efforts of Southwestern Power Administration (SWPA), was conducted to evaluate the hydrologic model accuracy and gauge restoration effectiveness. USACE, SWPA, ODWC, and USFWS staff along with representatives of the non-federal sponsor, were able to observe the

flow test from various locations throughout the study area. General observations concluded that the 1,000 cfs flow test matched the hydrologic modeling results and would deliver the expected environmental benefits.

Due to the small disturbance footprint of the proposed project within the study area, restorative function of all features proposed, and primary purpose of the pool structure operation and design being to maintain minimum river flow between water releases from Keystone Dam, USACE has determined the proposed action may affect, but is not likely to adversely affect the Interior Least Tern, while providing improvements in their breeding, foraging, and food base habitats.

Through informal coordination with the USFWS Oklahoma Office staff, the USACE has enclosed a copy of the *Arkansas River Corridor Threatened and Endangered Species Evaluation Report*, which includes the *Arkansas River Corridor 1,000 cfs Test from Keystone Dam* field notes and pictures for your review for informal consultation under Section 7 of the Endangered Species Act. The USACE requests concurrence with this determination from the USFWS. For more information, please contact Mr. Brandon Wadlington, Biologist, Environmental Compliance Branch, Regional Planning Environmental Center, at 817-886-1720 or, via email at Brandon.Wadlington@usace.army.mil.

Sincerely,

A handwritten signature in black ink, appearing to read 'D. Sims', with a stylized flourish at the end.

Douglas C. Sims, RPA
Chief, Environmental Compliance Branch
Regional Planning and Environmental Center

Enclosures

Threatened and Endangered Species Evaluation Report

Arkansas River Corridor Ecosystem Restoration Feasibility Report

Consultation Code: 02EKOK00-2018-SLI-0461

U.S. Army Corps of Engineers – **Tulsa District**
1645 S 101st E Ave
Tulsa, OK 74128



US Army Corps of Engineers

December 2017

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Acronyms

American burying beetle	ABB
Bald and Golden Eagle Protection Act	BGEPA
Biological Opinion	BO
Endangered Species Act	ESA
Engineering Regulation	ER
Information, Planning, and Conservation system	IPaC
Longitudinal Peaked Stone Toe Protection	LPSTP
Low Water Dam	LWD
Migratory Bird Treaty Act	MBTA
Nationwide Permit	NWP
Oklahoma Department of Wildlife Conservation	ODWC
Oklahoma Natural Heritage Inventory	ONHI
Pre-construction Engineering and Design	PED
River Mile	RM
Southwestern Power Administration	SWPA
U.S. Army Corps of Engineers	USACE
U.S. Fish and Wildlife Service	USFWS

1.0 Project Summary

The U.S. Army Corps of Engineers, Tulsa District (USACE), and Tulsa County, the non-federal sponsor, are conducting a Civil Works feasibility study, Arkansas River Corridor (ARC) Ecosystem Restoration Feasibility Study, evaluating aquatic ecosystem restoration opportunities within the ARC between Keystone Dam and the Tulsa/Wagoner County line. The proposed project purpose is to address aquatic ecosystem degradation in the greater Tulsa, Oklahoma area. The study area (Appendix A, Figure 1) spans nearly 42 river miles within the existing channel of the Arkansas River in Tulsa County, Oklahoma. The proposed restoration measures (Appendix A, Figure 2) restore riverine, wetland, and sandbar island habitat. The key constraint of the study is outlined in the Water Resources Development Act 2007, Section 3132, which limits ecosystem restoration measure consideration to only those found in the Indian Nations Council of Governments' 2005 Arkansas River Corridor Master Plan.

The proposed project includes constructing an instream pool structure at river mile (RM) 530 (Appendix A, Figure 3) that would operate to temporarily capture portions of the water releases from Keystone Dam and associated hydropower generation, and rerelease the water during periods of little to no flow from Keystone Dam. The target release flow rate to increase minimum river flow, would be 1,000 cubic feet per second (cfs) throughout the study area (Appendix A, Figures 4, 5, and 6). This would not increase river flow or depth downstream during larger releases from Keystone Dam. The 1,000 cfs target was identified by U.S. Fish and Wildlife Service (USFWS) and Oklahoma Department of Wildlife Conservation (ODWC) staff as having tangible aquatic ecosystem benefits providing a significant improvement over the little to no flow conditions that reoccur in the ARC. The pool structure can sustain the 1,000 cfs for approximately three and half days without additional releases from Keystone Dam. The design of the structure would allow water, fish, fish eggs, and sediment passage through a combination of adjustable full and partial height gates in order to maintain riverine conditions up and downstream of the structure. In addition, 5.34 acres of wetland restoration, entailing rock riffle placement and native wetland plantings, is proposed at the confluence of the Arkansas River and Prattville Creek (Appendix A, Figure 7) as well as three acres of sandbar island creation near Broken Arrow, Oklahoma using placed rock chevrons (Appendix A, Figure 8).

2.0 Introduction

The Arkansas River is a water resource serving numerous purposes within the City of Tulsa and surrounding communities. The river is dammed at the western Tulsa County line creating Keystone Lake which, along with the dam, provides flood risk management benefits, contributes to the eleven-reservoir-system operation of the McClellan-Kerr Arkansas River Navigation System, provides clean and efficient power through the associated hydropower plant, and provides a source of water for municipal and industrial uses. Historically, the river has served as an important resource for aquatic and terrestrial habitat of the nation's wildlife that live, breed, and migrate through the Arkansas River ecosystem. Construction, operation, and maintenance of the Keystone Dam, lake, associated hydropower operations, and other purposes have significantly degraded the riverine ecosystem structure, function, and dynamic processes along the Arkansas River within Tulsa County. In addition to the nationally significant purposes of flood risk management, inland navigation, hydropower, and water supply, the Arkansas River ecosystem is a nationally significant resource for the Federally-listed Interior Least Tern (*Sterna antillarum*), hereafter referred to as Least Tern, as well as a plethora of other

native species that support a functional riverine ecosystem.

The Arkansas River Corridor study is authorized in the Water Resources Development Act (WRDA) of 2007, Section 3132.

Section 3132. Arkansas River Corridor.

- (a) IN GENERAL. – The Secretary is authorized to participate in the ecosystem restoration, recreation, and flood damage reduction components of the Arkansas River Corridor Master Plan dated October 2005. The Secretary shall coordinate with appropriate representatives in the vicinity of Tulsa, Oklahoma, including representatives of Tulsa County and surrounding communities and the Indian Nations Council of Governments.
- (b) Authorization of Appropriations. – There is authorized to be appropriated \$50,000,000 to carry out this section.

This study was conducted in accordance with *Engineering Regulation (ER) 1105-2-100, Planning Guidance Notebook*, and is organized in the framework of the ER. The study has been conducted following the six-step planning process which originated in the *1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (also known as Principles and Guidelines or P&G). Implementation guidance provided for Section 3132 requires a cost-shared study be completed following the guidelines in ER 1105-2-100, Appendix H for projects authorized without a report. No project construction may be initiated until funds are specifically appropriated to accomplish the work. Pre-construction Engineering and Design is considered the next phase of this investigation.

The impacts on the aquatic and riparian ecosystem within the study area from Keystone Dam and associated operations are dramatic. Keystone Dam is a physical barrier for natural river flow and connectivity, sediment transport, and migratory and spawning life histories of native fauna. Outside of flood pool releases, river flow in the study area relies upon hydropower operations.

The generation of hydropower at Keystone Dam, which has been in operation since 1968, has had a significant influence over the health of the ecosystem within the study corridor. The Southwestern Power Administration (SWPA), as the region's Power Marketing Administration, is authorized to market the hydropower generation at Keystone Dam. When the Keystone lake level is in the flood pool, hydropower generation is used as the first method of flood control release as part of the USACE flood risk management strategy. When the lake level is in the conservation pool, SWPA schedules and calls on Keystone Dam hydropower generation to meet peak electricity demand needs of hydropower customers in a six-state region. Keystone Dam hydropower generation is operated as part of a system of numerous Federal hydropower projects in the region to meet the peak electricity demand. Generation schedules are subject to change due to a variety of factors.

During hydropower generation, the hydropower units can release an estimated 6000 cfs (1 unit) or 12,000 cfs (2 units) of water that flows through the river throughout the study area. During periods of low precipitation, water levels behind the dam drop into the conservation pool. Once in the conservation pool, the only water released downstream is to meet

hydropower or, occasionally, water supply demand, which is typically released via the hydropower units. As a result, the current flow regime within the study area exhibits daily bouts of brief 6,000-12,000 cfs river flow followed by extended periods of near zero river flow from Keystone Dam. Without releases from Keystone Dam, the Arkansas River within the study area is reduced from a flowing river to isolated pools and disconnected floodplain habitat lasting from several hours during the week to several days over the weekend. This creates an incredibly disruptive, unnatural flow regime impacting all aquatic and riparian habitat types as well as the flora and fauna throughout the study area. While the drying of rivers is a naturally occurring process in the southwestern region of the United States, those conditions are generally experienced in smaller drainages and during extended severe droughts. In the study area, flooding and drought conditions are exacerbated beyond this natural drying process by the impacts of Keystone Dam.

The Keystone Dam also traps a significant amount of sediment resulting in downstream sediment-starved flow causing channel and tributary incision and bank erosion. The impacted geomorphology has resulted in streambank erosion and the destruction of riverine wetlands, backwaters, and slackwater habitats that were once important fish nurseries and feeding/resting areas for resident and migrant waterfowl. As an example, the current mouth of Prattville Creek is an erosional shortcut to the Arkansas River, bypassing nearly one mile of the original Prattville Creek channel, caused in part by Arkansas River channel downcutting.

Within the study area, Federally-listed endangered Least Terns annually nest on the sandbar islands. As river flow diminishes and the river bed is exposed, the sandbar islands become connected to the shoreline. This fluctuating flow cycle coincides with peak Least Tern nesting activities in the study area, exposing the nesting colonies to inundation during high flows, and human and predator disturbances when low flows create land bridges to sandbar islands. The low flow conditions can also induce Least Terns to nest in unsuitable low-lying areas. Hours or days later when river flows return, the low-lying nests have a higher probability of being swept into the river. Both inundation and low flow conditions contribute to nesting failure in the Arkansas River Corridor.

Without river flow, the remaining shallow, isolated pools subject trapped fish, fish eggs and larvae, and aquatic invertebrates to increased predation, intolerable environmental conditions, and desiccation if river flow does not return in time. The disconnected river reaches and exposed river bed created by low flow conditions severely impact the ability of migratory fish, such as the Paddlefish (*Polyodon spathula*), Shovelnose Sturgeon (*Scaphirhynchus platyrhynchus*), and Sauger (*Sander canadensis*) to reach upstream spawning habitat within the backwater and slackwater habitats. These and other native fish species require continuous flows to prevent egg desiccation and to suspend larval offspring before they are fully mobile.

Along the shorelines, a variety of vegetation types including aquatic, emergent, shoreline, and moist soil dependent communities face similar challenges in a low flow condition. These habitats provide the vegetative structure necessary for refuge and critical nesting and nursery life histories for numerous species across all fauna. In addition, these habitats supply the base of the food web throughout the study area. Seed, zooplankton, forage fish, and insect production are all dependent on the presence and function of these habitats. The low or no-flow conditions disconnect the above described habitats from the hydrologic

regime they require to sustain growth. The result is a diminished food base with limited foraging opportunities, reducing the carrying capacity of the study area. Nesting Least Terns, migratory waterfowl, migratory fish, amphibians, bats and all other species that forage on small fish, seeds, zooplankton, and insects are faced with sustenance shortfalls.

Section 7 of the Endangered Species Act (ESA) requires Federal agencies to ensure that any action they authorize, fund, or carry out is not likely to adversely impact any federally listed threatened or endangered species or result in the destruction of critical habitat. The USACE is sponsoring all tasks associated with this project, and while the proposed project's primary purpose is ecosystem restoration, efforts must still be made to ensure no federally listed species will be adversely effected by the planned project activities through compliance with Section 7 of the ESA.

Through the USACE planning process, restorative measures from the ARC Master Plan were identified, assessed, and recommended to address the specific ecological problems within the Arkansas River Corridor.

The specific proposed project measures, objectives, and feasibility design parameters are as follows:

Pool Structure at River Mile 530

- The primary purpose and operation will be to provide minimum river flows of 1,000 cfs more consistently throughout the project area while not increasing flow rates or depth of other Keystone Dam releases (Appendix A, Figure 9). On September 11th, 2017, a 1,000 cfs test release from Keystone Dam was conducted to verify hydraulic and hydrology modeling as well as environmental benefits provided by 1,000 cfs river flow.
- Consists of a combination of full and partial height gates with a maximum surface water elevation of 638 feet.
 - The structure would have 6,730 acre-feet of storage capacity.
 - At full capacity, provide 1,000 cfs for approximately 3.4 days.
 - Coordination with downstream LWDs would occur to facilitate river flow throughout study area.
- Design and operation will not increase flood risk or impact Keystone Dam and hydropower operations.
- Design and operation will allow sediment transport and at least seasonal/larger flow fish and egg passage.
- Operation of the pool structure will be based on releases from Keystone Dam and hydropower generation.
 - During flood pool releases, all gates will be open to promote natural riverine conditions.
 - Between flood pool and hydropower releases, all gates will function to temporarily store and rerelease water at 1,000 cfs while not impacting Keystone Dam or hydropower generation.
- 1,000 cfs provides an additional 2,144 acres of riverine habitat over low flow conditions in the ARC.
 - Current low flow conditions, modeled at 100 cfs, provides 1,591 acres of

riverine habitat in the ARC.

- 2.8 acres of riverine habitat will be permanently lost within the footprint of the pool structure.

Prattville Creek Rock Riffle and Wetland Plantings

- The primary purpose of the rock riffle, native wetland plantings, and longitudinal peaked stone toe protection (LPSTP) is to restore 5.34 acres of backwater wetland habitat previously lost due to erosion and lack of floodplain connectivity (Appendix A, Figure 10).
 - The rock riffle will maintain a wetland area to support native aquatic vegetation while providing for ebb and flow of fluctuating river flows.
 - The LPSTP will prevent further bank erosion and sedimentation of the wetland footprint during larger releases from Keystone Dam.
 - Native wetland plantings, Common Rush (*Juncus effusus*) and bulrushes (*Schoenoplectus spp.*) will be randomly placed (spaced 1.5 feet apart on center) along the perimeter of the wetland.
 - 0.06 acres of backwater wetland habitat would be permanently lost within the footprint of the rock riffle and LPSTP.

Sandbar Island Creation

- The primary purpose of the sandbar island is to provide additional nesting habitat for the Least Tern (Appendix A, Figure 11).
 - The sandbar island will be created using the placement of rock chevrons, based on Oklahoma State University's design, which will aggregate sand into three acres of nesting habitat at flows up to 20,000 cfs.
 - The sandbar will be created as close to the middle of the river, and away from taller shoreline vegetation, as practicable in an effort to maximize least tern use and utilize existing county roads and previously disturbed shoreline areas for access and construction.

Detailed design, modeling, and operation parameters for all proposed measures will be developed in the next stage of the project, Pre-construction Engineering and Design (PED), with continued coordination with USFWS, ODWC, SWPA, and the non-federal sponsor.

3.0 Location

All elements of the proposed projects, along with their direct and indirect effects, are located within and along the river channel and immediate banks of the ARC in Tulsa County, Oklahoma. The ARC spans nearly 42 river miles between Keystone Dam and the Tulsa/Wagoner County line as it bisects the Greater Tulsa metropolitan area. USACE contracted CH2M Hill Inc. to inventory known biological resources, including threatened and endangered species, in the study area. The following sections below regarding habitat descriptions and threatened and endangered species in the study area are from CH2M Hill's *Biological Resource Report: Ecosystem Restoration for the Arkansas River Corridor Feasibility Study Tulsa County, Oklahoma*.

4.0 Natural Communities

Tulsa County and the surrounding region support diverse natural communities and native fauna. The mainstem of the Arkansas River within the study area contains much wetland habitat, including emergent herbaceous wetlands, riparian shrub habitat, and bottomland hardwood forests, which are described in this section.

4.1 Wetlands

Wetland habitats within the study area also provide essential habitat for amphibians, reptiles, birds, and mammals. Frogs and salamanders use these wetland areas for breeding grounds and egg laying. Ducks and migratory birds use them for resting areas on their migrations routes.

Emergent Herbaceous Wetlands

Emergent wetland areas, characterized by usually flooded areas with rooted, herbaceous hydrophytes, also occur within the study area. They can be found either along the edge of the Arkansas River or in depressional areas within the floodplain. Dominant perennial vegetation in these emergent wetlands may include rushes (*Juncus* spp.), smartweed (*Polygonum* spp.), spikerush (*Eleocharis* spp.), grassy arrowhead (*Sagittaria graminea*), cattail (*Typha latifolia*), and various sedges (*Carex* spp.). Buttonbush (*Cephalanthus occidentalis*) is also commonly found scattered throughout wetland areas where inundation is less frequent (Oklahoma State University, 1998).

Riparian Shrub Habitats

Riparian shrub wetlands, characterized by occasionally flooded areas with shrub and young woody vegetation, also occur within the study area. These are open areas dominated by shrub and hardwood saplings mixed with emergent herbaceous vegetation. Riparian shrub wetlands provide shelter, food, and nesting habitat for a variety of wildlife. Common vegetation in these wetland areas includes buttonbush (*Cephalanthus occidentalis*), hawthorn (*Crataegus crus-galli*), deciduous holly (*Ilex decidua*), big bluestem (*Andropogon gerardii*), and soft rush (*Juncus effusus*). Young hardwoods common to this habitat may include black willow (*Salix nigra*), cottonwood (*Populus deltoides*), oaks (*Quercus* spp.), sandbar willow (*Salix exigua*), and sycamore (*Plantanus occidentalis*) (Oklahoma State University, 1998).

Bottomland Hardwood Forests

Bottomland hardwood forests are an extensive component of the Arkansas River riparian corridor, occurring largely within the floodplain of the river and adjacent to small tributaries. This forest habitat is regarded as extremely important because of the wildlife diversity it supports, high soil productivity, and hydrologic regimes. The forested bottomland in the study area consists of large- to medium-sized trees with a moderate understory. The overstory is dominated by cottonwood, sycamore, green ash (*Fraxinus pennsylvanica*), pecan (*Carya illinoensis*), box elder (*Acer negundo*), river birch (*Betula nigra*), black willow, silver maple (*Acer saccharinum*), black walnut (*Juglans nigra*), sugarberry (*Celtis laevigata*), water oak (*Quercus nigra*), overcup oak (*Quercus lyrata*), and willow oak (*Quercus phellos*). The bottomland understory is largely dominated by swamp privet (*Forestiera acuminata*), greenbriar (*Smilax* spp.), poison ivy (*Toxicodendron radicans*), violets (*Viola* spp.), and trumpet-creeper (*Campsis radicans*), along with young hardwood species (Oklahoma State University, 1998).

Riverine Sand Bars

Riverine sand bars dominate the river channel habitats during lower flow conditions. Riverine sand bar habitat structure and function are influenced directly by the hydrology of the Arkansas River. The riverine sand bar size, location, and stability are dependent on the controlled flow conditions of the Arkansas River through releases from the Keystone Dam upstream. During typical river-stage conditions (less than 12,000 cfs), the sand bars within the study area are dry and not inundated by surface water. During higher river stages, the sand bars are partially or fully inundated by surface water.

Riverine sand bar habitats within the study area are mostly unvegetated. By their nature, the sand bars are subject to cycles of scour and deposition. At slightly higher elevations nearer the river banks, the riverine sand bars are less frequently inundated by surface waters and become more vegetated. Where established along the banks, vegetation is typically herbaceous shrubs, or smaller trees such as black willow, sandbar willow, buttonbush, sycamore, and big bluestem. The invasive species Johnson grass (*Sorghum halepense*) is readily abundant within these habitats because it quickly colonizes areas disturbed by the shifting river sands. The highest elevations within the riverine sand bar habitats include the bank slopes of the Arkansas River. The majority of the riverbanks are steep to near vertically sloped with areas that are sloughing and/or eroding or are reinforced with riprap or concrete rubble.

The primary ecological functions that the riverine sand bars provide within the study area include floodwater attenuation during high-river stage events; sediment source for downstream habitats; habitat for listed species; and foraging habitat for wading birds, waterfowl, and terrestrial species.

Riverine sand bars within the study area have the potential to provide habitat for three federally listed species: the interior least tern (*Sterna antillarum*), the piping plover (*Charadrius melodus*), and the red knot (*Calidris canutus rufus*). The bald eagle (*Haliaeetus leucocephalus*), which was recently removed from federal listing, is also known to use habitats within the study area.

Open Water

Open water habitats within the mainstem of the ARC include riffle and pool run complexes, isolated pools, and a reservoir pool (Zink Lake). The riffle and pool run complexes are features typical of a prairie river system. They are braided and relatively nonpermanent features that become repositioned within the river channel during higher flow conditions. Substrates are typically sand or bedrock with little gravel or cobble. At locations where the river channel substrate is bedrock, the riffle runs are more permanent features.

Isolated pools of open water are less common throughout the study area. They include features created through natural processes such as oxbows, which are relics of meandering riffle and pool run complexes and those created through anthropogenic activities such as sand mining and at locations below stormwater outfalls entering the river. Many of these isolated pools are temporary, as braided riffle and pool run complexes meander under various river flow conditions and as riverine sand bars shift and are redeposited. The more permanent pools are found adjacent to the ARC banks and are connected to other surface waters under higher river stages. Many of these have emergent

and shrub wetland vegetation present, creating a littoral fringe that helps stabilize the substrate. Water quality within the more permanent pools is typically reduced because of stormwater inputs and little to no mixing with other surface waters. Substrates within these pools include sand and organic sediments.

Zink Dam is located near 31st Street and Riverside Drive. The dam was constructed in 1983 creating a permanent reservoir pool known as Zink Lake. The backwater, or impounded area, extends upstream approximately 2 miles and encompasses approximately 298 acres when the dam is at the control elevation of 617 feet. The existing dam structure limits fish and fish egg passage, and reduces sediment transport downstream by trapping sediments in the reservoir.

The open water habitats within the study area provide foraging areas for wading and shorebirds, including the listed species least tern, piping plover, and red knot. They provide resting areas for waterfowl. The deeper and more permanent open water features provide habitat for fish communities. Wildlife species typically associated with these habitats are described in the Biological Resources section of this Report.

Streams

Stream habitats within the study area include named tributaries of the Arkansas River. Stream channels identified for potential restoration activities include the confluence of the perennial streams, Prattville Creek and Cherry Creek, along with slack water side channels of the Arkansas River along the left bank, upstream of Interstate 44 (I-44). These creeks drain rural watersheds within their upper segments and primarily urban watersheds in lower segments near their confluence with the Arkansas River. The lower segments of these creeks have been altered for flood control over the years, which typically include concrete-lined beds and banks and, in some instances, the relocation of stream channels. In unaltered segments of the stream channels, substrates are typically sand, gravel, and some cobble. Riparian buffers vary from intact, reduced, and removed depending on the proximity of the stream channel to development or agricultural areas. Many of the stream banks are unstable and exhibit moderate to severe erosion, primarily from a lack of vegetated banks/buffers, and flashy hydroperiods from increased runoff caused by watershed development. Of these streams, a segment of Polecat Creek is listed by the State of Oklahoma as impaired for pathogens (ODEQ, 2015). None of the named streams provide habitat for protected species. Some listed species, such as least terns, piping plovers, and red knots, may forage along the sand bars and more permanent pools at the mouth of the streams at their confluence with the Arkansas River; however, use of the stream habitat farther upstream into the urbanized watershed is unlikely.

4.2 Protected Species and Status within the Study Area

This section provides an assessment of the existing biological resources within the 42-mile ARC study area to address the potential effects of implementing the two alternatives. The federally protected species potentially present in the study area are listed in Table 1.

Table 1. Potentially Occurring Federally Protected Species within the Study Area

Name	Scientific Name	Federal Protection Status
Birds		
Interior Least Tern	<i>Sternula antillarum athalassos</i>	Endangered
Piping plover	<i>Charadrius melodus</i>	Threatened
Red knot	<i>Calidris canutus rufa</i>	Threatened
Insects		
American burying beetle	<i>Nicrophorus americanus</i>	Endangered
Mammals		
Northern long-eared bat	<i>Myotis septentrionalis</i>	Threatened

The following section provides a description of these species and their status within the study area.

Least Tern

The interior population of Least Tern (Interior Least Tern) is one of three subspecies of least tern, which is the smallest of the species in the tern family (*Sternidae*). The three subspecies of least tern are identical in appearance, morphology, habitat preferences, vocalization, and behavior and are distinguished only by their breeding ranges. The least tern is distinguished by being localized in the interior of the U.S. where it breeds along major tributaries in the Mississippi River basin.

USFWS (1985a) lists the Interior least tern population as federally endangered. As of May 2015, critical habitat has not been designated for Interior least tern (USFWS, 2015a). Tulsa County is located within the probable migratory path for least tern and provides stopover habitat. Since 2005, the USACE, Tulsa District, has annually monitored least terns in the Arkansas, Canadian, and Red Rivers in accordance with the USFWS 2005 Biological Opinion on the effects of USACE multipurpose projects (USFWS, 2005). Least tern monitoring by the USACE and USFWS is accomplished by conducting onsite surveys during the summer nesting season (June through August). There are documented occurrences, including breeding and nesting activities, of the least tern in Tulsa County, Oklahoma. Maps 1-9 show the locations where least terns were observed within the study area during the 2005-2014 monitoring period in relation to nearby Arkansas River Miles (ARMs) (USACE, 2015). There are no results in 2007 and 2015 because of the high flows during those years preventing a survey. The location of nesting colonies varies slightly depending on the flow conditions. Table 2 provides a summary of the least tern survey results for the past 5 years (2010-2014).

Table 2. Interior Least Tern Survey Results 2010-2014

Survey Year	Adults	Fledglings
2010	255	68
2011	356	235
2012	307	194
2013	216	100
2014	557	211
5-year average	338.2	161.6

High-river flows from rainfall can wash away nests or inundate colonies, causing the population results to vary annually. Other factors that impact populations include human disturbance, geese disturbance, and predators. Historically there are approximately 30 colony sites between ARMs 530 and 462. No nesting colonies have been detected in the footprint, or upstream, of the proposed pool structure since 2005 (Appendix A, Map 1). Colony sites vary in island density and size. Large islands may have nesting activity in one area or scattered over a large area. Colonies in areas of several smaller islands, which are typical of a braided river system, may have nesting occur on the different islands in close proximity, or scattered farther downstream. Although the islands may change in size, elevation, and even location, terns appear to be using the same general areas each year, particularly the downstream reaches of the study area.

Least terns typically arrive in the study area around May 15 and leave by August 22 (Lott, 2009). The least tern breeding season is approximately 100 days. They nest in colonies on barren to sparsely vegetated sand and gravel bars within braided streams and rivers, as well as on manmade structures (such as inland beaches, wastewater treatment plants, and gravel mines). They lay two to three eggs in shallow nests, guard and care for their chicks, and hover over and dive into shallow flowing or standing water to feed on small fish (USFWS, 1990). Additionally, least terns tend to forage no farther than 2 miles from their nest sites, although some may fly up to 4 miles to fish (USFWS, 1990). Peak nesting activity tends to occur in late June and early July (Lott, 2006). Least tern adults and fledglings depart the study area by September for wintering grounds, flying south into Central and South America.

Piping Plover

The piping plover is a migratory shorebird listed as endangered in the watershed of the Great Lakes and threatened in the remainder of its range (the Northern Great Plains, Atlantic coast, Gulf coast, the Bahamas, and the West Indies) (USFWS, 1985b). USFWS (2016a) identifies Tulsa County as “...situated within the probable migratory pathway between breeding and winter habitats [of the Northern Great Plains population], and contain[ing] sites that could provide stopover habitat during migration.” The Northern Great Plains population of piping plover spends up to 10 months a year on its wintering ground along the Gulf coast and arrives on prairie breeding grounds in early May. During migration periods, they use large rivers, reservoir beaches, mudflats, and alkali flats (Haig, 1986; Schwalbach, 1988). They feed on aquatic and terrestrial invertebrates. The sandbars and bare gravel islands along the Arkansas River within the study area could provide suitable habitat during the plovers’ spring and fall migrations (USFWS, 2011). Critical habitat for the

piping plover has been designated, but Oklahoma is not included in the critical habitat designation (USFWS, 2015b). The piping plover, if it occurred in the study area, would be considered a migrant through the area.

Red Knot

The red knot is a migratory shorebird listed as threatened wherever it is found (USFWS, 2016a). Tulsa County is listed as a location where the red knot is “known or believed to occur” and is located within the probable migratory path, between breeding in the Arctic tundra and winter habitats in the southern U.S., Central, and South America (USFWS, 2015c). Red knots forage along sandy beaches and mud flats; therefore, there is the potential for this species to use the study area for foraging. The sandbars and bare gravel islands along the Arkansas River within the study area could provide suitable habitat during the red knot’s spring and fall migrations. No critical habitat for the red knot has been designated (USFWS, 2015c).

American Burying Beetle

The American burying beetle (ABB) is a member of the family Silphidae (carrion, or burying beetles) and is the largest species of *Nicrophorus* in North America. USFWS (1989) lists the American burying beetle as federally endangered. The historical range of the American burying beetle once included much of eastern temperate North America. Existing populations of this species include eastern Oklahoma and the study area. The presence of the species has been documented in Tulsa County within the last 15 years (USFWS, 2010). In 2007, a survey for American burying beetle was conducted over three nights, in representative habitats along the Arkansas River corridor, from Keystone Lake to downstream of the City of Bixby (Eagle Environmental Consulting, Inc., 2007). The survey included five baited pit-fall trap lines, with trapping methods performed according to the *Survey Methods for the American Burying Beetle in Oklahoma and Arkansas* (Creighton et al., 1993). Four individual American burying beetles were documented, with each occurring east of the river near the City of Bixby. As of 2016, critical habitat has not been designated for the American burying beetle (USFWS, 2016b).

The habitat in the study area includes instream aquatic habitat and riparian streambanks. The riparian streambanks occurring within the study area are potentially suitable habitat for American burying beetle. The American burying beetle is known to inhabit level areas in grasslands, grazed pastures, bottomland forest, open woodlands, and riparian areas. Wetlands with standing water or saturated soils and vegetation typical of hydric soils and wetland hydrology are listed by the USFWS (2015d) as unfavorable habitats. American burying beetles are habitat generalists; however, it is thought that undisturbed habitat and the availability of carrion is the most likely influence on species distribution (USFWS, 1991).

Northern Long-eared Bat

The USFWS lists the Northern long-eared bat as threatened wherever it is found (USFWS, 2016c). It was federally listed in 2015 following studies that revealed a decline in populations from the spread of white nose syndrome. The Northern long-eared bat is found across much of the eastern and north central U.S., occurring in 37 states. The impact from the spread of white nose syndrome has been greatest in populations occurring in the northeastern U.S. where it is estimated that approximately 99 percent of the population has been affected. Currently, white nose syndrome is known to occur in 25 of the 37 states

where Northern long-eared bats occur and is expected to spread to the remaining states (USFWS 2016c). The USFWS lists Tulsa County as a location where Northern long-eared bats occur; however, no specific occurrence of the bats or hibernacula are provided (USFWS, 2016a). No occurrences of white nose syndrome have been observed within Tulsa County; however, Tulsa County is listed as a county within 150 miles of a county with a known infected hibernacula (Delaware County, Oklahoma) (USFWS 2016d).

Most Northern long-eared bats seasonally migrate between winter hibernacula and summer maternity or bachelor colonies. Roosting may take place in tree bark, tree cavities, caves, mines, and barns. Mating takes place prior to hibernation, and delayed implantation of the embryo occurs in spring/summer. Each female gives birth to a single offspring during late May to late July (USFWS, 2016c).

Northern long-eared bats forage along forested hillsides and ridges near roosting and hibernating caves. They emerge at dusk and feed on various insect species such as moths, flies, leafhoppers, caddisflies, and beetles from vegetation and water surfaces (USFWS, 2016c).

Federal Candidate Species

No federal listed candidate species occur within the study area (USFWS, 2017).

Critical Habitats

No Critical habitats for protected species have been designated within the study area (USFWS, 2017).

5.0 Endangered Species Act

The ESA of 1973 was promulgated to protect and recover imperiled species and the ecosystems upon which they inhabit. The USFWS administers the Act and has primary responsibility for terrestrial and freshwater organisms. Under the ESA, species may be listed as either endangered or threatened. "Endangered" means a species is in danger of extinction throughout all or a significant portion of its range. "Threatened" means a species is likely to become endangered within the foreseeable future.

The ESA directs all Federal agencies to work to conserve endangered and threatened species and to use their authorities to further the purposes of the Act. Section 7 of the Act, called "Interagency Cooperation," is the mechanism by which Federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species. In the event that a Federal agency determines that its action "may affect" a listed threatened or endangered species or designated critical habitat, the agency is required to consult with the USFWS regarding the degree of impact and measures available to avoid or minimize the adverse effects.

6.0 USFWS Project Review

The USFWS in Oklahoma utilizes an online "Project Review" process to satisfy informal Section 7 requirements and project approval once it has been determined the project is unlikely to affect Endangered and Threatened Species. The project review process consists of seven steps to evaluate listed species within a project area and includes:

6.1 Determination of the Action Area

The action area is defined by federal regulation as all areas to be affected directly or indirectly by the project action and not merely the immediate area involved in the action.

6.2 Delineate the Action Area and Obtain an Official Species List

To delineate the Action Area, the USFWS utilizes their Information, Planning, and Conservation system (IPaC) tool, which is a GIS based application that allows the user to subjectively define a project's Action Area, for this project the Action Area is considered synonymous with the ARC study area. Completion of the IPaC process for the ARC project resulted in an Action Area of 23,797 acres. The Action Area includes the footprints of the constructed features, the maximum extent of the pool storage and associated 1,000 cfs river flow, as well as the entire riparian corridor in the study area, as required by the USFWS (to account for human presence, noise, air quality, etc.). Upon completion of the Action Area determination, an official USFWS species list was generated and is presented in Appendix C.

6.3 Species Conclusion Table

The Species Conclusion Table is used to identify/list species obtained from the official USFWS (Appendix C) list that may be present in the Action Area, to include critical habitats. The USFWS List identified five endangered or threatened species that may occur in the Action Area which include:

- Least Tern (*Sterna antillarum*)
- Piping Plover (*Charadrius melodus*)
- Red Knot (*Calidris canutus rufa*)
- Whooping Crane (*Grus americana*)
- American Burying Beetle (*Nicrophorus americanus*)

The Species Conclusion Table can be found in Appendix C.

6.4 State Coordination

The Oklahoma Department of Wildlife Conservation (ODWC) and the Oklahoma Natural Heritage Inventory (ONHI) were contacted to determine if their databases indicated state or federally listed species presence or known occurrence within Tulsa County, Oklahoma. According to the ODWC database, there are no state-listed species present in Tulsa County. The ONHI reviewed the project area and found several occurrences of Federally protected species (bald eagle, ABB, and the least tern) within or in the vicinity of the project location. These species have been accounted for during the planning process for the proposed project as described in this report. The correspondence letter received by the ONHI is presented in Appendix C.

6.5 Suitable Habitat

USFWS Oklahoma species fact sheets were evaluated, along with informal consultation with USFWS Oklahoma Ecological Services staff, to determine if suitable habitat is available within the Action Area for any of the listed species identified by the official USFWS species list. Suitable habitat is present in the Action Area for the least tern (*Sterna antillarum*). Suitable habitat for the remaining listed species is absent. Results of the

habitat evaluation are provided on the Species Conclusion Table in Section 6. A brief summary, as described by the USFWS, of each listed species is provided below and individual species fact sheets are presented in Appendix D.

Least tern (*Sterna antillarum*) - Endangered

The Least tern is the smallest member of the tern family at about 9 inches long (23 cm) with a wingspan of 20 inches (50 cm). They have a grayish back and wings, and snowy white undersides. Least terns have a forked tail and narrow pointed wings. This species were formerly distributed along the major river systems of the Midwestern United States to include the Red, Rio Grande, Arkansas, Missouri, Ohio, and Mississippi river systems. Currently, they occur as small remnant colonies throughout their former range. In Oklahoma, Least terns nest along most of the larger rivers, as well as at the Salt Plains National Wildlife Refuge near Jet, Oklahoma.

Piping Plover (*Charadrius melodus*) - Threatened

The piping plover is a 5 ½ inch long pale grayish-brown shorebird with a white breast. During the breeding season, it has a black breast band which is sometimes incomplete and a black bar between its eyes. The bill is dull orange with a black tip and the legs and feet are orange. Piping plovers occur in three disjunct populations in North America: Northern Great Plains, Great Lakes, and Atlantic Coast. This species migrates through Oklahoma each spring and fall.

Red Knot (*Calidris canutus rufa*) - Threatened

Red knots are generally identified by their rusty head, neck and belly. The back is mottled gray, black and brown and the tail and wings are pale gray. In the fall, this sandpiper molts and turns pale gray with white flanks. Red knots have dull yellow or olive-green legs and a straight, dark bill. Most knots winter along the Chilean Coast and migrate to the Canadian Arctic breeding grounds by way of the Atlantic Coast. This red knot is known primarily to only fly over Oklahoma. To date, only 40 birds have been reported in the State.

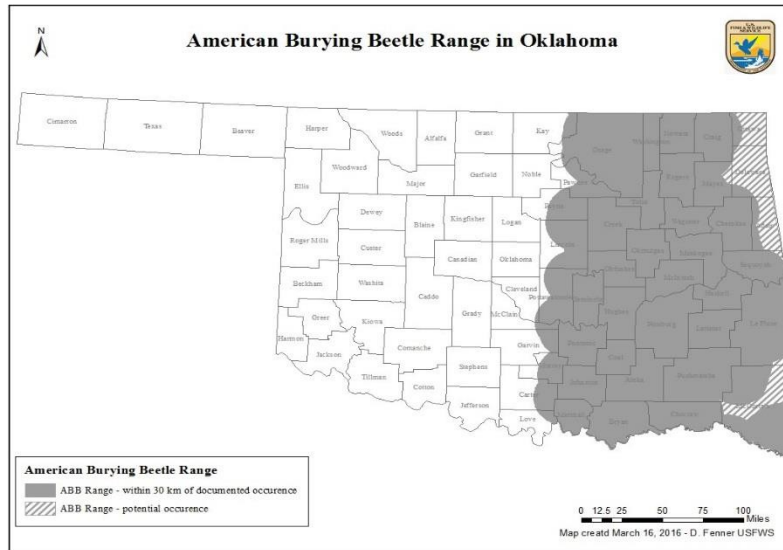
Whooping crane (*Grus americana*) - Endangered

This bird species is a snowy white, long-necked bird with long legs. Its black primary feathers show only during flight. Adults have a red crown and a patch of black feathers below the eye. Young are whitish overall, but have a rusty-colored head and neck. Whooping cranes pass through western Oklahoma each spring and fall during migration. The Salt Plains National Wildlife Refuge, near Jet, Oklahoma, is a known migration stopover area and is designated critical habitat. During migration, whooping cranes sometimes are sighted elsewhere in Oklahoma along rivers, in grain fields, or in shallow wetlands.

American Burying beetle (*Nicrophorus americanus*) - Endangered

The ABB is a large (0.98-1.4 inches long) shiny black beetle, with hardened protective wing covers (elytra) that meet in a straight line down the back. Each elytron has 2 scalloped-shaped orange-red markings. Its most distinguishing feature is the large orange-red marking on the raised portion of the pronotum (shield over the mid-section between head and wings), which is circular, with raised central portion and flattened margins. The ABB has orange-red frons (a mustache-like feature) and a single orange-red mark on the clypeus (face). This mark is triangular

in females and rectangular in males. Its known distribution is Rhode Island, South Dakota, Nebraska, Kansas, Arkansas, Texas, and Oklahoma, with 2 introduced populations in Massachusetts, and Missouri. Suitable habitat for this species includes native grassland, grazed pasture, riparian zone, coniferous forest, mature forest, and oak-hickory forest, as well as on a variety of soil types. The current range of the ABB in Oklahoma is illustrated in the map below (*Source: American Burying Beetle Impact Assessment for Project Reviews, USFWS, 2016*).



6.6 ESA Determination

The final step of the evaluation process was completed by making an ESA Determination for each of the identified species, (see the Species Conclusions Table in Appendix C).

Suitable habitat, including riverine and sandbar islands, is available for the red knot, piping plover, and the whooping crane. The restoration of these habitats by the proposed project would benefit these species. However, because these species rarely occur within the study area during migration seasons, the ESA determination for the project for these three species is “no effect”, as such no additional effort is required.

Suitable habitat may be present for the ABB within fringe riparian habitat along the banks of the Arkansas River in the study area. However, these areas experience reoccurring flooding and are largely fragmented by urbanization and agriculture lands. The proposed measures all occur within the banks of the Arkansas River featuring disturbed, hydric, frequently flooded soils, including the river channel itself and the extent of the 1,000 cfs wetted area. Therefore, because these habitat characteristics are considered uninhabitable for the ABB, the ESA determination for the project is “no effect”, and no additional effort is required.

The USACE concludes the resulting ESA determination for the least tern in the project area is “may affect, not likely to adversely affect”, for the following reasons:

- The proposed pool structure will provide more consistent minimum river flow of 1,000 cfs, which expands and improves available riverine and sandbar habitat used by least

terms while:

- Not increasing flows or river depths associated with other releases from Keystone Dam
- Not inundating areas outside of the existing river channel
- Maintaining riverine conditions up and downstream of the structure
- Providing at least season fish, fish eggs, and sediment transport
 - Detailed design will occur in the next phase of the project where passage and operation will be further refined
- Not removing sandbar habitat in known nesting locations
- Expanding and improving habitat for the least tern's food base
- The proposed rock riffle and wetland plantings will provide refuge and nursery habitat for the least tern's prey base as well as other habitat for other migratory and native species
- The proposed sandbar island creation will provide an additional three acres of sandbar island, at river flows up 20,000 cfs, that would otherwise not be available

Construction activities would occur outside of least tern nesting periods in order to avoid nesting disturbance and increased river flow that typically occurs during spring monsoons.

6.7 Project Review Completion

The ESA determination of "may affect, not likely to adversely affect" for the least tern requires no further action other than continued informal consultation with USFWS to fulfill the Section 7 consultation process under the ESA. This will ensure future project planning and detailed design does not negatively impact protected resources in the ARC, adequate Best Management Practices are in place, and restoration objectives are met.

7.0 Bald and Golden Eagle Protection Act/ Migratory Bird Treaty Act

With the exception of Arizona, the bald eagle is no longer protected under the Endangered Species Act. However, eagles in the United States are protected by the Bald and Golden Eagle Protection Act (BGEPA), in addition to the Migratory Bird Treaty Act (MBTA). The BGEPA prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export or import, of any eagle, alive or dead, including any part, nest, or egg, unless authorized by permit. The MBTA prohibits, among other actions, the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior through a permit or other regulation. A listing of potential migratory birds that may be present in the ARC is provided in the USFWS Official Species List (refer to Appendix C).

Suitable roosting or nesting habitat is available and used by bald eagles in the ARC. In addition, migratory bird nesting is expected to continue within the ARC. The restorative benefits to aquatic, and aquatically connected, habitats would increase overall ecosystem health, benefiting, or at a minimum not negatively impacting bald eagles or migratory birds. In addition, the proposed project entails construction of features within the river channel, minimizing impacts to riparian vegetation supporting migratory bird roosting and nesting activities. As such the planned project is not anticipated to have any adverse effect on bald eagles or other migratory birds. Guidance developed by the USFWS Oklahoma Ecological Services Field Office was reviewed to determine appropriate avoidance and minimization

measures that can be implemented during the construction phases of the project if they are encountered. Review of this document was recommended during the USFWS project review process and is presented as Appendix E for future reference.

8.0 Conclusion

The USFWS Oklahoma online Project Review process was used to determine threatened and endangered listed species that may occur within the project area, as well as to determine if planned project activities will have any adverse effects on these species. Results of the review process indicate the project will not have any effect on the piping plover, red knot, whooping crane, or American burying beetle due to the rare occurrence of the listed bird species in the ARC, and no suitable habitat available for the ABB within the restoration areas. However, suitable habitat is available for the Least Tern and is annually used for nesting and foraging in the ARC. Due to the small footprint of the proposed restoration measures, the least tern is expected to benefit from the increase in foraging and nesting habitat. Their prey base, small riverine fish, are also expected to benefit as the increase in river flow will expand and connect river and floodplain habitat. The ESA determination for the least tern is “may affect, not likely to adversely affect.” Through informal consultation under Section 7 of the Endangered Species Act, USACE will request concurrence with this determination from the USFWS and will include a current IPaC Report and a copy of this Endangered Species Evaluation Report for their review.

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Appendix A – Project Figures and Maps

Figure 1. Arkansas River Corridor Study Area

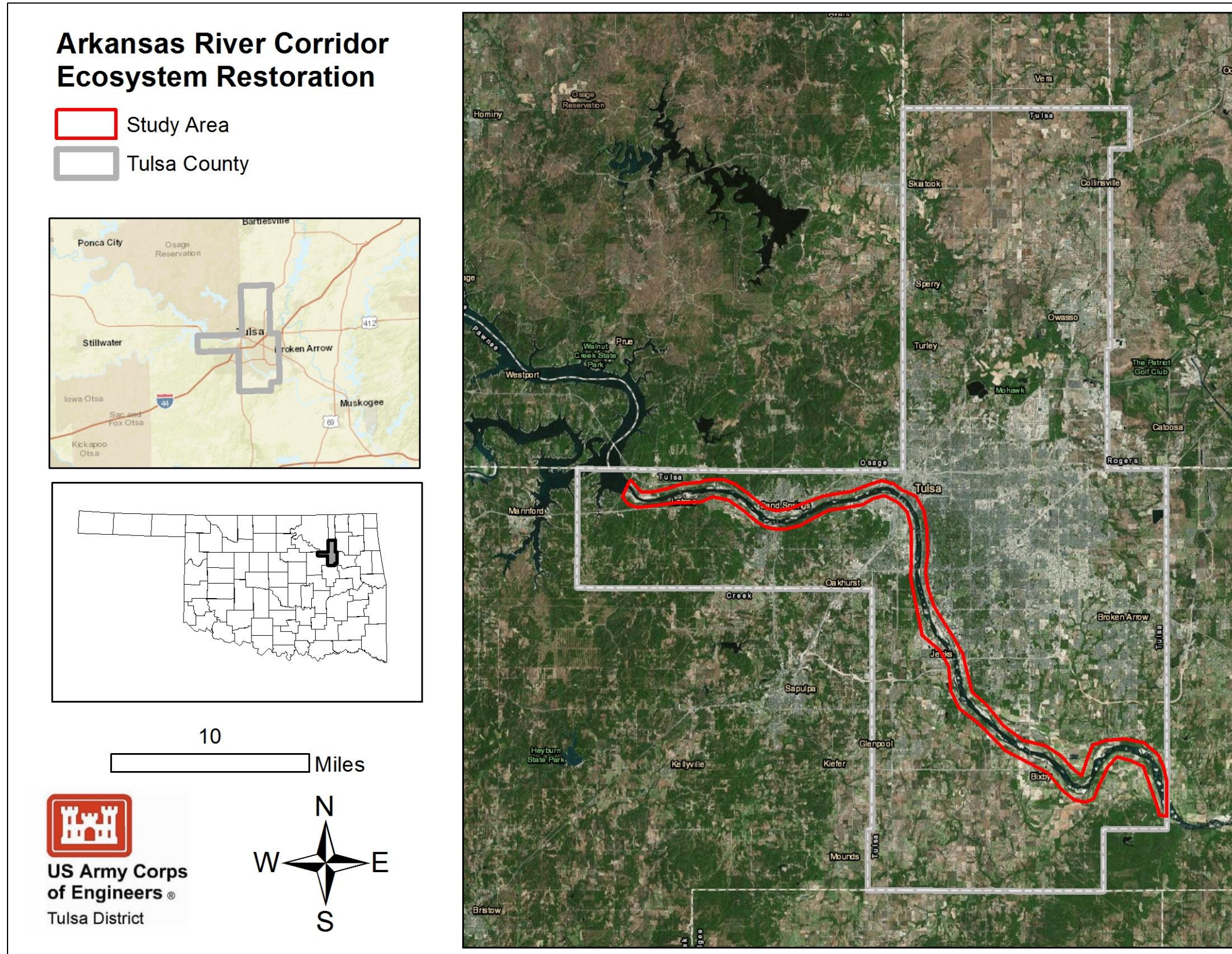


Figure 2. General Locations of Proposed Restoration Measures

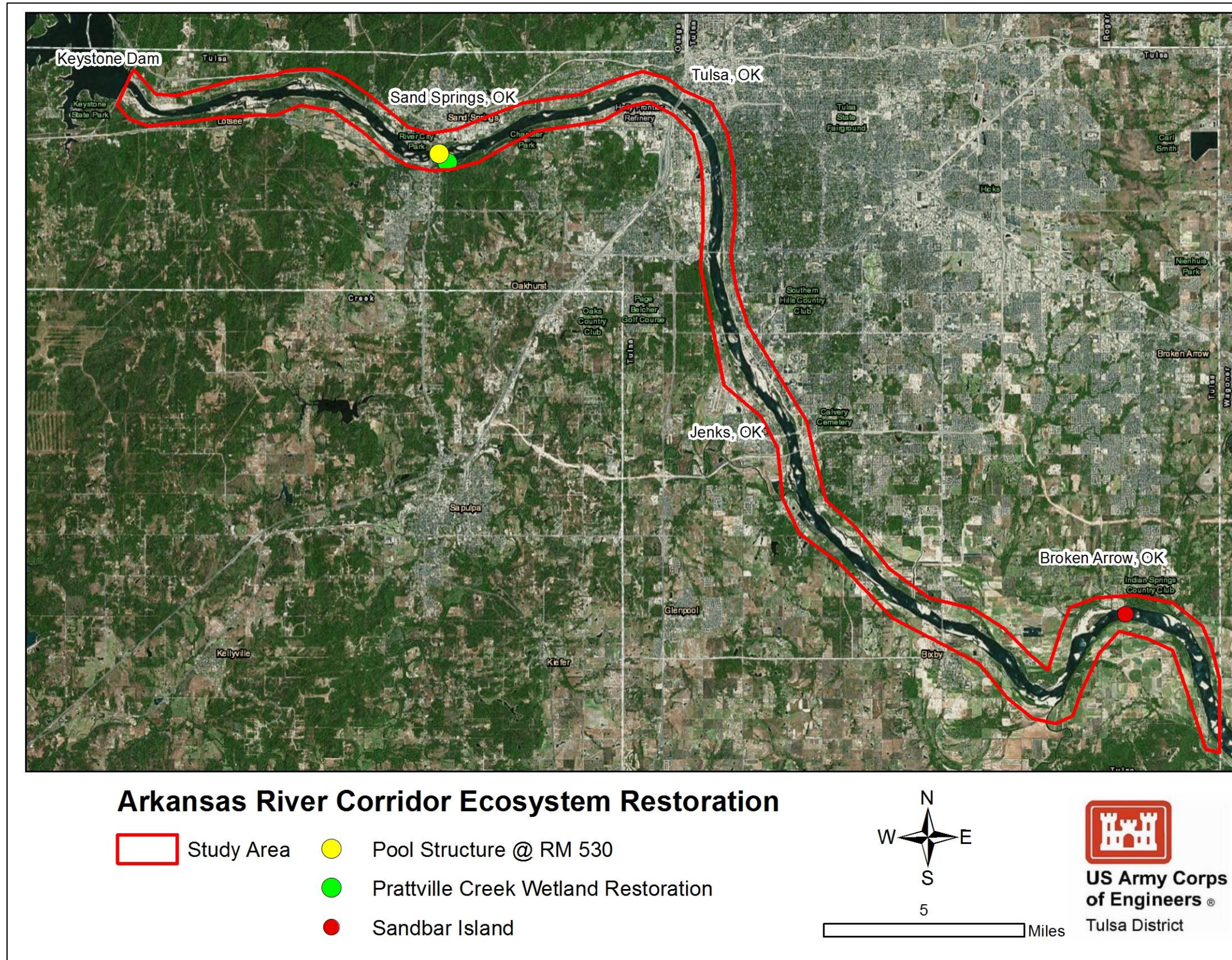


Figure 3. Pool Structure at River Mile 530

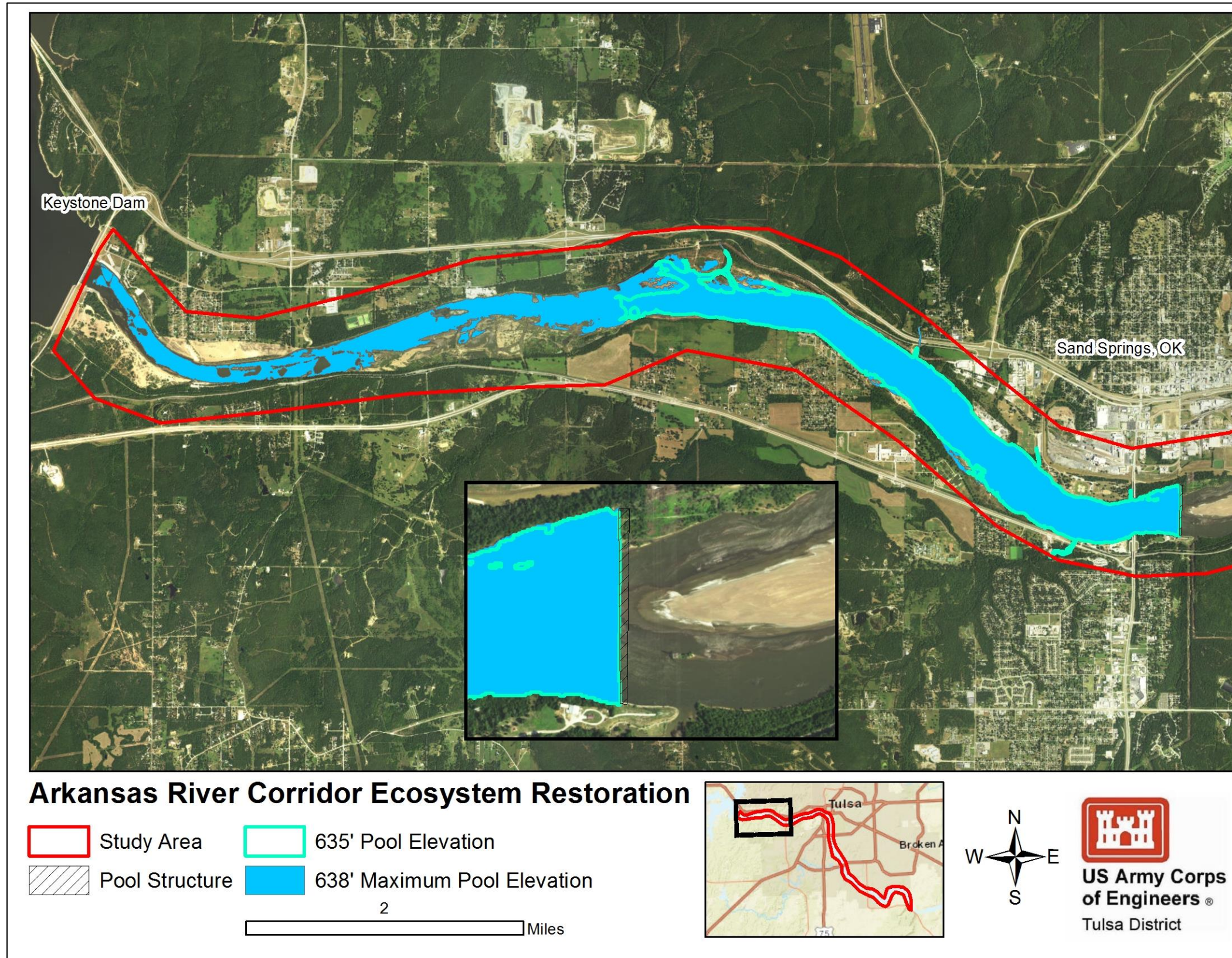


Figure 4. Arkansas River Extent at 100 cfs (Existing Low Flow Conditions)

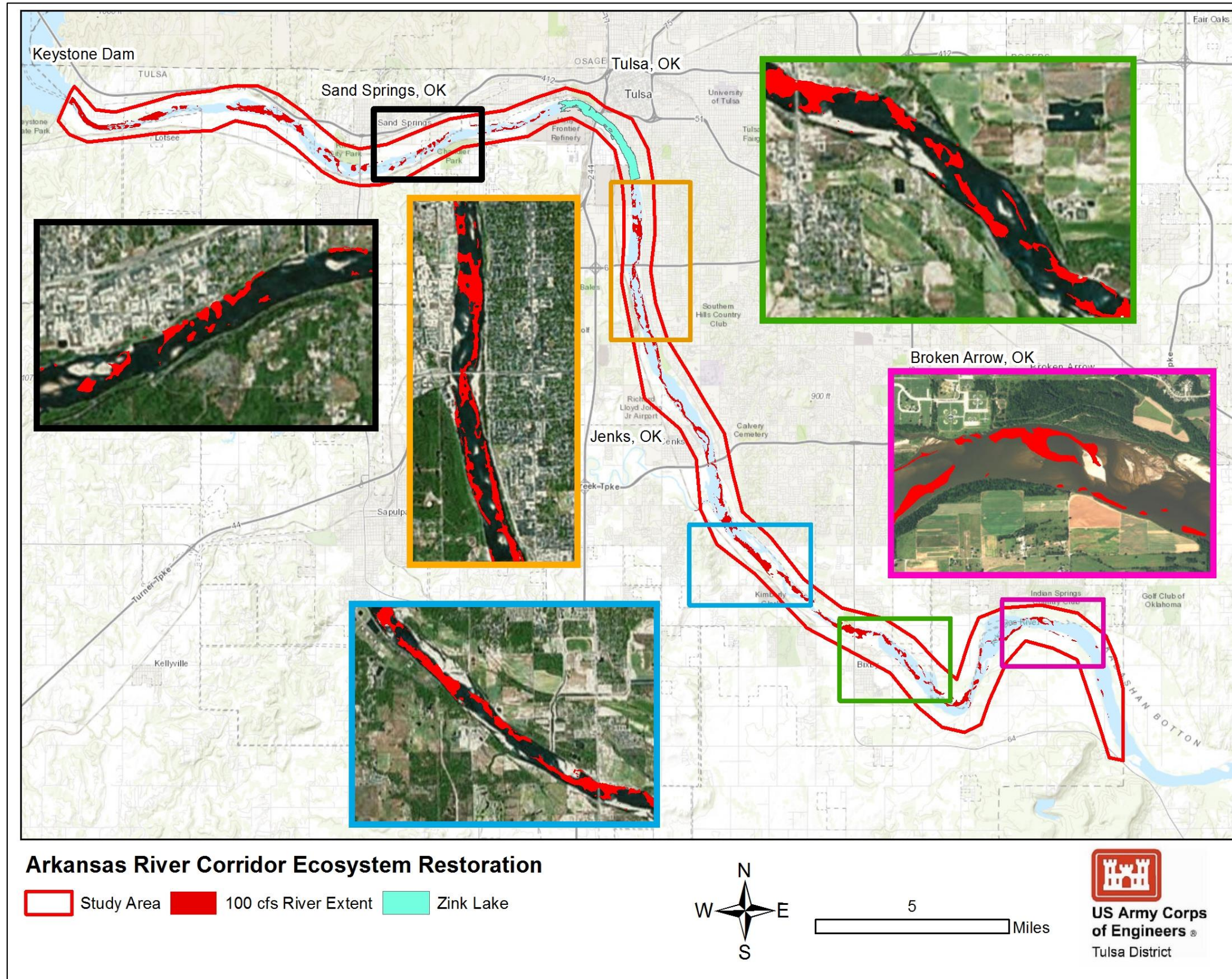


Figure 5. Arkansas River Extent at 1,000 cfs with Pool Structure

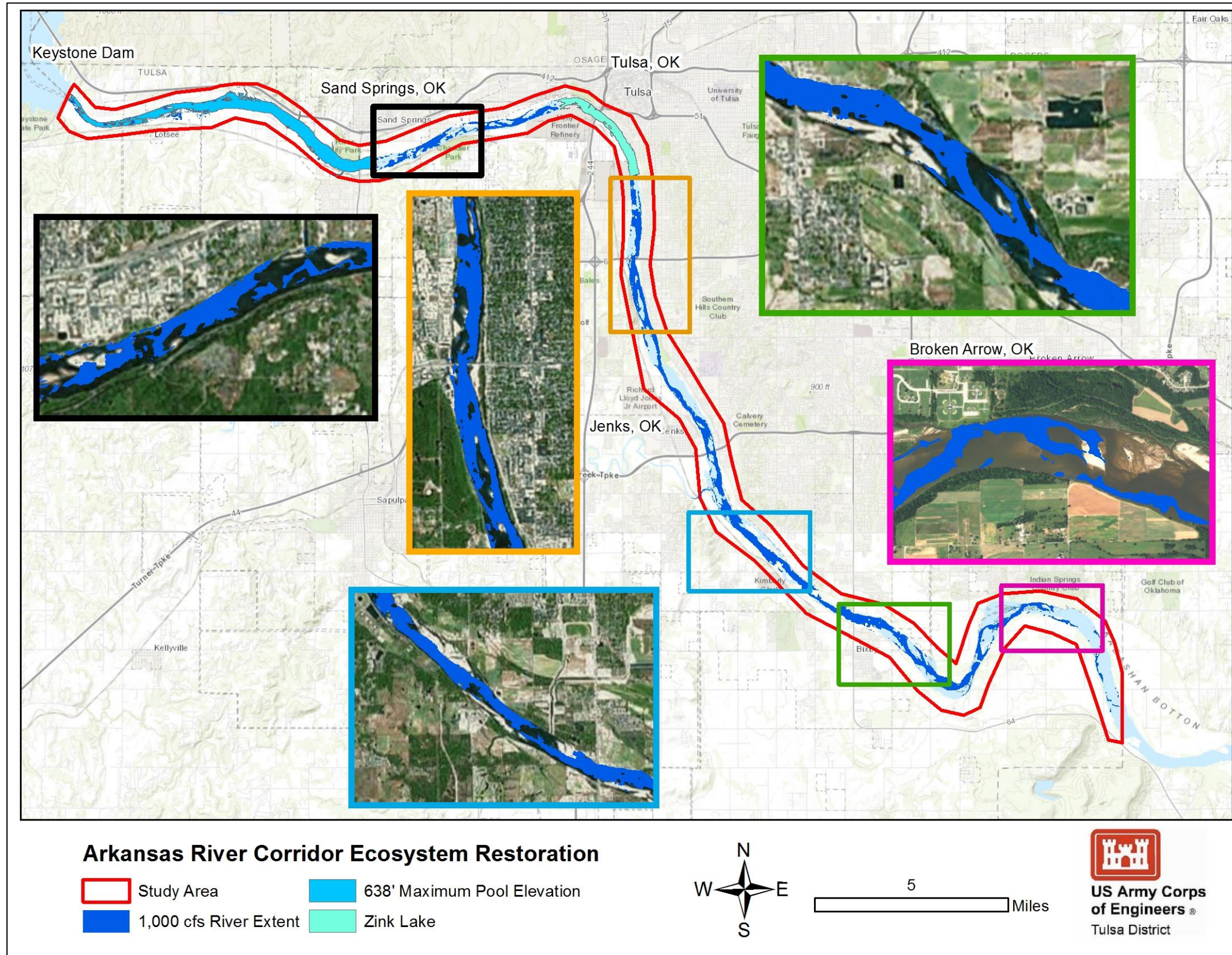


Figure 6. Existing 100 cfs River Extent vs. Pool Structure release of 1,000 cfs River Extent

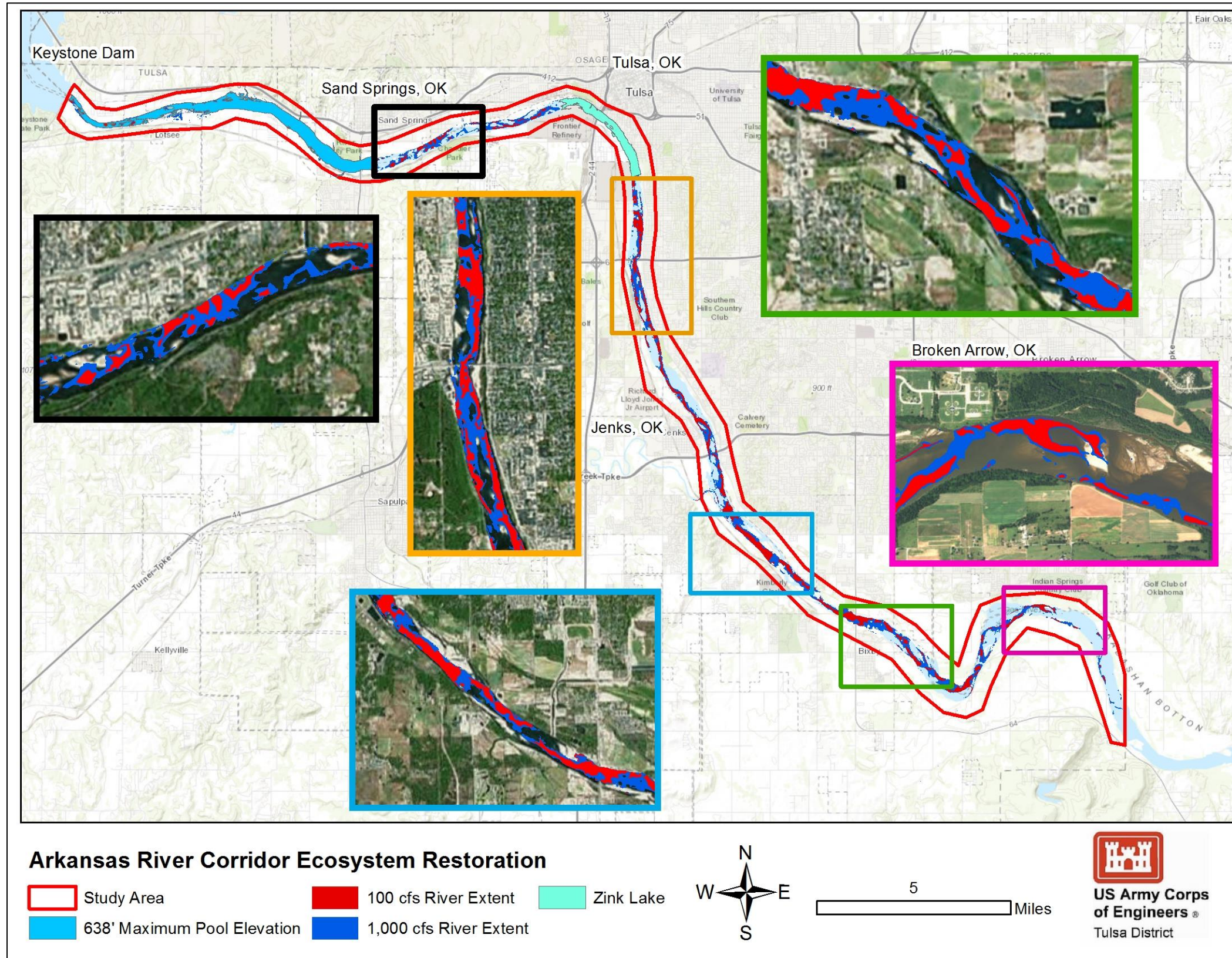


Figure 7. Prattville Creek Wetland Restoration

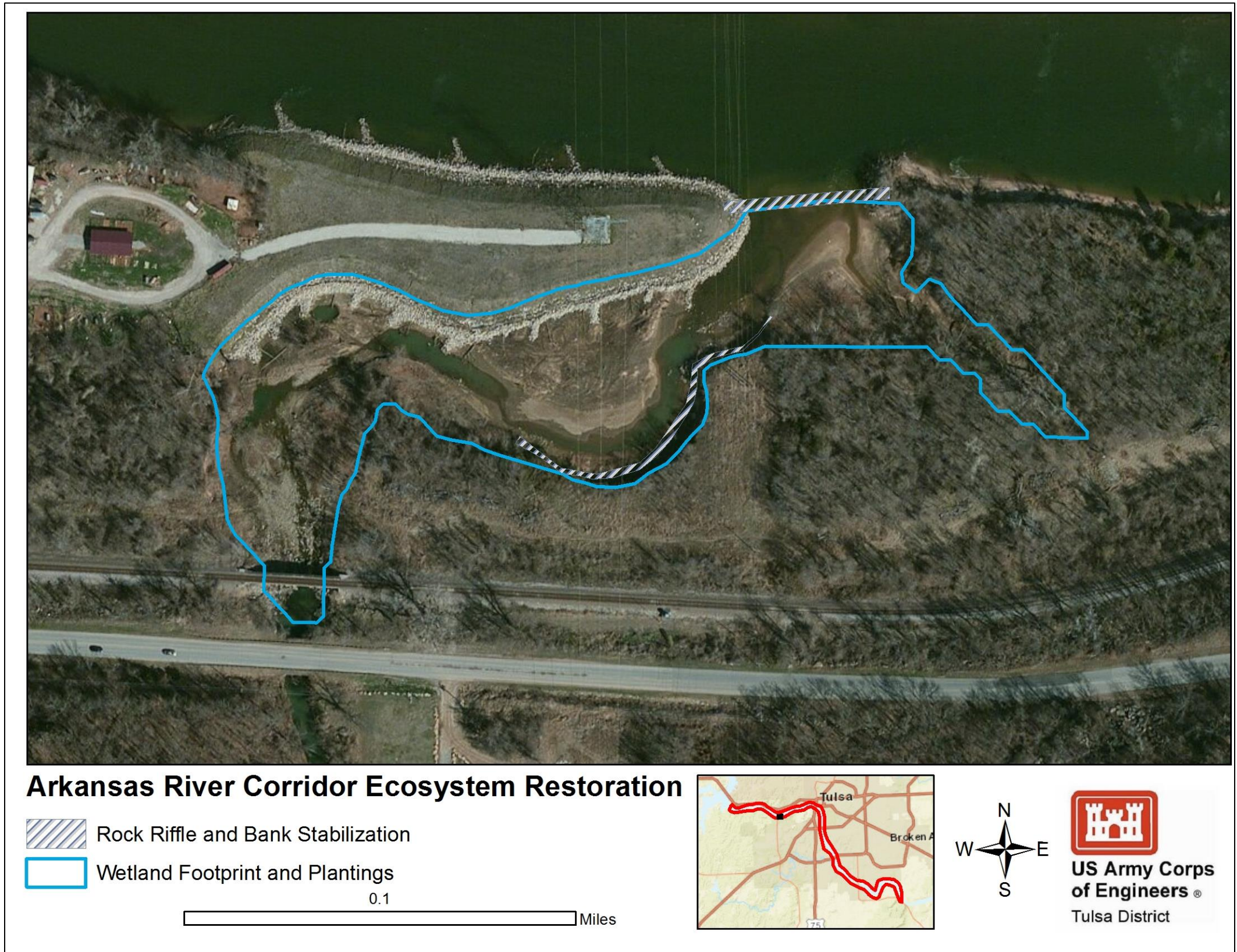


Figure 8. Sandbar Island Creation

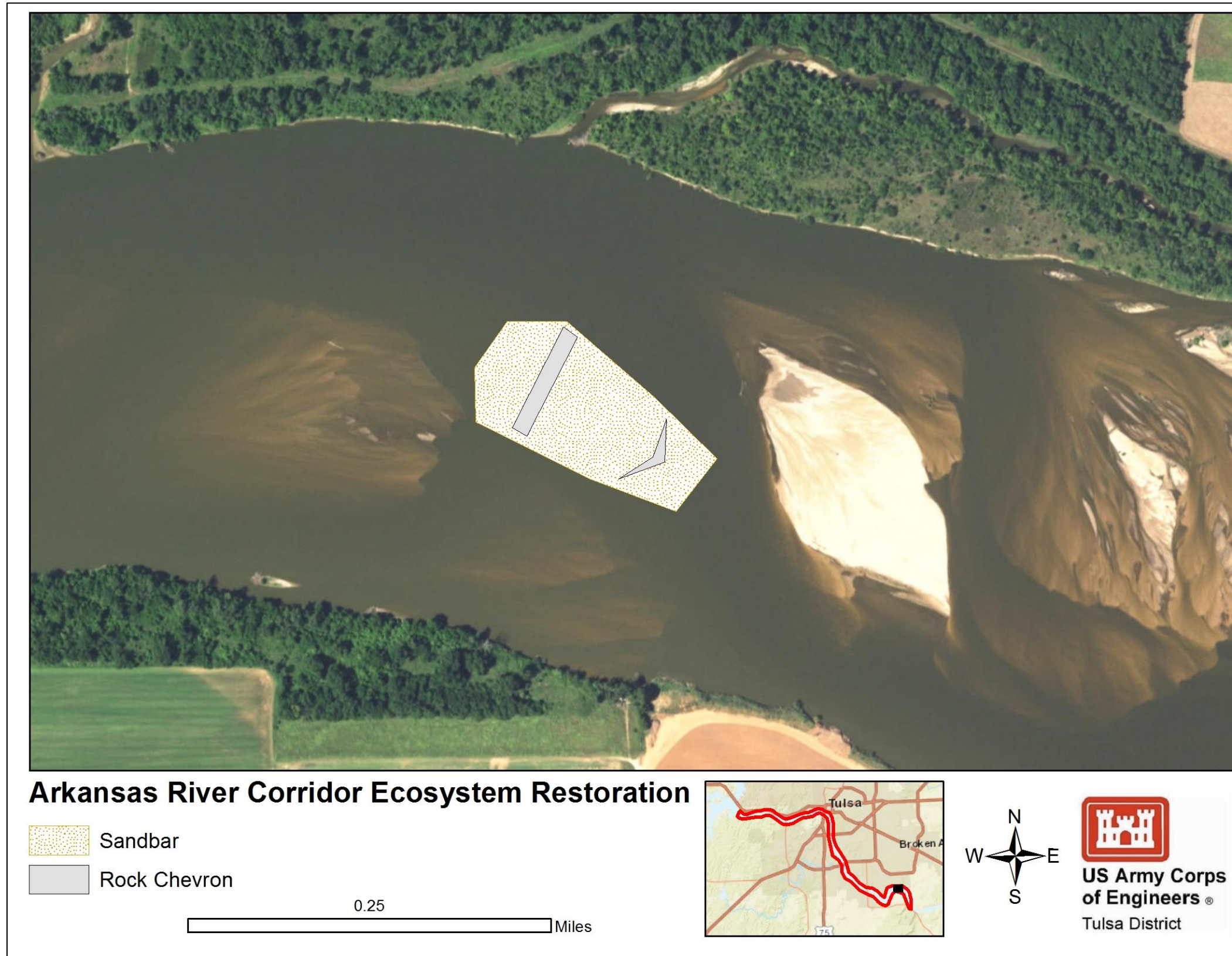
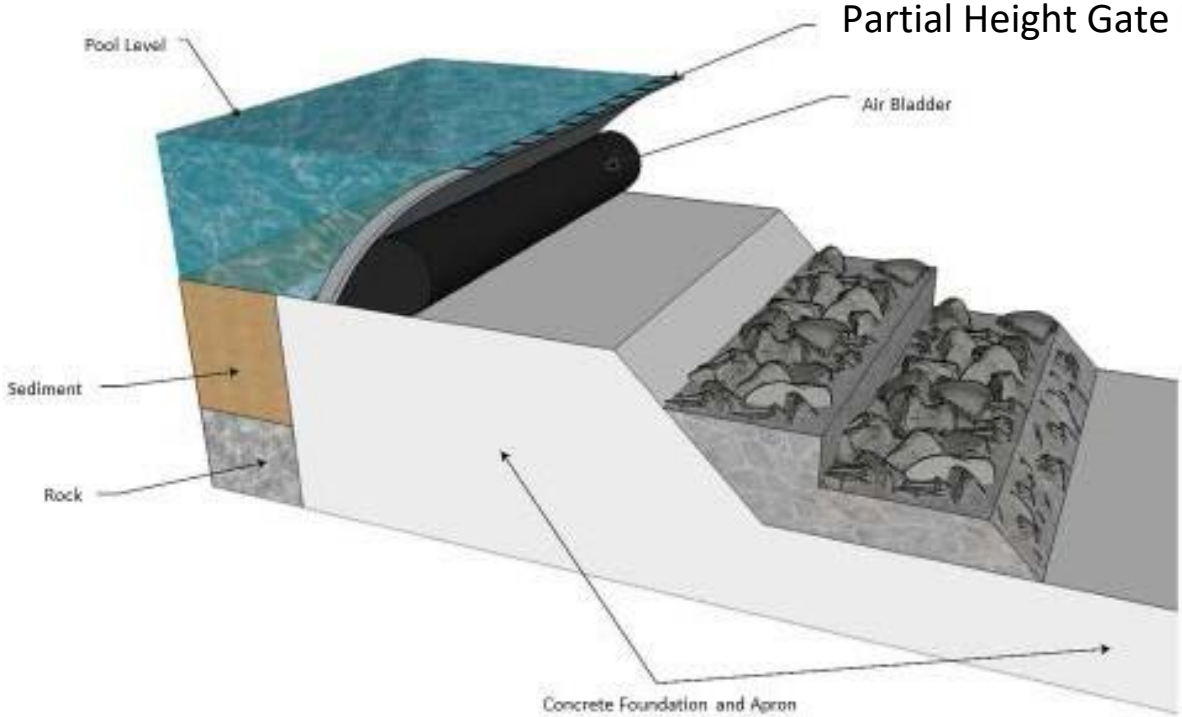


Figure 9. Pool Structure Gate Design Concepts



Final design will ensure partial and full height gate elevations, dimensions, and operation meet restoration objectives without impacting flood risk or Keystone Dam operations.

Full Height Gate laid down during larger release

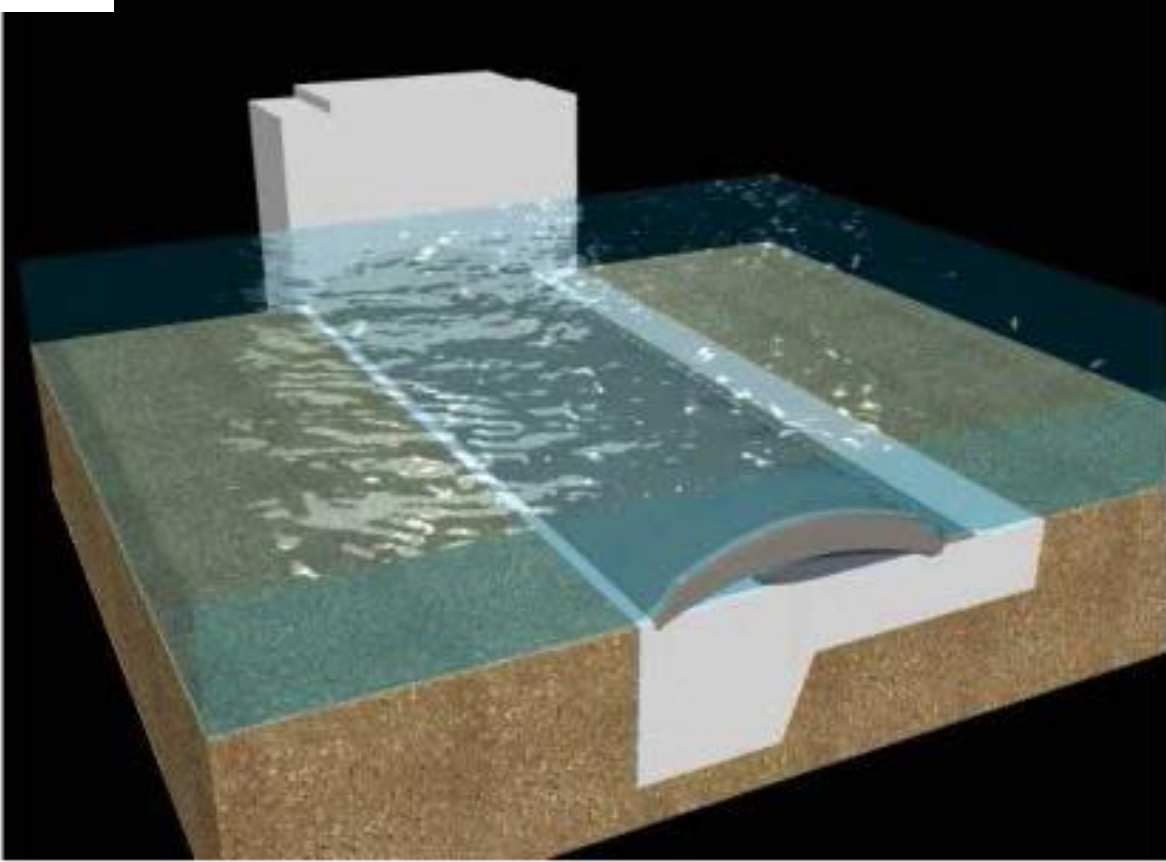
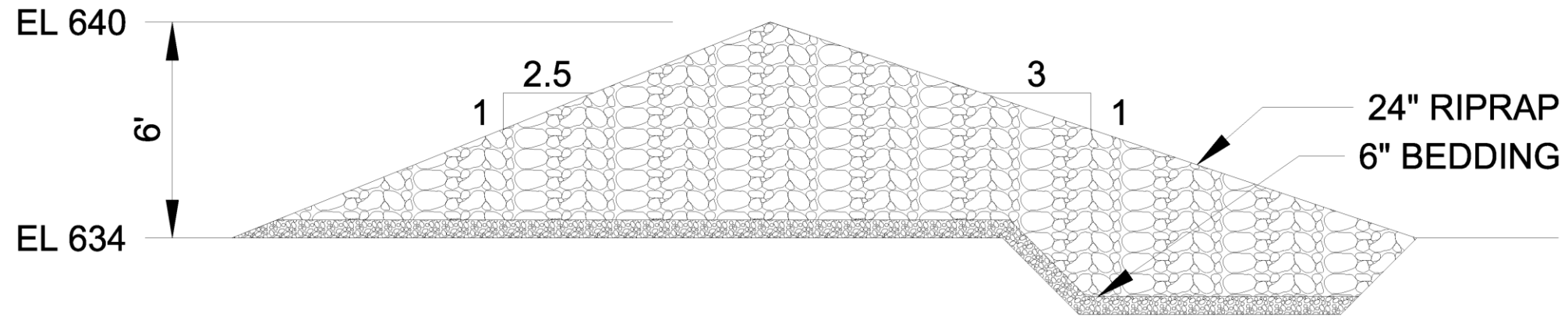
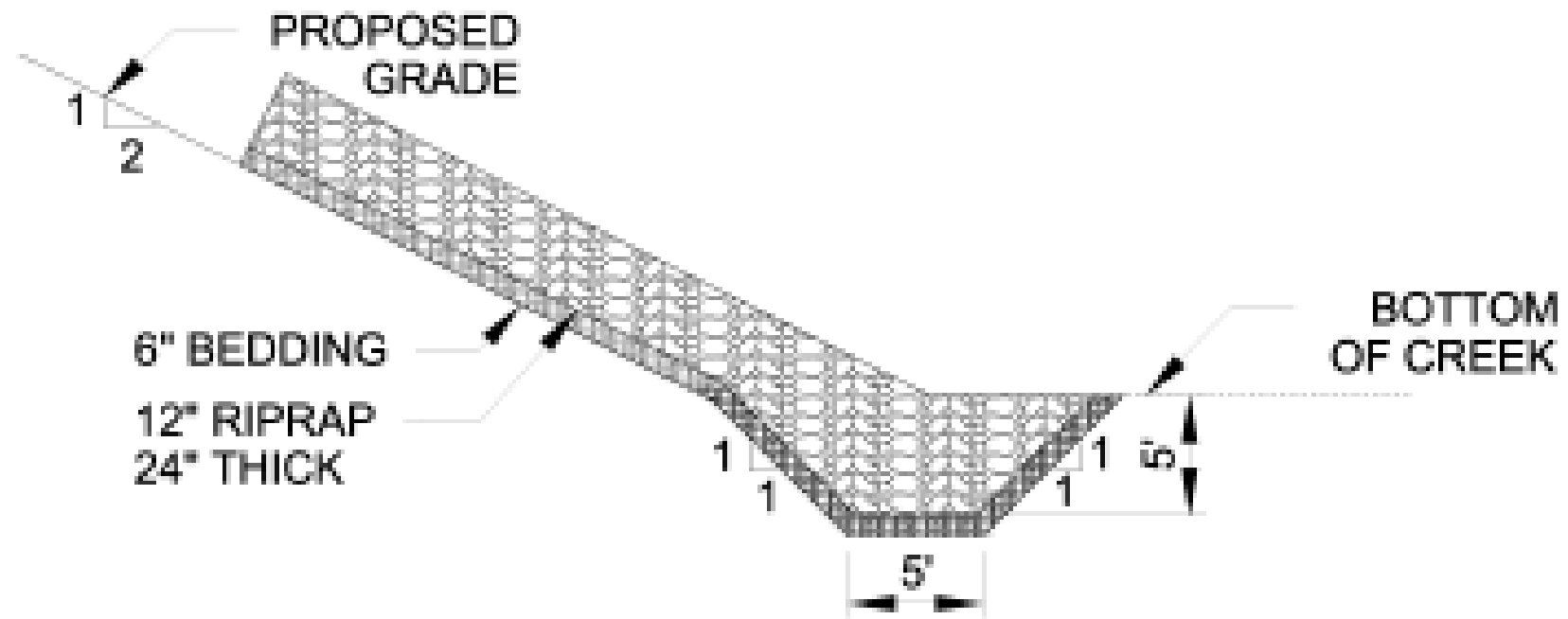


Figure 10. Prattville Creek Restoration Design Concepts

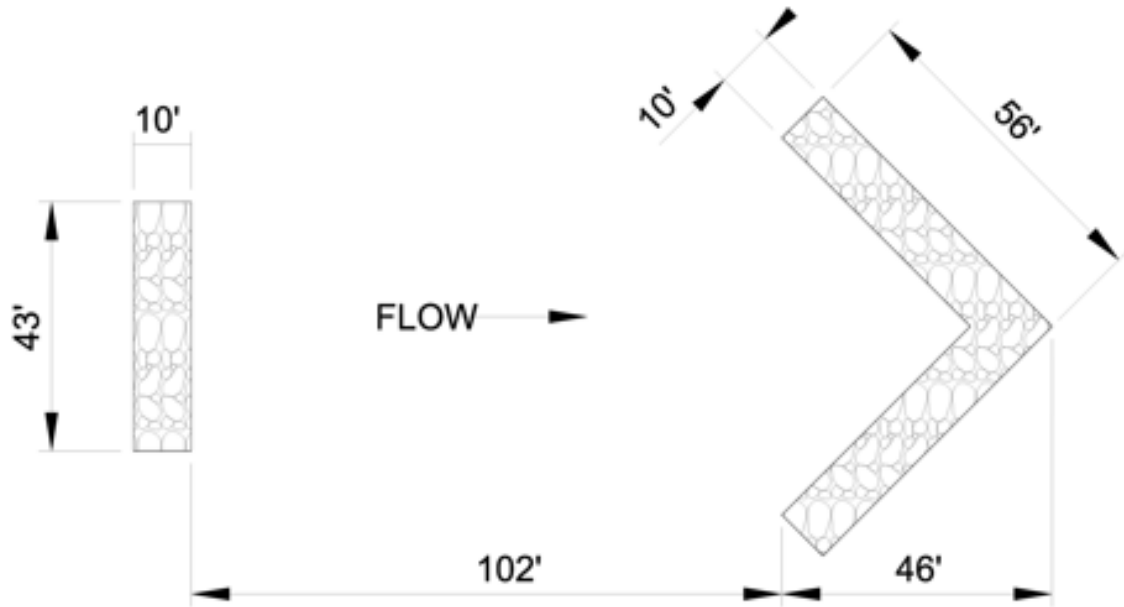


ROCKED RIFFLE CROSS SECTION

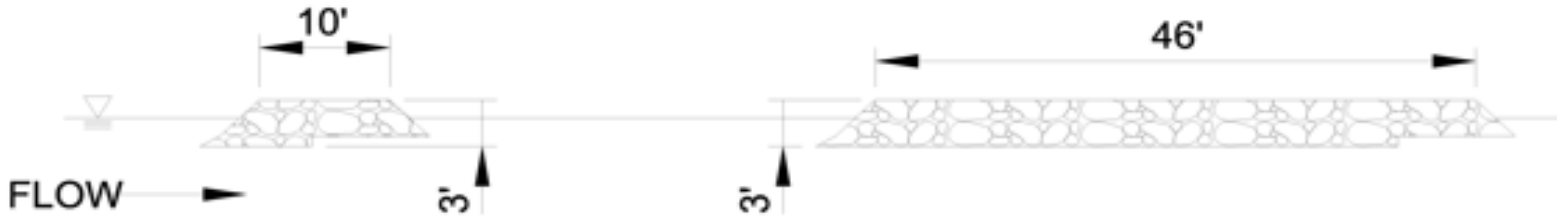


TYPICAL RIPRAP CROSS SECTION

Figure 11. Sandbar Island Design Concepts

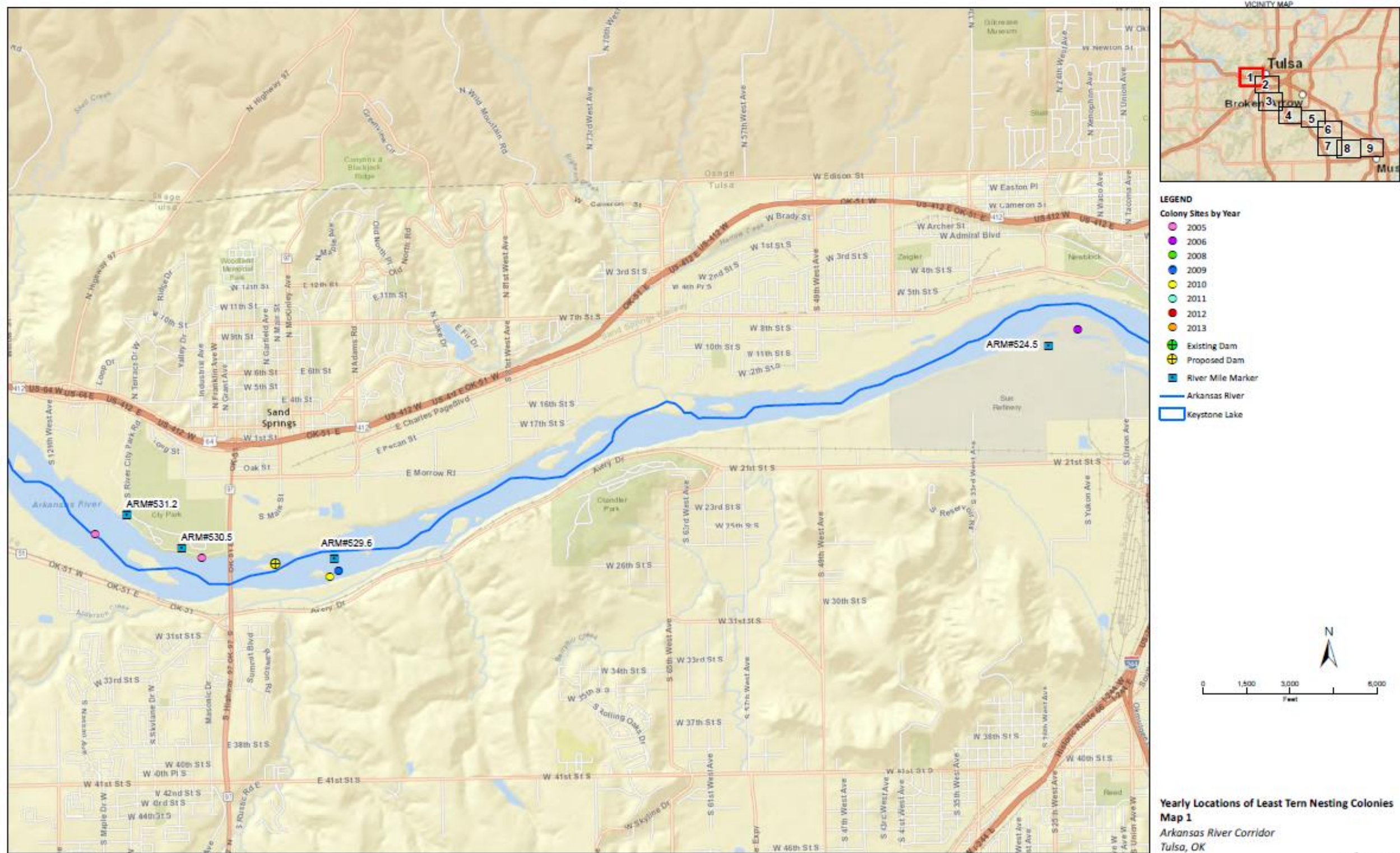


LEAST TERN ISLAND PLAN

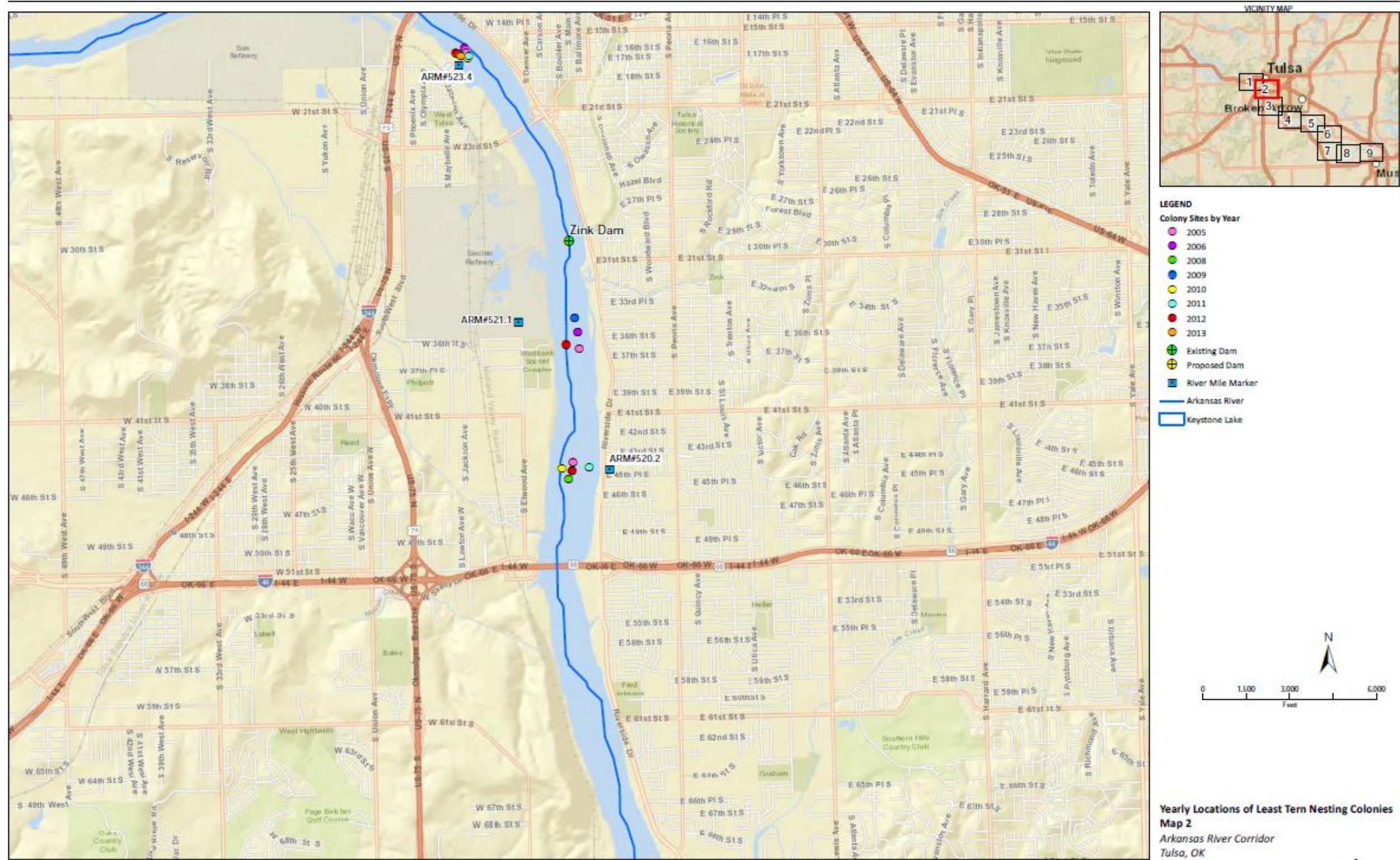


LEAST TERN ISLAND PROFILE  30" DIAM. RIP RAP

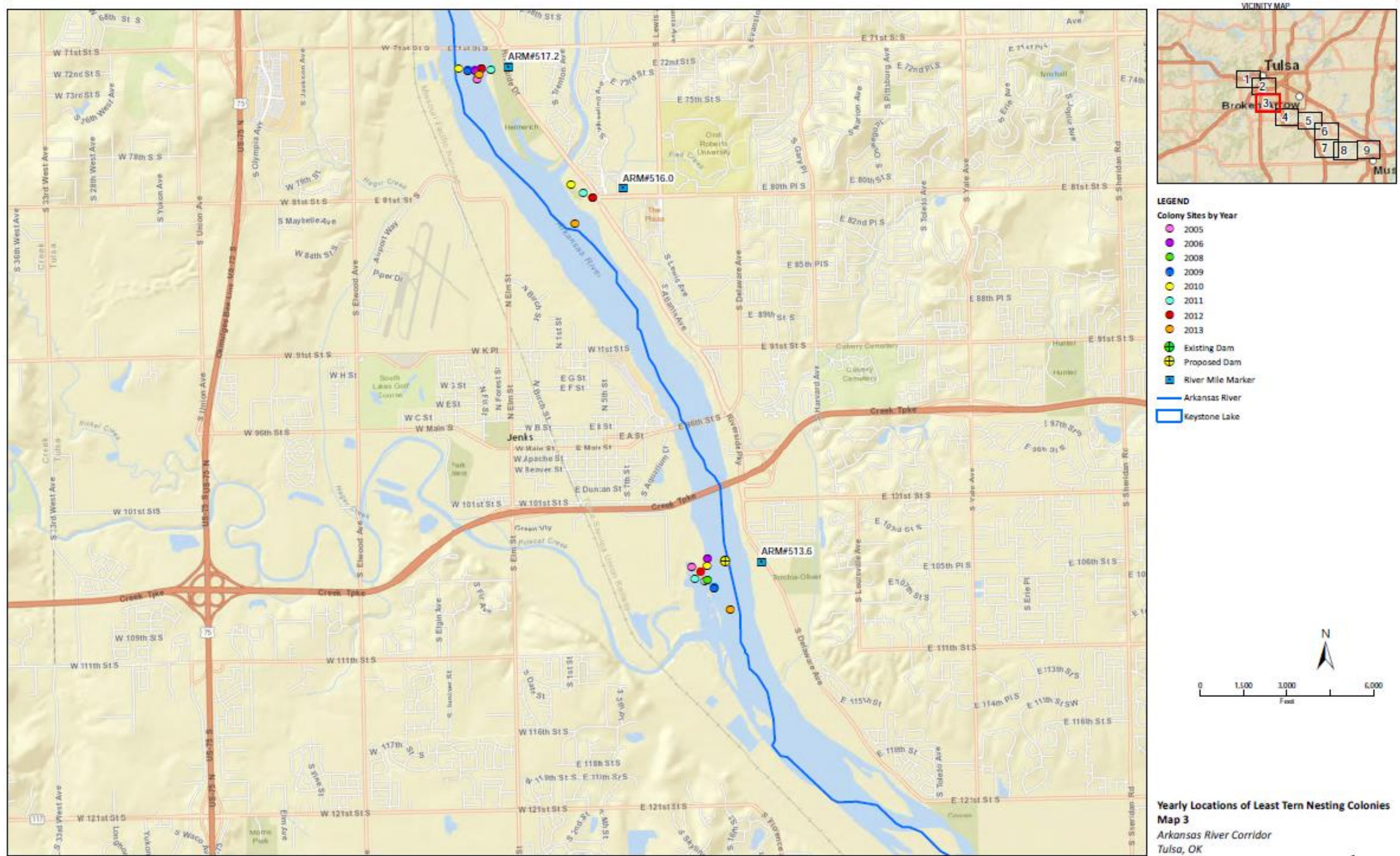
Map 1. Least Tern Nesting Colonies in the ARC Study Area.



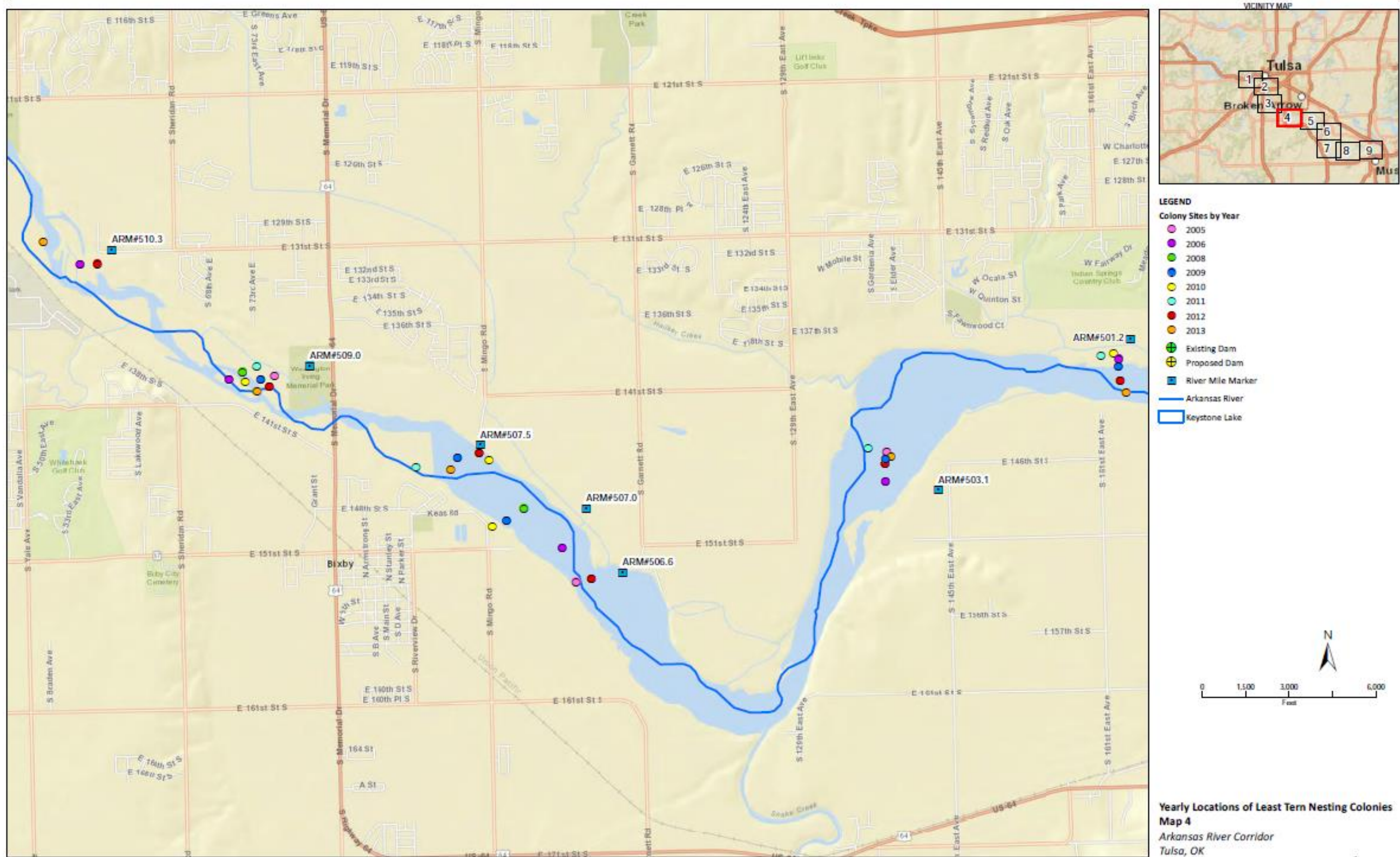
Map 2. Least Tern Nesting Colonies in the ARC Study Area.



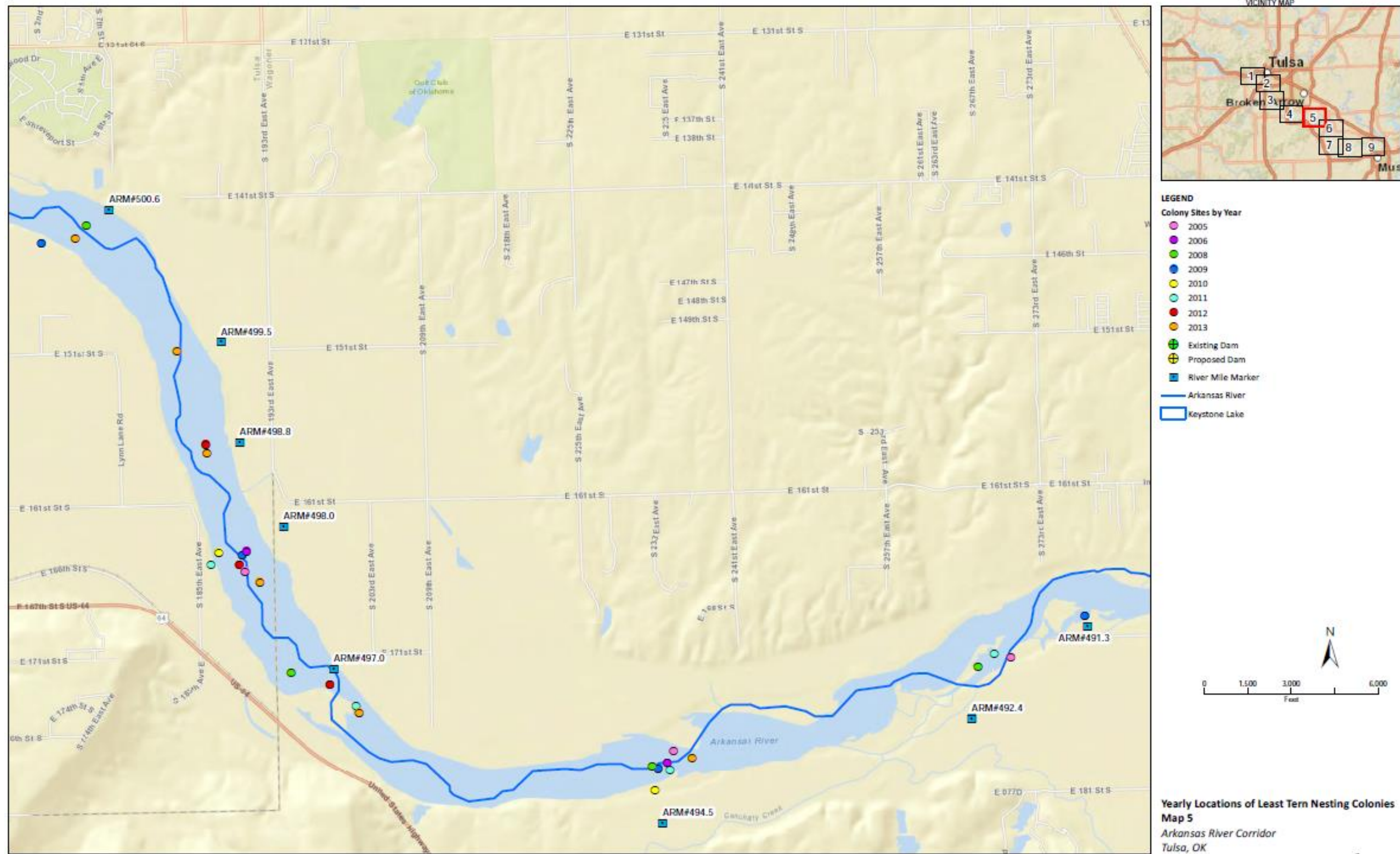
Map 3. Least Tern Nesting Colonies in the ARC Study Area.



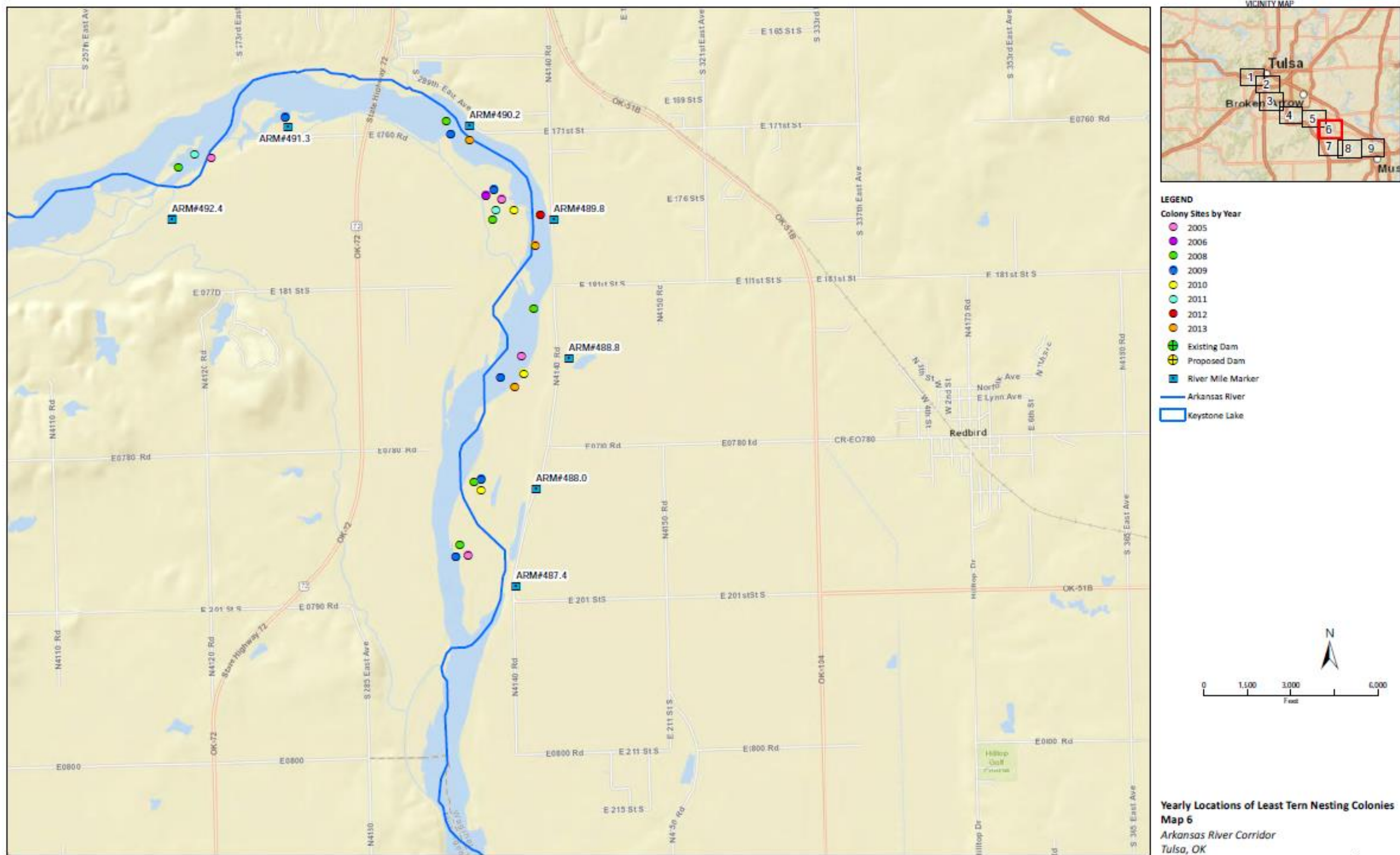
Map 4. Least Tern Nesting Colonies in the ARC Study Area.



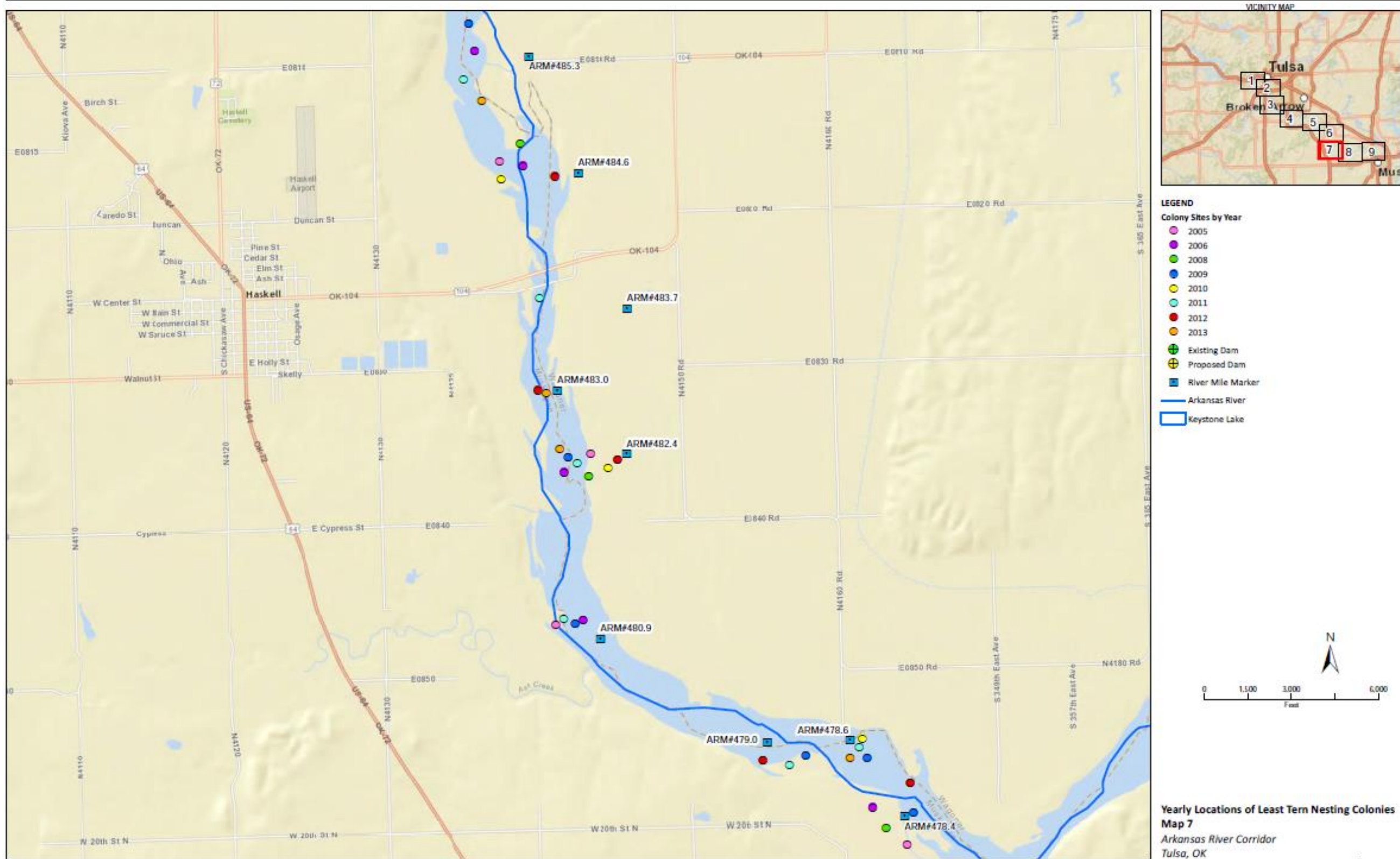
Map 5. Least Tern Nesting Colonies in the ARC Study Area.



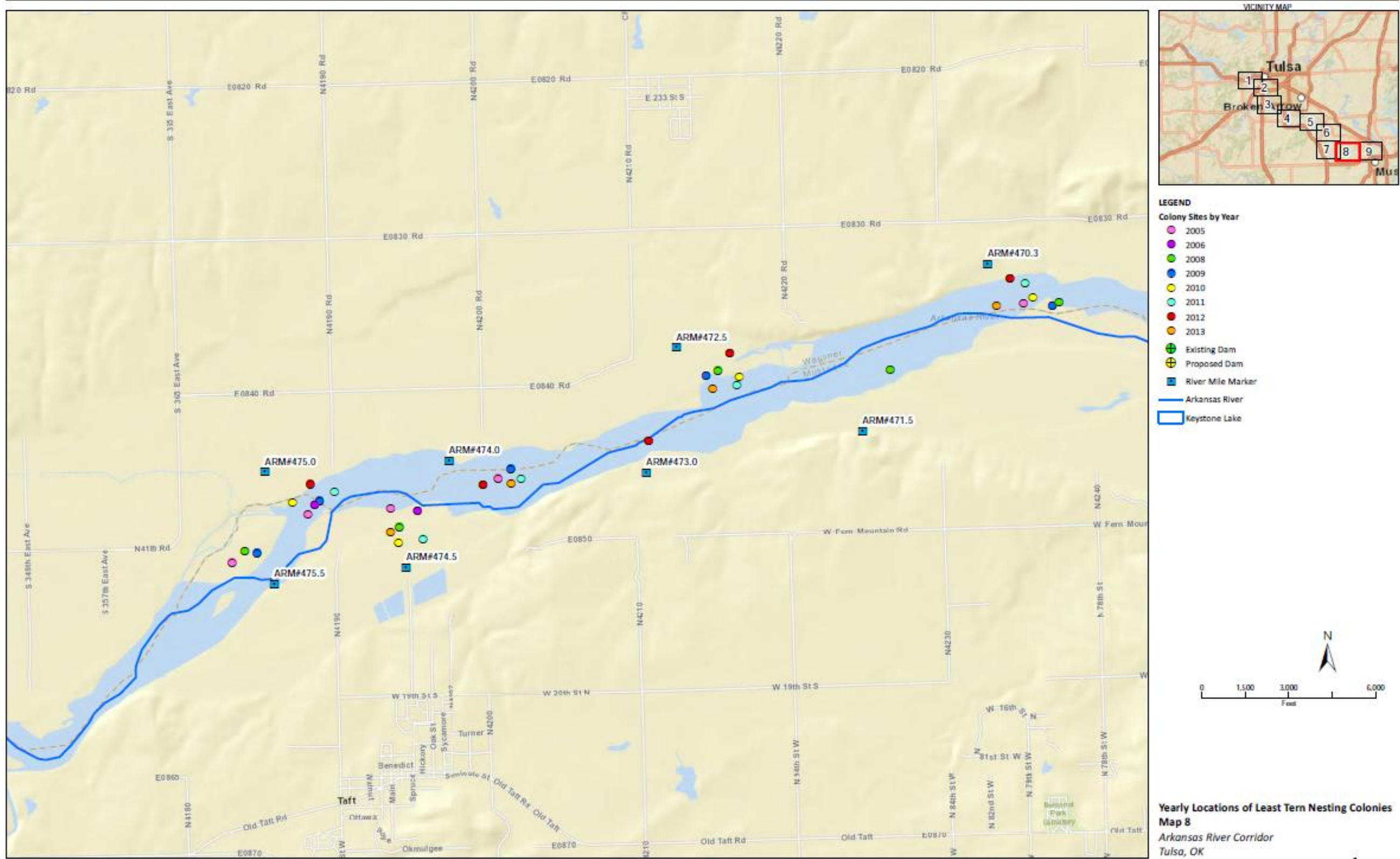
Map 6. Least Tern Nesting Colonies in the ARC Study Area.



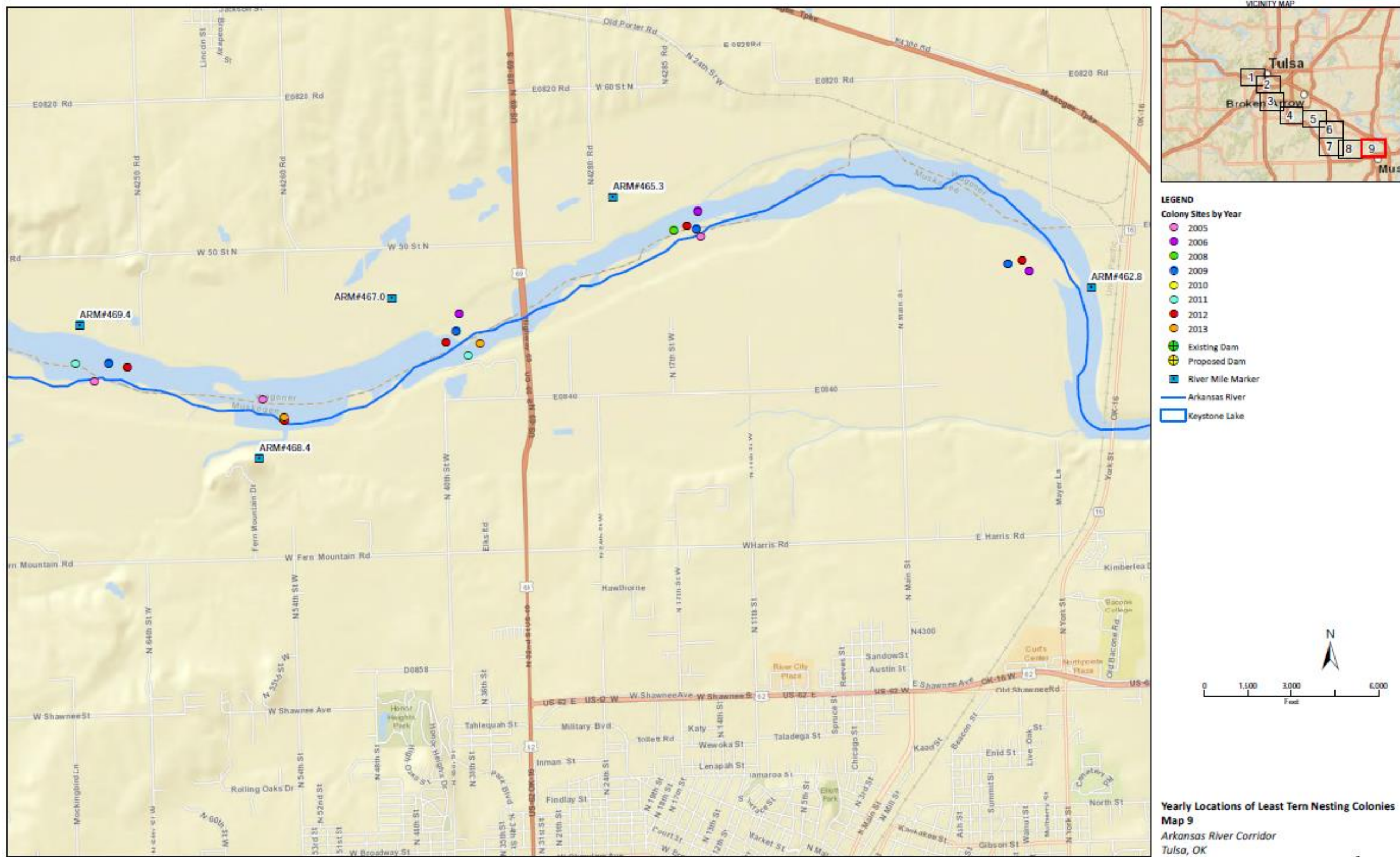
Map 7. Least Tern Nesting Colonies in the ARC Study Area.



Map 8. Least Tern Nesting Colonies in the ARC Study Area.



Map 9. Least Tern Nesting Colonies in the ARC Study Area.



Appendix B – ARC 1,000 cfs Test from Keystone Dam

Removed:

See Arkansas River Corridor Report Appendix M

Appendix C –Federal and State Protected Species Lists
and Species Conclusion Table



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Oklahoma Ecological Services Field Office
9014 East 21st Street
Tulsa, OK 74129-1428
Phone: (918) 581-7458 Fax: (918) 581-7467
<http://www.fws.gov/southwest/es/Oklahoma/>

In Reply Refer To:

December 10, 2017

Consultation Code: 02EKOK00-2018-SLI-0461

Event Code: 02EKOK00-2018-E-01067

Project Name: Arkansas River Corridor Ecosystem Restoration Feasibility Study

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the

human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Non-federal entities conducting activities that may result in take of listed species should consider seeking coverage under section 10 of the ESA, either through development of a Habitat Conservation Plan (HCP) or, by becoming a signatory to the General Conservation Plan (GCP) currently under development for the American burying beetle. Each of these mechanisms provides the means for obtaining a permit and coverage for incidental take of listed species during otherwise lawful activities.

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>; <http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit through our Project Review step-wise process <http://www.fws.gov/southwest/es/oklahoma/OKESFO%20Permit%20Home.htm>.

Attachment(s):

- Official Species List
-

- USFWS National Wildlife Refuges and Fish Hatcheries
 - Migratory Birds
 - Wetlands
-

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Oklahoma Ecological Services Field Office

9014 East 21st Street

Tulsa, OK 74129-1428

(918) 581-7458

Project Summary

Consultation Code: 02EKOK00-2018-SLI-0461

Event Code: 02EKOK00-2018-E-01067

Project Name: Arkansas River Corridor Ecosystem Restoration Feasibility Study

Project Type: LAND - RESTORATION / ENHANCEMENT

Project Description: The U.S. Army Corps of Engineers, Tulsa District (USACE) and Tulsa County, the non-federal sponsor, are conducting a Civil Works feasibility study, Arkansas River Corridor (ARC) Ecosystem Restoration Feasibility Study, evaluating aquatic ecosystem restoration opportunities within the ARC between Keystone Dam and the Tulsa/Wagoner County line. The proposed project purpose is to address aquatic ecosystem degradation in the greater Tulsa, Oklahoma area. The study area spans nearly 42 river miles within the existing channel of the Arkansas River in Tulsa County, Oklahoma. The key constraint of the study is outlined in Water Resources Development Act 2005, Section 3132, which limits ecosystem restoration measure consideration to only those found in Indian Nations Council of Governments' 2005 Arkansas River Corridor Master Plan.

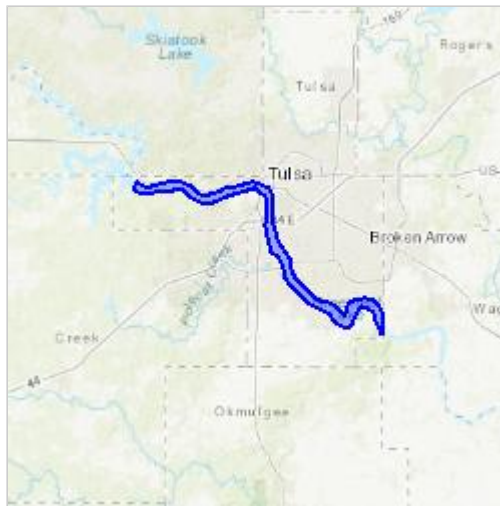
. The proposed project includes constructing an instream pool structure at river mile 530 that would operate to temporarily capture portions of water releases from Keystone Dam and associated hydropower generation, and rerelease the water during periods of little to no flow from Keystone Dam. The target release flow rate to increase minimum river flow, but not increase river flow or depth downstream during larger releases from Keystone Dam, throughout the study area is 1,000 cubic feet per second (cfs). The 1,000 cfs target was identified by U.S. Fish and Wildlife Service (USFWS) and Oklahoma Department of Wildlife Conservation (ODWC) staff as having tangible aquatic ecosystem benefits and a significant improvement over the little to no flow conditions that reoccur in the ARC. The pool structure can sustain the 1,000 cfs for up to approximately three and half days without additional releases from Keystone Dam to refill the pool. The design of the structure would allow water, fish, fish egg, and sediment passage through a combination of adjustable full and partial height gates in order to maintain riverine conditions up and downstream of the structure. In addition, 5.34 acres of wetland restoration, entailing rock riffle placement and native wetland plantings, is proposed at the confluence of the Arkansas River and Prattville Creek as well as three acres of sandbar island creation near Broken Arrow, Oklahoma using placed rock chevrons. Activities,

including heavy construction and hauling of materials, would occur outside of the Interior Least Tern breeding season (April through August) in areas with Interior Least Tern activity.

Project Location:

Approximate location of the project can be viewed in Google Maps:

<https://www.google.com/maps/place/36.03245355019266N95.96004087081215W>



Counties: Tulsa, OK

Endangered Species Act Species

There is a total of 5 threatened, endangered, or candidate species on this species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

Mammals

NAME	STATUS
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Birds

NAME	STATUS
Least Tern <i>Sterna antillarum</i> Population: interior pop. No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8505	Endangered
Piping Plover <i>Charadrius melodus</i> Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot <i>Calidris canutus rufa</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened

Insects

NAME	STATUS
American Burying Beetle <i>Nicrophorus americanus</i> Population: Wherever found, except where listed as an experimental population No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/66	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act¹ and the Bald and Golden Eagle Protection Act².

Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service³. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured. Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures, as described [below](#).

-
1. The [Migratory Birds Treaty Act](#) of 1918.
 2. The [Bald and Golden Eagle Protection Act](#) of 1940.
 3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern](#) (BCC) list or are known to have particular vulnerabilities in your project location. To learn more about the levels of concern for birds on your list, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your specific project area. To see maps of where birders and the general public have sighted birds in and around your project area, visit E-bird tools such as the [E-bird data mapping tool](#) (search for the scientific name of a bird on your list to see specific locations where that bird has been reported to occur within your project area over a certain time-frame) and the [E-bird Explore Data Tool](#) (perform a query to see a list of all birds sighted in your county or region and within a certain time-frame). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list can be found [below](#).

NAME	BREEDING SEASON
<p>American Bittern <i>Botaurus lentiginosus</i></p> <p>This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA</p> <p>https://ecos.fws.gov/ecp/species/6582</p>	<p>Breeds Apr 1 to Aug 31</p>
<p>American Golden-plover <i>Pluvialis dominica</i></p> <p>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	<p>Breeds elsewhere</p>
<p>Bald Eagle <i>Haliaeetus leucocephalus</i></p> <p>This is not a Bird of Conservation Concern (BCC), but is of concern in this area either because of the Eagle Act, or for potential susceptibilities in offshore areas from certain types of development</p>	<p>Breeds Mar 20 to Sep 15</p>

or activities.

<https://ecos.fws.gov/ecp/species/1626>

Black-billed Cuckoo <i>Coccyzus erythrophthalmus</i>	Breeds May 15 to Oct 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	
Bobolink <i>Dolichonyx oryzivorus</i>	Breeds May 20 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Eastern Whip-poor-will <i>Antrostomus vociferus</i>	Breeds May 1 to Aug 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Harris's Sparrow <i>Zonotrichia querula</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
Hudsonian Godwit <i>Limosa haemastica</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	
King Rail <i>Rallus elegans</i>	Breeds May 1 to Sep 5
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8936	
Long-billed Curlew <i>Numenius americanus</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5511	
Least Bittern <i>Ixobrychus exilis</i>	Breeds Aug 16 to Oct 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/6175	
Lesser Yellowlegs <i>Tringa flavipes</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	
Marbled Godwit <i>Limosa fedoa</i>	Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9481	
Prothonotary Warbler <i>Protonotaria citrea</i>	Breeds Apr 1 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and	

Alaska.

<p>Red-headed Woodpecker <i>Melanerpes erythrocephalus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	<p>Breeds May 10 to Sep 10</p>
<p>Rusty Blackbird <i>Euphagus carolinus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	<p>Breeds elsewhere</p>
<p>Short-billed Dowitcher <i>Limnodromus griseus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480</p>	<p>Breeds elsewhere</p>
<p>Semipalmated Sandpiper <i>Calidris pusilla</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	<p>Breeds elsewhere</p>
<p>Smith's Longspur <i>Calcarius pictus</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA</p>	<p>Breeds elsewhere</p>
<p>Sprague's Pipit <i>Anthus spragueii</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8964</p>	<p>Breeds elsewhere</p>
<p>Swallow-tailed Kite <i>Elanoides forficatus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8938</p>	<p>Breeds Mar 10 to Jun 30</p>
<p>Willet <i>Tringa semipalmata</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	<p>Breeds elsewhere</p>
<p>Wood Thrush <i>Hylocichla mustelina</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	<p>Breeds May 10 to Aug 31</p>

Additional information can be found using the following links:

- Birds of Conservation Concern <http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php>
 - Measures for avoiding and minimizing impacts to birds
<http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
 - Nationwide conservation measures for birds
<http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeas>
-

Wetlands

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

FRESHWATER EMERGENT WETLAND

- [PEM1A](#)
- [PEM1C](#)
- [PEM1F](#)
- [PEM1Fx](#)
- [PEM1Ax](#)
- [PEM1Cx](#)

FRESHWATER FORESTED/SHRUB WETLAND

- [PFO1A](#)
- [PFO1/EM1C](#)
- [PFO1/SS1A](#)
- [PSS1C](#)
- [PFO1C](#)
- [PSS1A](#)
- [PSS1/EM1A](#)
- [PSS1/EM1C](#)
- [PSS2A](#)
- [PFO1/EM1A](#)
- [PSS1F](#)

FRESHWATER POND

- [PUBHh](#)
- [PUBHx](#)
- [PUSC_x](#)
- [PUBF_x](#)
- [PUBH](#)
- [PUBF_h](#)

LAKE

- [L2UBF_x](#)
-

RIVERINE

- [R2USC](#)
 - [R2UBF](#)
 - [R2USA](#)
 - [R4SBC](#)
 - [R2UBHx](#)
 - [R2UBH](#)
-

OBS Ref. 2016-392-FED-ARM

Dear Mr. Sims,

Sep. 6, 2016

We have reviewed occurrence information on federal and state threatened, endangered or candidate species, as well as non-regulatory rare species and ecological systems of importance currently in the Oklahoma Natural Heritage Inventory database for the following location you provided:

Multiple locations along Arkansas River in Tulsa County

We found 122 occurrence(s) of relevant species within the vicinity of the project location as described.

See table on page 2

Additionally, absence from our database does not preclude such species from occurring in the area.

If you have any questions about this response, please send me an email, or call us at the number given below.

Although not specific to your project, you may find the following links helpful.

ONHI, guide to ranking codes for endangered and threatened species:
http://vmpincol.ou.edu/heritage/ranking_guide.html

Information regarding the Oklahoma Natural Areas Registry:
http://www.oknaturalheritage.ou.edu/registry_faq.htm

Todd Fagin
Oklahoma Natural Heritage Inventory
(405) 325-4700
tfagin@ou.edu

Table 1. Listed and protected species in site location.

Species Name	Common Name	Federal Status	County	TRS
Anthus spragueii	Sprague's Pipit	Candidate for Listing	Tulsa	Sec. 1-T19N-R12E
Anthus spragueii	Sprague's Pipit	Candidate for Listing	Tulsa	Sec. 1-T19N-R12E
Anthus spragueii	Sprague's Pipit	Candidate for Listing	Tulsa	Sec. 36-T20N-R13E
Anthus spragueii	Sprague's Pipit	Candidate for Listing	Tulsa	Sec. 8-T17N-R14E
Anthus spragueii	Sprague's Pipit	Candidate for Listing	Tulsa	UNKNOWN
Anthus spragueii	Sprague's Pipit	Candidate for Listing	Tulsa	UNKNOWN
Haliaeetus leucocephalus	Bald Eagle	Protected	Rogers	Sec. 32-T20N-R16E
Haliaeetus leucocephalus	Bald Eagle	Protected	Rogers	Sec. 32-T20N-R16E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 1-T18N-R12E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 10-T19N-R11E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 10-T19N-R11E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 11-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 11-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T18N-R12E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T18N-R12E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 12-T19N-R10E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 13-T17N-R13E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 13-T19N-R11E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 13-T19N-R11E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 13-T19N-R11E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 14-T17N-R13E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 14-T17N-R13E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 14-T19N-R12E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 14-T19N-R12E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 16-T17N-R14E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 18-T18N-R13E
Haliaeetus leucocephalus	Bald Eagle	Protected	Tulsa	Sec. 18-T18N-R13E

Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	Sec. 29-T17N-R14E
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	Sec. 36-T19N-R12E
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	Sec. 7-T17N-R13E
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Tulsa	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Wagoner	UNKNOWN
Sternula antillarum athalassos	Interior Least Tern	Listed Endangered	Wagoner	UNKNOWN

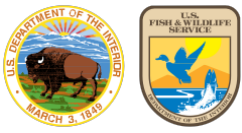
Species Conclusions Table

Project Name: Arkansas River Corridor Ecosystem Restoration Feasibility Study

Date: December 1, 2017

Species / Critical Habitat	Habitat Determination	Notes / Documentation	ESA Determination
Least tern (<i>Sterna antillarum</i>)	Habitat Present	No Critical Habitat in Study Area Nesting colony locations mapped from 2007-2014. The proposed ecosystem restoration project would benefit the least tern through increase riverine and sandbar island habitat. Construction activities would avoid areas with least tern nesting activity	May effect, not likely to adversely affect Continued Coordination with Oklahoma Ecological Services Field Office, Southwest Region. Project Review package to be submitted with Endangered and Threatened Species Evaluation Report as part of informal Section 7 Consultation with USFWS.
Piping Plover (<i>Charadrius melodus</i>)	Habitat Present	No Critical Habitat in Study Area Site Habitat Survey Completed	No effect
Red Knot (<i>Calidris canutus rufa</i>)	Habitat Present	No Critical Habitat in Study Area Not likely to occur in study area	No effect
Whooping crane (<i>Grus americana</i>)	Habitat Present	No Critical Habitat in Study Area Not likely to occur in study area	No effect
American Burying beetle (<i>Nicrophorus americanus</i>)	Habitat Present	No Critical Habitat in Study Area Restoration of aquatic habitat is the focus, aquatic habitat is considered uninhabitable.	No Effect

Appendix D -USFWS Oklahoma Species Fact Sheets



American Burying Beetle

Oklahoma Ecological Service Field Office

American Burying Beetle

Nicrophorus americanus

Description

The American burying beetle (ABB) is a large (0.98-1.4 inches) shiny black beetle, with hardened protective wing covers (elytra) that meet in a straight line down the back. Each elytron has 2 scalloped-shaped orange-red markings. Its most distinguishing feature is the large orange-red marking on the raised portion of the pronotum (shield over the mid-section between head and wings), which is circular, with raised central portion and flattened margins. The ABB has orange-red frons (a mustache-like feature) and a single orange-red mark on the clypeus (face). This mark is triangular in females and rectangular in males. The ABB has large antennae with notable orange clubs at tips.

Distribution

Rhode Island, South Dakota, Nebraska, Kansas, Arkansas, Texas, and Oklahoma, with 2 introduced populations in Massachusetts, and Missouri.

Life History

The ABB lives for just one year, it is nocturnal (active only at night), a strong flier, usually reproduces only once, and undergoes complete metamorphosis. The ABB is active in summer and inactive during winter. During winter months when temperatures are below 60°F (15°C), ABB bury themselves in the soil to overwinter. When temperatures are above 60°F (15°C) they emerge from the soil and begin mating and reproduction. ABB are scavengers dependent on carrion for their life cycle and must compete with vertebrate and other invertebrate species for carrion. Reproduction involves burying a small vertebrate carcass (1-9 ounces; 35-250 grams), laying eggs beside the carcass, and feeding the larvae from the carcass until mature. Both parents provide care to their young.

Habitat

Considered to be feeding habitat generalists, their reproductive habitat is believed to be more specialized. Habitat requirements for ABB, particularly



American Burying Beetle. © Roger Williams Park Zoo

reproductive habitat requirements are not fully understood. The ABB has been found in various habitat types including open fields and grasslands, oak-pine woodlands, oak-hickory forest, bottomland hardwoods, and natural edge habitats.

Conservation

Federally-listed as endangered (54 FR 29652; July 13, 1989). Critical habitat has not been designated. At the time of listing in 1989, there were only two known populations - Latimer County, Oklahoma and on Block Island, Rhode Island.

The ABB has disappeared from over 90% of its historic range and is currently restricted to the eastern and western extremities of its historic range. Habitat loss, alteration, and degradation have been attributed to the decline. In Oklahoma, the ABB is currently known to occur in 27 eastern counties. Of particular concern for ABB conservation is soil disturbances from construction projects because it is believed that the ABB stays underground or under leaf litter during the daytime and can easily be killed if soil is compacted or removed.

References

U.S. Fish and Wildlife Service. 1991. American burying beetle recovery plan. U.S. Fish and Wildlife Service, Newton Corner, Massachusetts.

Kozol, et al. 1988. *The American burying beetle, Nicrophorus americanus: studies on the natural history of a declining species.* *Psyche* 95:167-176.

Lomolino, M. V., J. C. Creighton, G. D. Schnell, and D. L. Certain. 1995. *Ecology and conservation of the endangered American burying beetle (Nicrophorus americanus).* *Conservation Biology* 9:605-614.

Sikes, D.S. and R. J. Raithel. 2002. *A review of hypotheses of decline of the endangered American burying beetle (Silphidae: Nicrophorus americanus Olivier).* *Journal of Insect Conservation* 6:103-113.

For Further Information

U.S. Fish and Wildlife Service
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9014 East 21st Street
Tulsa, OK 74129
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Least Tern

Oklahoma Ecological Service Field Office

Least Tern (Interior Population)

Sterna antillarum

Description

The least tern is the smallest member of the tern family at about 9 inches long (23 cm) with a wingspan of 20 inches (50 cm). They have a grayish back and wings, and snowy white undersides. Least terns have a forked tail and narrow pointed wings. They can be distinguished from all other terns by their combination of a black crown, white forehead, and a variable black-tipped yellow bill. First-year birds have a dark bill, a dark gray eye stripe, and a dusky brown cap.

Distribution

Formerly the major river systems of the Midwestern United States. These rivers included the Red, Rio Grande, Arkansas, Missouri, Ohio, and Mississippi river systems. Currently, they occur as small remnant colonies throughout their former range. In Oklahoma, least terns nest along most of the larger rivers, as well as at the Salt Plains National Wildlife Refuge near Jet, Oklahoma. Least terns winter in South America.

Life History

Least terns arrive at breeding sites from late April to early June where they typically spend four to five months. Pairs go through an elaborate courtship period that includes courtship feedings and a variety of postures and vocalizations. Least terns nest in small colonies on exposed salt flats, river sandbars, or reservoir beaches. Nests are small scrapes in the sand, and usually two or three eggs are laid. The young are fairly mobile soon after hatching. Both parents feed the young and remain with them until fall migration. Least terns will travel four or more miles (6+ km) from their breeding colonies to find the small fish that make up the major part of their diet.



Least Tern (Interior Population). USFWS

Conservation

The least tern was federally listed as an endangered species on May 28, 1985 (50 FR 21784). Least terns have declined due to habitat loss from permanent flooding by reservoirs and channelization projects, unpredictable water discharge patterns, and overgrowth of brush and trees. The recreational use of sandbars by humans is a major threat to the tern's reproductive success.

What Can You Do to Help

Avoid disturbing nesting areas from mid-May to late August. Pets, livestock, people, and vehicles should be kept off these areas when terns are present. Promote public awareness and report disturbance of least terns to wildlife law enforcement officials. Private landowners should manage lands to benefit habitat in nesting areas by limiting ATV and off-road vehicles use and blocking access of these vehicles to rivers. Restore or create additional nesting habitat in rivers, navigation systems, or lakes.

Purchase land or conservation easements in areas with high-quality least tern nesting habitat.

References

U.S. Fish and Wildlife Service. 1990. *Recovery plan for the interior population of the least tern *Sterna antillarum**. U.S. Fish and Wildlife Service, Twin Cities, Minnesota. 90 pp.

For Further Information

U.S. Fish and Wildlife Service
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August 2011



U.S. Fish & Wildlife Service

Piping Plover

Oklahoma Ecological Service Field Office

Piping Plover

Charadrius melodus

Description

The piping plover is a 5 ½ inch long pale grayish-brown shorebird with a white breast. During the breeding season, it has a black breast band which is sometimes incomplete and a black bar between its eyes. The bill is dull orange with a black tip and the legs and feet are orange.

Distribution

Piping plovers occur in three disjunct populations in North America: Northern Great Plains, Great Lakes, and Atlantic Coast. This species migrates through Oklahoma each spring and fall.

Life History

In Oklahoma, the piping plover is a bi-annual migrant, traveling between its nesting habitat to the north of Oklahoma (the Great Plains population nests from Kansas to southern Canada), and its wintering grounds on the gulf coast. There is a record of piping plovers nesting at Optima Lake in Texas County.

Migration through Oklahoma is likely to occur from March-May and July-September. Piping plovers usually migrate as individuals or small groups and may be seen along sandbars of major rivers, salt flats, and mudflats of reservoirs. Piping plovers forage on these shoreline habitats and eat small invertebrates.

More detailed information on life history is available at *The Birds of North America* website.



Piping plover. USFWS

Conservation

The Great Plains population of piping plover was federally listed as a threatened species on December 11, 1985 (50 CFR 21784). There is no designated critical habitat for piping plovers in Oklahoma. Conservation of this species has focused on breeding and wintering habitat and relatively little is known about the habitat used during migration. During migration, piping plovers have been documented in many areas of Oklahoma from the panhandle to the eastern border and probably migrate through or over all of Oklahoma.

What Can You Do to Help

Ongoing conservation of large river and salt flat stopover habitat is helpful. Avoid disturbance of any piping plovers that may use river or reservoir shoreline habitat during migration.

References

Great Lakes & Northern Great Plains Piping Plover Recovery Plan, U.S. Fish and Wildlife Service. 1998.

The Birds of North America, No.2, 1992

For Further Information

U.S. Fish and Wildlife Service
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918/581-7458

August 2011

RUFA RED KNOT

Calidris canutus rufa

The Endangered Species Act, enacted in 1973, serves to protect and recover imperiled species and the ecosystems upon which they depend. It is administered by the U.S. Fish and Wildlife Service.



Threatened - A Federally Protected Species

Imagine making a 3,000 mile grocery trip, twice a year. Though seemingly impossible for us, the red knot, a small shorebird with a 23-inch wingspan, makes this journey in just three days.

IDENTIFICATION

Red knots are most easily identified when in their late spring and summer breeding plumage. During this time, the bird earns its name with its rusty head, neck and belly. The back is mottled gray, black and brown and the tail and wings are pale gray. In the fall, this sandpiper molts and turns pale gray with white flanks. Red knots have dull yellow or olive-green legs and a straight, dark bill. The sturdy bill is used to probe mudflats for mollusks, insects and seeds.



The *rufa* red knot is one of the longest distance migrants known to the animal kingdom.

ADAPTATIONS FOR SURVIVAL

Most knots winter along the Chilean Coast and migrate to the Canadian Arctic breeding grounds by way of the Atlantic Coast. Some of these birds travel 18,000 miles a year! These birds often use Delaware and New Jersey's Delaware Bay area as a stopover, refueling on Horseshoe Crab eggs. But a small red knot population winters along the coast of Texas and migrates to the breeding grounds by way of the Great Plains. Even though this population passes over Oklahoma, these birds are often flying thousands of feet above the ground, seldom making landfall in our state. To date, only 40 birds have been reported in Oklahoma. Of those birds, 85% have been reported during the fall migration. It is suspected inclement weather, inexperience of younger birds or weakened physical condition forces these birds to land during migration.

Red knots have experienced severe population declines, with reduced food availability cited as the primary cause. These declines triggered the U.S. Fish and Wildlife Service's listing of the rufa red knot (the North American subspecies of red knot) as a threatened species under the Endangered Species Act. This decision was announced December 11, 2014.

The Wildlife Diversity Program, a program of the Oklahoma Department of Wildlife Conservation manages, monitors and promotes rare, declining and threatened species as well as those common species not hunted or fished. This program receives no state or federal tax appropriations and is primarily funded through the sale of publications, specialty license plates, the income tax check-off program and voluntary contributions.





U.S. Fish & Wildlife Service

Whooping Crane

Oklahoma Ecological Service Field Office

Whooping Crane

Grus americana

Description

At 5 feet (1.5 m), the whooping crane is the tallest American bird. It is a snowy white, long-necked bird with long legs. Its black primary feathers show only during flight. Adults have a red crown and a patch of black feathers below the eye. Young are whitish overall, but have a rusty-colored head and neck.

Distribution

Whooping cranes pass through western Oklahoma each spring and fall during migration. The Salt Plains National Wildlife Refuge, near Jet, Oklahoma, is a very important migration stopover area and is designated critical habitat. During migration, whooping cranes sometimes are sighted elsewhere in Oklahoma along rivers, in grain fields, or in shallow wetlands. Whooping cranes primarily use shallow, seasonally and semi permanently flooded palustrine wetlands and various cropland and emergent wetlands.

Life History

The whooping crane is a bi-annual migrant, traveling between its summer habitat in central Canada, and its wintering grounds on the Texas coast, across the Great Plains of the U.S. in the spring and fall of each year. Autumn migration normally begins in mid-September, with most birds arriving on the Texas wintering grounds between late October and mid-November. Spring migration departure dates are normally between late March and mid-April, with the last birds usually leaving by May 1. Whooping cranes migrate south as singles, pairs, in family groups, or as small flocks of 3 to 5 birds. They are diurnal migrants and stop daily to feed and rest. Whooping cranes eat a variety of things, including insects, frogs, small birds, rodents, minnows, and waste grains.



Whooping crane. USFWS

Conservation

By the mid- 1940s, only 15 whooping cranes were present in the wild. The whooping was federally listed as an endangered species on March 11, 1967 (32 FR 4001). An intensive captive-breeding program and careful protection of wild flocks have slowly increased the number in the wild to more than 120. Whooping cranes have declined primarily because of loss of wintering and breeding habitat. Current threats to wild cranes include collisions with manmade objects such as power lines and fences, shooting, predators, disease, habitat destruction, severe weather, and a loss of two thirds of the original genetic material.

What Can You Do to Help

Sightings are important for monitoring the status of federally-listed species.

To report whooping crane sightings to the US Fish and Wildlife Service please complete the sighting report form (<http://whoopingcrane.com/report-a-sighting/>) within the migration corridors, continue to gather sighting reports for whooping cranes and promote public awareness. Ongoing conservation of wetland habitat within historical stopover habitat is

helpful. Private landowners should be provided with incentives to manage lands to benefit wetlands in historic migration, breeding, and wintering areas. Additionally, purchase land or conservation easements in areas that still support healthy wetlands.

References

Canadian Wildlife Service and U.S. Fish and Wildlife Service. 2007. *International recovery plan for the whooping crane*. Ottawa: Recovery of Nationally Endangered Wildlife (RENEW), and U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 162 pp.

For Further Information

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August 2011

Appendix E - Oklahoma Ecological Services Field Office
Migratory Bird and Eagle Impact Avoidance Measures for
Actions Associated with Oil and Gas Projects

Oklahoma Ecological Services Field Office Migratory Bird and Eagle Impact Avoidance Measures for Actions Associated with Oil and Gas Projects

April 2014

Note to Users: This U.S. Fish and Wildlife Service (Service) document is intended to assist the oil and gas industry with project evaluation and compliance with the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) for activities within Oklahoma. These recommendations may also be useful for other industries and activities in Oklahoma. Guidance herein may also be useful in planning by agencies and organizations concerned with protecting avian resources, such as the Avian Power Line Interaction Committee (APLIC). The APLIC recently released an updated version of their guidance document entitled, Reducing Avian Collisions with Power Lines: State of the Art in 2012, available at www.aplic.org.

The following are general considerations that may apply to most, but not every situation that may occur during oil and gas activities within Oklahoma. Additional conservation measures may be considered and/or required to avoid or minimize impacts to eagles and other species of migratory birds.

With the exception of Arizona, the bald eagle is no longer protected under the Endangered Species Act. However, eagles (both bald eagles and golden eagles) in the United States are protected by the BGEPA, in addition to the MBTA. The BGEPA prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export or import, of any eagle, alive or dead, including any part, nest, or egg, unless authorized by permit. Further, activities that would disturb an eagle are prohibited under the BGEPA. "Disturb" means to agitate or bother an eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. If a proposed project or action would occur in areas where there are nesting, feeding, or roosting eagles, proponents of the project may need to take additional conservation measures to comply with BGEPA. New regulations (50 CFR § 22.26 and § 22.27) allow the take of eagles and their nests, respectively, to protect interests in a particular locality. However, consultation with the Service's Migratory Bird, Ecological Services, and Law Enforcement programs will be required before a permit may be issued for such take.

If eagles might be taken in association with oil and gas activities in a given area, the responsible party should develop an Eagle Conservation Plan and apply for a take permit under the BGEPA. Relevant recommendations and guidance can be accessed on the Service's Eagle Management web page:

<http://www.fws.gov/migratorybirds/BaldAndGoldenEagleManagement.htm>.

AVOIDING AND MINIMIZING NEGATIVE IMPACTS TO EAGLES

Both bald and golden eagles occur in Oklahoma. The western portion of Oklahoma has a small nesting population of golden eagles. Some golden eagles also winter throughout the state. However, this document primarily focuses on bald eagles, which have a larger population (both nesting and wintering) in Oklahoma. Please contact the Oklahoma Ecological Services Field Office for more information regarding potential impacts to golden eagles.

I. Thoroughly Document Area Use by Bald Eagles

For bald eagles, use Appendix 2 of the Service's 2009 Bald Eagle Post-delisting Monitoring Standard Operating Procedures to conduct aerial surveys for nests and communal roost sites. This protocol should be used for any aspect of oil and gas activities. Persons conducting bald eagle nest surveys must have previous experience conducting eagle nest surveys. Eagle nest surveys must be conducted during winter, when leaves are off deciduous trees. This protocol only applies to nesting bald eagles. Refer to the following website for the most recent version:

<http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BaldEagle/NationalBaldEagleManagementGuidelines.pdf>

Avoidance measures for eagles include protection of nests and nest sites, nesting adults, eggs, nestlings, and fledglings. Eagle nest surveys must be conducted prior to activities that may alter potential nest site habitat. Not all eagle nest locations are documented and new nests are found each year, as the resident population of bald eagles in Oklahoma expands. Examples of activities that may harm a nest or nest tree include construction of pads, roads, pipelines, and distribution lines. It is paramount to collect information regarding bald eagles well in advance of construction activities.

Surveys could be conducted from the ground or from aircraft. Ground-based surveys may be most appropriate for open terrain with good access for ground survey crews. Aerial surveys may provide the best coverage for large areas with rugged terrain (i.e., inaccessible by ground) and heavily forested areas.

Ground Surveys – Methods for nest surveys must be consistent with accepted, published methodologies and consider species-specific characteristics, terrain, vegetation, and accessibility of the survey area. Smaller projects with limited and open nesting habitat can be effectively surveyed from the ground by qualified observers with experience in identifying eagle nests. Survey routes or transects must adequately cover all potential nesting habitat. Potential eagle nests must be documented with photographs and GPS locations. If observers are unsure of species and occupancy status, and it's during what could be laying through early nestling stages, observers should avoid line-of-sight closer than 660' (per National Bald Eagle Management Guidelines) and return during what normally would be late nestling to fledging stage, or observe activity with scope from a distance (> 660' line-of-sight) for 4+ hours under good weather conditions to validate species and occupancy status.

At minimum, appropriate search protocol for each site must include timing and number of surveys needed, search area, and search techniques. Selecting the method with the lowest probability of causing disturbance to target species is a key element when developing survey protocols. Protocols should follow the most recent recommendations from the Service.

II. Avoidance and Minimization Measures for Bald Eagles

Examples of oil and gas activities that may harm an eagle nest or nest tree include construction of pads, roads, pipelines, and electrical distribution lines. If an oil and gas activity is proposed within 1 mile of a critical component of the bald eagle's life history, such as a nest, communal roost site, river, or freshwater wetland or reservoir covering more than 20 acres, measures listed below, or similar measures approved by the Service should be implemented. These critical life history needs are hereafter referred to as Eagle Use Areas (EUAs).

Bald eagles occurring in a given area throughout the year may also include migrants, overwintering individuals, immature and sub-adult residents, and non-breeding adult residents. Some oil and gas related activities could affect eagles and EUAs. All eagle life history stages should be considered when attempting to avoid and minimize negative impacts. In order to avoid take of bald eagles and their habitats, use the following recommendations as follows:

- a) For a complete description of how to avoid negative impacts to bald eagle nests refer to the National Bald Eagle Guidelines on pages 12-15.
<http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BaldEagle/NationalBaldEagleManagementGuidelines.pdf>
- b) All flared gases should produce no exposed flames and ends of pipes for flaring gases should be fitted with devices that deter birds from perching.
- c) For a given project, avoid locating electrical distribution lines in EUAs or else bury lines.
- d) If a new electrical distribution line cannot be buried in an EUA, it should be marked with special diverter devices, per the Service recommendations in APLIC 2012, to alert birds to the line so they can more readily avoid it. As a minimization measure for the above ground electrical distribution lines in EUAs, if possible, mark an equal amount of existing electrical distribution lines within 1 mile of other EUAs.
- e) All power poles within an EUA should be designed to protect eagles from electrocution risk, following standard practices in the APLIC document referenced above.
- f) As a minimization measure, pre-existing electrical distribution lines and power poles in EUAs also need to be marked per Service recommendations in APLIC 2012.

Before eagle nest surveys are conducted, check with appropriate state agencies or interest groups to determine what data is already available.

AVOIDING AND MINIMIZING NEGATIVE IMPACTS TO OTHER SPECIES OF MIGRATORY BIRDS

The MBTA prohibits the taking, killing, possession, and transportation and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by a permit from the Service or by regulations. However, there is no provision for incidental take under the MBTA. Species of birds protected by the MBTA are listed in 75 FR 9282 or on the Service's website:

<http://www.fws.gov/migratorybirds/RegulationsPolicies/mbta/mbtandx.html>

Recommendations for avoiding and minimizing potential impacts to migratory birds are provided in Appendix A. Additional information may be obtained through the Service's Migratory Birds Division.

Suggested Conservation Actions for Projects to Avoid or Minimize Potential for Take of Protected Species of Migratory Birds

**U.S. Fish and Wildlife Service, Division of Migratory Birds, Southwest Region
P.O. Box 1306, Albuquerque, NM 87103; Phone 505-248-6878**

May 2013

The Migratory Bird Treaty Act (MBTA, 16 U.S.C. 703-712) prohibits, among other actions, the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior through a permit or other regulation. Protected species of birds are listed under Title 50, Code of Federal Regulations, Part 10. Currently 1,007 species of birds are protected by the MBTA, including nearly all species that are native to the United States.

Activities that involve modification of habitats in which birds are nesting, or occurring adjacent to habitats in which birds are nesting may take protected birds through direct mortality of eggs, nestlings, or adults, or indirectly by causing nest abandonment, thereby leading to death of eggs or nestlings. The MBTA is a strict liability statute, in that the developer need not know that the nesting birds are present and potentially at risk by the development activities. There is also no permit available under the MBTA that will authorize the unintentional take of migratory birds. The only way to ensure compliance with the MBTA is to avoid the take altogether. Below are suggestions for minimizing or eliminating the potential for take during construction activities.

1. Conduct the activity outside the local nesting season so there are no active nests of birds that may be inadvertently damaged or destroyed by the project actions, and no need to conduct surveys for active nests.
2. Minimize the loss, destruction, or degradation of migratory bird habitat during the local nesting season if activities must occur during that timeframe. Within the Southwest Region, although most species nest between early April and mid-August, some nesting activity may occur during all months of the year depending on location. In desert regions, for example, nesting may begin in January and continue into November. Some eagles, owls, and finches may nest in mid-winter. Due to this variability, project proponents should contact the U.S. Fish and Wildlife Service's (Service) Regional Migratory Bird Office (see above) for details on timing of nesting in the area of the project. The proponent should be knowledgeable of which species may nest outside of the core "nesting season" that is often cited by various entities.
3. Document extent of below- and above-ground construction activities and the habitats through which those will pass. Recommendations on avoidance practices, timing of surveys, and the suite of species potentially affected may differ accordingly.

4. For projects planned well in advance, clearing of vegetation in the year prior to construction (outside the nesting season) may discourage future nesting attempts of birds in the proposed project area, thereby decreasing chance of take during construction activities.
5. If a proposed project or action may take migratory birds through disturbance or alteration of nesting habitat, and work cannot occur outside the local nesting season, project proponents should provide the Service with an explanation for why work has to occur during the migratory bird nesting season. In these cases, project proponents should also demonstrate that all efforts to complete the work outside the migratory bird nesting season were attempted, and that the reasons work needs to be completed during the nesting season were beyond the proponent's control.
6. To determine if migratory birds are nesting on-site and therefore potentially at risk by the activity, project proponents should conduct initial general surveys of the project area during the best biological timeframe for detecting the presence of the locally nesting birds (to locate potential territories that may be in harm's way), followed by nest searches in the project area shortly before the disturbance will occur (ideally within a week of the start of construction due to the speed with which nests may be built). Contact the Service's Division of Migratory Birds for survey protocol recommendations.

Except for the nests of large species, bird nests are well hidden and very difficult to find, and nest searches can be time intensive. Surveyors must be experienced in locating nests, as doing so successfully often relies on the ability to interpret subtle behavioral cues by the adult birds. Project proponents should also be aware that results of migratory bird surveys are subject to spatial and temporal variability and should be conducted at the most appropriate times of day and season for detection of territories and ultimately nests.

7. If no migratory birds are found nesting in proposed project or action areas immediately prior to the time when construction and associated activities are to occur, then the project activity may proceed as planned.
8. If protected species of birds are present and nesting in the proposed project or action area when project activities are slated to occur, contact your nearest Service Ecological Services Field Office and the Service's Regional Division of Migratory Birds for guidance on appropriate next steps for minimizing risk of violating the MBTA.

* These proposed conservation measures presume that no Endangered or Threatened animal or plant species (including migratory birds) exist in the project/action area. If Endangered or Threatened species are or potentially could be present and the project/action may affect these species, then consult with your nearest Service Ecological Services Office before proceeding with any project/action.

** The MBTA prohibits the taking, killing, possession, and transportation, (among other actions) of migratory birds, their eggs, parts, and nests, except when specifically permitted by regulations. Although the Act has no provision for allowing unintentional take, the Service realizes that some birds may be killed due to construction activities, even if all known reasonable and effective measures to protect birds are used. The Service's Office of Law Enforcement (OLE) carries out its mission to protect migratory birds through investigations and enforcement, as well as by fostering relationships with individuals, companies, and industries that have taken effective steps to avoid take of migratory birds and by encouraging others to implement measures to avoid take of migratory birds. It is not possible to absolve individuals, companies, or agencies from liability even if they implement bird mortality avoidance or other similar protective measures. However, the OLE focuses its resources on investigating and prosecuting individuals and companies that take migratory birds without identifying and implementing all reasonable, prudent and effective measures to avoid that take. Companies are encouraged to work closely with Service biologists to identify available protective measures when developing project plans and/or avian protection plans, and to implement those measures prior to/during construction or similar activities.

*** Bald and golden eagles receive additional protection under the BGEPA. BGEPA prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit. Further, activities that would disturb bald or golden eagles are prohibited under BGEPA. "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. If a proposed project or action would occur in areas where nesting, feeding, or roosting eagles occur, then project proponents may need to take additional conservation measures to achieve compliance with BGEPA. Regulations at 50 CFR 22.26 and 22.27 allow the take of bald and golden eagles and their nests, respectively, to protect interests in a particular locality. Consultation with the Migratory Bird and Ecological Services programs of the Service will be required before a permit may be considered.

**** Under the Service's Nest Destruction Policy, empty nests (except for eagles) may be destroyed without need for a permit from the Service. See the policy language below.

MBPM-2
Date: April 15, 2003

MIGRATORY BIRD PERMIT MEMORANDUM

SUBJECT: Nest Destruction

PURPOSE: The purpose of the memorandum is to clarify the application of the Migratory Bird Treaty Act (MBTA) to migratory bird nest destruction, and to provide guidance for advising the public regarding this issue.

POLICY: The MBTA does not contain any prohibition that applies to the destruction of a migratory bird nest alone (without birds or eggs), provided that no possession occurs during the destruction. To minimize MBTA violations, Service employees should make every effort to inform the public of how to minimize the risk of taking migratory bird species whose nesting behaviors make it difficult to determine occupancy status or continuing nest dependency.

The MBTA specifically protects migratory bird nests from *possession, sale, purchase, barter, transport, import, and export, and take*. The other prohibitions of the MBTA – *capture, pursue, hunt, and kill* – are inapplicable to nests. The regulatory definition of *take*, as defined by 50 CFR 10.12, *means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue hunt, shoot, wound, kill, trap, capture, or collect*. Only *collect* applies to nests.

While it is illegal to collect, possess, and by any means transfer possession of any migratory bird nest, the MBTA does not contain any prohibition that applies to the destruction of a bird nest alone (without birds or eggs), provided that no possession occurs during the destruction. The MBTA does not authorize the Service to issue permits in situations in which the prohibitions of the Act do not apply, such as the destruction of unoccupied nests. (Some unoccupied nests are legally protected by statutes other than the MBTA, including nests of threatened and endangered migratory bird species and bald and golden eagles, within certain parameters.)

However, the public should be made aware that, while destruction of a nest by itself is not prohibited under the MBTA, nest destruction that results in the unpermitted take of migratory birds or their eggs, is illegal and fully prosecutable under the MBTA.

Due to the biological and behavioral characteristics of some migratory bird species, destruction of their nests entails an elevated degree of risk of violating the MBTA. For example, colonial nesting birds are highly vulnerable to disturbance; the destruction of unoccupied nests during or near the nesting season could result in a significant level of take. Another example involves ground nesting species such as burrowing owls and bank swallows, which nest in cavities in the ground, making it difficult to detect whether or not their nests are occupied by eggs or nestlings or are otherwise still essential to the survival of the juvenile birds.

The Service should make every effort to raise public awareness regarding the possible presence of birds and the risk of violating the MBTA, the Endangered Species Act (ESA), and the Bald and Golden Eagle Protection Act (BGEPA), and should inform the public of factors that will help minimize the likelihood that take would occur should nests be destroyed (i.e., when active nesting season normally occurs).

The Service should also take care to discern that persons who request MBTA permits for nest destruction are not targeting nests of endangered or threatened species or bald or golden eagles, so that the public can be made aware of the prohibitions of the ESA and the BGEPA against nest destruction.

In situations where it is necessary (i.e., for public safety) to remove (destroy) a nest that is occupied by eggs or nestlings or is otherwise still essential to the survival of a juvenile bird, and a permit is available pursuant to 50 CFR parts 13 and 21, the Service may issue a permit to take individual birds.

Note: A signed version of this Policy may be found at:

<http://www.fws.gov/migratorybirds/mbpermits/PoliciesHandbooks/MBPM-2.nest.PDF>

LITERATURE CITED

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United States Department of the Interior

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Colonel Christopher Hussin
District Engineer
U.S. Army Corps of Engineers
(Attn: CESWF-PEC)
P.O. Box 17300
Fort Worth, Texas 76102-0300

Dear Colonel Hussin:

This letter constitutes the U.S. Fish and Wildlife Service's (Service) final report on the U.S. Army Corps of Engineers' (USACE) Arkansas River Corridor Ecosystem Restoration Feasibility Study Report and Environmental Assessment in Tulsa County, Oklahoma in accordance with Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

In summary, habitat quality and abundance will be positively impacted as a result of project implementation. Results from the FWP conditions analysis for the Proposed Plan restoration features are found in Tables 12, 14, and 29. While there will be loss of 2.89 acres of riverine habitat type for the construction of restoration measures; there will be an increase, or positive impact to riverine, wetland, and sandbar habitat types. A total of 3,375 acres of riverine habitat will be restored and maintained, up from the existing 1,422 acres maintained by the current no/low flow conditions. In addition, 5 acres of backwater wetlands will be restored as well as 3 acres of sandbar island habitat.

The Service supports the proposed action for the Arkansas River Corridor Ecosystem Restoration Feasibility Study. The proposed aquatic ecosystem restoration action promotes riverine, wetland, and sandbar habitat throughout the 42 river mile study area. Habitat improvement activities include a pool structure to temporarily store and release water at a target release rate of 1,000 cfs between water releases from Keystone Dam. Rock riffles and native aquatic wetland plantings would restore wetland functions to backwater areas at Prattville Creek. Three acres of sandbar island habitat, at flows up to 20,000, would be created by placing rock chevrons to aggregate and maintain sandbar habitat.

The Service has determined that there are no designated critical habitat areas within the project area. While there are several listed threatened or endangered species that occur within the ARC study area, these species are not expected to occur within the project area itself except for the Least Tern, no adverse impacts to any of these species would be anticipated.

The Service appreciates the opportunity to assist in the planning of this project. If you have any questions or comments please contact Kevin Stubbs at (918)-382-4516.

Sincerely,

Jonna Polk
Field Supervisor

Enclosure

cc: Josh Johnston, Oklahoma Department of Wildlife Conservation, Jenks, Oklahoma.



Executive Summary

The U.S. Army Corps of Engineers, Tulsa District (USACE), and Tulsa County, the non-federal sponsor, are conducting a Civil Works feasibility study, Arkansas River Corridor (ARC) Ecosystem Restoration Feasibility Study, evaluating aquatic ecosystem restoration opportunities within the ARC between Keystone Dam and the Tulsa/Wagoner County line. The proposed project purpose is to address aquatic ecosystem degradation in the greater Tulsa, Oklahoma area. The study area (Figure ES 1) spans nearly 42 river miles within the existing channel of the Arkansas River in Tulsa County, Oklahoma.

The impacts on the aquatic and riparian ecosystem within the study area from Keystone Dam and associated operations are dramatic. Keystone Dam is a physical barrier for natural river flow and reach connectivity, sediment transport, and migratory and spawning life histories of native fauna.

The Keystone Dam also traps a significant amount of sediment resulting in downstream sediment-starved flow causing channel and tributary incision and bank erosion. The impacted geomorphology has resulted in streambank erosion and the destruction of riverine wetlands, backwaters, and slack water habitats that were once important fish nurseries and feeding/resting areas for resident and migrant waterfowl.

Outside of flood pool releases, river flow in the study area is relies upon hydropower operations.

The Arkansas River Corridor study is authorized in the Water Resources Development Act (WRDA) of 2007, Section 3132.

Section 3132. Arkansas River Corridor.

- (a) IN GENERAL. – The Secretary is authorized to participate in the ecosystem restoration, recreation, and flood damage reduction components of the Arkansas River Corridor Master Plan dated October 2005. The Secretary shall coordinate with appropriate representatives in the vicinity of Tulsa, Oklahoma, including representatives of Tulsa County and surrounding communities and the Indian Nations Council of Governments.
- (b) Authorization of Appropriations. – There is authorized to be appropriated \$50,000,000 to carry out this section.

The key constraint of the study is outlined in the Water Resources Development Act 2007, Section 3132, which limits ecosystem restoration measure consideration to only those found in the Indian Nations Council of Governments' 2005 Arkansas River Corridor Master Plan.

Initial alternatives evaluated for implementation vary from no action to constructing an instream structure to restore riverine habitat by providing more consistent minimum river flow, wetland restoration and supplemental vegetation plantings to increase wetland and riparian habitat value and diversity, as well as constructing sandbar island habitat to support nesting Least Terns during larger flood pool releases from Keystone Dam.

The generation of hydropower at Keystone Dam, which has been in operation since 1968, has had a significant influence over the health of the ecosystem within the study corridor. The dam houses two hydropower-generating turbines with a power-generating capacity of 80 megawatts and a full-power discharge from the reservoir of 12,000 cubic feet per second (cfs). The Southwestern Power Administration (SWPA), as the region's Power Marketing Administration, is authorized to market the hydropower generation at Keystone Dam. When the Keystone lake

level is in the flood pool, hydropower generation is used as the first methods of flood management release as part of the USACE flood risk management strategy. When the lake level is in the conservation pool, SWPA schedules and calls on Keystone Dam hydropower generation to meet peak electricity demand needs of Federal hydropower customers in a six-state region. Keystone Dam hydropower generation is operated as part of a system of numerous hydropower projects in the region to meet the peak electricity demand. Generation schedules are subject to change due to a variety of factors.

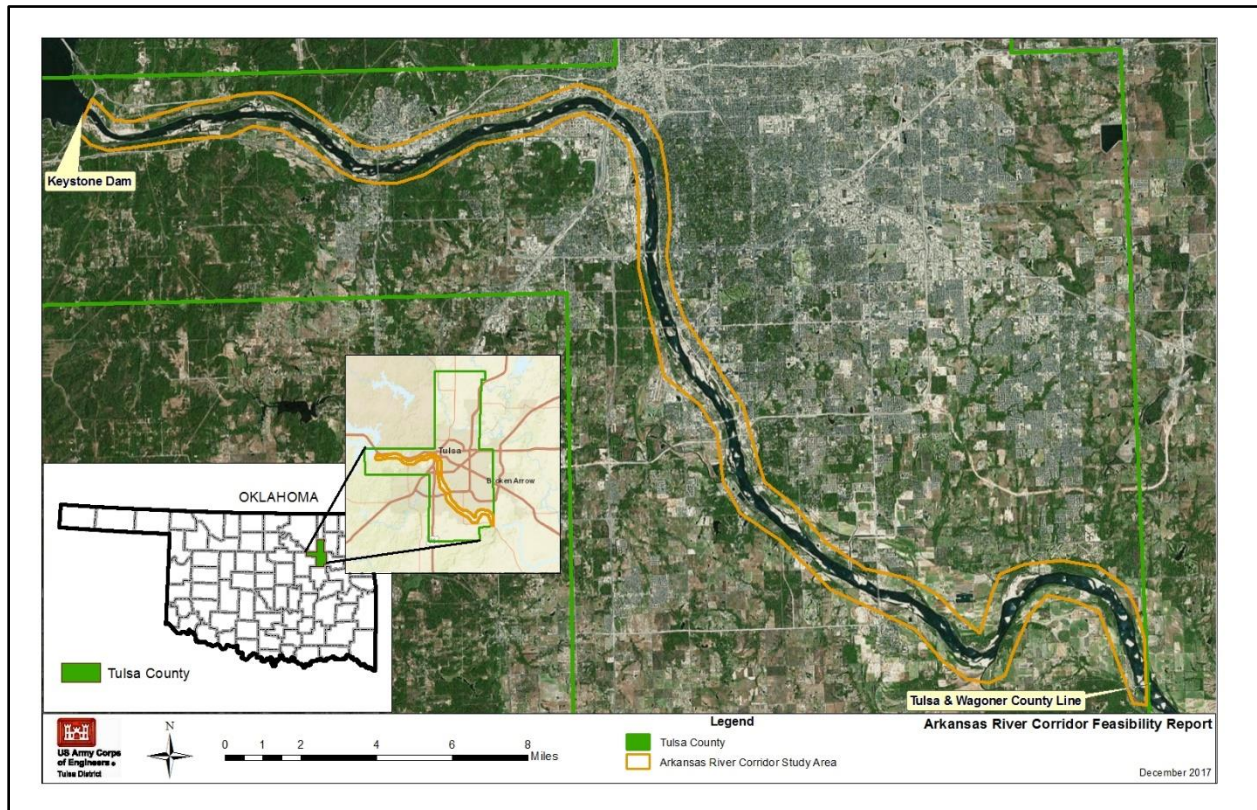


Figure ES 1: Arkansas River Corridor Study Area Location Map.

During hydropower generation, the hydropower units can release an estimated 6000 cfs (1 unit) or 12,000 cfs (2 units) of water that flows through the river throughout the study area. During periods of low precipitation, water levels behind the dam drop into the conservation pool. Once in the conservation pool, the only water released downstream is to meet hydropower or, occasionally, water supply demand, which is typically released via the hydropower units. As a result, the current flow regime within the study area exhibits daily bouts of brief 6,000-12,000 cfs river flow followed by extended periods of near zero river flow from Keystone Dam. Without releases from Keystone Dam, the Arkansas River within the study area is reduced from a flowing river to isolated pools and a disconnected floodplain habitat lasting from several hours during the week to several days over the weekend. This creates an incredibly disruptive, unnatural flow regime impacting all aquatic and riparian habitat types as well as the flora and fauna throughout the study area. While the drying of rivers is a naturally occurring process in the southwestern region of the United States, those conditions are generally experienced in smaller drainages and during extended severe droughts. In the study area, flooding and drought

conditions are exacerbated beyond this natural drying process by the impacts of Keystone Dam and hydropower releases.

Within the study area, Federally-listed endangered Least Terns annually nest on the sandbar islands. As river flow diminishes and the river bed is exposed, the sandbar islands become connected to the shoreline. This fluctuating flow cycle coincides with peak Least Tern nesting activities in the study corridor, exposing the nesting colonies to inundation during high flows, and human and predator disturbances when low flows create land bridges to sandbar islands. The low flow conditions also induce Least Terns to nest in unsuitable low-lying areas. Hours or days later when river flows return, the low-lying nests have a higher probability of being swept into the river. Both inundation and low flow conditions contribute to the documented nesting failure in the Arkansas River Corridor.

The aquatic and terrestrial data collected were analyzed using the U.S. Fish and Wildlife Service's Habitat Evaluation Procedures to describe the various existing habitats in the study area. The portion of the study area evaluated contains approximately 3,735 acres of river habitat, 5.89 acres of wetland, 3.82 acres of mixed riparian forest/scrub, and 5 acres of sandbar habitat. The remaining 20,321 acres in the study areas consists of primarily river bed, and shoreline riparian shrub/forest, and urban and agriculture use areas. To varying degrees, all of the study area is subjected to past and/or ongoing human disturbance from nearby commercial and residential activities, agriculture operations, sand mining, automotive traffic, recreational activities, runoff of pollutants, etc. Wildlife habitat quality appears to vary throughout the area investigated. Areas subjected to less frequent impact appear to contain reasonably intact mixed riparian forest patches. Riverine and aquatically connected habitats are likely the most viable to benefit from preservation and restoration efforts to improve habitat diversity and quality, while promoting a variety of resident and migratory wildlife species.

This report describes existing/Future Without Project (FWOP), and Future With Project (FWP) fish and wildlife habitat conditions using field and desktop data collected from the Arkansas River Corridor study area between Keystone Dam and the Tulsa-Wagoner County line in Tulsa County, Oklahoma.

The study is being conducted in accordance with USACE *Engineering Regulation (ER) 1105-2-100, Planning Guidance Notebook*, and is organized in the framework of the ER. The study has been conducted following the six-step planning process which originated in the 1983 *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (also known as Principles and Guidelines or P&G). Implementation guidance provided for Section 3132 requires a cost-shared study be completed following the guidelines in ER 1105-2-100, Appendix H for projects authorized without a report. No project construction may be initiated until funds are specifically appropriated to accomplish the work. Pre-construction Engineering and Design is considered the next phase of this investigation.

Existing Conditions for the Arkansas River Corridor Ecosystem Restoration Feasibility Study



United States Fish and Wildlife Service
Oklahoma Ecological Services Field Office
9014 East 21st Street
Tulsa, Oklahoma 74129-1428
February 2018

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Existing Habitat Conditions for the Arkansas River Corridor Ecosystem Restoration Feasibility Study

Introduction

The purpose of this report is to describe existing fish and wildlife resources within the Arkansas River Corridor study area in Tulsa County, Oklahoma and to recommend preliminary measures for ecosystem restoration. This planning assistance is provided to the U.S. Army Corps of Engineers (Corps), pursuant to the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 et seq). This information does not represent a final report of the Secretary of the Interior within the meaning of Section 2(b) of the FWCA. It is being provided to assist the Corps in the Arkansas River Corridor Ecosystem Restoration Feasibility Study.

Study Area

Location

The Arkansas River Corridor (ARC) study area includes 42-river miles along Arkansas River downstream of Keystone Dam to the Tulsa/Wagoner County boundary (Figure 1). Key tributary streams include, but are not limited to, Prattville Creek at Sand Springs, Crow Creek in Tulsa, and Vensel Creek at Jenks. The study area, encompassing 23,797 acres, is confined to within the existing banks of the Arkansas River and adjacent riparian corridor. Currently, there are three other major projects either under construction or in the planning phase within the study area.

Zink Lake Dam is located on the Arkansas River near 31st Street. It was completed in 1983 by the City of Tulsa. The low water dam is named after John Steele Zink, whose family foundation was a major private contributor to the project. Zink Lake, located adjacent to the River Parks Authority trail system is a popular area for fishing and rowing. Immediately downstream of Zink Lake Dam once was a popular spot for kayaking the “Tulsa Wave.” Tulsa County is in the process of rehabilitating the Zink Lake Dam.

The Muskogee (Creek) Nation has been actively involved in development along the Arkansas River Corridor. An existing attraction is the River Spirit Casino near 81st and Riverside Drive. On-going initiatives include renovation of Riverwalk Crossing and construction of the Margaritaville project that includes a 27-story, 483-room hotel and other associated amenities in the vicinity of the casino.

A Gathering Place for Tulsa is a project of the George Kaiser Family Foundation, *A Gathering Place for Tulsa* will transform nearly 100 acres of waterfront along the Arkansas River as it passes through the city of Tulsa into a recreation area that blends nature with an urban setting.

The South Tulsa / Jenks Pool was identified as a top priority low water dam location in the 2005 Master Plan, the proposed low water dam and pool at river mile 514, would enhance future commercial, recreational, and residential development in the area. Public safety, sedimentation, fish passage, and habitat restoration are important considerations in development of plans at this site. Local funding for this project was approved by City of Tulsa and Jenks voters in April 2016. This project is currently in the 404 permitting process.

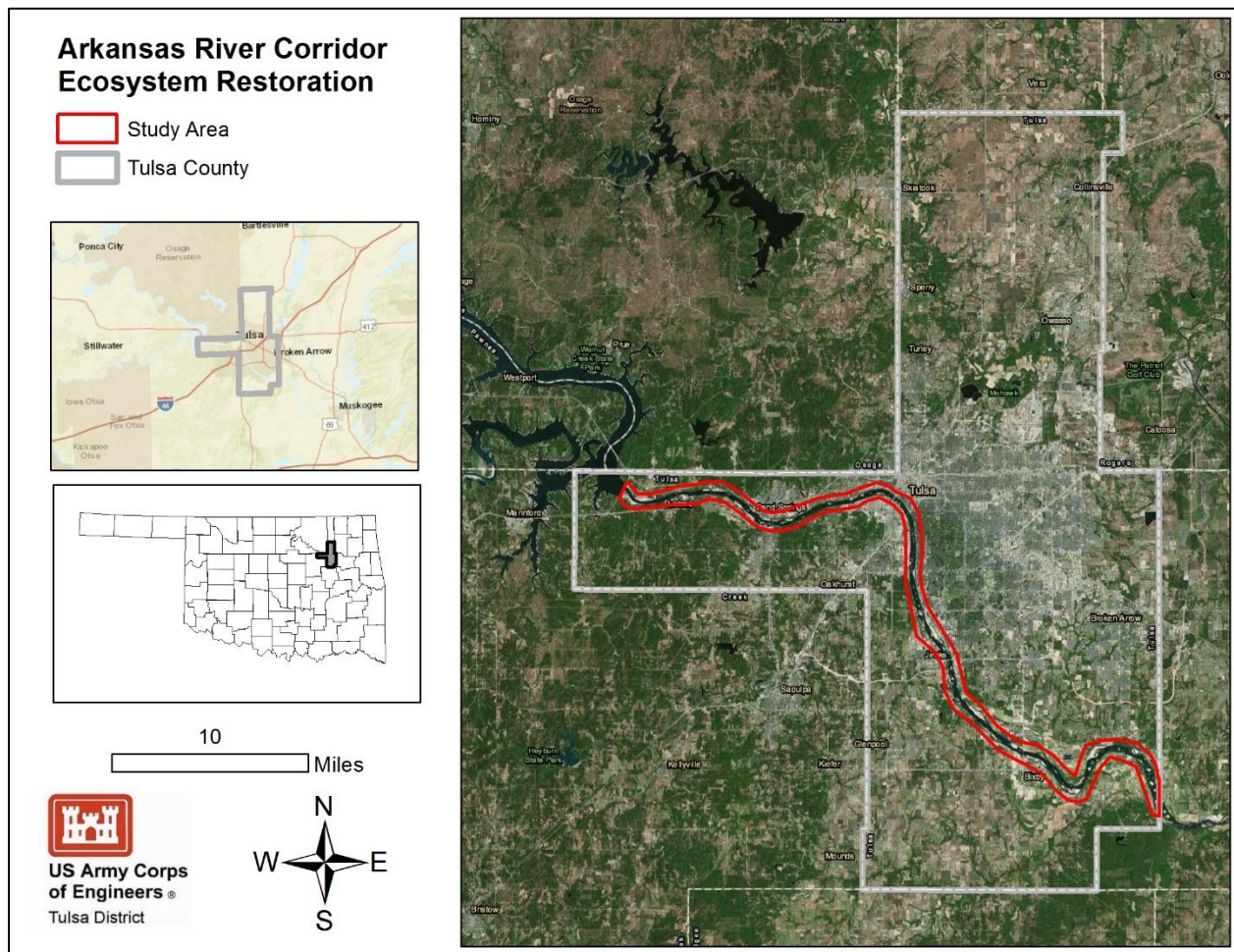


Figure 1. ARC Study Area Overview.

Climate, Topography, and Ecology

The climate in the Tulsa area is considered continental, characterized by abundant sunshine and rapid fluctuations in temperature. Winters are generally mild, though temperatures occasionally fall below 0 degrees Fahrenheit (°F) for brief periods of time. During the summer, temperatures often exceed 100°F from late July to early September. The average annual temperature is 60°F, with average highs ranging from 88°F to 93°F during the summer and from 46°F to 53°F during the winter. Average low temperatures in the winter months generally range between 26°F and 31°F (NWS 2011).

Average annual precipitation in the study area is 42 inches (NWS 2011). Thunderstorms account for a significant amount of the annual precipitation and are most frequent in the spring. Generally, wet weather events take place only for a day or two, followed by fair skies. Snowfall is most prevalent in January and early March, with annual snowfall amounts averaging 9.2 inches (NWS 2011). In addition to local precipitation, rain and snowfall events throughout the Arkansas River watershed can impact flow conditions in the Tulsa area.

Large hail and windstorms may occur throughout the year, but are most common in spring and early summer. Typically these storms create scattered damage. Oklahoma has a very high level of tornado activity, with an average of 53 tornadoes a year state-wide, with an average of 12 in Tulsa County per year (NWS 2011b).

The Arkansas River is the fourth longest river in the U.S. It flows from the headwaters near Leadville, Colorado, to the confluence with the Mississippi River near Rosedale, Mississippi. The river flows 1,450 miles through Colorado, Kansas, Oklahoma, and Arkansas. The Arkansas River has a watershed area of almost 195,000 square miles (mi²) at the confluence of the Mississippi River and a watershed area of 74,615 mi² at the Tulsa gaging station maintained by the U.S. Geological Survey (USGS). The Arkansas River drains most of Tulsa County, but tributaries of the Verdigris, principally Bird Creek and the Caney River, drain the northern portion.

Tulsa County contains 587 mi² of land and water area. The landscape includes prairies and sandstone hills, with the lowlands of the Arkansas River Valley providing excellent farming soil. The Arkansas River flows through the study area in a wide, braided, sandy-bottomed channel referred to as a prairie river. Prairie rivers are a mix of runs and riffles that change within the larger river channel when higher flows move and redeposit sand. At lower flow conditions, these sandbars are exposed and may establish rooted vegetation or remain barren. Reservoirs such as Keystone and Kaw, which provide flood control and hydropower generation, have altered the seasonal pattern of hydrologic inputs from rainfall. Outside of flood pool releases and hydropower generation, the lack of river flow has changed the river hydrology that limited ecosystem function remains. The Arkansas River does support navigation up to Muskogee, Oklahoma, but is considered non-navigable within the study area.

The study area is located on the mainstem of the Arkansas River within Tulsa County, Oklahoma, which includes its banks from the Keystone Dam downstream to the Tulsa/Wagoner County line (42 miles), and is located entirely within the Polecat-Snake Watershed (HUC 11110101). Much of the surrounding land use includes the urbanized Tulsa metropolitan area, which includes the cities of Bixby, Owasso, Broken Arrow, Jenks, and Sand Springs. The remaining watershed land use is primarily agricultural with some commercial land use. Zink Dam and its associated reservoir pool are located near 31st Street and Riverside Drive in Tulsa, Oklahoma.

Between Keystone Dam and the Tulsa/Wagoner County line, is generally located within urbanized environment; therefore, the natural landscape has been heavily altered. Examples of modifications within the study area include riprap and graded banks, fill, concrete channels, commercial and residential development, and industrial facilities. Keystone Dam was built in 1964 along the Arkansas River upstream from Tulsa to control flooding and stabilize river flow. This has affected the ARC within Tulsa and its suburbs, changing the normal water levels downstream, and facilitating development along the banks.

The tributaries Euchee Creek, Fisher Creek, and old Prattville Creek, enter the Arkansas River within the study area. Of these tributaries, the Prattville Creek confluence and the surrounding area is the only area where additional restoration and ecosystem improvement work is required for this alternative. The Arkansas River flows west to east where the old Prattville Creek meets with the river, and the confluence is located on the south side of the Arkansas River directly north of Prattville and south of Sand Springs.

While the Arkansas River has long been a significant natural resource for the surrounding land and its inhabitants, historical alterations have substantially altered watershed conditions and degraded the river's ecosystem. Keystone Dam, which was constructed in 1964 to protect nearby communities from extreme flood events, significantly changed the natural hydrology of the Arkansas River. Additionally, growth and development associated with the Tulsa metropolitan area, and related intensive land use practices, have led to streambank erosion, destruction of riverine wetlands, increased stormwater runoff, and a high degree of sediment transport to the river. As a result, ecosystems native to the Arkansas River area have been compromised, and instream habitats continue to be depleted and degraded.

Emergent wetland areas, characterized by usually flooded areas with rooted, herbaceous hydrophytes, also occur within the study area. They can be found either along the edge of the Arkansas River or in depressional areas within the floodplain. Dominant perennial vegetation in these emergent wetlands may include rushes (*Juncus* spp.), smartweed (*Polygonum* spp.), spikerush (*Eleocharis* spp.), grassy arrowhead (*Sagittaria graminea*), cattail (*Typha latifolia*), and various sedges (*Carex* spp.). Buttonbush (*Cephalanthus occidentalis*) is also commonly found scattered throughout wetland areas where inundation is less frequent (Oklahoma State University, 1998).

Riparian shrub wetlands, characterized by occasionally flooded areas with shrub and young woody vegetation, also occur within the study area. These are open areas dominated by shrub and hardwood saplings mixed with emergent herbaceous vegetation. Riparian shrub wetlands provide shelter, food, and nesting habitat for a variety of wildlife. Common vegetation in these wetland areas includes buttonbush (*Cephalanthus occidentalis*), hawthorn (*Crataegus crus-galli*), deciduous holly (*Ilex decidua*), big bluestem (*Andropogon gerardii*), and soft rush (*Juncus effusus*). Young hardwoods common to this habitat may include black willow (*Salix nigra*), cottonwood (*Populus deltoides*), oaks (*Quercus* spp.), sandbar willow (*Salix exigua*), and sycamore (*Plantanus occidentalis*) (Oklahoma State University, 1998).

Bottomland hardwood forests are an extensive component of the Arkansas River riparian corridor, occurring largely within the floodplain of the river and adjacent to small tributaries. This forest habitat is regarded as extremely important because of the wildlife diversity it supports, high soil productivity, and hydrologic regimes. The forested bottomland in the study area consists of large- to medium-sized trees with a moderate understory. The overstory is dominated by cottonwood, sycamore, green ash (*Fraxinus pennsylvanica*), pecan (*Carya illinoensis*), box elder (*Acer negundo*), river birch (*Betula nigra*), black willow, silver maple (*Acer saccharinum*), black walnut (*Juglans nigra*), sugarberry (*Celtis laevigata*), water oak (*Quercus nigra*), overcup oak (*Quercus lyrata*), and willow oak (*Quercus phellos*). The bottomland understory is largely dominated by swamp privet (*Forestiera acuminata*), greenbriar (*Smilax* spp.), poison ivy (*Toxicodendron radicans*), violets (*Viola* spp.), and trumpet-creeper (*Campsis radicans*), along with young hardwood species (Oklahoma State University, 1998).

Riverine and sandbar habitat dominate the river channel habitats during lower flow conditions. Riverine sandbar habitat structure and function are influenced directly by the hydrology of the Arkansas River. The riverine sandbar size, location, and stability are dependent on the controlled flow conditions of the Arkansas River through releases from the Keystone Dam upstream. During typical river-stage conditions (less than 12,000 cfs), the sandbars within the study area are dry and not inundated by surface water. During higher river stages, the sandbars are partially or fully inundated by surface water.

Riverine sandbar habitats within the study area are mostly unvegetated. By their nature, the sandbars are subject to cycles of scour and deposition. At slightly higher elevations nearer the river banks, the riverine sandbars are less frequently inundated by surface waters and become more vegetated. Where established along the banks, vegetation is typically herbaceous shrubs, or smaller trees such as black willow, sandbar willow, buttonbush, sycamore, and big bluestem. The invasive species Johnson grass (*Sorghum halepense*) is readily abundant within these habitats because it quickly colonizes areas disturbed by the shifting river sands. The highest elevations within the riverine sandbar habitats include the bank slopes of the Arkansas River. The majority of the riverbanks are steep to near vertically sloped with areas that are sloughing and/or eroding or are reinforced with riprap or concrete rubble.

The primary ecological functions that the riverine sandbars provide within the study area include floodwater attenuation during high-river stage events; sediment source for downstream habitats; habitat for listed species; and foraging habitat for wading birds, waterfowl, and terrestrial species

Riverine sandbars within the study area have the potential to provide habitat for the federally listed Interior Least Tern (*Sterna antillarum*). The bald eagle (*Haliaeetus leucocephalus*), which was recently removed from federal listing, is also known to use habitats within the study area.

Open water habitats within the mainstem of the ARC include riverine riffle and pool run complexes, isolated pools, and a reservoir pool (Zink Lake). The riffle and pool run complexes are features typical of a prairie river system. They are braided and relatively nonpermanent features that become repositioned within the river channel during higher flow conditions. Substrates are typically sand or bedrock with little gravel or cobble. At locations where the river channel substrate is bedrock, the riffle runs are more permanent features.

Isolated pools of open water occur throughout the study area in the absence of flood pool or hydropower releases. They include features created through natural processes such as oxbows, which are relics of meandering riffle and pool run complexes and those created through anthropogenic activities such as sand mining and at locations below stormwater outfalls entering the river. Many of these isolated pools are temporary, as braided riffle and pool run complexes meander under various river flow conditions and as riverine sandbars shift and are redeposited. The more permanent pools are found adjacent to the ARC banks and are connected to other surface waters under higher river stages. Many of these have emergent and shrub wetland vegetation present, creating a littoral fringe that helps stabilize the substrate. Water quality within the more permanent pools are typically reduced because of stormwater inputs and little to no mixing with other surface waters. Substrates within these pools include sand and organic sediments.

Zink Dam is located near 31st Street and Riverside Drive. The dam was constructed in 1983 creating a permanent reservoir pool known as Zink Lake. The backwater, or impounded area, extends upstream approximately 2 miles and encompasses approximately 298 acres when the dam is at the control elevation of 617 feet. The existing dam structure limits fish and fish egg passage, and reduces sediment transport downstream by trapping sediments in the reservoir.

The open water habitats within the study area provide foraging areas for wading areas and shorebirds, including the listed species Least Tern. They provide resting areas for waterfowl. The deeper and more permanent open water features provide habitat for fish communities.

Emergent wetland habitats found within the study area provide food and shelter for fish and other species including macroinvertebrates, which make up the foundation of the aquatic food chain. These wetland areas also provide habitat for amphibians, reptiles, birds, and insects. Frogs and salamanders use these wetland areas for breeding grounds and for egg laying. Ducks and migratory birds use them for resting areas on migration routes and for nesting. Insects associated with open water and emergent habitats include true flies (order Diptera), mayflies (order Ephemeroptera), caddisflies (order Trichoptera), dragonflies and damselflies (order Odonata), and beetles (order Coleoptera). These aquatic insects not only provide a food source for fish, aquatic invertebrates, amphibians, reptiles, and birds, they also break down organic material present in riverine and riparian wetland areas common throughout the study area.

Many species of reptiles and amphibians inhabit the riparian bottomland forests and emergent wetlands along the Arkansas River, with amphibians being more prevalent in the bottomland swamp areas and other aquatic habitats. Common reptiles include the western ribbon snake (*Thamnophis proximus*), eastern hognose snake (*Heterodon platyrhinos*), fence lizard (*Sceloporus undulatus*), timber rattlesnake (*Crotalus horridus*), common snapping turtle (*Chelydra serpentina*), red-eared slider (*Chrysemys scripta elegans*), and three-toed box turtle (*Terrapene carolina triunguis*). Common amphibians include the southern leopard frog (*Rana sphenoccephala*), northern spring peeper (*Hyla crucifer*), American toad (*Bufo americanus*), bullfrog (*Rana catesbeiana*), and green frog (*Rana clamitans melanota*) (CH2M, 2010).

Bird species commonly found in forested habitats surrounding the area include pileated woodpecker (*Dryocopus pileatus*), belted kingfisher (*Ceryle alcyon*), wood duck (*Aix sponsa*), herons and egrets (*Ardea* spp. and *Egretta* spp.), barred owl (*Strix varia*), and red-shouldered hawk (*Buteo lineatus*). Birds common in the wetland areas are similar to those that occur in upland forested habitats, particularly waterfowl such as herons, egrets, and cormorants (*Phalacrocorax* spp.).

The Arkansas River and its tributaries within the study area support a prominent fishery providing valuable recreational opportunities to area residents. Additionally, populations of suitable forage species for Least Terns and wading birds are relatively abundant in the Arkansas River. Sources cited in the Least Tern recovery plan (USFWS, 1990) identify species of *Notropis*, *Pimephales*, *Gambusia*, *Dorosoma*, and *Carpionodes* among important fish genera in the diet of Least Tern. Species of *Cyprinella* and *Labidesthes* also are small fish that are potentially suitable as prey. These smaller forage fishes are most abundant in pool runs, Zink Lake, and temporary and permanent isolated pools. Their local seasonal abundance is dependent on river flows, pool connections to other river channel surface waters, and water quality.

A seasonal fisheries survey conducted by ODWC biologists from October 2006 through September 2007 (Cherokee CRC, 2009) reported the occurrence of 41 species of fish in 12 families from the Arkansas River in Tulsa County. Of these reported species, three are listed as invasive exotics: grass carp (*Ctenopharyngodon idella*), common carp (*Cyprinus carpio*), and white perch (*Morone americana*). The families represented by the most species were sunfish (*Lepomis* spp.) (9 species), carp (family Cyprinidae) and minnows (8 species), and suckers (7 species). The principal sport fishes collected included largemouth bass (*Micropterus salmoides*), spotted bass (*Micropterus punctulatus*), striped bass (*Morone saxatilis*), channel catfish (*Ictalurus punctatus*), flathead catfish, white crappie (*Pomoxis annularis*), a variety of sunfish,

and sauger (*Sander canadensis*). ODWC collected 29 species from the reach between Keystone Dam and Zink Dam and 37 species from the reach downstream of Zink Dam. Eleven species were collected exclusively downstream of Zink Dam, potentially indicative of habitat differences, water quality conditions, or Zink Dam as an impediment to upstream dispersal (as currently operated). The 11 species included 4 native minnows, and the larger native riverine species paddlefish (*Polyodon spathula*), river redhorse (*Moxostoma carinatum*), golden redhorse (*Moxostoma erythrurum*), sauger (*Sander canadensis*), and walleye (*Sander vitreus*). Recent occurrence (2015) of paddlefish in the Arkansas River in Tulsa County have also been reported. Numerous paddlefish were observed in pools below Zink Dam in late summer and early fall 2015, following elevated river stages throughout most of the summer, which likely allowed the paddlefish to travel farther upstream than during typical river stages.

From October 2006 to April 2008, Eagle Environmental Consulting, Inc., conducted aquatic macroinvertebrate surveys along the Arkansas River at locations upstream and downstream of the study area. The most common species collected were Chironomids (midges), Naiads (dragonflies and mayflies), Hyalellans (amphipods), and Daphnia (water fleas). Freshwater mussels with the potential to occur within the action area of the Arkansas River and its tributaries include white heelsplitter (*Lasmigonia complanata*), fragile papershell (*Leptodea fragilis*), giant floater (*Pyganodon grandis*), pink papershell (*Potamilis ohioensis*), and mapleleaf (*Quadrula quadrula*) (Eagle Environmental Consulting, Inc., 2008). The shifting substrate of the river in most locations likely provides poor habitat for mussels, which generally prefer a stable substrate; however, this is not the case in Zink Lake.

According to the USGS Nonindigenous Aquatic Species (NAS) database, a record from 2006 indicated that zebra mussels (*Dreissena polymorpha*) in the Polecat Snake Watershed (HUC 11110101) of the Arkansas River downstream of the Zink Dam, had an established population (reproducing and overwintering) (USGS, 2016; ODWC, 2012). The infestation of zebra mussels in the Arkansas Rivers appears to have come from a commercial vessel in 1992 (USACE, 2010b). The infestation has continued down the Arkansas River, through Tulsa County, to the already infested navigation system.

Existing Aquatic and Terrestrial Habitats and Wildlife Resources

Habitat Evaluation Methods

Habitat Evaluation Procedures (HEP) were developed by US Fish and Wildlife Service (USFWS) in 1980 to quantify impacts of resource developments on fish and wildlife habitats (USFWS 1980 a,b,c). HEP was used to model existing habitat conditions and project changes in habitat quantity and quality over time using Habitat Suitability Indices (HSIs) to mathematically express habitat quality under alternative future scenarios. HSIs are calculated using environmental variables such as vegetation cover, hydrologic regime, and water quality for species and/or community. Algorithms are used to define habitat quality on a scale from 0-1, with 1 being the highest quality habitat. Habitat Units (HUs) are then calculated by multiplying the HSI value by the number of habitat acres assessed.

A meeting was held on 23 May 2016 including Josh Johnston (ODWC) Northeast Region Fisheries Supervisor, Kevin Stubbs, (USFWS) fish and wildlife biologist based out of the Oklahoma Ecological Services Field Office, and USACE Regional Planning and Environmental Center (RPEC) biologists Daniel Allen, David Gade, Brandon Wadlington, and RPEC section

chief Kelly Burks-Copes. The purpose of the meeting was to select Corps certified species HEP models that would best represent the Arkansas River Corridor study area habitats (riverine/sandbar, wetlands, riparian) to evaluate existing habitat, future without project conditions, and habitat response to proposed restorative measures. These species models would also aid in selection of the most practicable habitat restoration alternative(s). Species models selected included the Least Tern (Carreker, 1985), Paddlefish (Hubert, Anderson, Southall, & Crance, 1984), Walleye (McMahon, Terrell, & Nelson, 1984), Bigmouth Buffalo (Edwards, 1983), Slider Turtle (Morreale & Gibbons, 1986), and the Red-winged Blackbird (Short, 1985). All models selected are certified by USACE Headquarters for use and were also evaluated and endorsed by the USACE Ecosystem Restoration Planning Center of Expertise for use based on regional and cover type applicability.

Walleye was selected as a surrogate species for Sauger, a pelagic spawning species highly dependent on a constantly flowing Arkansas River to support reproductive activities. Sauger eggs and larval spawn must remain suspended in the flowing river for several days to avoid desiccation or being stranded and buried by sediment along the river bed.

An attempt was made by the team to select a certified HSI model representing forage fish habitat for Least Tern and other larger fish species. The team identified the Bigmouth Buffalo as the best available model to represent the feeder fish community habitat.

The Least Tern, Paddlefish, Walleye, and Bigmouth Buffalo models were selected to evaluate riverine habitat throughout the study area within the ARC. The Least Tern model was also used to evaluate riverine habitat for sandbar restoration. While Slider Turtle and the Red-winged Blackbird were selected to evaluate wetland and riparian scrub. All variables for each species and their respective Habitat Suitability Index equations can be found in Attachment A.

Field data collection was initially scheduled for the week of May 30th-June 3rd 2016. The week leading up to the effort brought additional widespread precipitation to the Upper and Lower Arkansas River Basins. Keystone Lake elevations continued to climb in the flood control pool as did subsequent water releases. On May 30th, according to a stream gage located approximately 15 river miles downstream of Keystone Dam at the Interstate 244 bridge, the Arkansas River exhibited flows in excess of 31,000 cfs. With personnel safety in mind, in addition to river habitat being outside the target condition, the survey was postponed.

Low flow conditions were not expected to return until at least early July, assuming no additional precipitation occurred in the basin. This was concluded based on the amount of water present in the flood control pool at Keystone Lake and the estimated time it would take to return the lake back to conservation pool level.

Initial concerns regarding the collection of substrate composition, aquatic vegetation, and other habitat feature data outside of target conditions were identified based on the increased flows as water levels may limit the survey team's ability to access or assess riverine habitat.

After further discussions with USACE Hydraulics and Hydrology staff on June 6th and 7th, 2016, the flow rates for the study area were expected to be back within the upper hydropower release rates (~11,500 cfs) by June 8th, 2016. Based on the following, field data collection was conducted on June 9th and 10th, 2016:

- Target conditions were at least a month away, but not guaranteed to occur then either
- Hydropower releases would continue to impact survey efforts regardless of base flow rates
- Local resource agency staff, the non-federal sponsor representative, and USACE biologists were all available to participate in data collection efforts within this time frame
- The local professional knowledge and experience within the interagency field survey team would limit assumptions using previous data collection efforts, on-site discussion, and consensus building
- Similar assumptions would likely be made regardless of the sampling period due to the influences of FRM, hydropower, and urban development on the study area.
- Additional data could be collected to describing the high flow conditions to aid in forecasting future with and future without project conditions.

The interagency field survey team consisted of three USACE Regional Planning and Environmental Center (RPEC) biologists Melinda Fisher, Zia Flossman and Brandon Wadlington, two ODWC Fisheries Division biologists, Eric Brennan and Chris Whisenhunt, based out of the Northeast Region Jenks, Oklahoma Office, and Gaylon Pinc, the owner/senior environmental program manager of the Program Management Group, LLC and non-federal sponsor representative based out of Tulsa, Oklahoma. Josh Johnston, ODWC Northeast Region Fisheries Supervisor, and Kevin Stubbs, fish and wildlife biologist based out of the USFWS' Oklahoma Ecological Services Field Office were unable to attend but were contacted following survey efforts to relay field conditions, assumptions being made and to provide input on model projections.

As mentioned above, sampling locations were limited to sites with safe access to target habitat types. Riverine habitat was sampled at eight separate locations while wetland and riparian conditions were surveyed at 5 locations throughout the study area (Figure 2). Attachment B contains approximate survey locations, data collected, and general area pictures taken while surveying habitat conditions.

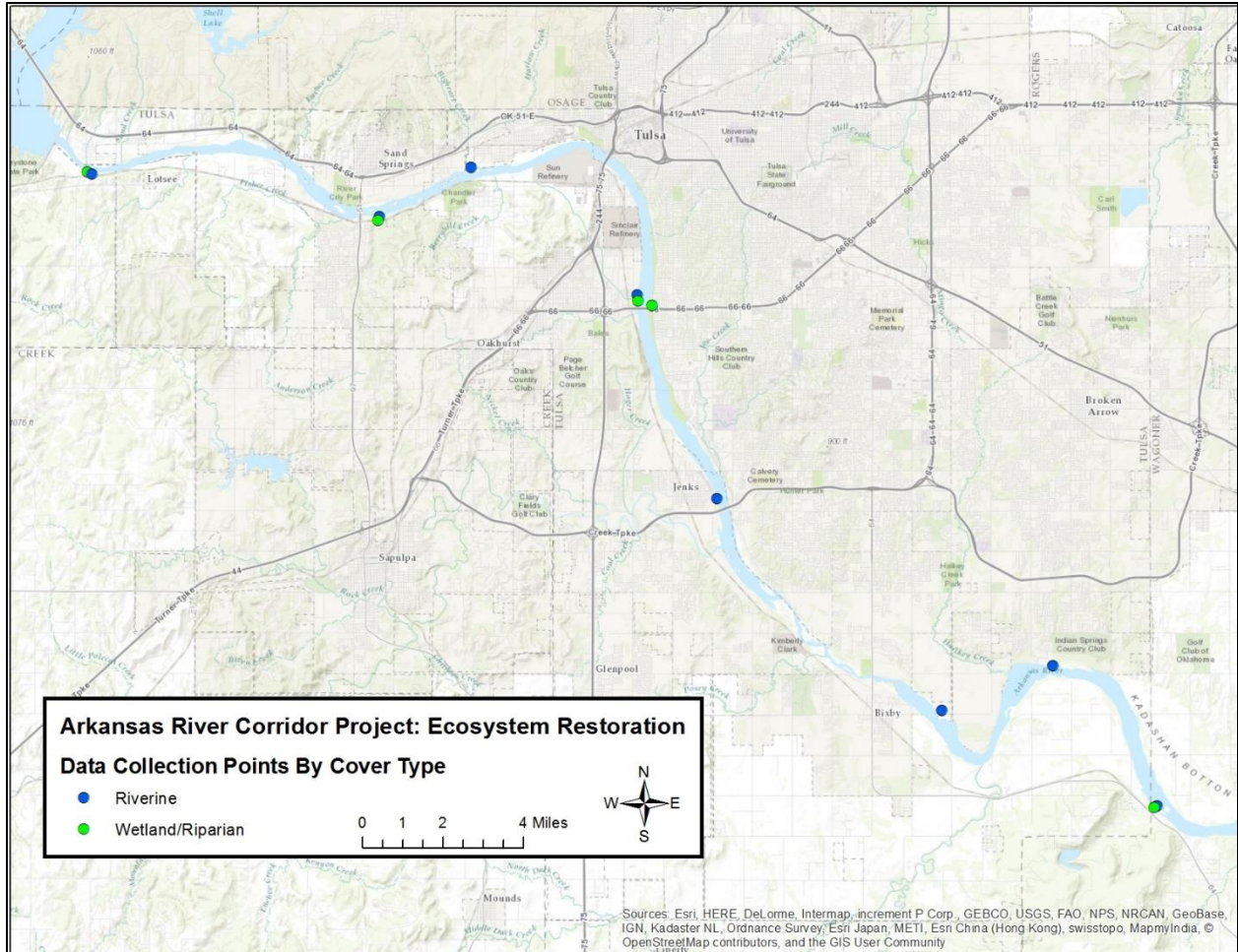


Figure 2. Arkansas River Corridor Project. Data Collection Points by Cover Type.

The collective knowledge of HEP, field sampling techniques, previous and on-going biological studies knowledge, and most importantly intimate knowledge of local riverine habitat conditions during low flow periods allowed for reliable data collection outside of target habitat conditions. In addition, past, present, and planned projects impacting the study area were also discussed during data collection efforts and are accounted for within the projected habitat conditions, particularly the acreage of riverine habitat. Expected future projects included the increase in pool size above the Zink Low Water Dam and the construction of a low water dam within city limits of Jenks, Oklahoma. The surface water acreage maintained upstream of those low water dams were not included as part of the riverine acre totals as those areas were assumed to be lake habitat.

Target Year (TY) 0 habitat conditions are represented by the existing, or baseline, habitat conditions. The field and desktop collected data were used to describe the habitat and quantify habitat units. Target Year 0 conditions serve as a basis of comparison for both future without and future with project scenarios.

Additional TYs were identified based on when implemented measures would be expected to elicit community responses represented by changes in the projected habitat variables.

Target Year 1 is used as a standard comparison year to identify and capture changes in habitat conditions that occur within one year after measures have been constructed. Amount of wetted area, reduction in invasive species, improved water regimes are likely variables that may improve within this time period.

In general wetland diversity in restored areas can match nearby reference condition wetlands within 2-5 years. Therefore, TY 4 was selected to allow enough time for wetland plantings establishment and invasive species management to restore and stabilize the selected areas. Aquatic vegetative abundance and diversity are key variables to assess community response at this target year.

Similarly, TY 10 was selected capture the riparian scrub habitat associated with the restored wetlands. These areas would entail targeted riparian scrub species plantings. Ten years post-planting is adequate to capture a mature riparian scrub habitat that buffers the restored wetlands. Riparian plant abundance and diversity are also key response variables for this target year.

Target Year 50 is the planning life span of the project and is used as the last projected target year for the study. Restorative measures should be produce mature habitat by this target year and represent the restored habitat types within the study area.

Habitat Descriptions and Suitability Index Values

Habitat Units and AAHUs were then derived to serve as a basis for comparison between the Without- and With-Project scenarios. Four species were used to characterize the same riverine cover type. Each species model contained metrics that, as a whole, represented the structure and function of the ecosystem as a whole rather than just for these four species. In order to avoid under, or over, estimating habitat conditions based on any one of those species they were all weighted equally.

Baseline habitat conditions are expressed as a numeric function (HSI value) ranging from 0.0 to 1.0, where 0.0 represents no suitable habitat for an indicator species and 1.0 represents optimum conditions for the species. HSI values ranging from 0.01 to 0.24 are considered “poor” habitat, 0.25 to 0.49 are considered “below average” habitat, 0.50 to 0.69 are “average” habitat, 0.70 to 0.89 are “good” habitat, and 0.90 to 1.00 are considered “excellent” habitat. Habitat Units are calculated by multiplying the HSI for each habitat by the amount of acres of the same habitat.

Baseline Riverine Habitat Conditions in the ARC

Release data from Keystone Dam was evaluated for the years 2000 through 2014 to determine how frequently the Arkansas River downstream of Keystone Dam had flows of less than 1,000 cfs. Over the fifteen year period, an average of 228 days per year had an hourly release from Keystone Dam that was 0 cfs, and on average, there are 97 days where the minimum flow was greater than 1,000 cfs.

Flood pool releases were estimated based on the average daily flows exceeding the capacity of the hydropower generation system. Over the 15 year period, there was an average of approximately 54 days of releases exceeding the hydropower generation capacity. In 2014,

there were no flood releases, and 155 days of flood releases in 2007. The median for this set of data was 44 days of flood releases.

The 100 cfs flow was used to represent the reoccurring low to no flow conditions in the ARC. These limiting conditions can occur throughout the year in the study area as river flow in the study area is dependent of flood pool and hydropower releases. Riverine habitat during the existing no to low flow period, was calculated using the Hydrologic Engineering Center's River Analysis System (HEC-RAS) with river flow modeled at 100 cubic feet per second (cfs). Figure 3 shows the FWOP extent of riverine habitat in the study area.

Table 1 is a summary of estimated total and riverine water surface area, in acres, in the ARC comparing the existing conditions/FWOP, and the FWP.

Table 1. Summary of estimated acreages of total and riverine water surface areas in the ARC.

Scenario	Discharge	Description	Year 0 (ac)	Year 1 (ac)	Year 4 (ac)	Year 10 (ac)	Year 50 (ac)
Existing Conditions (Without Project)	100 cfs	Total ARC Water Surface Area	1,824	1,824	1,961	2,297	2,297
		Zink Lake Pool Area	233	233	403	403	403
		Jenks Pool Area	0	0	0	472	472
		Riverine Water Surface Area	1,591	1,591	1,558	1,422	1,422

Including the existing Zink Lake pool, total water surface area in the ARC from Keystone Dam to the Tulsa County boundary at a discharge level of 100 cfs is 1,824 acres. Subtracting the 233 acres of Zink Lake pool area (elevation at 617 feet) from that total, riverine water surface area in the ARC at a flow rate of 100 cfs is 1,591 acres in Year 0. Riverine acreages diminish in the future as Zink Dam modifications and Jenks Dam construction occurs, and pools generated by these activities inundate riverine areas.

Acreage within the Zink and proposed Jenks pools were not counted as riverine habitat, as the operation and design of those structures are not part of this project. The Zink Dam modification (increasing the pool height from elevation 617 to 620 feet) is assumed to occur in the near future (Year 4), while the Jenks Low Water Dam completion (elevation 597 feet) is pushed further into the future (Year 10).

Least Tern habitat value scored higher than anticipated. The relationship between the percentage of surface and the large river system allowed Least Tern HSI value for forage to score high. The limiting HSI for the Least Tern was the nesting substrate quality. Due to altered sediment transport and extreme flow fluctuations, few areas in the study area contain the ideal mix of sand, silt, and gravel for nesting.

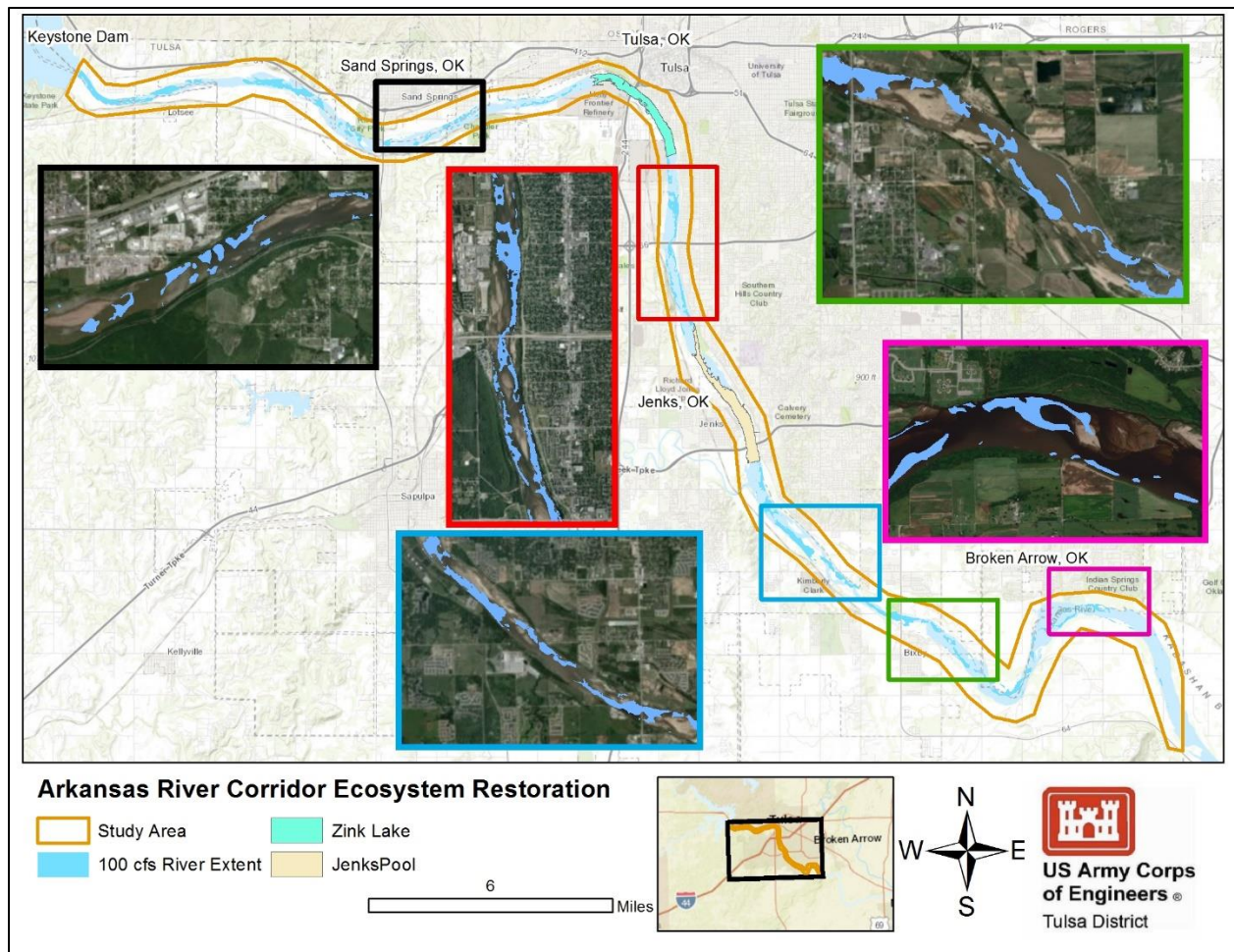


Figure 3. Extent of FWOP Riverine Habitat in the ARC.

Paddlefish HSI scores were largely influenced by the quantity of available spawning and summer habitat. These areas consist of deeper aquatic habitats found within river systems including slack water areas or impoundments. With the increase of Zink Dam and the anticipated South Tulsa/Jenks low water dam, a slight increase in available habitat availability was identified assuming the upgrades and design of those structures would accommodate upstream fish movements.

Walleye and Bigmouth Buffalo scores were low due to minimal aquatic vegetation within the ARC. The drastic changes in the river stage and flow promote little aquatic vegetation growth, especially the frequent periods of dry shoreline and riverbeds being exposed to high summer temperatures. Table 2 shows the projected FWOP conditions in regards to riverine habitat in the study area.

Table 2. Without Project Conditions for Riverine Habitat.

Without-Project Conditions- Riverine Habitat						
Least Tern						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.650	0.650	1591	1591	1,034.150
1	4	0.650	0.650	1591	1558	3,070.275
4	10	0.650	0.650	1558	1422	5,811.000
10	50	0.650	0.650	1422	1422	36,972.000
Without-Project AAHUs:						937.749
Paddlefish						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.445	0.445	1591	1591	708.372
1	4	0.445	0.473	1591	1558	2,168.929
4	10	0.473	0.510	1558	1422	4,394.198
10	50	0.510	0.510	1422	1422	29,030.970
Without-Project AAHUs:						726.049
Walleye						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.183	0.183	1591	1591	290.358
1	4	0.183	0.183	1591	1558	862.039
4	10	0.183	0.183	1558	1422	1,631.551
10	50	0.183	0.183	1422	1422	10,380.600
Without-Project AAHUs:						263.291
Bigmouth Buffalo						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.000	0.000	1591	1591	0.035
1	4	0.000	0.000	1591	1558	0.104
4	10	0.000	0.000	1558	1422	0.197
10	50	0.000	0.000	1422	1422	1.252
Without-Project AAHUs:						0.032
Average Without-Project Riverine AAHUs:						481.780

Baseline Wetland and Riparian Habitat Conditions at Prattville Creek

The mouth of Prattville Creek (Figure 4) contains remnants of backwater wetlands and riparian habitat. Erosion, flooding, and infrastructure right of way maintenance have limited ecological output. The largely degraded tributary mouth has lost virtually all of its backwater wetland properties.

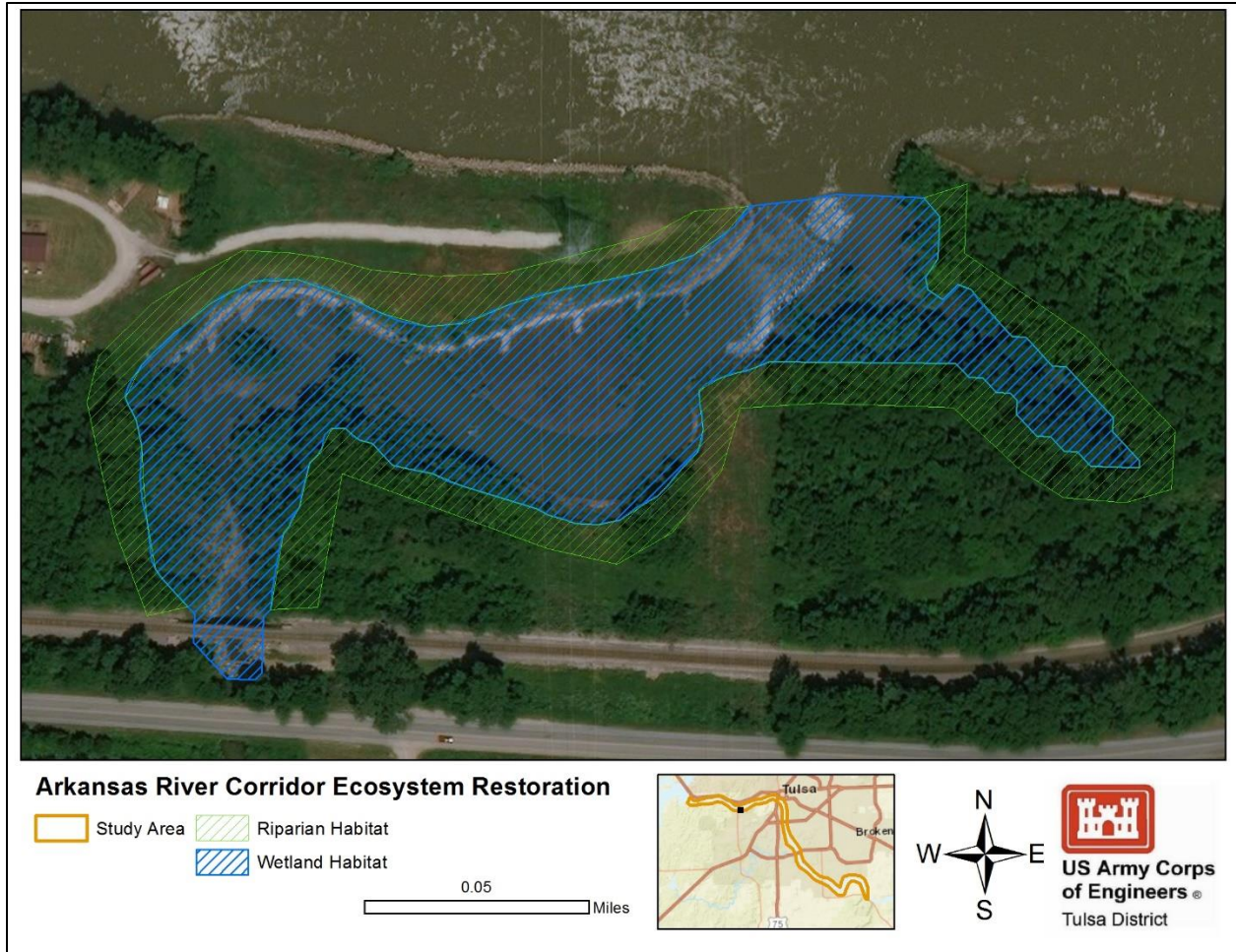


Figure 4. Riparian and Wetland Habitat Assessed at Prattville Creek.

Very little wetland function remains (Table 3). The primary driver in the function loss is the frequent ebb and flow of the area. As high flow water releases are made erosion and instant inundation coupled with extended periods of exposed dry soil limit aquatic vegetation growth.

The riparian habitat that immediately buffers Prattville Creek is largely altered due to powerline right of way maintenance and invasive species encroachment. Namely Salt Cedar and Johnson grass. Additionally, riparian habitat quality for the Red-winged Blackbird is also tied to the adjacent wetland's aquatic plant diversity, which was shown to be poor. Table 4 shows the riparian habitat output for the riparian area surrounding the Prattville Creek and Arkansas River confluence area.

Table 3. Without Project Conditions for Prattville Creek Wetland Habitat.

Without-Project Conditions at Prattville Creek: Wetland Habitat						
Slider Turtle						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0	0	5.34	5.34	0
1	4	0	0	5.34	5.34	0
4	10	0	0	5.34	5.34	0
10	50	0	0	5.34	5.34	0
Without-Project AAHUs:						0

Table 4. Without Project Conditions for Prattville Creek Riparian Habitat.

Without-Project Conditions at Prattville Creek: Riparian Habitat						
Red-winged Blackbird						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.000	0.001	2.24	2.24	0.001
1	4	0.001	0.001	2.24	2.24	0.007
4	10	0.001	0.001	2.24	2.24	0.013
10	50	0.001	0.001	2.24	2.24	0.090
Without-Project AAHUs:						0.002

Baseline Wetland and Riparian Habitat Conditions at I-44/Riverside

Similar wetland conditions exist at the I-44/Riverside location (Figure 5 and Table 5). The only difference in this area was a small area impounded by riprap that maintained a small wetted area. This area exhibited small patches of aquatic vegetation, thus the small increase in habitat value. Numerous slider turtles were also seen in the survey area.

Table 5. Without Project Conditions for I-44/Riverside Wetland Habitat.

Without-Project Conditions at I-44/Riverside: Wetland Habitat						
Slider Turtle						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.120	0.120	0.55	0.55	0.066
1	4	0.120	0.120	0.55	0.55	0.198
4	10	0.120	0.120	0.55	0.55	0.396
10	50	0.120	0.120	0.55	0.55	2.640
Without-Project AAHUs:						0.066

Once again riparian habitat was largely missing except for small patches of Salt Cedar. Habitat value (Table 6) remained virtually non-existent.



Figure 5. Riparian and Wetland Habitat Assessed at I-44/Riverside.

Table 6. Without Project Conditions for I-44/Riverside Riparian Habitat.

Without-Project Conditions at I-44/Riverside: Riparian Habitat						
Red-winged Blackbird						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.000	0.000	1.58	1.58	0.000
1	4	0.000	0.000	1.58	1.58	0.000
4	10	0.000	0.000	1.58	1.58	0.001
10	50	0.000	0.000	1.58	1.58	0.006
Without-Project AAHUs:						0.000

Baseline Sandbar Habitat Conditions near the Indians Springs Sports Complex

In order to assess an area for sandbar island restoration, the Least Tern's riverine cover type model was applied as the sandbar islands reside within the river channel (Figure 6). The area

surveyed is noted to have increased Least Tern nesting presence. The relationship between the percentage of shoreline vegetated to open water habitat dictates the area's habitat quality. The shorelines in this area are heavily vegetated giving Least Tern's little option for shoreline nesting. However, foraging opportunities and nesting substrate scored higher as this area is located within the lower extent of the study area farther away from Keystone Dam which attenuates some of the high energy from water releases (Table 7). This allows for more diverse substrates to remain in the river channel as well as increased fish abundance.

Table 7. Without Project Conditions for Indian Springs Sandbar Habitat.

Without-Project Conditions at Indian Springs: Sandbar (Riverine) Habitat						
Least Tern						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.4	0.4	5	5	2.0
1	4	0.4	0.4	5	5	6.0
4	10	0.4	0.4	5	5	12.0
10	50	0.4	0.4	5	5	80.0
Without-Project AAHUs:						2.00

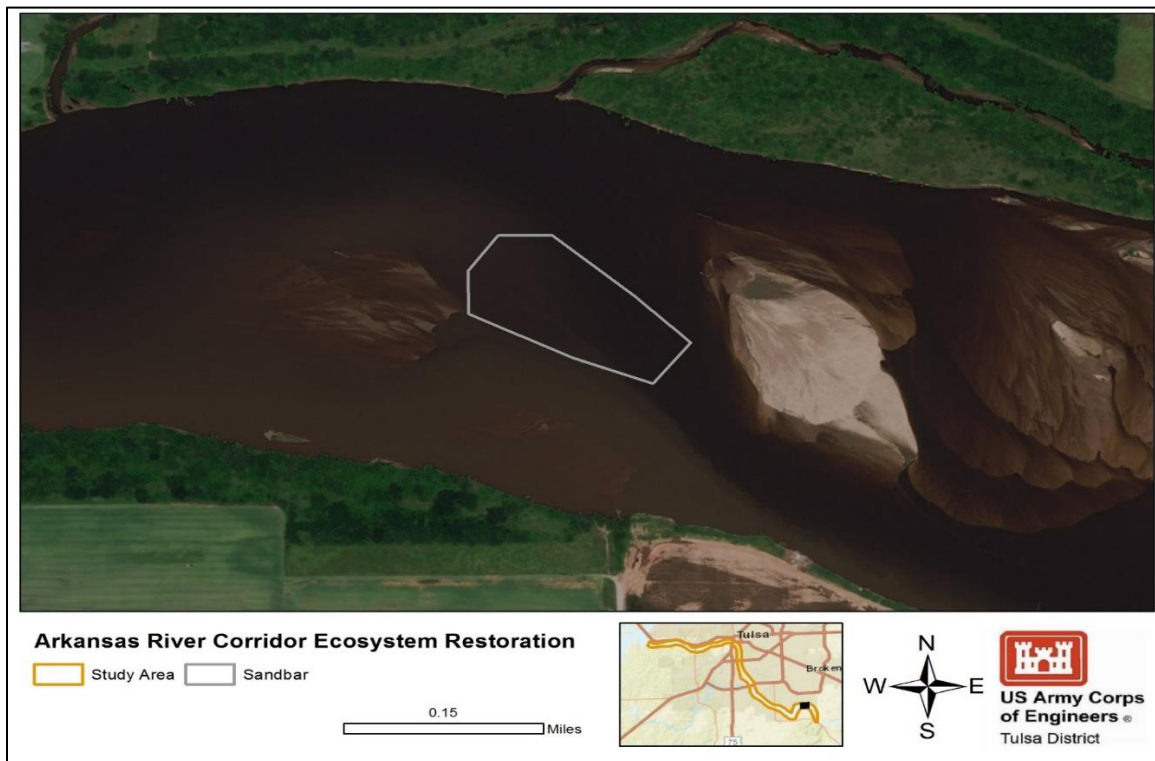


Figure 6. Riverine Habitat Assessed for Sandbar Restoration.

Threatened and Endangered Species and Birds of Conservation Concern

Federally listed threatened and endangered species potentially occurring in the ARC include the endangered Interior Least Tern (*Sterna antillarum*) and American Burying Beetle (*Nicrophorus americanus*) and the threatened Northern Long-eared Bat (*Myotis septentrionalis*), Piping Plover (*Charadrius melodus*), and the Red Knot (*Calidris canutus rufa*). No critical habitats are present for these species in the ARC.

The American burying beetle and Northern long-eared bat can occur in the terrestrial upland and riparian forests and grasslands along the ARC.

Whooping cranes may be encountered in any county in central Oklahoma during migration. Autumn migration normally begins in mid-September, with most birds arriving on the wintering grounds at Aransas National Wildlife Refuge between late October and mid-November. Spring migration occurs during March and April. Whooping cranes prefer isolated areas away from human activity for feeding and roosting, with vegetated wetlands and wetlands adjacent to cropland being utilized along the migration route. Foods consumed usually include frogs, fish, plant tubers, crayfish, insects, and waste grains in harvested fields. It is possible that whooping cranes may temporarily utilize wetland habitats present within the study area during their annual migration but an encounter would be a rare occurrence. Therefore, impacts to the whooping crane within the study area as a result of any of the project alternatives would be unlikely.

Temporary stopover habitats, consisting of open shorelines and sandbars, exist for the piping plover and red knot throughout the ARC during their annual migration, but encounters would be a rare occurrence. Impacts to these species within the study area as a result of any of the project alternatives would be unlikely.

Likewise, suitable temporary stopover, foraging, and nesting habitats for the Interior least tern exist and are annually utilized in the ARC. Nesting colonies of least terns are annually surveyed in the ARC by USACE and USFWS staff (USACE 2005-2006, 2008-2014). Open sandbar islands, in particular, provide ideal nesting habitat for least terns when isolated in the main channel of the Arkansas River from terrestrial predators and human disturbance. Foraging opportunities, primarily small fish, are available within the river and backwater areas. Impacts to the least tern are likely to occur as a result of this project.

The Bald Eagle (*Haliaeetus leucocephalus*) was formerly listed in study area but was removed from the federal threatened and endangered species list, effective August 8, 2007. However, bald eagles are still afforded safeguards under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. We recommend all activities be conducted in accordance with the Service's National Bald Eagle Management Guidelines which may be accessed at <http://www.fws.gov/migratorybirds/issues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf>.

The Service published the *Birds of Conservation Concern 2008* (BCC). In the 2002 BCC, the Service states "The overall goal of the BCC is to accurately identify the migratory and non-migratory bird species (beyond those already designated as Federally threatened or endangered) that represent our highest conservation priorities and draw attention to species in need of conservation action" (U.S. Fish and Wildlife Service 2002).

Copies of the *Birds of Conservation Concern 2008* may be obtained by writing to the Chief, Division of Migratory Bird Management, U.S. Fish and Wildlife Service, 4401 North Fairfax

Drive, Mail Stop 4107, Arlington, VA 22203-1610, ATTN: BCC 2008. It is also available for downloading on the Division of Migratory Bird Management's web page at <http://migratorybirds.fws.gov>.

The following 26 species on the BCC lists may utilize appropriate habitat types within the general vicinity of study area:

American Bittern (*Botaurus lentiginosus*)
American Golden-plover (*Pluvialis dominica*)
Bald Eagle (*Haliaeetus leucocephalus*)
Black-billed Cuckoo (*Coccyzus erythrophthalmus*)
Bobolink (*Dolichonyx oryzivorus*)
Buff-breasted Sandpiper (*Calidris subruficollis*)
Cerulean Warbler (*Dendroica cerulean*)
Eastern Whip-poor-will (*Antrostomus vociferous*)
Harris's Sparrow (*Zonotrichia querula*)
Hudsonian Godwit (*Limosa haemastica*)
Kentucky Warbler (*Oporornis formosus*)
King Rail (*Rallus elegans*)
Least Bittern (*Lxobrychus exilis*)
Lesser Yellowlegs (*Tringa flavipes*)
Long-billed Curlew (*Numenius americanus*)
Marbled Godwit (*Limosa fedoa*)
Prothonotary Warbler (*Protonotaria citrea*)
Red-headed Woodpecker (*Melanerpes erythrocephalus*)
Rusty Blackbird (*Euphagus carolinus*)
Semipalmated Sandpiper (*Calidris pusilla*)
Short-billed Dowitcher (*Limnodromus griseus*)
Smith's Longspur (*Calcarius pictus*)
Sprague's Pipit (*Anthus spragueii*)
Swallow-tailed Kite (*Elanoides forficatus*)
Willet (*Tringa semipalmata*)
Wood Thrush (*Hylocichla mustelina*)

Because some of these species could potentially utilize appropriate habitats within the study area, especially as temporary stopover breaks during annual migration, we recommend that future projects avoid and/or minimize adverse impacts to intact upland, riparian, and grassland habitats whenever possible. Accordingly, we recommend that efforts be made to plan construction activities outside the migratory bird nesting season between April 15 and August 1.

Preliminary Planning Recommendations

The habitat analysis indicates the following specific measures could be beneficial for the restoration of natural habitats impacted by Keystone Dam operations and other developments in the study area:

1. Increase and maintain more consistent minimum river flow of 1,000 cfs. The limiting factor within the ARC aquatic ecosystem is frequent low/no flow conditions. These conditions occur throughout the year in the absence of flood pool releases or hydropower generation. As such, without improved river flow, other aquatic restoration efforts would likely have limited success.

The 1,000 cfs target was conceptualized with ODWC, USACE, and USFWS staff based on flow data from the previously existing reregulating dam within the ARC and observations of river flow in the ARC. The 1,000 cfs would be expected to provide substantial aquatic ecosystem benefits throughout the study area.

The recommended method for delivery of the 1,000 cfs would be a change in Keystone Dam operations. However, based on the language in 2007 WRDA authorization for the project, this option may not be available. The low water dam concept can be an acceptable option if it were designed and operated to meet the following criteria:

The structure should be located as far upstream in the study area, as practicable, while maintaining the ability to deliver 1,000 cfs for at least 72 hours. This performance metric would provide river flow through weekends when hydropower production typically does not occur, thus extending periods of no/low river flow. Aquatic habitat closer to Keystone Dam has already been impacted by reoccurring water releases. Adverse impacts on these habitats would be minimal.

The primary purpose of the structure, and full volume storage upstream, would be to deliver 1,000 cfs river downstream. Operation of Zink Dam and any proposed low water dams downstream should be coordinated with USACE to ensure the 1,000 cfs river flow is allowed to continue through the study area.

Fish passage would be provided for, at a minimum, during flood pool releases. Flood pool releases often coincide with, or trigger fish migration and spawning. Fish passage would likely require full height gates and sloped approaches as the fish species in the study area are unable to use traditional fish ladders. Additional fish passage should be evaluated and provided during reregulation and hydropower generation periods, as long as those features or operations do not impact the structure's ability to deliver 1,000 cfs.

Sediment transport downstream of the structure would need to occur in order to maintain downstream sandbar habitat as well as upstream water storage capacity.

2. Increase backwater/wetland habitat function. Herbaceous backwater wetlands could be restored in side channel, eroded shoreline areas, and tributary confluences. These areas could provide essential nesting, brooding, and spawning habitat along with several benefits that contribute to water quality improvements. Wetlands also provide diversity in the landscape and supply a unique habitat for many plant and animal species.

Plantings should include locally available native aquatic plants and shrubs around the water edges. We recommend the use of locally available native sedges (*Carex* sp.), and bulrushes (*Schoenoplectus* sp.). The wetland should not be mowed or treated with herbicide unless it is absolutely necessary to manage non-desirable plant species (i.e., invasives, exotics).

3. Increase sandbar island habitat. Increasing minimum river flow in the study area would maintain some sandbar island isolation from shoreline disturbances and promote least tern nesting in higher laying areas. However, larger releases from Keystone Dam inundates low elevation sandbars. Sandbar islands could be created away further down in study area where higher Least Tern usage would occur. The sandbar island would be most utilized in less urban areas and away from tall shoreline vegetation. The sandbar would need to be mostly clear

vegetation prior to Least Tern nesting activity and above hydropower pulses to avoid frequent inundation. Sand mining for maintenance of braided channels around the sandbar can be implemented, when and where appropriate to maintain optimum nesting conditions.

In addition, the following are some general recommendations for improving and maintaining lands in and adjacent to the study area for wildlife habitat that the USACE and Tulsa County could practice and recommend to landowners:

1. Reduce mowing on managed areas and along the edges of waterbodies. Reseed and manage portions of these areas as native grasslands, riparian forests, or herbaceous wetlands.
2. Develop a program to eradicate exotic plants in areas where their abundance may prevent natural reestablishment of native vegetation. Use only native plants during the restoration project.
3. Control bank erosion through use of biological engineering to the extent possible and necessary.
4. Develop a plan to greatly reduce or eliminate the use of fertilizers, pesticides, and herbicides on public lands.
5. Initiate a program to help landowners/developers to plan their development footprint in order to avoid sensitive areas and provide upland buffers adjacent to the Arkansas River and tributaries.

Summary

All habitats surveyed within the ARC have been heavily impacted by Keystone Dam operations and urban and agriculture development. However, there are remaining aquatic habitats in the study area that would benefit from aquatic ecosystem restoration efforts. Habitat restoration measures, including those recommended in this report, could help improve some of the natural habitats that have been impacted and advance habitat diversity and quality of remaining habitats, thus benefiting a variety of resident and migratory fish and wildlife species.

Attachment A: HEP Species Variable Parameters

<u>Species</u>	<u>Life Requisite Suitability Indices (LRSI)</u>	<u>HSI Formula</u>
Least Tern	Cover, Forage, Reproduction	Minimum LRSI value between Forage and Reproduction
<u>Life Requisite Suitability Index Formulas & Variables</u>		
Cover	Equal to V3	
Forage	$((2*V1)+V2)/3$	
Reproduction	Minimum value between V3 and V5	
	V1 Percent aquatic area	
	V2 # of disparate aquatic wetlands	
	V3 % herbaceous and shrub cover	
	V4 Average height of herbaceous and shrub canopy	
	V5 Quality of nesting substrate	

<u>Species</u>	<u>Life Requisite Suitability Indices (LRSI)</u>	<u>HSI Formulas</u>
Paddlefish	Reproduction, Habitat	Individual HSI values are derived for each LRSI component Reproduction = $(V1*V2*V3*V4*V5*V6)^{1/6}$ Habitat = $(V7*V8*V9^2*V10)^{1/5}$
<u>Life Requisite Suitability Index Formulas & Variables</u>		
Reproduction	$(V1*V2*V3*V4*V5*V6)^{1/6}$	
Habitat	$(V7*V8*V9^2*V10)^{1/5}$	
	V1 Yearly frequency of at least a 21 day period of rising water between 10-17C	
	V2 Yearly frequency of spring access to upstream spawning river	
	V3 Accessible area of gravel and cobble substrate	
	V4 Average magnitude of spring water rise/average midwinter flow for a period exceeding 10 days with water temps 10-17C	
	V5 Average current velocity	
	V6 Min DO in potential spawning areas while water temps are 10-17C	
	V7 Area of possible summer and winter habitat	
	V8 Average width of river channel or reservoir inhabited during summer and winter	
	V9 % of water area continuous with summer and winter habitat w/ current velocity of <0.05 m/sec in the river system (backwaters, reservoirs)	
	V10 # of eddies in summer and winter channel habitats	

<u>Species</u>	<u>Life Requisite Suitability Indices (LRSI)</u>	<u>HSI Formula</u>
Walleye	Cover, Food, Reproduction, Water Quality	Minimum LRSI value between Cover, Food, Reproduction, and Water Quality
<u>Life Requisite Suitability Index Formulas & Variables</u>		
Cover	$((3*V1)+V3)/4$	
Food	$(V1+V2)/2$	
Reproduction	Minimum value between V7,V10,V11,V12, & V13	
Water Quality	Minimum value between V4,V5,V6,V8 & V9	
	V1	Average transparency depth in summer
	V2	Relative abundance of small (<12cm) forage fish in spring & summer
	V3	% water body w/cover (boulders, logs, brush, veg) & DO > 3mg/L in summer
	V4	Least suitable pH during year
	V5	Min DO in pools and run (R) or above thermocline (L) in summer
	V6	Min DO during summer-fall along shallow shoreline
	V7	Min DO in spawning areas in spring
	V8	Mean weekly water temp in pools R, or above thermocline in summer (L)
	V9	Mean weekly water temp in shallow shoreline in late spring-early summer
	V10	Mean weekly water temp during spawning in spring
	V11	Degree days between 4-10C from Oct 30-April 15
	V12	Spawning habitat index
	V13	Water level during spawning and embryo development
	V14	Trophic status of lake

<u>Species</u>	<u>Life Requisite Suitability Indices (LRSI)</u>	<u>HSI Formula</u>
Bigmouth Buffalo	Food/Cover, Water Quality, Reproduction, Other	Minimum LRSI value between Food/Cover*Water, Quality*Reproduction ² *Other ^{1/5} , and Reproduction
<u>Life Requisite Suitability Index Formulas & Variables</u>		
Food/Cover	(V1*V13) ^{1/2}	
Water Quality	(V2*V3*V4 ² *V6*V8) ^{1/6}	
Reproduction	Minimum value between (V5 ² *V6*V9 ²)*V11 and V5*V9	
Other	Equal to V7	
	V1	% of Pools/marsh waters during spring & summer
	V2	Average max monthly turbidity in average summer
	V3	pH during the year
	V4	Max water temp in summer (adult)
	V5	Average max water temps in nursery habitats in spring & summer
	V6	Min DO during spring and summer
	V7	Average current velocity
	V8	Max salinity in spring & summer
	V9	Dominant Substrate Type in spawning areas
	V10	% littoral area & protected embayments during summer
	V11	Water level fluctuation before and after spawning
	V12	Min TDS during growing season
	V13	% veg cover in pools, backwater, marshes/embayments, shorelines

<u>Species</u>	<u>Life Requisite Suitability Indices (LRSI)</u>	<u>HSI Formula</u>
Slider Turtle	Food/Cover, Water, Temperature	Minimum LRSI value between Food/Cover, Water, and Temperature
<u>Life Requisite Suitability Index Formulas & Variables</u>		
Food/Cover	Equal to V1	
Water	Minimum value between V2,V3, and V4	
Temperature	Equal to V5	
	V1	% cover of emergent and submerged vegetation
	V2	Velocity
	V3	Water Depth
	V4	Water regime
	V5	mean water temp during critical period

<u>Species</u>	<u>HSI Formula & Variables</u>
Red-winged Blackbird	Type of emergent vegetation (V1)*Water Regime (V2)*Carp Presence (V3)*Odonata presence (V4)*Water-Vegetation Ratio (V5)
	V1 If emergent herb. Veg. is mostly broad cattails (1.0), if not 0.1
	V2 If water usually present throughout year (1.0), if not 0.1
	V3 If carp are absent (1.0), if not 0.1
	V4 If Odonata larvae are present (1.0), if not 0.1
	V5 If wetland contains equal mix of water and emer. Herb. Veg. (1.0), dense veg (0.3), little veg (0.1)
	V6 If suitable foraging area in cond. A wetland (0.9), mid-overstory (0.4), understory (.1)
	V7 If upland provides dense, tall, herb. Veg (1.0), if not (0.1)
	V8 If moving, grazing, or burning, etc do not occur in most years (0.1), if not (0)

Attachment B: Survey Location Coordinates, Data Collected, and Pictures

Site	Cover_Type	UTM_X	UTM_Y
County Line	Riverine	792504	3979029
County Line	Wetland/Riparian	792384	3978973
Indian Springs	Riverine	788092	3984450
Sand Plant	Riverine	783677	3982534
ODWC	Riverine	774314	3990660
Riverside	Wetland/Riparian	771461	3998243
Cherry Creek	Riverine	770843	3998656
Zink	Riverine	763966	4003504
Prattville	Riverine	760321	4001423
Prattville	Wetland/Riparian	760270	4001278
Swift Park	Wetland/Riparian	748459	4002848
Swift Park	Riverine	748651	4002750
Cherry Creek	Wetland/Riparian	770872	3998400

Swift Park Looking Upstream



Prattville Creek Looking North



Prattville Creek Looking South



Zink Looking South



Cherry Creek Looking Southeast



I-44/Riverside Looking South



ODWC Looking East



<u>Species</u>	<u>Habitat</u>	<u>Variable</u>	<u>Variable Description</u>	<u>Swift Park</u>	<u>Prattville</u>	<u>Zink</u>	<u>Cherry Creek</u>	<u>Riverside</u>	<u>ODWC</u>	<u>Sandplant</u>	<u>Indian Springs</u>	<u>County Line</u>	
Bigmouth Buffalo	R	V1	% of Pools	5	5	0	0	X	20	40	60	40	
	R,L	V2	Avg Max Turbidity (NTU, ≈ JTU)	24	24	24	24	X	24	24	24	24	24
		V3	Avg annual pH	7.9	7.9	7.9	7.95	X	7.95	7.95	8	8	8
		V4	Max Water Temp	33	33	34.3	34.3	X	34.3	34.3	34.1	34.1	34.1
		V5	Avg. Max Temp	20.8	20.8	21.6	21.6	X	21.6	21.6	21	21	21
		V6	Min DO	5.8	5.8	5.3	5.3	X	5.3	5.3	5.8	5.8	5.8
		V7	Avg Velocity	2.13	2.13	2.13	2.74	X	2.74	2.74	2.74	2.74	2.74
		V8	Max Salinity	2.2	2.2	2.2	2.2	X	1.8	1.8	1.8	1.8	1.8
	R,L	V9	Veg Substrate	no veg	no veg	no veg	little veg/objects	X	little veg/few objects	no veg	little veg/no objects	little veg/object	little veg/object
		V11	Water fluctuation	A	A	A	A	X	A	A	A	A	A
		V12	Min TDS	196	196	196	196	X	834	834	834	834	834
	R,L	V13	% Veg cover in Pools	0	0	0	0	X	0	0	5	0	0
	Walleye	R,L	V1	water transparency	0.4	0.4	0.5	0.5	X	0.5	0.5	0.5	0.5
R,L		V2	forage fish	100	100	50	200	X	100	400	400	50	
R,L		V3	% feature cover	1	1	1	1	X	1	5	5	1	
		V4	pH	7.2	7.2	7.2	7.2	X	7.2	7.2	7.2	7.2	
		V5	Min DO in pools	3.9	3.9	4.6	4.6	X	4.6	4.6	4.7	4.7	
		V6	Min DO in summer	4.8	4.8	5.7	5.7	X	5.7	5.7	5.6	5.6	
		V7	Min DO in spawning	7.7	7.7	7.3	7.3	X	7.3	7.3	6.9	6.9	
		V8	Mean water temp	26.9	26.9	27.4	27.4	X	27.4	27.4	27	27	
		V9	Mean water temp	22.8	22.8	23	23	X	23	23	23.1	23.1	
		V10	Mean water temp	14.5	14.5	15.7	15.7	X	15.7	15.7	14.8	14.8	
		V11	Degree Days	575	575	575	575	X	575	575	575	575	
R,L		V12	Spawning Index	0	1200	0	0	X	425	0	275	275	
			Gravel	5	5	5	15	X	25	30	10	5	
			Boulder	80	5	0	0	X	0	0	0	0	
		Sand	15	90	95	85	X	70	60	70	90		
		Veg	0	0	0	0	X	0	0	0	0		
	Silt	0	0	0	0	X	5	10	20	5			

Species	Habitat	Variable	Variable Description	Swift Park	Prattville	Zink	Cherry Creek	Riverside	ODWC	Sandplant	Indian Springs	County Line
			% Water with Riffle	0	20	0	0	X	5	0	5	5
			Avg Water Depth	1.5	0.3	0.5	0.3	X	0.75	0.75	0.5	1
		V13	Water level spawning	Fluctuating	Fluctuating	Fluctuating	Fluctuating	X	Fluctuating	Fluctuating	Fluctuating	Fluctuating
Paddlefish		V1	Yearly rising water temp	1	1	1	1	x	1	1	1	1
		V2	Access to upstream spawning	0	0	0	0	x	0	1	1	1
	R/lentic	V3	Access to gravel/cobble	0	0	0	0	x	5	5	0	0
		V4	Mag. Of rising water	0.5	0.5	0.5	0.5	x	0.5	0.5	0.5	0.5
	R/lentic	V5	Avg. velocity	0.0213	0.0213	0.0213	0.0274	x	0.0274	0.0274	0.0274	0.0274
	R/lentic	V6	Min DO	5.2	5.2	5.2	5.2	x	5.2	5.2	5.2	5.2
		V7	Area of Summer/winter habitat	0	0	233	0	x	0	0	0	0
		V8	Avg. Width of River Channel	50	50	50	50	x	50	50	50	50
		V9	% of water area	0	0	0	0	x	0	0	0	0
	R/lentic	V10	# of eddies	0	0	10	20	x	20	10	10	10
Slider Turtle	HW	SIV1	% Emergent/submergent	0	0	x	0	1	x	x	x	0
	HW	SIV2	Velocity	0	0	x	0	.1 f/sec	x	x	x	0
	HW	SIV3	Water Depth	1	0	x	0	0.3	x	x	x	0.3
	HW	SIV4	Water Regime	temp flooded	temp flooded	x	temp flooded	temp flooded	x	x	x	Intermittent Flooded
	HW	SIV5	Water Temp	23.3	23.3	x	23.8	23.8	x	x	x	23.2
Red-winged Blackbird	HW(UH)	V1	Broadleaf Veg	N	N	x	Y	N	x	x	x	Y
	HW(UH)	V2	Yearround water	N	N	x	N	N	x	x	x	Y
	HW(UH)	V3	Carp absent	N	N	x	N	N	x	x	x	N

<u>Species</u>	<u>Habitat</u>	<u>Variable</u>	<u>Variable Description</u>	<u>Swift Park</u>	<u>Prattville</u>	<u>Zink</u>	<u>Cherry Creek</u>	<u>Riverside</u>	<u>ODWC</u>	<u>Sandplant</u>	<u>Indian Springs</u>	<u>County Line</u>
	HW(UH)	V4	Odonate larvae	Y	Y	x	Y	Y	x	x	x	Y
	HW(UH)	V5	Wetland Diversity	Few patches	Few patches	x	Few patches	Few patches	x	x	x	Few patches
	HW(UH)	V6	Suitable Foraging habitat	midstory	understory	x	midstory	understory	x	x	x	Midstory
	HW(UH)	V7	Upland Veg	Y	Y	x	Y	Y	x	x	x	Y
	HW(UH)	V8	Disturbance	N	N	x	N	N	x	x	x	N
Least tern	R	SIV1	% aquatic area	50	30	20	30	x	35	55	30	20
		SIV2	# Disparate wetlands	1	1	1	1	x	1	1	1	1
		SIV3	% Herb Canopy	5	5	1	0	x	0	0	0	0
		SIV4	Avg Herb Height	100	100	60	0	x	0	0	0	0
		SIV5	Nesting Substrate	F100	SA90 F10	SA95 F4 S11	SA90 F10	x	SA70 F25 S15	SA60 F30 S10	SA70 F10 S120	SA90 F5 S15

Future With Project Conditions for the Arkansas River Corridor Ecosystem Restoration Feasibility Study

Project Alternatives Evaluated

This study is limited to those items of restoration addressed in the ARC Master Plan. The USACE project delivery team (PDT) reviewed the ARC Master Plan and developed a list of potential categories or types of management measures that could restore degraded habitat in the ARC (Table 8). Simultaneously, the PDT considered the following items in relationship to identified measures.

The measure types above were then developed into more specific measures for consideration within the project area. Management measures considered and screened out are listed in Table 9. Ultimately, all measures carried forward for use in the development of alternatives are also components of the ARC Master Plan.

Table 8: Management Measure Types

Management Measure Types	Description
Flow Regime Management	Restores a more natural minimum river flow to promote aquatic and riparian vegetation habitats and improves conditions for the Least Tern, as well as other native fish and wildlife.
Constructed Least Tern Islands	Provides habitat for Least Tern and other species
Rock Riffle	Creates wetland/slack water habitat and reduces downgrading erosion in the upstream tributary. Wetland functions include fish and wildlife habitat, biological productivity and water quality improvement,
Wetland Plantings	After being slowed by a wetland, water moves around plants allowing the suspended sediment to drop out and settle to the wetland floor. Plants also function as fish and wildlife shelter and food.
Wing Deflectors	Directs flows away the stream bank, creates scour pools, and creates a riffle or bar a short distance downstream
Rock Cross Vanes	Reduces streambank erosion, facilitates sediment transport, and provides aquatic habitat
Floodplain Bench	Restores the interactions between the stream and its floodplain
Joint Plantings	Establishes riparian vegetation in existing riprap
Longitudinal Peaked Stone Protection	Stabilizes and vegetates degraded streambanks
Riparian Plantings	Provides streamside native vegetation to lower water temperatures, improve, habitat, and reduce pollutants migrating to the stream

Ecosystem restoration at Franklin Creek, Joe Creek, Fred Creek, and Vensel Creek tributaries would not be compatible with local plans for future recreation and economic development features in the vicinity of these sites. Restoration at the Cherry Creek tributary would produce relatively small benefits to a limited number of species and may require a higher level of maintenance than what the local sponsor could provide. It is anticipated that aquatic ecosystem

restoration features at the Polecat Creek confluence would be accomplished by others. Restoration at the Haikey Creek tributary is not currently a high priority and could be addressed in the future under the USACE Continuing Authorities Program.

Table 9: Management Measures Considered and Screened Out

Management Measure	Reason for Elimination from Further Consideration
Keystone and/or Kaw Lakes Reallocation.	This measure is outside the scope of the Section 3132 of the WRDA of 2007 authorization. A cost-effectiveness analysis indicated that reallocation under another authority would not warrant investment.
Rock Riffle and Joint Plantings at mouth of Franklin Creek	Uncertainty due to local conceptual plan to create a “Lazy River” along Franklin Creek for recreation use.
Floodplain bench near the mouth of Crow Creek with rock cross vanes.	The George Kaiser Family’s “A Gathering Place for Tulsa” project Section 404 permit includes provisions that would improve conditions for the scrub shrub wetlands. The floodplain bench measure is dropped due to uncertainties of future phased work in that area.
Joint Plantings at the Cherry Creek confluence.	The thickness of the existing riprap and the anticipated need for special equipment to establish pilot holes along with concerns about low plant survival rates would combine to result in undesirable high operation and maintenance cost. Benefits gains were very low for the high operation and maintenance costs.
Stabilization, native plantings, and instream aquatic habitat at the Joe Creek confluence.	Uncertainties due to Creek Nation River Spirit Casino economic development in this area, sand mining, and non- economic development/recreation pool.
Stabilization, native plantings, and instream aquatic habitat at the Fred Creek confluence (between 71 st Street and Jenks/South Tulsa Riverfronts).	Uncertainties due to Creek Nation River Spirit Casino economic development in this area, sand mining, and non- economic development/recreation pool.
Streambank stabilization at mouth of Vensel Creek.	Uncertainties due to local plans to create a recreation feature associated with the future Jenks South Tulsa pool.
Instream aquatic habitat in the vicinity of the Polecat Creek confluence	Uncertainties associated with potential future environmental mitigation features by Public Service Company of Oklahoma and sand mining.
Streambank stabilization, native plantings, and aquatic habitat at the mouth of Haikey Creek.	The Broken Arrow Riverfront development and associated non-interest in ecosystem restoration would likely be a future long-term initiative that could be addressed by the USACE Continuing Authorities Program.

After this first screening, the following management measures were carried forward for further analysis:

- Flow Regime Management – Pool Control Structure at RM 531
- Flow Regime Management – Pool Control Structure at RM 530
- Rock Riffle Complexes – at Prattville Creek and/or I-44 Riverside
- Wetland Plantings – at Prattville Creek and/or I-44 Riverside
- Riparian Plantings – at Prattville Creek and/or I-44 Riverside
- Constructed Least Tern Island

Figure 7 shows the general location of each ecosystem restoration measure within the study area.

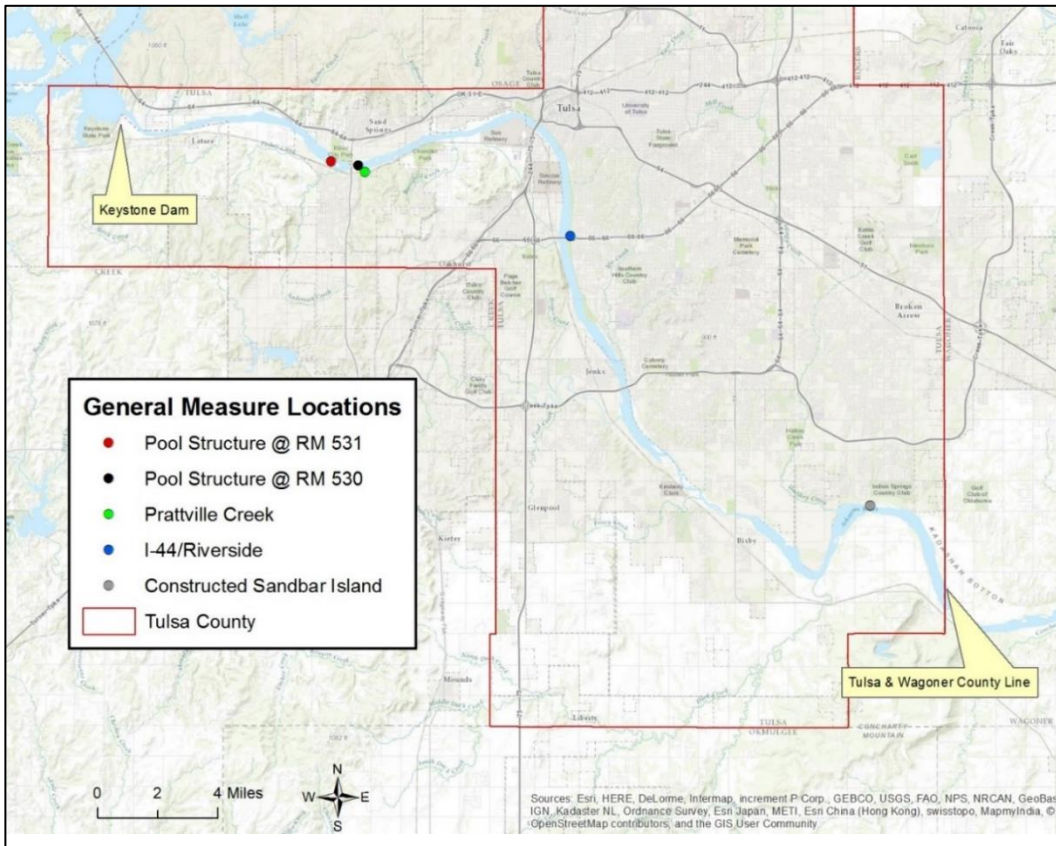


Figure 7. General Measure Locations within the Arkansas River Corridor

Future With Project Conditions – Riverine Habitat

To increase minimum river flow in the ARC, a flow regime management measure would be needed to temporarily store and rerelease water between releases from Keystone Dam. The pool structure will function similarly to a reregulation dam removed in 1985 designed to provide controlled seasonal minimum flows ranging from 300 to 1,110 cfs, and to smooth hydropower releases from Keystone Dam. A pool structure would capture and slowly release hydropower discharge pulses and include additional design features addressing safety concerns, and sediment and fish passage. Pool structure storage capacity was developed for two separate locations through modeling (Hydrologic Engineering Centers River Analysis System) and geographic information system analysis. Modeling analysis of pool structure function and downstream flow was compared to historical post-Keystone Dam downstream discharge to estimate the potential to alleviate periods of no flow.

From 2000 to 2014, an average of 228 days per year had an hourly release from Keystone Dam that was 0 cfs, and on average, there are 97 days where the minimum flow was greater than 1,000 cfs. The average daily flow was greater than 1,000 cfs for an average of 274 days per year. Therefore, on average, the daily flows could be redistributed to provide a more consistent 1,000 cfs flow rate on 177 days per year. In order to provide minimum flows during the

weekends when hydropower is not commonly generated, the pool control structure would need to be sized and located to be able to provide flows over a three day period. The average three day flows were greater than 1,000 cfs on average 298 days per year.

The pool control structure storage would have a capacity that could provide a flow of 1,000 (cfs) approximately 80% of the time between periods of hydropower releases. There are two candidate sites for pool control structures. River mile (RM) 531 is the site of the Lake Keystone Project reregulating dam that was removed in 1985. Another potential site is at RM 530. This site was identified during development of the ARC Master Plan. An instream pool control structure is a prerequisite for all other management measures. Sites further downstream from the RM 530 location were screened out due to potential Hazardous Toxic Radiologic Waste (HTRW) concerns along the river bank. Potential sites upstream of RM 531 were screened because sites further upstream could not provide the storage needed to maintain flows downstream. Locations between these two sites were screened out as unsuitable due to the proximity of a railroad and highway bridges close to the river bank, which would constrain construction of the necessary structure.

The design of the proposed structure will capture and slowly release peaking hydropower releases from the Keystone Dam, and, with further design input and advice from resources agencies, provide sediment passage, and at least seasonal fish passage (upstream migration and spawn/fry movement downstream). At a maximum effective structure height of 638 feet, the pool volume capacity for the RM 531 is approximately 4,860 acre-feet with a pool surface area of 1,112 acres (Figure 8). This full volume could provide downstream flows of 1,000 cfs for 2.5 days, 750 cfs for 3.3 days, or 500 cfs for 4.9 days.

At a maximum effective structure height of 638 feet, the pool volume capacity for the RM 530 location is approximately 6,730 acre-feet with a pool surface area of 1,321 acres (Figure 8). This full volume could provide downstream flows of 1,000 cfs for 3.4 days, 750 cfs for 4.5 days, or 500 cfs for 6.8 days. Figures 8a and 8b display the extent of riverine habitat that would result from the release of the 1,000 cfs in comparison to the existing no/low flow condition.

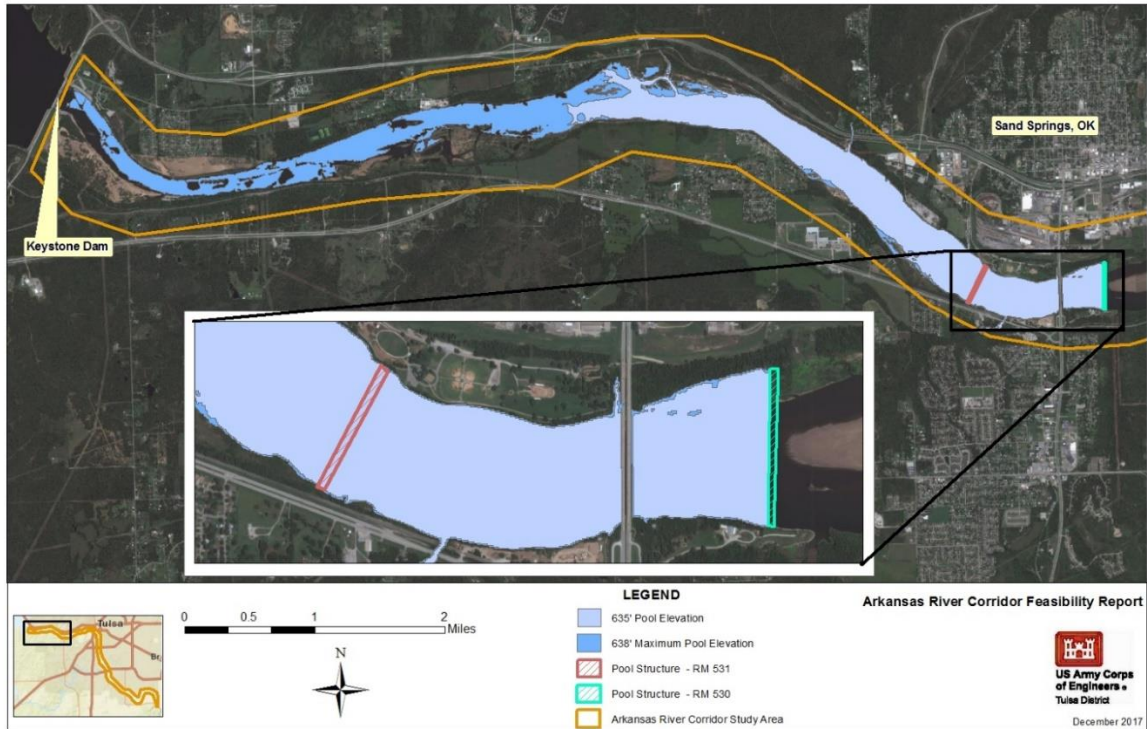


Figure 8. Potential locations for a pool structure: RM 531 (Old reregulation dam [removed in 1985] site) or RM 530 near Sand Springs, OK.

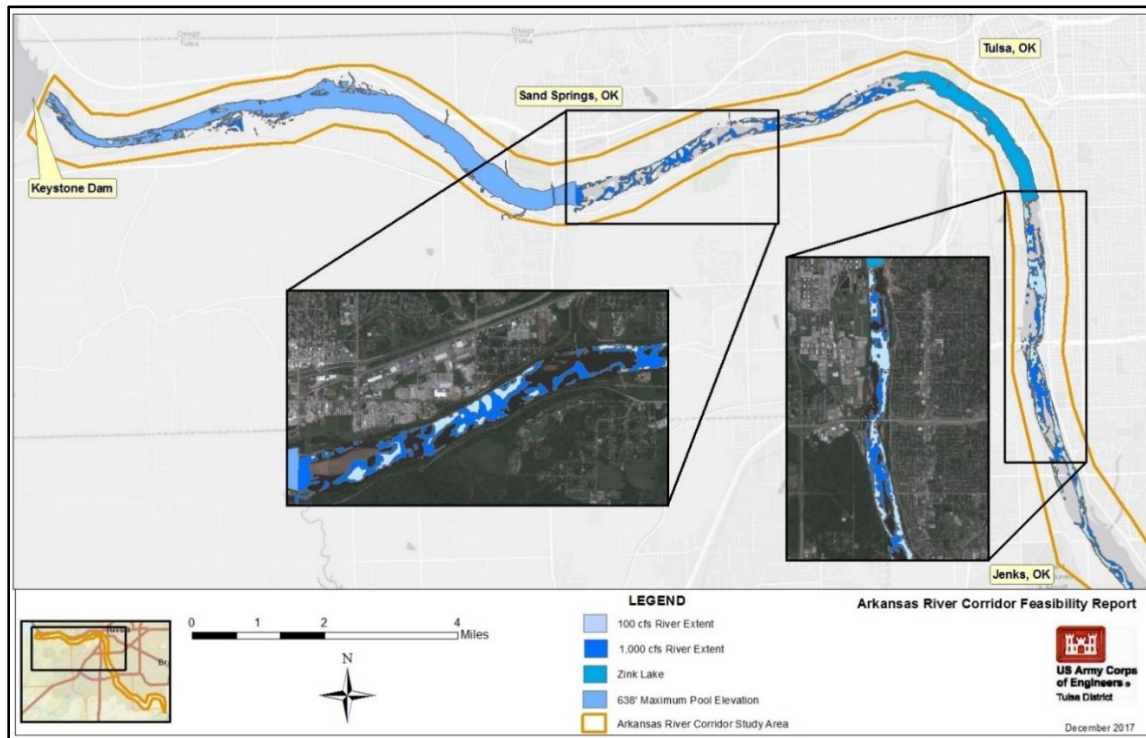


Figure 8a. A comparison of FWOP and FWP water surface area in the ARC (upper region).

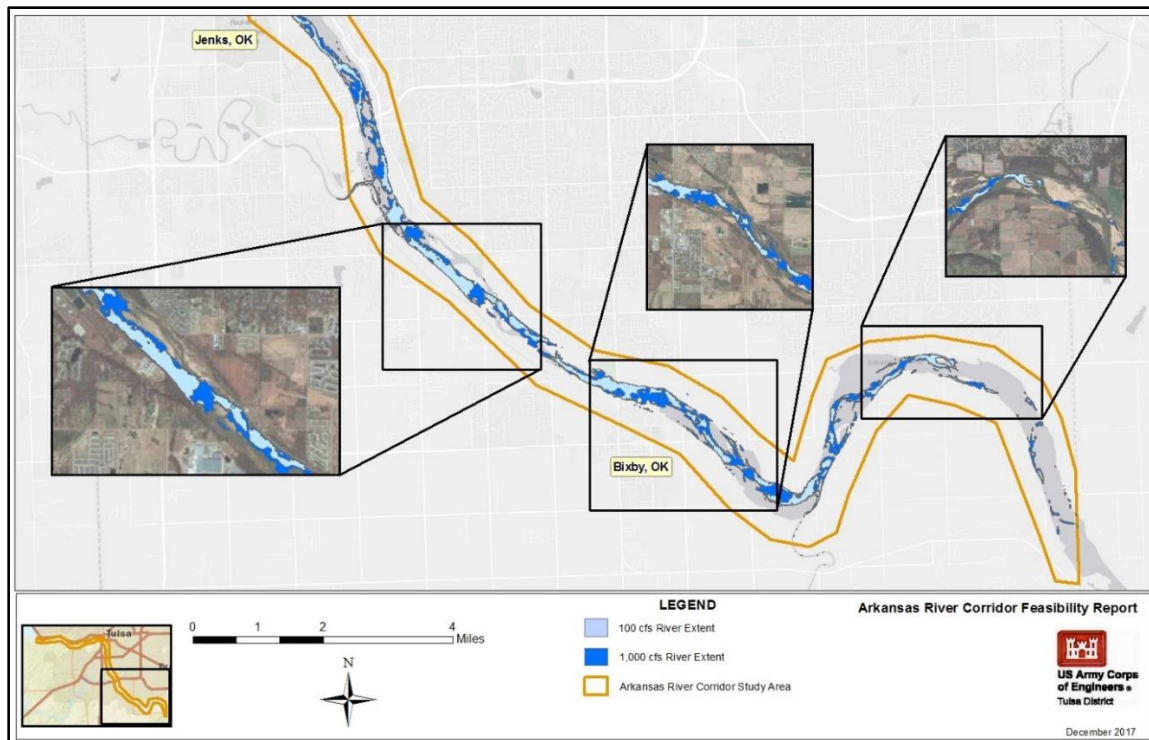


Figure 8b. A comparison of FWOP and FWP water surface area in the ARC (lower region).

With the implementation of a pool structure at river mile 531, the quantity of riverine habitat increases by 2,023 acres. This is the major driver of the gain in net habitat benefits (Table 11). The expansion of available habitat on a large scale offers all aquatic species in the study area increased resources to fulfill their cover, forage, and reproductive needs.

While vast improvements were made in the amount of available surface area water, again the Least Tern habitat quality was limited by the existing substrate composition. Not captured in the model was the restoration of existing sandbar island habitat. Restored river flow maintains the river barrier between disturbances and the nesting areas.

Modest habitat quality improvements were made for the Paddlefish, however the pool structure affords the Paddlefish access to more breeding and summer habitat. Perhaps the greatest improvement, although not captured in the model, was the restoration of river reach connectivity. This will allow expanded migratory routes and access to additional spawning grounds within the ARC.

Walleye habitat quality remaining stagnant, although aquatic vegetation was projected to increase in small increments. Still, not enough to capture an increase in the Walleye model.

Table 10. Summary of estimated acreages of total and riverine water surface areas in the ARC.

Scenario	Discharge	Description	Year 0 (ac)	Year 1 (ac)	Year 4 (ac)	Year 10 (ac)	Year 50 (ac)
Existing Conditions (Without Project)	100 cfs	Total ARC Water Surface Area	1,824	1,824	1,961	2,297	2,297
		Zink Lake Pool Area	233	233	403	403	403
		Jenks Pool Area	0	0	0	472	472
		Riverine Water Surface Area	1,591	1,591	1,558	1,422	1,422
Pool Structure (River Mile 531)	1,000 cfs	Total ARC Water Surface Area	1,824	4,229	4,304	4,489	4,489
		Pool Area (@ 638 structure elevation)	0	1,112	1,112	1,112	1,112
		Zink Lake Pool Area	233	233	403	403	403
		Jenks Pool Area	0	0	0	472	472
		Riverine Water Surface Area	1,591	3,996	3,901	3,614	3,614
Pool Structure (River Mile 530)	1,000 cfs	Total ARC Water Surface Area	1,824	4,350	4,426	4,610	4,610
		Pool Area (@ 638 structure elevation)	0	1,321	1,321	1,321	1,321
		Zink Lake Pool Area	233	233	403	403	403
		Jenks Pool Area	0	0	0	472	472
		Riverine Water Surface Area	1,591	4,117	4,023	3,735	3,735

However, the Bigmouth Buffalo was able to register habitat quality improvements. These were primarily driven by the projected increases in shorelines and backwater aquatic vegetation. Although not projected to be large swaths of vegetated areas. Smaller, narrows areas along the shoreline in protected areas will have a marked impact on the amount of nursery and refuge area for forage fish and aquatic invertebrates.

With the implementation of a pool structure at river mile 530, the quantity of riverine habitat increases by 2,144 acres. Once again this is the major driver of the gain in net habitat benefits. The only difference is the area between the two pool structures. The pool structure at river mile 530 offers and additional 121 acres of riverine habitat containing depth and flow diversity as well as shoreline and backwater microhabitats (Table 12).

Again small to modest increases in surface area water, shoreline and backwater aquatic vegetation, and areas of deeper water were projected. Largely the same limitations that applied to the same measure at river mile 531 applied to this location as well.

Table 11. With Project Conditions for Riverine Habitat.

With-Project Conditions: Pool Structure @ River Mile 531: Riverine Habitat						
Least Tern						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.650	0.650	1591	3996	1,815.775
1	4	0.650	0.650	3996	3901	7,699.575
4	10	0.650	0.650	3901	3614	14,654.250
10	50	0.650	0.650	3614	3614	93,964.000
With-Project AAHUs:						2,362.672
Net AAHUs:						1,424.920
Paddlefish						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.445	0.541	1591	3996	1,397.125
1	4	0.541	0.543	3996	3901	6,421.785
4	10	0.543	0.580	3901	3614	12,657.760
10	50	0.580	0.590	3614	3614	84,628.230
With-Project AAHUs:						2,102.098
Net AAHUs:						1,376.050
Walleye						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.183	0.183	1591	3996	509.814
1	4	0.183	0.183	3996	3901	2,161.805
4	10	0.183	0.183	3901	3614	4,114.464
10	50	0.183	0.183	3614	3614	26,382.210
With-Project AAHUs:						663.366
Net AAHUs:						400.070
Bigmouth Buffalo						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.000	0.005	1591	3996	8.368
1	4	0.005	0.011	3996	3901	93.151
4	10	0.011	0.028	3901	3614	427.620
10	50	0.028	0.031	3614	3614	4229.321
With-Project AAHUs:						95.169
Net AAHUs:						95.137
Average Net With-Project AAHUs:						824.05

Future With Project Conditions: Pool Structure @ RM 530

Table 12. With Project Conditions for Riverine Habitat.

With-Project Conditions: Pool Structure @ River Mile 530: Riverine Habitat						
Least Tern						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.650	0.650	1591	4117	1,855.100
1	4	0.650	0.650	4117	4023	7,936.500
4	10	0.650	0.650	4023	3735	15,128.100
10	50	0.650	0.650	3735	3735	97,100.000
With-Project AAHUs:						2,440.594
Net AAHUs:						1,502.850
Paddlefish						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.445	0.541	1591	4117	1,427.934
1	4	0.541	0.543	4117	4023	6,619.393
4	10	0.543	0.580	4023	3735	13,067.210
10	50	0.580	0.590	3735	3735	87,461.660
With-Project AAHUs:						2,171.524
Net AAHUs:						1,445.475
Walleye						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.183	0.183	1591	4117	520.855
1	4	0.183	0.183	4117	4023	2,228.326
4	10	0.183	0.183	4023	3735	4,247.507
10	50	0.183	0.183	3735	3735	27,265.510
With-Project AAHUs:						685.244
Net AAHUs:						421.950
Bigmouth Buffalo						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.000	0.005	1591	4117	8.730
1	4	0.005	0.011	4117	4023	97.722
4	10	0.011	0.028	4023	3735	449.235
10	50	0.028	0.031	3735	3735	4,446.944
With-Project AAHUs:						100.053
Net AAHUs:						100.021
Average Net With-Project AAHUs:						867.57

Future With Project Conditions – Wetland and Riparian Habitat at Prattville Creek

Prattville Creek is a right-bank tributary to the Arkansas River downstream of the Highway 97 Bridge at Sand Springs, Oklahoma (Figure 9). The fundamental measure consists of a rock riffle at the current confluence of Prattville Creek with the Arkansas River to restore a 5.34-acre wetland area. An engineered rocked riffle with weighted toe placed at the mouth of Prattville Creek at a maximum elevation of approximately 640 feet. The structure will impound flows from Prattville Creek, and will be over-topped by high flows in the Arkansas River. An engineered rocked riffle placed at the mouth of Prattville Creek would create a wetland providing additional shallow water habitat to the ARC system, and an area immediately upstream of the rock riffle conducive to velocity refuge, foraging, and nursery habitat for fish. The wetland increases the area of open water and provides an opportunity for the incorporation of additional management measures consisting of aquatic and riparian plant communities. The structure will divert some Prattville Creek flow into the original Prattville Creek channel that parallels the right bank of the Arkansas River to the original confluence, approximately 1 mile east (downstream) of the current mouth. The restored wetland will primarily provide additional shallow water aquatic habitat to the ARC system, and an area immediately upstream of the rock riffle conducive to velocity refuge, and nursery habitat for fish.

The north peninsula forming the current mouth of the Prattville Creek confluence has already received shoreline protection both on the Arkansas River side and on the Prattville Creek side. Considering the potential for erosive high flows moving down Prattville Creek directed into the south bank of the mouth area, longitudinal peaked stone toe protection for approximately 600 feet of the south bank of the proposed wetland area will maintain bank stability.

The rock riffle structure is a prerequisite for riparian and wetland plantings. Those plantings within the existing Public Service Company of Oklahoma (PSO) electrical transmission corridor will generally be under 15 feet in height at maturity to limit the potential for vegetation to interfere with the operation of the line. Wetland Plantings around the perimeter of the created wetland (approximately 3,000 feet excluding the rock riffle) include Common Rush (*Juncus effusus*) and bulrushes (*Schoenoplectus spp.*) (randomly planted and spaced approximately 1.5 feet on center). Wetland plantings will help stabilize banks of the wetland area, and provide forage and cover for insects, amphibians, mammals and waterfowl. Riparian areas bounding the wetland include 2.24 acres in two sections (0.88 ac and 1.36 ac). Plantings would consist live-staked Sandbar (*Salix interior*) and/or Prairie (*Salix humilis*) Willow (approximately 5 feet on center). Riparian planting will provide additional bank/slope stabilization, shading for wetland area edge zones, allochthonous organic input into the wetland system, and provide forage and cover for insects, amphibians, mammals, and birds.

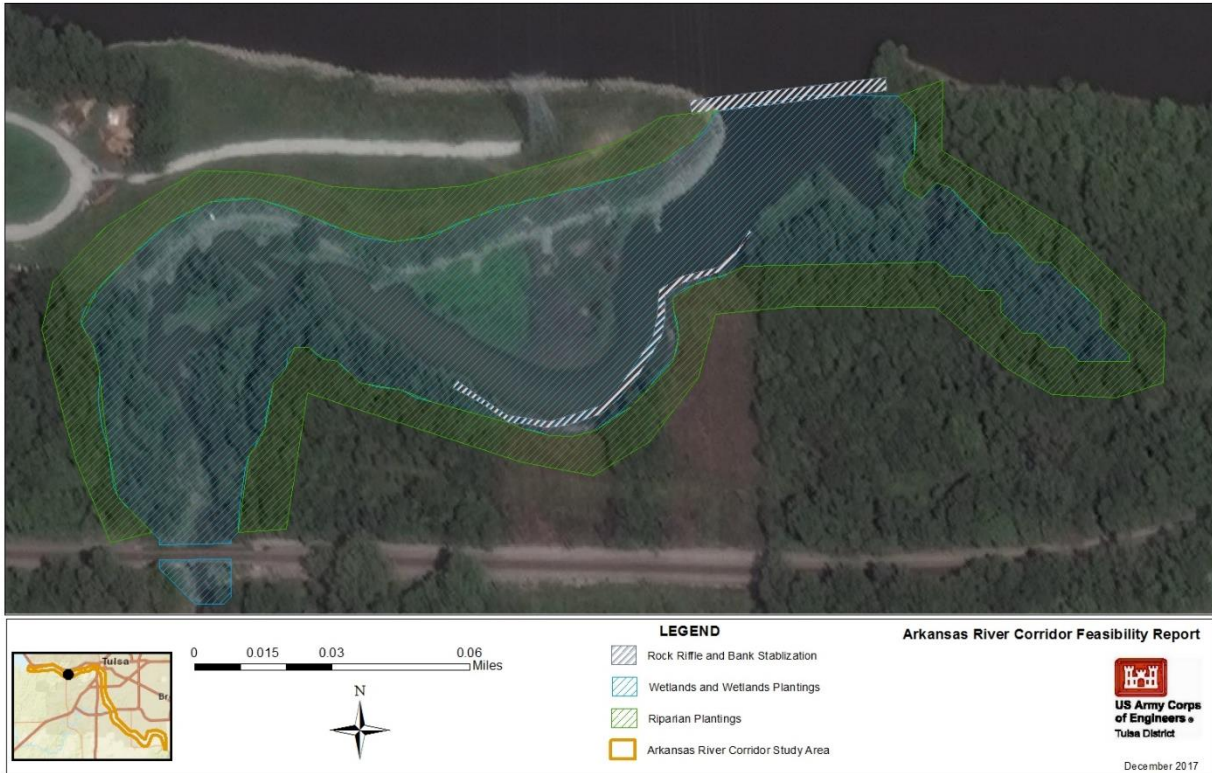


Figure 9. Prattville Creek Wetland Restoration Measures

Immediate habitat improvements were projected with the implementation of a rock riffle complex to provide the hydroperiod necessary to support moist soil and aquatic vegetation (Table 13). This promotes a diverse wetland habitat.

Table 13. With Project Conditions for Wetland Habitat.

With-Project Conditions: Prattville Creek - Rock Riffle Complex						
Slider Turtle						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0	0.289	5.34	5.34	0.771
1	4	0.289	0.378	5.34	5.34	5.340
4	10	0.378	0.467	5.34	5.34	13.528
10	50	0.467	0.556	5.34	5.34	109.173
With-Project AAHUs:						2.576
Net AAHUs:						2.58

Further increasing diversity while shortening the time to wetland maturity, additional wetland plantings are projected to restore a functioning wetland system at this locations (Table 14).

Table 14. With Project Conditions for Wetland Habitat.

With-Project Conditions: Prattville Creek – Rock Riffle Complex + Wetland Plantings						
Slider Turtle						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0	0.556	5.34	5.34	0.989
1	4	0.556	0.822	5.34	5.34	11.036
4	10	0.822	1.000	5.34	5.34	29.192
10	50	1.000	1.000	5.34	5.34	213.600
With-Project AAHUs:						5.096
Net AAHUs:						5.10

Although buffering riparian habitat would further benefit nesting and resting migratory birds and reduce erosion and sedimentation of the wetland, no added benefits were captured when projected both rock riffles and riparian plantings at the Prattville Creek site (Table 15).

Table 15. With Project Conditions for Wetland Habitat.

With-Project Conditions: Prattville Creek – Rock Riffle Complex + Riparian Plantings						
Slider Turtle						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0	0.289	5.34	5.34	0.771
1	4	0.289	0.378	5.34	5.34	5.340
4	10	0.378	0.467	5.34	5.34	13.528
10	50	0.467	0.556	5.34	5.34	109.173
With-Project AAHUs:						2.576
Net AAHUs:						2.58

As described above, the measure combination of rock riffles and wetland plantings restores wetland structure and function. The additional of riparian plantings to the projection did not add to the habitat quality (Table 16).

Table 16. With Project Conditions for Wetland Habitat.

With-Project Conditions: Prattville Creek – Rock Riffle Complex + Riparian Plantings + Wetlands Plantings						
Slider Turtle						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0	0.556	5.34	5.34	0.989
1	4	0.556	0.822	5.34	5.34	11.036
4	10	0.822	1.000	5.34	5.34	29.192
10	50	1.000	1.000	5.34	5.34	213.600
With-Project AAHUs:						5.096
Net AAHUs:						5.10

Future With Project Conditions: Prattville Creek – Riparian Habitat

The construction of a rock riffle complex to maintain hydroperiod for moist soil and aquatic habitat increases habitat quality in the Red-winged Blackbird model marginally (Table 17). However, wetland and riparian plant diversity would still remain low and limiting to habitat quality.

Table 17. With Project Conditions for Riparian Habitat.

With-Project Conditions: Prattville Creek - Rock Riffle Complex						
Red-winged Blackbird						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.000	0.001	2.24	2.24	0.001
1	4	0.001	0.001	2.24	2.24	0.007
4	10	0.001	0.001	2.24	2.24	0.013
10	50	0.001	0.001	2.24	2.24	0.090
With-Project AAHUs:						0.002
Net AAHUs:						0

Adding riparian plantings to the rock riffle measure increases habitat quality, only slightly though due to carp likely present in the area (Table 18).

Table 18. With Project Conditions for Riparian Habitat.

With-Project Conditions: Prattville Creek – Rock Riffle Complex + Riparian Plantings						
Red-winged Blackbird						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.000	0.010	2.24	2.24	0.011
1	4	0.010	0.010	2.24	2.24	0.067
4	10	0.010	0.010	2.24	2.24	0.134
10	50	0.010	0.010	2.24	2.24	0.896
With-Project AAHUs:						0.022
Net AAHUs:						0.02

Replacing riparian plantings with wetland plantings yields similar results (Table 19). The need for a diverse plant community to produce both forage and cover is evident in the Red-winged Blackbird model.

Table 19. With Project Conditions for Riparian Habitat.

With-Project Conditions: Prattville Creek – Rock Riffle Complex + Wetland Plantings						
Red-winged Blackbird						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0	0.010	2.24	2.24	0.011
1	4	0.010	0.010	2.24	2.24	0.067
4	10	0.010	0.010	2.24	2.24	0.134
10	50	0.010	0.010	2.24	2.24	0.896
With-Project AAHUs:						0.022
Net AAHUs:						0.02

The combination of all three measures at the Prattville Creek location allows for the greatest increase in the habitat quality (Table 20). Yet again, only slight gains are produced due to the limiting factor being carp access to the restoration site.

Table 20. With Project Conditions for Riparian Habitat.

With-Project Conditions: Prattville Creek – Rock Riffle Complex + Riparian Plantings + Wetland Plantings						
Red-winged Blackbird						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0	0.100	2.24	2.24	0.112
1	4	0.100	0.100	2.24	2.24	0.672
4	10	0.100	0.100	2.24	2.24	1.344
10	50	0.100	0.100	2.24	2.24	8.960
With-Project AAHUs:						0.222
Net AAHUs:						0.22

Future With Project Conditions – Wetland and Riparian Habitat at I-44/Riverside

The primary measure at this location consists of two rock riffle (grade control) structures and three wing deflectors to restore wetlands and sustainable slack water habitat on the left bank Arkansas River just upstream of I-44 Bridge (Figure 10). Rock riffle features will be composed of sized rock and designed to pool water at an elevation of approximately 612 feet at the mouths of two stormwater outfalls restoring two wetland areas of 0.22 and 0.33 acres. Wing deflectors, providing erosion protection for the rock riffle features, will be composed of sized rock able to withstand anticipated maximum velocities in the Arkansas River. Each wing deflector will extend into the stream bank for stability at an elevation comparable to existing bank elevations, and extend into the river channel approximately 250 feet, at a slight downstream angle [approx. 10-20 degrees]. Instream elevations of the wing deflectors (approximately 607.1 feet) will be overtopped by stream discharge in excess of approximately 12,000 cfs (maximum two-turbine hydropower release). In addition to providing high flow erosion protection for the restored wetland areas, the wing deflectors will generate instream slack water areas. The measure will

provide additional resilient wetland areas totaling 0.55 acres, and velocity refuge zones for fish and wildlife within the ARC.

Rock riffle structures are a prerequisite for wetland and riparian restoration planting. Wetland area plantings immediately downstream and adjacent to wing deflectors, and around the perimeters of two pooled wetland areas generated by rock riffle features (380 feet and 420 feet, excluding rock riffle structures), will stabilize banks of the wetland areas, and provide forage and cover for insects, amphibians, mammals and waterfowl. Proposed plantings include a combination Common Rush, and bulrushes 1.5 feet on center. Riparian restoration plantings proposed for the area include three areas of 0.67, 0.35, and 0.57 acres. Riparian plantings proposed include live-stake plantings of Sandbar/Prairie Willow (5 feet on center). Riparian planting will provide additional bank/slope stabilization, shading for wetland area edge zones, allochthonous organic input into the wetland systems, and provide forage and cover for insects, amphibians, mammals, and birds.

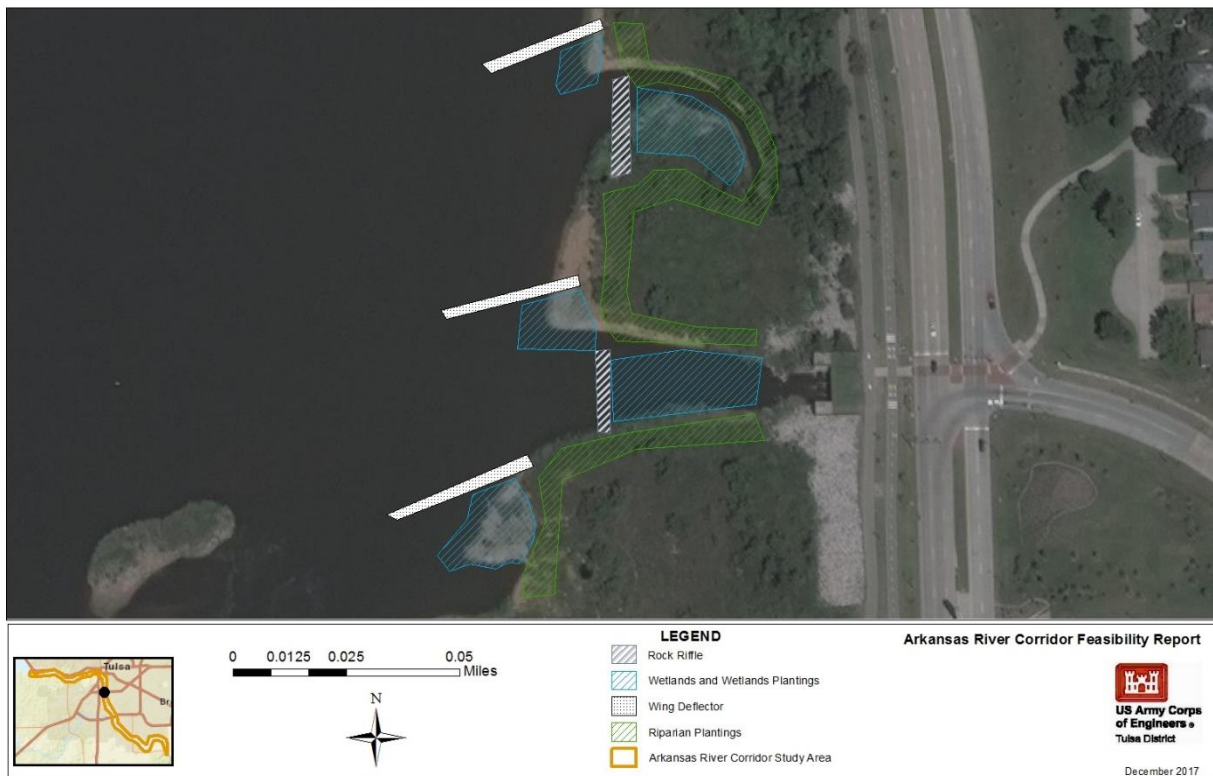


Figure 10. I-44/Riverside Wetlands and Slack water

Similar to the projected wetland conditions at the Prattville Creek area, habitat improvements were projected with the implementation of a rock riffle complex to provide the hydroperiod necessary to support moist soil and aquatic vegetation (Table 21). This promotes a diverse wetland habitat and increased habitat value.

Table 21. With Project Conditions for Wetland Habitat.

With-Project Conditions: Riverside - Rock Riffle Complex						
Slider Turtle						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.120	0.289	0.55	0.55	0.112
1	4	0.289	0.378	0.55	0.55	0.550
4	10	0.378	0.467	0.55	0.55	1.393
10	50	0.467	0.556	0.55	0.55	11.244
With-Project AAHUs:						0.266
Net AAHUs:						0.200

Likewise, when wetland plantings are paired with the rock riffle complex, the wetland area is projected to be fully restored (Table 22).

Table 22. With Project Conditions for Wetland Habitat.

With-Project Conditions: Riverside – Rock Riffle Complex + Wetland Plantings						
Slider Turtle						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.120	0.566	0.55	0.55	0.186
1	4	0.556	0.822	0.55	0.55	1.137
4	10	0.822	1.00	0.55	0.55	3.007
10	50	1.00	1.00	0.55	0.55	22.000
With-Project AAHUs:						0.527
Net AAHUs:						0.460

Again, while there are obvious buffering qualities, riparian plantings do not increase habitat value when compared to implementing the rock riffle complex alone (Table 23).

Table 23. With Project Conditions for Wetland Habitat.

With-Project Conditions: Riverside – Rock Riffle Complex + Riparian Plantings						
Slider Turtle						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.120	0.289	0.55	0.55	0.112
1	4	0.289	0.378	0.55	0.55	0.550
4	10	0.378	0.467	0.55	0.55	1.393
10	50	0.467	0.556	0.55	0.55	11.244
With-Project AAHUs:						0.266
Net AAHUs:						0.200

Wetland habitat quality is projected to be maximized with the combination of rock riffles and wetland plantings to supplement any native vegetation that may exist to fully diversify the area (Table 24). Adding riparian plantings to this scenario did not increase the habitat quality in the models.

Table 24. With Project Conditions for Wetland Habitat.

With-Project Conditions: Riverside – Rock Riffle Complex + Riparian Plantings + Wetlands Plantings						
Slider Turtle						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.120	0.566	0.55	0.55	0.186
1	4	0.556	0.822	0.55	0.55	1.137
4	10	0.822	1.00	0.55	0.55	3.007
10	50	1.00	1.00	0.55	0.55	22.000
With-Project AAHUs:						0.527
Net AAHUs:						0.460

Future With Project Conditions: I-44/Riverside Riparian Habitat

The addition of a rock riffle complex to maintain hydroperiod for moist soil and aquatic habitat increased habitat quality in the Red-winged Blackbird marginally (Table 25). However, wetland and riparian plant diversity would still remain low and limiting to habitat quality.

Table 25. With Project Conditions for Riparian Habitat.

With-Project: Riverside - Rock Riffle Complex						
Red-winged Blackbird						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.000	0.001	1.58	1.58	0.001
1	4	0.001	0.001	1.58	1.58	0.005
4	10	0.001	0.001	1.58	1.58	0.009
10	50	0.001	0.001	1.58	1.58	0.063
With-Project AAHUs:						0.002
Net AAHUs:						0.002

Riparian plantings, in addition to the rock riffle increases the habitat quality, however the possible presence of carp, an invasive fish species known to impact aquatic plant communities minimizes the output of the habitat in the Red-winged Blackbird model (Table 26).

Table 26. With Project Conditions for Riparian Habitat.

With-Project: Riverside – Rock Riffle Complex + Riparian Plantings						
Red-winged Blackbird						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.000	0.010	1.58	1.58	0.008
1	4	0.010	0.010	1.58	1.58	0.047
4	10	0.010	0.010	1.58	1.58	0.095
10	50	0.010	0.010	1.58	1.58	0.632
With-Project AAHUs:						0.016
Net AAHUs:						0.02

With the combination of the rock riffle and wetland plantings, the Red-winged Blackbird models shows similar improvements in habitat quality to the combination of the rock riffle and riparian plantings due to the increases in plant diversity (Table 27).

Table 27. With Project Conditions for Riparian Habitat.

With-Project: Riverside – Rock Riffle Complex + Wetland Plantings						
Red-winged Blackbird						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.000	0.010	1.58	1.58	0.008
1	4	0.010	0.010	1.58	1.58	0.047
4	10	0.010	0.010	1.58	1.58	0.095
10	50	0.010	0.010	1.58	1.58	0.632
With-Project AAHUs:						0.016
Net AAHUs:						0.02

The combination of all measures possible at the I-44/Riverside site yields the highest increase in habitat quality (Table 28). However, the likelihood of carp in the area prevents and significant increases in habitat quality.

Table 28. With Project Conditions for Riparian Habitat.

With-Project: Riverside – Rock Riffle Complex + Riparian Plantings + Wetland Plantings						
Red-winged Blackbird						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.000	0.100	1.58	1.58	0.079
1	4	0.100	0.100	1.58	1.58	0.474
4	10	0.100	0.100	1.58	1.58	0.948
10	50	0.100	0.100	1.58	1.58	6.320
With-Project AAHUs:						0.156
Net AAHUs:						0.16

Future With Project Conditions – Sandbar Island Habitat

In order to restore Least Tern nesting habitat capable of withstanding reoccurring hydropower releases, a constructed sandbar island would be needed to maintain adequate elevation. This management measure increases nesting habitat for the Interior Least Tern. While Keystone Dam has limited sediments available within the study area, other sandbar islands still exist. Therefore, it is believed that enough sediments are passed through Keystone Dam or originate from tributaries below the dam to create and maintain the proposed sandbar island.

Ideal nesting habitat for Least Terns consists of sandbar islands isolated by river flows. While normal hydropower releases reach up to 12,000 cfs, typical mid-late summer rain events can increase river height and flow to 20,000 cfs. Sandbar islands that remain unsubmerged during flows reaching 20,000 promote more reliable, sustainable Least Tern nesting habitat. The constructed sandbar would be approximately 5 acres in size. Approximately 3 acres of which would sustain nesting habitat during flows reaching 20,000 cfs. The sandbar island will be circular to oblong in shape, with maximum surface area and a surface height above water to exceed 18 inches at nest initiation that is usually in May or June. Based on an Oklahoma State University design (developed for the USACE-Tulsa District in May 2003), the proposed tern island will develop approximately 5 acres of surface area at 1,000 cfs flow in the Arkansas River. The Oklahoma State University design consists of placement of a rectangular riprap structure and a downstream chevron riprap structure to promote mid-stream sediment deposition resulting in habitable sandbar development. Sediment transporting high and flood flow releases from Keystone Dam will promote sandbar development about the riprap structures, and provide scour to limit vegetative growth on sandbars when developed. The proposed location is in the Arkansas River just south of the Indian Springs Sports Complex in Broken Arrow, Oklahoma (Figure 11). Based on consultation with the U.S. Fish and Wildlife Service and information from USACE Least Tern surveys, the most desirable reach in the study area is upstream of the Tulsa County line where the river more closely resembles a braided prairie stream. The nesting substrate for the constructed island consists of native riverine sediments ranging in size from fine sand to small stones. Sediment movement during high (flood control) releases from Keystone Dam (flows > 20,000 cfs) will accumulate adjacent to placed rock chevrons ensuring development of additional, exposed, and resilient least tern island nesting habitat area of approximately 3 acres at flows up to 20,000 cfs.

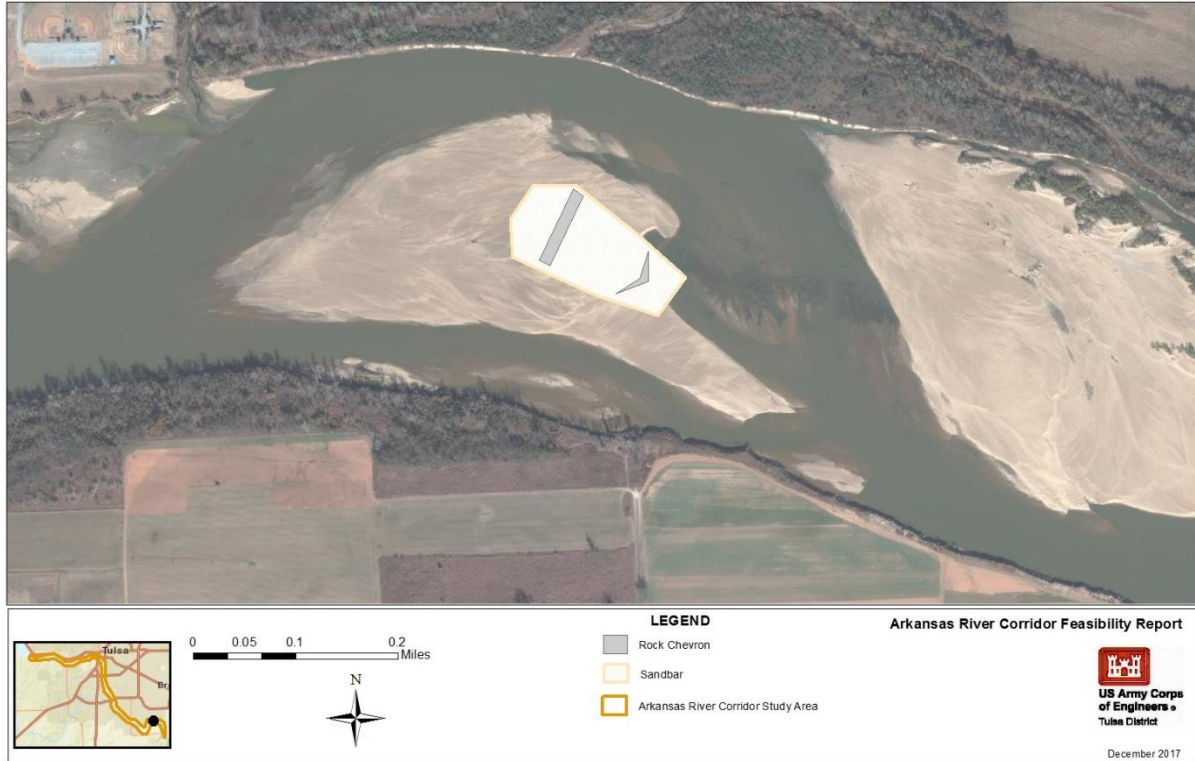


Figure 11. Constructed Least Tern Island

With restored river flow, the Indian Springs area provides foraging areas for the Least Tern. Nesting habitat would be limited due to shoreline vegetation. However, with the construction of a sandbar island, the combination of abundant forage fish, isolated nesting grounds, and the chevrons structures maintaining substrate diversity, the conditions are set for ideal Least Tern habitat (Table 29).

Table 29. With Project Conditions for Sandbar Habitat.

Least Tern						
With-Project: Constructed Sandbar Island						
TY 1	TY 2	HSI 1	HSI 2	Acres 1	Acres 2	HUs
0	1	0.4	1.0	5	5	3.5
1	4	1.0	1.0	5	5	15.0
4	10	1.0	1.0	5	5	30.0
10	50	1.0	1.0	5	5	200.0
With-Project AAHUs:						4.97
Net AAHUs:						2.97

Project Alternatives Comparison

The management measures included two possible locations (but not both) for a pool structure, rock riffle structures, and wetland and riparian plantings at Prattville Creek and/or I-44/Riverside. These were combined into 11 plans, consisting of stand-alone plans and partially formed plans,

for populating Institute for Water Resources (IWR) Planning Suite to generate alternatives, or combination of the plans. All plans assumed South Tulsa/Jenks low water dam is in place and functioning as the Future With Project Condition. Benefits and first costs were developed for each of the 11 partially formed/stand-alone plans. The array of plans are:

- Pool structure located at RM 531 (former site of Lake Keystone Project reregulating dam)
- Pool structure located at RM 530
- Constructed Least Tern Island
- Rock Riffle Structures at Prattville Creek
- Rock Riffle Structures and Wetland Plantings at Prattville Creek
- Rock Riffle Structures and Riparian Planting at Prattville Creek
- Rock Riffle Structures, Wetland Plantings, and Riparian Plantings at Prattville Creek
- Rock Riffle Structures at I-44 Riverside
- Rock Riffle Structures and Wetland Plantings at I-44 Riverside
- Rock Riffle Structures and Riparian Planting at I-44 Riverside
- Rock Riffle Structures, Wetland Plantings, and Riparian Plantings at I-44 Riverside

Cost and benefits were developed for each of the measures and partially formed plans, as described in the sections below. The information was entered into IWR Planning Suite in order to arrange the measures into all possible combinations, with the following conditions set: (1) a pool structure measure is required prior to combination with any other measure, (2) the two pool structure measures are not combinable with each other, and (3) rock riffle structures are required prior to combining any planting measures. This resulted in 101 alternatives to be further screened using Cost Effectiveness and Incremental Cost Analyses (CE/ICA).

In order to determine benefits of an environmental restoration plan, future with-project environmental outputs are compared to future without-project outputs. The benefits are expressed as Average Annual Habitat Units (AAHU). The difference between the two represents the benefits from project implementation. The resulting benefits are then used, along with annualized costs, to identify cost effective plans and perform incremental cost analysis. For this study, future without-project conditions are expected to deteriorate further from existing conditions through the future implementation of locally funded projects including refurbishment of the Zink Dam, and construction of South Tulsa/Jenks Dam. Given the poor quality of the existing habitat, there is a lack of foreseeable positive change in that quality without intervention. The calculation of benefits (AAHU outputs) are shown in Table.

Table 30: Summary of Annual AAHU Benefits

Management Measure Area	Incremental Partially-formed Alternative	Future Without Project AAHU	With Project AAHU	Annual Benefits AAHU	Future With Project Acres
Flow Regime	Pool structure located at Keystone Lake Project reregulating dam (RM 531)	481.78	1305.83	824.05	3,614
	Pool structure located at RM 530	481.78	1349.35	867.57	3,735
Nesting Habitat	Constructed Least Tern Island	2.00	4.97	2.97	3
Prattville Creek	Rock Riffle Structures	0.002	2.58	2.58	5.34
	Rock Riffle Structures + Wetland Plantings	0.002	5.12	5.12	5.34
	Rock Riffle Structures + Riparian Plantings	0.002	2.60	2.60	7.58
	Rock Riffle Structures + Wetland Plantings + Riparian Plantings	0.002	5.32	5.32	7.58
I-44 / Riverside	Rock Riffle Structures	0.066	0.27	0.20	0.55
	Rock Riffle Structures + Wetland Plantings	0.066	0.54	0.48	0.55
	Rock Riffle Structures + Riparian Plantings	0.066	0.28	0.22	2.13
	Rock Riffle Structures+ Wetland Plantings + Riparian Plantings	0.066	0.68	0.62	2.13

Through the CE/ICA process, eight alternatives produced for final consideration (Table 31).

Table 31: Final Array of Alternatives

Measures	Alternatives								
	1	2	2a	3	4	5	6	7	8
No Action	X								
Pool Structure at RM 531 (former reregulation dam site)		X	X						
Pool Structure at RM 530				X	X	X	X	X	X
Prattville Creek Rock Riffle with Wetland Plantings			X		X	X	X	X	X
New Least Tern Island			X			X	X	X	X
Riverside/I-44 Rock Riffle with Wetland Plantings							X	X	X
Riverside/I-44 Riparian Plantings								X	X
Prattville Riparian Plantings									X

Comparing benefits and costs for ecosystem restoration provides a challenge to biologists and decision makers because benefits and costs are not measured in the same units. Environmental restoration benefits can be measured in habitat units or some other physical unit, while costs are measured in dollars. Therefore benefits and costs cannot be directly compared. While cost effective analysis and incremental cost analysis are conducted to help planners and decision makers identify plans for implementation, these analyses themselves do not identify a single ideal plan.

Each alternative plan within the final array represents an incremental increase in the level of restoration which can be viewed from two perspectives – quality of restoration achieved and quantity of acres restored. Because all of the action plans in the final array of alternatives represents some level of restoration and provide habitat for a diverse community of fish and wildlife species, additional criteria need to be considered through an “is it worth it” analysis to help differentiate each alternative from the others in selecting the Proposed Plan.

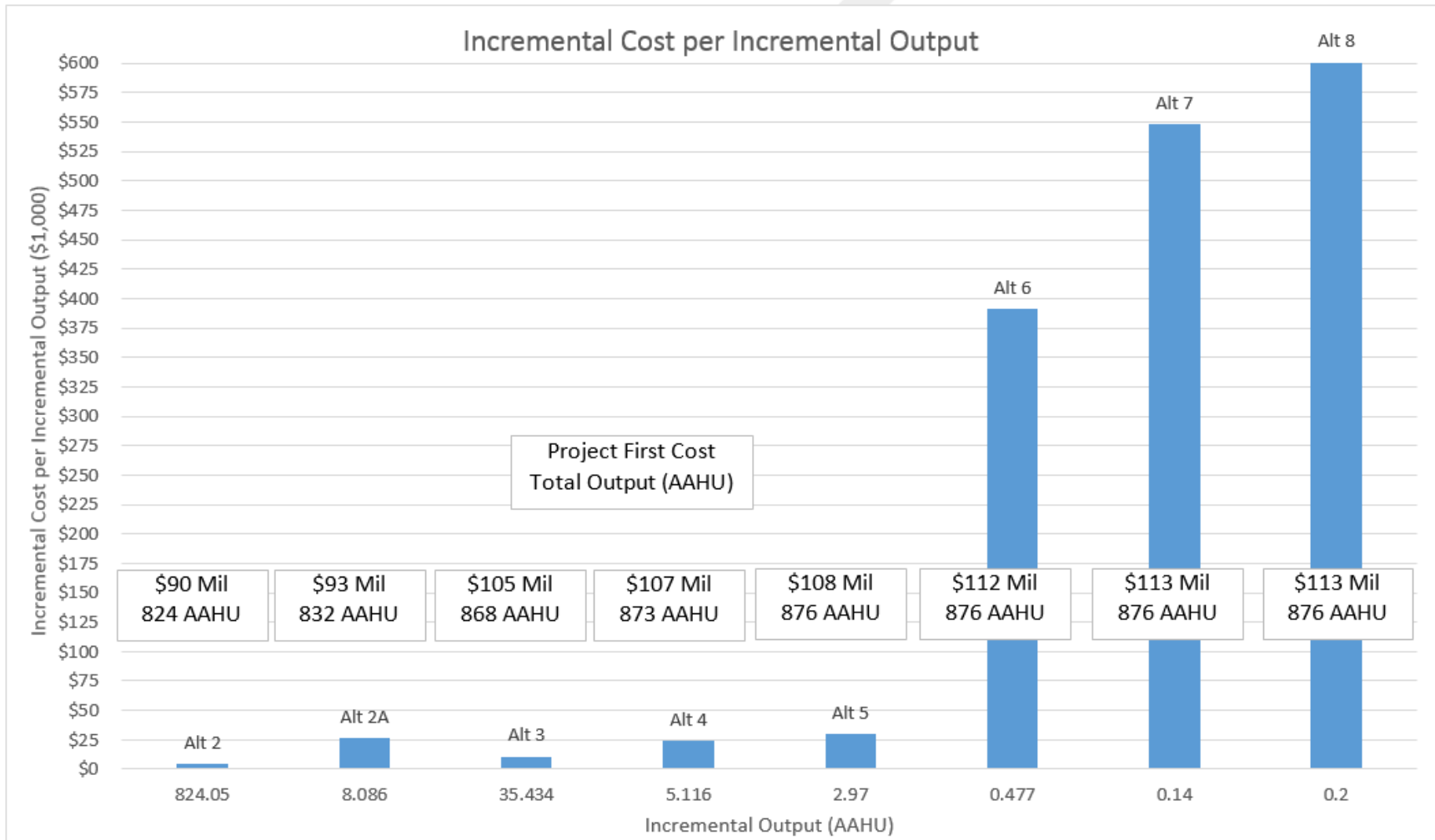
The “is it worth it” analysis for alternatives in the final array includes quantitative and qualitative discussions utilizing the following selection criteria:

- Incremental benefit
- Incremental cost
- Quantity of restored riverine acres
- Quality of restored habitat
- Number of targeted habitat types restored

Figure 12 displays the incremental cost per incremental output for each alternative. Note, while AAHUs are presented as the sum of each alternative’s environmental benefits, not all AAHUs are equal or of the same habitat type. For example, the numeric AAHU output for the Prattville Creek restoration measures can be considered small when compared to the numeric AAHU output of one of the pool structures. However, the restored function and productivity of a wetland or other type of niche habitat, especially in a hydrologically stressed system as the ARC, must be taken into consideration when evaluating the final array of alternatives. Increments of environmental benefits, while sometimes appearing small in term of AAHUs, were

also taken into consideration as they relate to habitat type restoration (wetlands, sandbars, etc.) in the comparative analysis. This ensured restoration opportunities, where comparatively small in AAHU output but instrumental in ecosystem recovery, received full consideration as they relate to the study's ecosystem-wide restoration goals.

Figure 12: Comparison of the Final Array of Alternatives



Proposed Alternative

The difference between the Alternatives 2 and 2a, and 5 is the location of the pool structure. The pool structure in Alternative 5 is one mile downstream from the pool structure in Alternative 2a. Alternatives 2 and 2a's pool structure would only be able to provide the 1,000 cfs river flow for 2.5 days, potentially requiring frequent reductions in flow delivery and lower ecological output. Therefore Alternatives 2 and 2a were not considered for implementation.

Alternatives 3 and 4 provide for restored river flow and wetlands, respectively, however they both lack the additional restorative components necessary to expand the carrying capacity of the Arkansas River Corridor to support additional nesting Least Terns or expand available niche habitats. Sand abundance and sediment load transport have been severely impacted by the construction of Keystone Dam, hydropower and flood pool releases, and to a lesser extent localized sand mining operations. Restored river flow would help support the existing sandbars, however some are inundated or their above water surface areas are substantially reduced during releases from Keystone Dam. Without additional sandbar islands constructed to withstand at least the hydropower release of 12,000 cfs, which raises water depth approximately 1 to 5 feet within the river, nesting habitat abundance for Least Terns would remain unchanged.

In an ecosystem restoration study, it is critical to understand that all AAHUs are not the same from study to study or even within a single study. While the bulk of the restorative benefits in this study are generated from the pool structure, realizing that the benefits derived from the sandbar island and wetland restoring measures may be smaller, but provide entirely different functions from that of the riverine benefits is paramount. Alternatives 3 and 4, while having benefits to riverine habitat, were not further considered for implementation as they only restore one or two targeted habitat types.

The extensive urban, industrial, and agricultural development along the banks of the river exacerbate the problems associated with Keystone Dam. One of the biggest issues, is the limited area available for wetlands. The 5.34 acres of restored wetlands at the mouth of Prattville Creek represent a substantial increase in the abundance and quality of existing wetlands. Amphibians, fish, waterfowl, aquatic insects and plants would all benefit from the restoration of a functioning wetland. The rock riffle complex would largely protect and maintain the hydrologic profile to sustain the wetland communities while the wetland vegetative plantings would provide the basis for habitat diversity and for the return of native species. This measure would also provide a seed source for habitats downstream to naturally combat the encroachment of non-native species. While this measure produces fewer AAHUs than the pool structure, the type of benefits produced by a restored wetland differ greatly and would serve to compliment the riverine benefits to further strengthen and diversity the study area.

The same can be said of the few benefits produced by the sandbar island measure, it produces fewer benefits compared to its pool structure counterpart, however the type of benefits produced differ greatly from the riverine and wetland benefits. The construction of a sandbar island adds to the sustainability of nesting habitat in the area. This measure separates Alternatives 4 and 5 as Alternative 5, the Proposed Plan, addresses this key conservation issue for Least Terns. As flows and related river depth increase, the amount of available nesting habitat decreases due to inundation. The constructed tern island would provide approximately 5 acres of nesting area at approximately 1,000 cfs. However, during hydropower generation flows can reach up to approximately 12,000 cfs. The constructed tern island would still provide approximately 3 acres

of suitable nesting habitat at 20,000 cfs allowing continued nesting use of the sandbar island during late season flood pool releases from Keystone Dam. Aside from Least Terns, as the Arkansas River flows from mostly west to east in the study area spanning a large section of the Central Flyway, millions of migratory waterfowl, songbirds, and other marsh and wading birds move through the study area. Alternative 5 would promote additional carrying capacity and habitat diversity within the study area, relieving stress placed on wintering habitats further south, and breeding habitats to the north.

Alternatives 6, 7, and 8 consist of the same measures found in Alternative 5, plus additional wetland and riparian improvements, however due to their large annual incremental cost per output these alternatives were not recommended.

Alternative 5 is the Proposed Alternative and includes a pool structure at RM 530, rock riffle and wetland plantings at Prattville Creek, and sandbar island creation in the downstream reach of the study area. This alternative restores:

- 99.8% of total acreage identified for restoration within the study area
- 3 (riverine, wetland, sandbar) out of the 4 targeted habitat types
- Resilient nesting habitat for the Federally-listed endangered Least Tern
- River and floodplain connectivity throughout the 42 river mile study area

There is no known timeframe for the next phase, Preconstruction Engineering and Design (PED), for the ARC Ecosystem Restoration Feasibility. During PED, final design and operation of the Proposed Plan would be completed over the course of approximately two years. However, general operation and design features of the Proposed Plan that have already been developed include:

- Primary purpose of the pool structure and water stored would be to maintain downstream flows at a release target of 1,000 cfs.
- Existing and proposed low water dams in the ARC would be coordinated with to ensure the 1,000 cfs is allowed to pass through the study.
- Independent sections of full and partial height gates would be open during flood pool releases to allow riverine conditions as if the pool structure
 - Gates would be operated to deliver 1,000 cfs in the absence of water releases from Keystone Dam while allowing at least seasonal fish passage and sediment transport during larger releases from Keystone Dam.
 - Additional fish passage during 1,000 cfs releases will be further developed and incorporated in PED, as long as those operations/features do not impact the ability to deliver the 1,000 cfs release.
 - Diverse fish passage areas, including sloped areas with and without boulder fields, would be further refined in PED to maximize safe fish passage for the diverse fish community within the ARC.
- Monitoring and Adaptive Management of the pool structure would include
 - Monitoring downstream flows to ensure the 1,000 cfs flow is achieved.
 - Monitoring flow fields to ensure fish passage is being provided.
 - Ongoing maintenance of the pool structure would ensure gate operation and sedimentation do not impact the ability to deliver 1,000 cfs flow downstream.
- The rock riffle feature at Prattville Creek would be refined to ensure reoccurring aquatic connectivity to river flow is achieved

- The minimal amount of bank stabilization would be used to ensure the wetland would not fill in over time
- Only native aquatic plants would be planted
- Monitoring and Adaptive Management would include mechanical or herbicide treatment of invasives/noxious plants.
- The exact location for the constructed sandbar island would be identified in PED to ensure the sandbar island is
 - Created as close to the middle of the river channel and away from heavily vegetated shorelines, as practicable and
 - Flow fields maximize substrate deposition and annual removal of vegetation by flood pool releases from Keystone Dam
 - Monitoring and Adaptive Management would include mechanical or hand removal of vegetation from the sandbar prior to Least Tern nesting activity.

From 2000 through 2014, the daily minimum flow rate of 1,000 cfs was observed 26.7% of days. Based on a three-day average releases, with the pool control structure in place, the minimum flow rate could be achieved 81.8% of days. On an annual basis, the observed minimum flow ranged from 6.6 to 52.5% of days, and based on the three day flow average, the minimum flow could be achieved 54.4 to 98.1% of days. The minimum annual increase in days with 1,000 cfs average flow was 37.7% of days in 2012, and the maximum increase was 67.9% of days in 2002.

The Pool Structure at RM 530 would operate for the primarily purpose of maintaining 1,000 cfs river flow downstream in the absence of flood pool or hydropower releases. The full pool volume could provide downstream flows of 1,000 cfs for 3.4 days, 750 cfs for 4.5 days, or 500 cfs for 6.8 days. This flexibility would allow for prolonged flow delivery during extended periods of no river releases from Keystone Dam.

Riverine habitats within the mainstem channel would become more persistent and increase in acreage, from 1,422 acres to 3,735 acres throughout the study area from increases in more consistent minimum flow.

The potential impacts from the construction of the pool control structure on fish and wildlife within the study area are expected to provide significant, long-term positive effects from the increase in daily minimum flows and stabilization and increase of available aquatic habitats. Loss of riverine and sandbar habitat, totaling 2.89 acres would occur from the construction of the Proposed Plan, fish and wildlife displaced during construction would have access to habitats in the vicinity of the structure. The construction and operation of the pool structure would significantly increase riverine habitat up and downstream of the structure, which would promote an increase in abundance and biomass of fish, including forage species of the Least Tern.

CH2M (2009) compiled fish passage flow constraints for many species in the study area in a technical memorandum *Arkansas River Corridor Projects: Fish Passage Data Review and Analysis*. Paddlefish, considered one of the less capable species in the study area in regards to swimming performance, would require flow fields to be in the range of 2-4 feet per second (fps). Other more agile fish in the ARC, such as sauger and striped bass, are much more capable of navigating higher flow fields, and boast burst speeds between 4.9-11.5 and 5.2-8.5 fps, respectively.

The pool structure design and operation would maintain passage for migratory fish such as Shovelnose Sturgeon and Paddlefish to upstream habitats and would allow for the passage of fish eggs and larvae to downstream habitats during flood pool releases from Keystone Dam. As such, fish access to the 10 river miles of spawning areas upstream of the pool structure would continue with the pool structure in place. Preliminary flow field analyses show that, when the full height gates are down, flow fields between 2-4 fps are maintained through the pool structure allowing fish passage for migrating and spawning fish. Boulder fields and sloped approaches would also be placed in select areas to provide diverse fish passage routes. Boulder fields provide flow refuge for smaller fish species, as well as interstitial habitat for minnow sized fish. Larger migratory fish would use more direct passage routes through sloped areas without boulder fields. These areas allow fish passage for larger species while limiting obstructions that could cause fish physical damage if swam into with excessive speed. As in the case of the paddlefish whose elongated rostrum can be damaged if the fish encounters large objects while swimming. As such, access to the 10 river miles of spawning areas upstream of the pool structure would continue with the pool structure in place. These areas contained larger shoreline and side channel rock and cobble substrates encountered during field surveys, potentially originating from nearby or upstream rip-rap areas. Regardless of origin, the rock and cobble substrates provide egg deposition areas and cover for several fish species.

Preliminary flow field analyses also show that during the 1,000 cfs flow releases, flow fields would be approximately 8 fps and initially limit fish passage opportunities to the more agile fish species. During reregulation periods, as pool height falls, flow fields would become lower providing additional periods of fish passage for species needing slower moving water. These additional fish passage periods would be provided to the maximum extent practicable through gate operation and detailed design, provided those operations and features do not impact the ability to deliver the 1,000 cfs flow, as the primary function of the pool structure is to provide river flow in the absence of water releases from Keystone Dam.

The pool structure does not present a significant barrier in regards to fish movement in the study area. The flow fields through the pool structure's full height gate sections during flood pool releases, which trigger and promote fish migration and spawning, would maintain the upstream river reach connectivity during the most critical periods.

In the current condition, no/low river flow regularly limits fish movements throughout the study area. While fish passage through the pool structure would be limited to more agile species during the 1,000 cfs release, nearly 30 river miles of connected, flowing riverine habitat would be maintained downstream that would otherwise be limited to fragmented reaches with minimal to no flow. The increase of minimum flow in the ARC from 100 cfs to 1,000 cfs would expand riverine habitat from 1,422 acres to 3,735 acres. 2,414 of the 3,735 acres would occur downstream of the pool structure in areas less impacted by urban development and Keystone Dam operations.

Sandbar islands and shoreline vegetation are more persistent in the downstream areas, likely due to the increased distance from Keystone Dam and larger metropolitan areas that allows some dissipation of water release energy and less fragmented shoreline habitats. During the 1,000 cfs test release from Keystone Dam, aerial photography displayed the increased connectivity to backwater wetland and tributary habitat throughout the study area as indicated in the HEC-RAS modeling. Connectivity to these habitats increases refuge habitat for small fish from warmer temperatures, predators, and larger water releases. Subsequently, minor, long-

term benefits would occur throughout the food web as these areas promote forage fish. Other fish, numerous migratory wading birds, raptors, and small mammals would realize minor, long-term benefits from the increase feeding opportunities.

Upstream of the structure, up to 1,321 acres of riverine habitat spanning nearly ten river miles would be available for fish and other wildlife that would otherwise be the first area of riverine habitat to be reduced to low/no river flow conditions.

Cherokee CRC (2009) reported that during a seasonal fisheries survey in the ARC from October 2006 through September 2007, 11 species including four native minnows and other larger species were only collected downstream of Zink Dam. Habitat differences, water quality conditions, and/or Zink Dam (as currently operated) were identified as potential limiting factors of species absence upstream of Zink Dam. With the increase of minimum river flow and more persistent river connectivity within the floodway to backwater areas and shoreline cover, minor, long-term benefits for fish species diversity and distribution are expected. Increased availability of persistent habitat for fish species not detected upstream of Zink Dam, and other species already present upstream of Zink Dam, would allow them to proliferate and balance species distribution throughout the ARC.

River flow during broadcast spawning and fish egg incubation periods is critical for fish reproductive success in the ARC. Sauger, paddlefish, striped bass, and shovelnose sturgeon for example, all need continued river flow to complete reproductive life histories. Striped bass broadcast eggs in river currents which need to drift downstream for 36-75 hours before hatching. Sauger, paddlefish, and shovelnose sturgeon deposit eggs on coarser substrates where they need to remain submerged in river flow, but unburied for several days up to 2 weeks. Under current conditions, the loss of river flow can strand striped bass eggs on river beds, shorelines, and or in isolated pools. Deposit spawners' eggs can become exposed and desiccate during no/low flow conditions. Lower flow can also bury eggs with sediment deposition. With the release of 1,000 cfs to fill in river flow gaps, fish eggs along with sauger fry, and other aquatic species that depend on river flow in early life stages, will have more consistent river flow and habitat availability throughout the 30 river miles of downstream river habitat below the pool structure. As such, the 1,000 cfs water release would be conducive to and improve long-term reproductive success of several fish species in the ARC. The release of 1,000 cfs would maintain the minimum 1 fps river flow needed to keep eggs suspended in the water column through the pool structure and continue floating downstream.

Downstream of the pool control structure, the increase in the acreage, stability, and connectivity of available riverine habitats would benefit fish, invertebrates, reptiles, amphibians, and birds. The increase of 2,414 acres stable wetland and open water habitats would provide additional nurseries for juvenile fish which provide a food source for foraging birds such as the Least Tern. The connectivity of these habitats would promote an increase of wildlife abundance throughout the study area.

By maintaining more consistent river flow, riverine habitat output in the ARC nearly doubles from 482 AAHUs to 867 AAHUs.

Some minor, long-term negative impacts may include the increase in abundance and occurrence of invasive species already present in the study area such as grass carp, common carp, white perch, flathead catfish, and zebra mussel.

The potential impacts on wildlife from the wetland restoration measures at Prattville Creek would include localized positive benefits to wildlife from the creation of 5.34 acres of wetland and open water habitats. Initial assessments of this area found virtually all wetland functions had been lost due to the frequent drying regime. Through the rock riffle feature, and native aquatic plantings, a wetland footprint would be maintained to promote nursery habitat for juvenile fishes and habitat for invertebrates. The planted wetland vegetation would increase foraging and nesting opportunities for wading birds and shorebirds. The Proposed Plan elevates this areas output from essentially zero AAHUs, to five AAHUs through restored aquatic vegetation communities. Amphibians and wildlife would also benefit from the shoreline habitat structures which would provide refuge and nesting opportunities. Erosion and fill of the wetland area would also be minimized by the rock riffle as it would stabilize eroding banks and serve a breakwater function during larger releases. During initial field survey efforts, the only areas with submergent and emergent aquatic vegetation was behind a similar rock riffle feature that maintained a wetland area during no/low flow conditions. Numerous slider turtles were also observed within that wetland footprint. Due to limited wetland habitat within the ARC, there would be a minor, long-term positive impact on wildlife within the study area from the ecosystem restoration measures at Prattville Creek.

Additionally, the need for wetland and sandbar island restoration is based on the limited function of those habitats within the study area due to swings in river flow in the ARC. Therefore, in order to meet study goals and objectives and increase the overall carrying capacity of the Arkansas River Corridor for the Least Tern, and all aquatic fauna, the Proposed Plan must, and does, restore river flow, wetland abundance and function, and sustainable sandbar habitat.

The Service appreciates the opportunity to coordinate and comment on the ARC Ecosystem Restoration Feasibility Study. Pre-construction Engineering and Design is considered the next phase of this investigation. The Service looks forward to continued coordination with USACE to help inform final design and operation of the Proposed Plan features.

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Public Comments on Draft Report

Brandon Wadlington, Biologist
Coastal Section- Environmental Compliance Branch
Regional Planning and Environmental Center
US Army Corps of Engineers Tulsa, OK - Brandon.Wadlington@usace.army.mil

March 6, 2017

Dear Mr. Wadlington,

Thanks for your time explaining the Corps restoration of Arkansas River Corridor ecosystems at recent public meeting Case Community Center -Sand Springs. Applaud your in-depth river plans from Keystone Dam downstream to Snake Creek area.

As we briefly discussed here are my comments of record: In Corps draft report- AR River Corridor Feasibility Study <http://www.swt.usace.army.mil/> see p. 34

Key Uncertainties: The potential exists to encounter a number of 26 constituents (at concentrations of concern) in the subsurface or possibly in leachate (drainage) associated with excavations. These could include any of the previously identified contaminants of concern, most probably lead, zinc, barium, copper, and organic compounds such as benzene, toluene, and chlorinated hydrocarbons. In addition, the possibility exists to encounter sulfuric acid sludge. Potential Impacts: Should construction of the pool structure at river mile 530 occur and contaminants extend beyond the EPA (Superfund) site boundary, the non-Federal Sponsor (NFS) would have to provide a clean project site prior to Implementation of any measures in proximity. While the sponsor is willing to take that risk, the risk to the government is that USACE could commit to a plan at a contaminated location.

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See USACE subject report- Appendix D 2. **OVERALL CONCERNS.** P. 1 & 2 -2.1.

Impaired Waters. The following map from the EPA MyWaters Mapper Site shows that most of the study area river corridor is listed as Impaired Water due to pathogens (harmful bacteria, viruses, and protozoans), which is also the leading cause of water impairment in our nation's rivers and streams. Once in a stream, lake, or estuary, these harmful microbes can infect humans through ingestion of water, skin contact, or contaminated fish and shellfish. Common sources of pathogens in waterbodies include discharges from wastewater treatment plants, combined sewer overflows and runoff from livestock operations. The Impairment is classified under Clean Water Act Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs). The inlet from Braveheart (formerly Blackboy) Creek and Harlow Creek at approximately 11.5 miles from Keystone Dam (the most downstream area of impairment) shows an impairment as a result of from Escherichia Coli (E. Coli). The Page 2 of 12 Arkansas River is listed as impaired (303(d)) throughout the rest of study area because of Fecal Coliform and Enterococcus Bacteria exceeding TMDLs.

Comment: The **Key Uncertainties & OVERALL CONCERNS** prompt appreciation of USACE –Tulsa for their disclosing report on impaired water (poor water quality) which was not disclosed to Tulsa citizens during 2016 Vision per-voting period. Quite the contrary citizens were told ‘Arkansas Rivers’ proposed low water dams including rebuilt Zink Dam’s lake waters are swimmable!

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Tulsans deserve professional second opinions on how Vision river projects are funded, engineered and built. New Orleans ignored countless warning to reinforce levees before hurricane Katrina left much of the city in ruins.’ Let’s not allow a New Orleans disaster happen to Tulsa! Bob Jackman, Tulsa robertjackman@sbcglobal.net

‘Application of USACE Climate Change Adaption Plan’ – June 2014 this draft report validates our shared concerns expressed in my above letter’s... ‘fears of climate changes frequent rain-bomb flooding.’

Looking forward to reading comments sent in by Study’s recipients listed in Appendix I and USACE final report

Regards – Bob Jackman

Brandon Wadlington
Biologist
Coastal Section- Environmental Compliance Branch
Regional Planning and Environmental Center
US Army Corps of Engineers

2 March 2017

Dear Mr. Wadlington,

I appreciate your team's presence at the public meeting in Sand Springs and your time spent with me. I am in full support of your plans and methods to improve the ecosystem along the river corridor as it has been a long time coming. In general, this study is very comprehensive in its scope. This letter will form my input to the report as a citizen of Tulsa.

As a previous Corps design electrical and corrosion engineer with the Tulsa District, I have a fairly extensive knowledge of the design constraints requisite for any water control structure and its operation. I am also extremely keen on enhancing the Corps' reputation as a recognized authority in water control structures.

Keystone dam and the related powerhouse are very familiar to me due to various studies I have conducted there for the Corps over the decades and various engineering support provided while with the District. Based upon that knowledge and my involvement the past two years on Tulsa's Vision 2025 projects, I offer the following comments and observations for your consideration in writing the final report. You may have already addressed them and, if so, please excuse my lack of a more thorough reading of your report.

Some of these comments come from those previously made to the ARC design team during their development of the current Vision reports for the City. Although I have tried to read as much of this draft report as I can, the time constraints for public input were too tight for me to provide more comments on all report areas that might need expansion, clarification, or revision. With that in mind, I have focused on the following key areas that I feel may need addressing: operability, maintainability, flood control, and enhancements.

As a previous Corps District engineering staff member, I found that many times maintainability was not "designed in" so to speak. This is especially true when outside consultants performed design rather than the Corps. Keystone dam was designed based upon many decades of Corps experience and has resulted in a maintainable structure for flood control. Therefore, in your selection of a water control structure for the new Sand Springs reregulation structure, I would hope that maintainability be one the key priorities. I have not seen that maintainability adequately factored into the present low water dam schematic designs proposed for use at the new Zink Dam. The present designs have no provisions for dewatering the gates or a pedestrian bridge design that will assist in gate repainting or replacement without pool drainage and interference with hydropower generation. Due to unrealistically low maintenance projections the City of Tulsa has not budgeted enough within their trust fund to adequately maintain the new Zink Dam. I doubt the Corps will make the same mistakes since the organization is well aware of what is required of structures on the Arkansas River system. That being said, would you provide a schematic drawing of the proposed reregulation dam upon which the estimate was based? I did not see one in the report.

Maintainability Question: Since the new reregulation dam will be a fixed crest dam with either fixed wiers or gates, what will keep the dam from just being another sand trap like the existing Zink Dam? The study states that Keystone still provides some sand/sediment transport downstream. Will this not require levels of dredging similar to Zink Dam to keep the capacity of the reregulation pool up? Page 90 of the report addresses this somewhat but the statement: *“the potential for significant sediment accumulation within the pool is anticipated to be low. There is likely to be an increased potential of local bed and bank scour in the downstream proximity of the structure; therefore, the engineering design would need to minimize the potential and or include protective measures in the design.”* What is envisioned in the design to minimize the sediment build-up? What is considered “low” accumulation? Any dredging operations could impact generation at the powerhouse with resulting revenue losses to SWPA. Could sediment buildup be clarified/expanded somewhat, even though the maintenance costs may have been included in the report? Has bypass scouring of the new reregulation structure and resulting repair costs been factored in? Remember Oroville Dam!

Operability: Designing a structure that can modulate flows to mimic the natural flows, while allowing for simultaneous fish passage, is quite a challenge. If it is desired to improve the fish habitat all the way to Keystone dam, what type fish ladder/ramp/bypass is envisioned in your design? Drawings or sketches would be most helpful. If the final design of the new reregulation dam meets all of these operational challenges, you should be aware that the proposed new Zink Dam design will not mimic this flow plan. Fish passage past the new Zink Dam can only be attained by loss of the entire Zink pool during much of the year. There is no permanent 500-1,000 cfs fish bypass around the structure. During the migration and spawning months, which, according to other studies, can be a 6 month window, the pool will effectively have to be drained. To quote from some of the correspondence in this report the wildlife experts stated: *“If LWDs (low water dams) are operated for benefit of native aquatic species, pools may not be available for desired recreational uses during spawning periods (March – June).”* While this reality may seem to be insignificant to operation of the reregulation dam, to date the City has not made this clear to the citizens that their “lake” may not be there half of the year. If the Zink pool is lost March through June when water is more plentiful, what will be the impact on the Zink pool during the other low flow months of July-August and winter months. I would recommend expanding on the requisite operations of any downstream dams during these periods. Unless the public knows what is expected, resistance will be encountered when operations constraints run counter to expectations. Without proper design and operation of these other dams, the goals of this study will not be met.

Floodplain Concerns: To my knowledge there has been no hydraulic HEC-RAS model run on the Sand Springs portion of the river with a fixed crest reregulation dam in place. Since the old reregulation dam was removed in 1985, its impact was not felt during the 1986 flooding and as a result, the public has no feel of the impact of a fixed crest structure. In the discussion of the new reregulation dam, page 91 of the report states: *“No impacts to floodplains would be expected, as the proposed action would be designed to avoid any increase in base flood elevation.”* This implies a “no-rise” criteria similar to that used to support the choice of inflatable low water dams. What are the impacts of a fixed crest design? It is hard to imagine a fixed crest dam that could achieve a no-rise flood control release from Keystone. Additionally, will upstream levees be required if there is a net rise during flows equal to or exceeding 100,000-350,000 cfs? If an updated hydraulic HEC-RAS model has been developed with this fixed crest dam in place, could you provide the public a copy of the study results? It could be posted on-line similar to this report.

Finally, suggested enhancements to the plan. Even with installation of the new reregulation dam, optimization of continuous river flows would require some releases from Keystone in addition to those during hydropower peaking generation. So that precious water is not just used for environmental flow

purposes, consider the following as an enhancement. This is an amplification of the following excerpt from the minutes of a meeting with Oklahoma Ecological Services Office contained in Appendix I of this report.

“From the resource agency perspective, the critical element providing ecosystem benefit, given proposed LWD development, would be minimum flow releases (> 100 cfs) from Keystone Dam obtained through allocation from unclaimed storage within the Keystone/Kaw Lake pool(s), alteration of current hydropower generation regime, or retrofitting Keystone Dam with ‘miniature’ power generation units (= < 1000 cfs). Absent consideration of altered flow release regime from Keystone Dam, critical components to enhance aquatic habitat include reregulation (flow smoothing) potential of a Sand Springs LWD, and refurbishment of Zink Dam for fish passage.”

Part of the problem created by the original design for the Keystone hydropower plant is that it is limited to only two different flow levels governed by the generator turbine characteristics. Flows will either be approximately 6,000 or 12,000 cfs. If smaller 500kW- 1.5 MW units are installed in a few of the dam sluice gate conduits, flows over the range of 500- 1,000 cfs through these seldom used conduits could be achieved. Keystone, unlike many other hydropower facilities, was never designed with a continuously running small turbine supplying the powerhouse operational power. This was omitted for a number of reasons, not the least of which is the projected unreliable inflows to the lake.

My preliminary economic analyses of the smaller turbines, based on historical stream flows, show that with proper sluice gate operations and generator selection, the requisite comparable environmental flows could be made most of the year and significantly improve any downstream pools. The smaller generation units would only need to be operated when the main units are not operating to achieve the stated goals. As a minimum, this could extend the 2-3 day capacity of the reregulation pool a minimum of another 2-3 days when lake levels are within the power pool levels. If the small turbines operate during pool levels above the power pool, and if the remaining unallocated 2,000 ac-ft of lake water is utilized, even more power could be marketed. I would be more than happy to provide you a more in depth discussion of this enhancement to the study along with supporting data and other possibilities for additional available water allocations. This enhancement can be attained without significantly impacting the monetary requirements because there are public and private funding entities which could help or even offset the cost increase. The benefits of these smaller turbines?

- Longer low flows
- Ecosystem improvement beyond that presently planned
- Water quality improvement in the Zink and other downstream pools
- Expansion of the Keystone generation regimen from 500 to 12,000 cfs
- A reduction in the purchased power needed for Keystone powerhouse and Project Office
- More marketable power for SWPA, the Corps, or other interested parties
- Provide compliance with Corps and Department of Energy goals to reclaim available renewable energy at existing non-powered (hydropower) water control structures where studies show that over 6,000 MW of undeveloped hydropower are going to waste

A rough estimate of cost of the installed generation would most likely be less than one-tenth that of the reregulation dams proposed. **It should be clear though that this option would not eliminate the requirement for the Sand Springs reregulation dam.** This has been misconstrued by many people in the past.

Beginning on line 19 of the Executive Summary this statement appears. *“The Southwestern Power Administration (SWPA) markets the hydroelectric power in the area from the USACE-operated multipurpose dams. SWPA’s current authorization is to produce only peak power which also impacts flow release schedules.”* This limitation of only producing peaking power cannot be true and I would ask for support of this statement. SWPA is, by general authorization, allowed to market any and all power from a generation plant at a Federal dam. SWPA has stated in public meetings that when pool levels are above the power pool they generate base power quite often. Other hydropower plants within their system are not used solely for peaking power and base load power is always generated by the smaller powerhouse “house units”. For the purpose of accuracy, please provide the SWPA regulations or laws placing such a restriction on the power generated or simply delete this statement. I would also note that the Corps of Engineers also has authorization to market any power created at a Federal project under their jurisdiction.

In closing, I again thank you for entertaining public questions and input to this important assessment of and enhancements to the ARC planning and the river environment. I am sure that some of my hurried comments to meet the March 7 deadline may need expansion or supportive documents. If so, please let me know.

Sincerely,

Charles Pratt, P.E.
4338 S. Jamestown Ave.
Tulsa, OK 74135
918-744-7172

Memo to: Arkansas River Corridor Ecosystem Restoration Feasibility Study Project Delivery Team

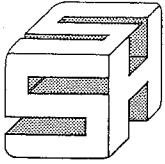
From: Brandon Wadlington

Date: Tuesday March 14, 2017

Subject: Public comment received regarding the Arkansas River Corridor Ecosystem Restoration Feasibility Study via voicemail.

On March 9th, 2017 Cynthia Kitchens received a voicemail message regarding the Arkansas River Corridor. I listened to and transcribed the comment to a written format to the best of my ability so that the comment can be added to the comment record. The transcribed comment is listed below.

Yes this is Pat Daly and I'm reading an article in the Sand Springs paper about the information feasibility study for the Arkansas River. I'm a resident of that area and a frequent river user and my comments are, yes great we're doing a feasibility study that's really good. I'm a, I would be very much in favor of any minimum flow through the river. It sometimes just gets desperate for the stream life, the fisheries, etc in the river during low or no water periods. I've actually seen fish kills on the river. That also of course has a detrimental impact on all wildlife in the river. Low water dam, that's ok but I think it's absolutely critical that there is a strong and viable fish passage way so that fish can migrate both up and down the river. It's a very viable fishery and not only do we depend on it below keystone dam which is a very popular fishing area but the eagles and the seagulls and the big white birds, pelicans, really are heavily reliant on the fish upstream migration as well as whatever comes through or over the dam. So thanks for all of your great work and looking forward to learning about this study. Anything to making the river more viable I'm all for. Thank you.



SAND SPRINGS HOME

15 WEST 2ND STREET
P.O. BOX 278
SAND SPRINGS, OK 74063-0278

EXECUTIVE OFFICES
BOARD OF TRUSTEES
(918) 245-1391

February 27, 2017

Mr. Brandon Wadlington
Environmental Compliance Branch
Regional Planning and Environmental Center
819 Taylor Street
Room 3A12
Fort Worth, TX 76102-0300

Re: Arkansas River Ecosystem Restoration Study Comments

Dear Mr. Wadlington:

The Sand Springs Home, located in Sand Springs, Oklahoma, has received the Public Notice for the Public Meeting on the Arkansas River Ecosystem Restoration Study and offer the following comments.

The Sand Springs Home is the owner of the property where the proposed Control Structure/Low Water Dam is to be constructed. We have been involved in the project since INCOG and the Corps of Engineers began the development of the Arkansas River Corridor Mast Plan in 2003. We are familiar with the components included in the proposed Corps of Engineers recommended plan and support their implementation to improve the Arkansas River ecosystem and provide numerous local and downstream environmental and other benefits. The Sand Springs Home will continue to stay involved as the Feasibility Study progresses and will continue to cooperate in the implementation process.

We highly support and recommend the continuance of the Feasibility Study and the implementation of these very important proposed projects. If you need additional information from us, please do not hesitate to contact us.

Sincerely,

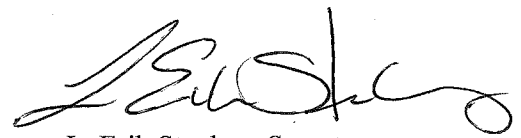


Joe A. Williams, Pres.

918-245-1393
PO Box 278
Sand Springs, OK 74063



R. A. Weese, Vice- Pres.



L. Erik Stuckey, Secretary



March 1, 2017

Mr. Brandon Wadlington
Environmental Compliance Branch
Regional Planning and Environmental Center
819 Taylor Street
Room 3A12
Fort Worth, Texas 76102

RE: Arkansas River Corridor Feasibility Report Comments

Dear Mr. Wadlington:

The Indian Nations Council of Governments (INCOG) has been actively involved in the planning of the Arkansas River corridor development and was a key player, along with the U.S. Army Corps of Engineers (USACE), in the development of the Arkansas River Corridor Master Plan in 2003 and other studies before and since then. We have reviewed the Arkansas River Corridor Feasibility Report released in February, 2017 and fully support the USACE's ecosystem restoration project.

INCOG also supports the USACE's choice of alternative 5 as the most cost effective approach to mitigating some of the negative aspects of the fluctuating river flows resulting from the intermittent release schedule at Keystone Dam. Alternative 5, and an adaptive management program, will help restore the overall aquatic habitat and significant aquatic-related terrestrial resources ultimately restoring some of the river's lost potential.

Since the original reregulation dam was removed in 1985 due to safety concerns, there has been no means to moderate fluctuating instream flows. This is a critical step in reestablishing a healthy riverine ecosystem which will benefit threatened and endangered species, the aquatic community in general and help restore the valuable asset the Arkansas River is to our community.

INCOG will continue to stay involved as the Feasibility Study progresses and will continue to cooperate in the implementation process.

We highly support and recommend the continuance of the Feasibility Study and the implementation of the measures recommended in this report. If you would like additional information from INCOG, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink that reads "Rich Brierre". The signature is written in a cursive, flowing style.

Rich Brierre
Executive Director
INCOG

Original



Oklahoma Archeological Survey

THE UNIVERSITY OF OKLAHOMA

March 9, 2017

Brandon Wadlington
Environmental Compliance Branch
Regional Planning and Environmental Center
819 Taylor Street, Room 3A12
Fort Worth, Texas 76102

Re: Draft Feasibility Report with Integrated Environmental Assessment for the Arkansas River Corridor
Ecosystem Restoration Study
Tulsa County, Oklahoma

Dear Mr. Wadlington,

Thank you for your Notice of Availability of the above-listed proposed undertaking. We acknowledge that this document, as well as the EA and draft FONSI, are part of the compliance process for the National Environmental Policy Act (NEPA). We expect that there will be further coordination with our office, the State Historic Preservation Office (SHPO), and any other consulting parties as part of the process of complying with Section 106 of the National Historic Preservation Act (NHPA). As part of that consultation process, we look forward to receiving documentation that is relevant to our understanding of the potential impacts to historic properties, including archaeological resources, that might occur as a result of the proposed undertaking.

Sincerely,

Kary L. Staackelbeck, Ph.D.
State Archaeologist

cc: SHPO



From: [Theodore Isham](#)
To: [Wadlington, Brandon E CIV USARMY CESWF \(US\)](#)
Subject: [EXTERNAL] Feasibility Report for Arkansas River Corridor Ecosystem Restoration Study
Date: Wednesday, March 08, 2017 11:46:28 AM

The Seminole Nation of Oklahoma wishes to comment on the Feasibility Report for Arkansas River Corridor Ecosystem Restoration Study by stating this tribal entity would like to have Traditional/ Medicinal plants replanted within the ecosystem. The Cherokee 7 medicinal plants plus the river cane are sufficient.

Theodore Isham

Seminole Nation of Oklahoma

Historic Preservation Officer

PO Box 1498

Seminole, Ok 74868

Phone: 405-234-5218

e-mail: isham.t@sno-nsn.gov <<mailto:isham.t@sno-nsn.gov>>

Public Comments Received

Concern Type

Response

Brandon Wadlington, Biologist
 Coastal Section- Environmental Compliance Branch
 Regional Planning and Environmental Center
 US Army Corps of Engineers Tulsa, OK - Brandon.Wadlington@usace.army.mil

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HTRW

Elements of the Recommended Plan, namely the pool structure, would be placed upstream of the known extent of a Superfund site that was previously contained on site. Contaminants are not expected to have traveled up slope into the would be construction area. Part of Tulsa County's non-federal sponsor responsibilities is to provide USACE with sufficient land, free of contaminants, for the construction of the Recommended Plan. The Non Federal sponsor has already begun appropriate surveys to ensure construction activities would not encounter or expose contaminated soil.

See USACE subject report- Appendix D 2. OVERALL CONCERNS. P. 1 & 2 -2.1.

Impaired Waters. The following map from the EPA MyWaters Mapper Site shows that most of the study area river corridor is listed as Impaired Water due to pathogens (harmful bacteria, viruses, and protozoans), which is also the leading cause of water impairment in our nation's rivers and streams. Once in a stream, lake, or estuary, these harmful microbes can infect humans through ingestion of water, skin contact, or contaminated fish and shellfish. Common sources of pathogens in waterbodies include discharges from wastewater treatment plants, combined sewer overflows and runoff from livestock operations. The Impairment is classified under Clean Water Act Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs). The inlet from Braveheart (formerly Blackboy) Creek and Harlow Creek at approximately 11.5 miles from Keystone Dam (the most downstream area of impairment) shows an impairment as a result of from Escherichia Coli (E. Coli). The Page 2 of 12 Arkansas River is listed as impaired (303(d)) throughout the rest of study area because of Fecal Coliform and Enterococcus Bacteria exceeding TMDLs.

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Flood Risk Management

Flood Risk Management is a priority mission of USACE. The ARC study focuses on another very important USACE mission, ecosystem restoration. Increasing flood risk within the ARC study area was considered a project constraint, meaning the Recommended Plan was developed to not increase flood risk. Potential impacts of the Recommended Plan on current flood risk within the ARC study area were evaluated using HEC-RAS and found to be less than significant. Further details can be found in the H&H appendix, as well as the consideration of climate change in the Climate Change appendix. USACE recommends Tulsa County continue coordination efforts with USACE to improve flood safety throughout flood prone areas.

More Citizens Vision Committees Needed! Tulsa World praised Mayor Bynum’s new Commission on Community Policing to monitor Vision’s public safety project. Suggest the Mayor also form ‘Tulsa Independent Hydrological Commission’ and ‘Municipal Bonds - Oversight Commission’ for Vision’s projects. Municipal Tax-Anticipation Bond Underwriters are called Bond Daddies by insiders, and with their known tricks and traps in fees - we need some citizens’ financial guard dogs!

Citizen Oversight of Vision 2025 Projects

USACE commends Tulsa County and Tulsa County citizens for their collective efforts and input on the Vision 2025 Plan. USACE recommends continued coordination between Tulsa County and its citizens to ensure that all Vision 2025 projects are developed and funded, including the Recommended Plan, consistent with local priorities.

Regards Independent Hydrological Commission: After Vision passed, Corps of Engineers released risk assessment on Tulsa County Levees finding Tulsa levees with highest risk to public safety in the US and urgently needing rebuilding. Plus Fed Executive Order 13690 raised Federal Flood Risk Management Standards higher two to three feet on levees due to climate change. Has all this been modeled and factored in Vision river projects?

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Brandon Wadlington
Biologist
Coastal Section- Environmental Compliance Branch
Regional Planning and Environmental Center
US Army Corps of Engineers

2-Mar-17

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I appreciate your team’s presence at the public meeting in Sand Springs and your time spent with me. I am in full support of your plans and methods to improve the ecosystem along the river corridor as it has been a long time coming. In general, this study is very comprehensive in its scope. This letter will form my input to the report as a citizen of Tulsa.
As a previous Corps design electrical and corrosion engineer with the Tulsa District, I have a fairly extensive knowledge of the design constraints requisite for any water control structure and its operation. I am also extremely keen on enhancing the Corps’ reputation as a recognized authority in

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Response

water control structures. Keystone dam and the related powerhouse are very familiar to me due to various studies I have conducted there for the Corps over the decades and various engineering support provided while with the District. Based upon that knowledge and my involvement the past two years on Tulsa's Vision 2025 projects, I offer the following comments and observations for your consideration in writing the final report. You may have already addressed them and, if so, please excuse my lack of a more thorough reading of your report.

Some of these comments come from those previously made to the ARC design team during their development of the current Vision reports for the City. Although I have tried to read as much of this draft report as I can, the time constraints for public input were too tight for me to provide more comments on all report areas that might need expansion, clarification, or revision. With that in mind, I have focused on the following key areas that I feel may need addressing: operability, maintainability, flood control, and enhancements.

As a previous Corps District engineering staff member, I found that many times maintainability was not "designed in" so to speak. This is especially true when outside consultants performed design rather than the Corps. Keystone dam was designed based upon many decades of Corps experience and has resulted in a maintainable structure for flood control. Therefore, in your selection of a water control structure for the new Sand Springs reregulation structure, I would hope that maintainability be one the key priorities. I have not seen that maintainability adequately factored into the present low water dam schematic designs proposed for use at the new Zink Dam. The present designs have no provisions for dewatering the gates or a pedestrian bridge design that will assist in gate repainting or replacement without pool drainage and interference with hydropower generation. Due to unrealistically low maintenance projections the City of Tulsa has not budgeted enough within their trust fund to adequately maintain the new Zink Dam. I doubt the Corps will make the same mistakes since the organization is well aware of what is required of structures on the Arkansas River system. That being said, would you provide a schematic drawing of the proposed reregulation dam upon which the estimate was based? I did not see one in the report.

Design, Maintenance, Operation, and Costs

As part of the USACE planning process, costs (including operation, maintenance, and repairs over the life span of the project) are developed to provide decision makers with realistic expectations of funding needs. Preliminary design is provided in the Civil appendix, costs are provide in the Cost Appendix. Note this is a preliminary design, costs and detailed design, would be further refined during the Preconstruction Engineering & Design phase. Maintainability and operability are critical to the longevity of any project. Several design and operation constraints are discussed in the report and in the Civil appendix, including independent full height gates and sloped approaches, to maintain sediment transport, allow large flows to pass over/through the pool structure, and minimize erosion, shear stresses, and safety risk.

Maintainability Question: Since the new reregulation dam will be a fixed crest dam with either fixed wiers or gates, what will keep the dam from just being another sand trap like the existing Zink Dam? The

Pool Structure Operations & Fish Passage

The primary purpose of the ARC study, and all elements of the Recommended Plan is ecosystem restoration. The pool structure would be operated to facilitate river flow with minimal obstruction, via full and partial height gates, during larger releases from Keystone Dam. This would allow river flow, sediment transport, and fish movement to continue much like it does today without inducing additional flooding. During periods of no releases from Keystone Dam, the pool structure would deliver river flow downstream. During this period downstream fish movement would still continue while upstream fish movement may be limited to more agile fish and would become a secondary goal behind maintaining river flow downstream. Detailed design and gate operations developed during the Preconstruction Engineering & Design would maximize fish passage opportunities while first ensuring the delivery of the 1,000 cfs, and avoiding impacts to life safety, flood risk, and hydropower operations.

study states that Keystone still provides some sand/sediment transport downstream. Will this not require levels of dredging similar to Zink Dam to keep the capacity of the reregulation pool up? Page 90 of the report addresses this somewhat but the statement: "the potential for significant sediment accumulation within the pool is anticipated to be low. There is likely to be an increased potential of local bed and bank scour in the downstream proximity of the structure; therefore, the engineering design would need to minimize the potential and or include protective measures in the design." What is envisioned in the design to minimize the sediment build-up? What is considered "low" accumulation? Any dredging operations could impact generation at the powerhouse with resulting revenue losses to SWPA. Could sediment buildup be clarified/expanded somewhat, even though the maintenance costs may have been included in the report? Has bypass scouring of the new reregulation structure and resulting repair costs been factored in? Remember Oroville Dam!

Operability: Designing a structure that can modulate flows to mimic the natural flows, while allowing for simultaneous fish passage, is quite a challenge. If it is desired to improve the fish habitat all the way to Keystone dam, what type fish ladder/ramp/bypass is envisioned in your design? Drawings or sketches would be most helpful. If the final design of the new reregulation dam meets all of these operational challenges, you should be aware that the proposed new Zink Dam design will not mimic this flow plan. Fish passage past the new Zink Dam can only be attained by loss of the entire Zink pool during much of the year. There is no permanent 500-1,000 cfs fish bypass around the structure. During the migration

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and spawning months, which, according to other studies, can be a 6 month window, the pool will effectively have to be drained. To quote from some of the correspondence in this report the wildlife experts stated: "If LWDs (low water dams) are operated for benefit of native aquatic species, pools may not be available for desired recreational uses during spawning periods (March – June)." While this reality may seem to be insignificant to operation of the reregulation dam, to date the City has not made this clear to the citizens that their "lake" may not be there half of the year. If the Zink pool is lost March through June when water is more plentiful, what will be the impact on the Zink pool during the other low flow months of July-August and winter months. I would recommend expanding on the requisite operations of any downstream dams during these periods. Unless the public knows what is expected, resistance will be encountered when operations constraints run counter to expectations. Without proper design and operation of these other dams, the goals of this study will not be met.

Floodplain Concerns: To my knowledge there has been no hydraulic HEC-RAS model run on the Sand Springs portion of the river with a fixed crest reregulation dam in place. Since the old reregulation dam was removed in 1985, its impact was not felt during the 1986 flooding and as a result, the public has no feel of the impact of a fixed crest structure. In the discussion of the new reregulation dam, page 91 of the report states: "No impacts to floodplains would be expected, as the proposed action would be designed to avoid any increase in base flood elevation." This implies a "no-rise" criteria similar to that used to support the choice of inflatable low water dams. What are the impacts of a fixed crest design? It is hard to imagine a fixed crest dam that could achieve a no-rise flood control release from Keystone. Additionally, will upstream levees be required if there is a net rise during flows equal to or exceeding 100,0000-350,000 cfs? If an updated hydraulic HEC-RAS model has been developed with this fixed crest dam in place, could you provide the public a copy of the study results? It could be posted on-line similar to this report.

Finally, suggested enhancements to the plan. Even with installation of the new reregulation dam, optimization of continuous river flows would require some releases from Keystone in addition to those during hydropower peaking generation. So that precious water is not just used for environmental flow

Page 3 of 4
purposes, consider the following as an enhancement. This is an amplification of the following excerpt from the minutes of a meeting with Oklahoma Ecological Services Office contained in Appendix I of this report.
"From the resource agency perspective, the critical element providing ecosystem benefit, given proposed LWD development, would be minimum flow releases (> 100 cfs) from Keystone Dam obtained through allocation from unclaimed storage within the Keystone/Kaw Lake pool(s), alteration of current hydropower generation regime, or retrofitting Keystone Dam with 'miniature' power generation units (= < 1000 cfs). Absent consideration of altered flow release regime from Keystone Dam, critical components to enhance aquatic habitat include reregulation (flow smoothing) potential of a Sand Springs LWD, and refurbishment of Zink Dam for fish passage."
Part of the problem created by the original design for the Keystone hydropower plant is that it is limited to only two different flow levels governed by the generator turbine characteristics. Flows will either be approximately 6,000 or 12,000 cfs. If smaller 500kW- 1.5 MW units are installed in a few of the dam sluice gate conduits, flows over the range of 500- 1,000 cfs through these seldom used conduits could be achieved. Keystone, unlike many other hydropower facilities, was never designed with a continuously running small turbine supplying the powerhouse operational power. This was omitted for a number of

Reallocation/Hydropower

As noted in the study authorization, the ARC study team could only evaluate elements of the ARC Master Plan for ecosystem restoration, however, changes to Keystone Dam Operations, including constructing additional hydropower turbines, to increase minimum flows were considered early in the study process. These measures would require reallocation of water storage behind Keystone Dam. Additionally, cursory project cost estimates of evaluating, implementing, and construction of either additional hydropower turbines or changes in Keystone Dam Operations were found to be higher than the Recommended Plan. The Recommended Plan would not require additional releases from Keystone Dam, rather capture portions of water releases for subsequent release to fill in flow needs. The storage area would go dry during extended periods without releases from Keystone Dam, these periods would be utilized for inspection, maintenance, and repair activities. The analysis of reallocation and changes in dam operations are addressed in Chapter 3 of the main report.

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reasons, not the least of which is the projected unreliable inflows to the lake.

My preliminary economic analyses of the smaller turbines, based on historical stream flows, show that with proper sluice gate operations and generator selection, the requisite comparable environmental flows could be made most of the year and significantly improve any downstream pools. The smaller generation units would only need to be operated when the main units are not operating to achieve the stated goals. As a minimum, this could extend the 2-3 day capacity of the reregulation pool a minimum of another 2-3 days when lake levels are within the power pool levels. If the small turbines operate during pool levels above the power pool, and if the remaining unallocated 2,000 ac-ft of lake water is utilized, even more power could be marketed. I would be more than happy to provide you a more in depth discussion of this enhancement to the study along with supporting data and other possibilities for additional available water allocations. This enhancement can be attained without significantly impacting the monetary requirements because there are public and private funding entities which could help or even offset the cost increase. The benefits of these smaller turbines?

- Longer low flows
- Ecosystem improvement beyond that presently planned
- Water quality improvement in the Zink and other downstream pools
- Expansion of the Keystone generation regimen from 500 to 12,000 cfs
- A reduction in the purchased power needed for Keystone powerhouse and Project Office
- More marketable power for SWPA, the Corps, or other interested parties
- Provide compliance with Corps and Department of Energy goals to reclaim available renewable energy at existing non-powered (hydropower) water control structures where studies show that over 6,000 MW of undeveloped hydropower are going to waste

A rough estimate of cost of the installed generation would most likely be less than one-tenth that of the reregulation dams proposed. It should be clear though that this option would not eliminate the requirement for the Sand Springs reregulation dam. This has been misconstrued by many people in the past.

Page 4 of 4

Beginning on line 19 of the Executive Summary this statement appears. "The Southwestern Power Administration (SWPA) markets the hydroelectric power in the area from the USACE-operated multipurpose dams. SWPA's current authorization is to produce only peak power which also impacts flow release schedules." This limitation of only producing peaking power cannot be true and I would ask for support of this statement. SWPA is, by general authorization, allowed to market any and all power from a generation plant at a Federal dam. SWPA has stated in public meetings that when pool levels are above the power pool they generate base power quite often. Other hydropower plants within their system are not used solely for peaking power and base load power is always generated by the smaller powerhouse "house units". For the purpose of accuracy, please provide the SWPA regulations or laws placing such a restriction on the power generated or simply delete this statement. I would also note that the Corps of Engineers also has authorization to market any power created at a Federal project under their jurisdiction.

In closing, I again thank you for entertaining public questions and input to this important assessment of and enhancements to the ARC planning and the river environment. I am sure that some of my hurried comments to meet the March 7 deadline may need expansion or supportive documents. If so, please let me know.

Sincerely,
 Charles Pratt, P.E.
 4338 S. Jamestown Ave.
 Tulsa, OK 74135
 918-744-7172

1-Mar-17

Mr. Brandon Wadlington
 Environmental Compliance Branch

Public Comments Received

Concern Type

Response

Regional Partners - Regional Solutions
2 West Second Street Suite 800 | Tulsa, OK 7 4103 | 918.584.7526 | www,INCOG.org
Regional Planning and Environmental Center
819 Taylor Street
Room 3A12
Fort Worth, Texas 76102

RE: Arkansas River Corridor Feasibility Report Comments

Dear Mr. Wadlington:

The Indian Nations Council of Governments (INCOG) has been actively involved in the planning of the Arkansas River corridor development and was a key player, along with the U.S. Army Corps of Engineers (USACE), in the development of the Arkansas River Corridor Master Plan in 2003 and other studies before and since then. We have reviewed the Arkansas River Corridor Feasibility Report released in February, 2017 and fully support the USACE's ecosystem restoration project. INCOG also supports the USACE's choice of alternative 5 as the most cost effective approach to mitigating some of the negative aspects of the fluctuating river flows resulting from the intermittent release schedule at Keystone Dam. Alternative 5, and an adaptive management program, will help restore the overall aquatic habitat and significant aquatic-related terrestrial resources ultimately restoring some of the river's lost potential. Since the original reregulation dam was removed in 1985 due to safety concerns, there has been no means to moderate fluctuating instream flows. This is a critical step in reestablishing a healthy riverine ecosystem which will benefit threatened and endangered species, the aquatic community in general and help restore the valuable asset the Arkansas River is to our community. INCOG will continue to stay involved as the Feasibility Study progresses and will continue to cooperate in the implementation process. We highly support and recommend the continuance of the Feasibility Study and the implementation of the measures recommended in this report. If you would like additional information from INCOG, please do not hesitate to contact me.

In support of Project

Thank you

Sincerely,
Rich Briere
Executive Director
INCOG

Brandon Wadlington
Environmental Compliance Branch
THE UNIVERSITY
Regional Planning and Environmental Center
819 Taylor Street, Room 3A12
Fort Worth, Texas 76102

Re: Draft Feasibility Report with Integrated Environmental Assessment for the Arkansas River Corridor Ecosystem Restoration Study
Tulsa County, Oklahoma

Dear Mr. Wadlington,

Thank you for your Notice of Availability of the above-listed proposed undertaking. We acknowledge that this document, as well as the EA and draft FONSI, are part of the compliance process for the National Environmental Policy Act (NEPA). We expect that there will be further coordination ,with our office, the State Historic Preservation Office (SHPO), and any other consulting parties as part of the process of complying with Section 106 of the National Historic Preservation Act (NHPA). As part of that consultation process, we look forward to receiving documentation that is relevant to our understanding of the potential impacts to historic properties, including archaeological resources, that might occur as a result of the proposed undertaking.

Coordination

Documents have been sent to all appropriate parties for consultation under Section 106 of the NHPA. A Programmatic Agreement has been fully executed to ensure compliance with NHPA throughout the life of the project.

State Archaeologist
cc: SHPO

Public Comments Received

Concern Type

Response

TRIBAL HISTORIC PRESERVATION OFFICE

Date: March 22, 2017 File: 1617-19450K-2

RE: USACE, Fort Worth District, Arkansas River Corridor Ecosystem Restoration Study, Tulsa County, Oklahoma

Fort Worth District

Brandon Wadlington

819 Taylor Street, Room 3A12

Fort Worth, TX 76102

Dear Mr. Wadlington,

The Osage Nation Historic Preservation Office has received notification and accompanying information for the

Coordination

Documents have been sent to all appropriate parties for consultation under Section 106 of the NHPA. A Programmatic Agreement has been fully executed to ensure compliance with NHPA throughout the life of the project.

proposed project listed as USACE, Fort Worth District, Arkansas River Corridor Ecosystem Restoration Study, Tulsa County, Oklahoma. The Osage Nation requests that a cultural resources survey be conducted for this project.

In accordance with the National Historic Preservation Act, (NHPA) [54 U.S.C. § 300101 et seq.] 1966, undertakings subject to the review process are referred to in 54 U.S.C. § 302706 (a), which clarifies that historic properties may have religious and cultural significance to Indian tribes. Additionally, Section 106 of NHPA requires Federal agencies to consider the effects of their actions on historic properties (36 CFR Part 800) as does the National Environmental Policy Act (43 U.S.C. 4321 and 4331-35 and 40 CFR 1501.7(a) of 1969).

The Osage Nation has a vital interest in protecting its historic and ancestral cultural resources. The Osage Nation anticipates reviewing and commenting on the planned Phase I cultural resources survey report for the proposed USACE, Fort Worth District, Arkansas River Corridor Ecosystem Restoration Study, Tulsa County, Oklahoma.

Should you have any questions or need any additional information please feel free to contact me at the number listed below. Thank you for consulting with the Osage Nation on this matter.

John Fox

Archaeologist

Memo to: Arkansas River Corridor Ecosystem Restoration Feasibility Study Project Delivery Team

From: Brandon Wadlington

Date: Tuesday March 14, 2017

Subject: Public comment received regarding the Arkansas River Corridor Ecosystem Restoration Feasibility Study via voicemail.

On March 9th, 2017 Cynthia Kitchens received a voicemail message regarding the Arkansas River Corridor. I listened to and transcribed the comment to a written format to the best of my ability so that the comment can be added to the comment record. The transcribed comment is listed below.

Yes this is Pat Daly and I'm reading an article in the Sand Springs paper about the information feasibility study for the Arkansas River. I'm a resident of that area and a frequent river user and my comments are, yes great we're doing a feasibility study that's really good. I'm a, I would be very much in favor of any minimum flow through the river. It sometimes just gets desperate for the stream life, the fisheries, etc. in the river during low or no water periods. I've actually seen fish kills on the river. That also of course has a detrimental impact on all wildlife in the river. Low water dam, that's ok but I think it's absolutely critical that there is a strong and viable fish passage way so that fish can migrate both up and down the river. It's a very viable fishery and not only do we depend on it below keystone dam which is a very popular fishing area but the eagles and the seagulls and the big white birds, pelicans, really are heavily reliant on the fish upstream migration as well as whatever comes through or over the dam. So thanks for all of your great work and looking forward to learning about this study. Anything to making the river more viable I'm all for. Thank you.

Fish Passage

The primary purpose of the ARC study, and all elements of the Recommended Plan, is ecosystem restoration. The pool structure would be operated to facilitate river flow with minimal obstruction, via full and partial height gates, during larger releases from Keystone Dam. This would allow river flow, sediment transport, and fish movement to continue much like it does today without inducing additional flooding. During periods of no releases from Keystone Dam, the pool structure would deliver river flow downstream. During this period downstream fish movement would still continue while upstream fish movement may be limited to more agile fish and would become a secondary goal behind maintaining river flow downstream. Detailed design and gate operations developed during the Preconstruction Engineering & Design would maximize fish passage opportunities while first ensuring the delivery of the 1,000 cfs, and avoiding impacts to life safety, flood risk, and hydropower operations.

27-Feb-17

Mr. Brandon Wadlington
Environmental Compliance Branch
Regional Planning and Environmental Center
819 Taylor Street
Room 3A12

Public Comments Received

Concern Type

Response

Fort Worth, TX 76102-0300
Re: Arkansas River Ecosystem Restoration Study Comments
Dear Mr. Wadlington:
EXECUTIVE OFFICES
BOARD OF TRUSTEES
(918) 245-1391

The Sand Springs Home, located in Sand Springs, Oklahoma, has received the Public Notice for the Public Meeting on the Arkansas River Ecosystem Restoration Study and offer the following comments. The Sand Springs Home is the owner of the property where the proposed Control Structure/Low Water Dam is to be constructed. We have been involved in the project since INCOG and the Corps of Engineers began the development of the Arkansas River Corridor Mast Plan in 2003. We are familiar with the components included in the proposed Corps of Engineers recommended plan and support their implementation to improve the Arkansas River ecosystem and provide numerous local and downstream environmental and other benefits. The Sand Springs Home will continue to stay involved as the Feasibility Study progresses and will continue to cooperate in the implementation process. We highly support and recommend the continuance of the Feasibility Study and the implementation of these very important proposed projects. If you need additional information from us, please do not hesitate

In Support of Project

Thank you

to contact us.
Sincerely,
918-245-1393
PO Box 278
Sand Springs, OK 74063

From: Theodore Isham
To: Wadlington, Brandon E CIV USARMY CESWF (US)
Subject: [EXTERNAL] Feasibility Report for Arkansas River Corridor Ecosystem Restoration Study
Date: Wednesday, March 08, 2017 11:46:28 AM

The Seminole Nation of Oklahoma wishes to comment on the Feasibility Report for Arkansas River Corridor Ecosystem Restoration Study by stating this tribal entity would like to have Traditional/ Medicinal plants replanted within the ecosystem. The Cherokee 7 medicinal plants plus the river cane are sufficient.

Coordination - Plant Request

The Cherokee 7 medicinal plants and river cane were considered for use in the ARC ecosystem restoration study. Riparian plantings measure were not part of the Recommended Plan, limiting opportunities for planting the Cherokee 7 medicinal plants. However, these plants were recommended to the non-federal sponsor for consideration in future Vision 2025 project plantings. River cane was considered for the Prattville Creek wetland plantings, concerns over river cane's ability to quickly grow and out compete other native species, limiting wetland diversity, ultimately led to the decision to no include it as part of the Recommended Plan.

Theodore Isham
Seminole Nation of Oklahoma
Historic Preservation Officer
PO Box 1498
Seminole, Ok 74868
Phone: 405-234-5218
e-mail: isham.t@sno-nsn.gov <mailto:isham.t@sno-nsn.gov>

27-Feb-17

Mr. Brandon Wadlington
Environmental Compliance Branch
Fort Worth District Corps of Engineers
P.O. Box 17300
Fort Worth, TX 76102
RE: File #0806-17 [Former File #2410-16]; Arkansas River Corridor Ecosystem Restoration Study,
Tulsa, Tulsa County, Oklahoma

Public Comments Received

Concern Type

Response

<p>Dear Mr. Wadlington:</p> <p>We are in receipt of the U.S. Army Corps of Engineers (COE), Fort Worth, Texas District, Notice of Availability for the Draft Feasibility Report with Integrated Environmental Assessment for the Arkansas River Corridor Ecosystem Restoration Study, Tulsa County, Oklahoma.</p> <p>Based upon the nature and amount of ground disturbing activities proposed for the project, we assume that the COE will be consulting with our office per Section 106 of the National Historic Preservation Act (NHPA) as appropriate regarding the proposed project.</p> <p>If you have any questions, please contact Catharine Wood, Historical Archaeologist, at (405) 521-6381. Please reference the above underlined file number when responding. Thank you.</p> <p>Sincerely, Melvena Reisch Deputy State Historic Preservation Officer MH:pm cc: Mr. Douglas C. Sims, COE, Fort Worth District Mr. Andrew Commer, COE, Tulsa District Dr. Kary Stackelbeck, OAS</p>	<p>Coordination</p>	<p>Documents have been sent to all appropriate parties for consultation under Section 106 of the NHPA. A Programmatic Agreement has been fully executed to ensure compliance with NHPA throughout the life of the project.</p>
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Department of Energy
Southwestern Power Administration
One West Third Street
Tulsa, Oklahoma 74103-3502

March 10, 2017

Mr. Brandon Wadlington
U.S. Army Corps of Engineers
Environmental Compliance Branch
Regional Planning and Environmental Center
819 Taylor Street, Room 3A12
Fort Worth, TX 76102

RE: Arkansas River Corridor Feasibility Report – Draft Report, Prepared by the U.S. Army Corps of Engineers Tulsa District, 06 February 2017

Dear Mr. Wadlington:

This letter provides the comments of Southwestern Power Administration (Southwestern) on the “Arkansas River Corridor Feasibility Report – Draft Report, Prepared by the U.S. Army Corps of Engineers Tulsa District, 06 February 2017” (Draft Report), including the integrated Environmental Assessment (EA) and draft Finding of No Significant Impacts (FONSI). Southwestern is an agency within the U.S. Department of Energy that markets hydroelectric power from 24 multi-purpose Federal water resources projects constructed and operated by the U.S. Army Corps of Engineers (Corps), in the states of Arkansas, Missouri, Oklahoma, and Texas. Those projects include Keystone Dam, which is located upstream of the Arkansas River Corridor (ARC) considered in the Draft Report, and Webbers Falls Lock and Dam, which is located downstream of the ARC. By statute, the Federal hydropower serves not-for-profit customers, largely rural electric cooperatives and municipalities, in the four previously mentioned states as well as Kansas and Louisiana. Additionally, Southwestern is obligated to repay the Federal investment allocated to the hydropower purpose at the water resource projects with revenues received from the sale of power. Therefore, Southwestern has a clear and direct interest in any activities which may impact the operation of these projects, which directly influence Southwestern’s ability to fulfill Federal contractual obligations and repayment to the Federal Treasury. Southwestern’s specific comments on the Draft Report are included in the attachment, and our major concerns regarding the Draft Report are detailed below.

Foremost, Southwestern is concerned that the Sand Springs low water dam (LWD) proposed in the Draft Report, and the expectations set forth by its installation, will directly affect Keystone Dam operations. First, Southwestern is concerned about the use of the term “adaptive management” to address the unknowns of the proposed LWD. The Draft Report states the proposed LWD will release 1,000 cubic feet per second (cfs) and empty the full volume of the LWD pool in 3.4 days with no Keystone Dam releases. The contributing watershed above the proposed LWD and below Keystone Dam is less than 40 square miles; however, the contributing watershed above Keystone Dam is 22,351 square miles. As such, the proposed LWD is almost entirely dependent on Keystone Dam generation and flood releases for its inflow. Because of the lack of flexibility in

the operation of the proposed LWD, Southwestern is concerned that the “adaptive management” plan will depend upon significant changes to current Keystone Dam operations. Southwestern strongly reiterates that the proposed LWD, and the National Ecosystem Restoration (NER) plan, should not affect existing Keystone Dam operations. To ensure there is no impact to Keystone Dam operations, any operational or “adaptive management” plans need to be thoroughly vetted by all involved resource agencies, including Southwestern, and appropriate Corps personnel (i.e., hydropower, reservoir management, regulatory) before development of the NER plan and construction of the proposed LWD.

Another operational concern is the impact of the proposed LWD on the Keystone Dam tailwater and consequently on the head differential (difference in elevation between the lakeside and the tailwater) at Keystone Dam. The top of the proposed LWD is elevation 638.0 (638.5 feet in Appendix B). The elevation of Keystone Dam tailwater during periods of no generation, and no significant conduit or tainter gate releases, is approximately 637.6 feet. There is a riffle complex approximately a half mile downstream of Keystone Dam that controls the tailwater elevation during those periods. While the proposed LWD may not affect Keystone Dam tailwater elevation in periods of light generation of less than six hours per day, the proposed LWD will likely impact the tailwater elevation in periods of heavy generation of more than six hours per day. Six hours of generation per day is significant because that is the estimated amount of generation required to fill the pool of the proposed LWD assuming it is completely empty. Southwestern expects that the Corps will complete a hydraulic study that will demonstrate the effect of the proposed LWD on Keystone Dam tailwater. A rise in tailwater will reduce the head differential, which will affect the available capacity, energy production, and efficiency of hydropower generation.

Additionally, Southwestern is concerned with the proposed creation of riverine habitat that will be inundated weekly (if not daily) by hydropower releases, and even further so by flood control releases. The Corps Tulsa District Regulatory Branch has historically not considered the ARC land located below bankfull elevation to be habitat due to the expected regular inundation by hydropower and flood releases, and that approach has governed their issuance of Section 404 permits. Southwestern is unclear how Corps regulatory policy will be affected by creating habitat in areas that the Corps has never considered to be habitat. Southwestern requests clarification from the Corps on its policy regarding habitat in the Arkansas River, and whether the proposed NER plan for the ARC and the LWD presented in the Draft Report represents a change to current policy.

Furthermore, Southwestern is concerned with the mischaracterization of the Interior Least Tern (ILT) nesting in the ARC. Southwestern has been in consultation with the Corps and the U.S. Fish and Wildlife Service (USFWS) since 1986 regarding the ILT, and Southwestern and the Corps have been operating Keystone Dam under the provisions of the 1998, 2005, and 2013 Biological Opinions. In 2002, the ILT committee was established and created guidelines for the dam operations of Tulsa District and Southwestern. The ILT committee has conducted weekly or bi-weekly meetings during the ILT nesting season every year since 2002. During these meetings, the results of the ILT surveys are discussed, and actions are implemented to prevent land bridging of

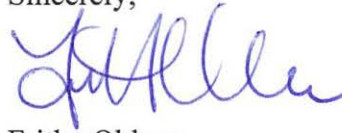
nesting islands, to protect low elevation nests from flooding, and to provide flows that allow the ILT surveyors to conduct the surveys by boat, to the extent feasible. As a member of the ILT committee, Southwestern fully cooperates and coordinates with the Corps and USFWS, even when the consensus recommended actions are detrimental to hydropower. Southwestern is concerned that the Draft Report describes impacts to the ILT that are addressed every year by the ILT committee, but makes no mention of the ILT committee and the successes achieved through its cooperative operations. The Draft Report also fails to acknowledge that Keystone Dam hydropower and flood releases will still be the controlling factor in ILT nesting in the ARC even if the proposed LWD is constructed, as the LWD release of 1,000 cfs will have relatively little to no effect on ILT habitat and nesting. Additionally, Southwestern believes the Draft Report overestimates the importance of the NER plan in the delisting activities for the ILT. The USFWS completed a 5-Year Review of the ILT in 2013 which found that the ILT is biologically recovered, and recommended delisting after completion of a range wide population model, a conservation plan, and a monitoring plan. Since 2013, Federal agencies across the ILT population range put a significant amount of effort into completing all three of these objectives, without considering the effect of the NER plan recommended in the Draft Report. In fact, Southwestern expects that the strategies for habitat maintenance included in the Draft Outline of the Conservation Plan for the Southwestern Division of the Corps will not only be significantly less expensive than the NER plan, but also yield more favorable nesting results.

Southwestern was also disappointed in the mischaracterization throughout the Draft Report of Keystone Dam hydropower operations, as hydropower is a Congressionally-authorized purpose of the Keystone project and is one of the Corps' missions. The Draft Report labels hydropower releases from Keystone Dam as "severe" and "extreme," often without also referencing the much higher flows caused by flood control releases. In actuality, the maximum hydropower release fills only 11% of the Arkansas River channel capacity and is a normal, regularly occurring function of the Keystone project as authorized and designed. The construction of Keystone Dam allowed for storage and regulation of what were previously truly extreme flows in times of flood. Conversely, in times of drought, hydropower releases, in addition to providing clean, renewable electricity to the region, provide for downstream flow without which the Arkansas River would experience more extended dry conditions.

Finally, as Southwestern plays a significant role in the operation of Keystone Dam, Southwestern should be made aware of all project developments, including meetings between the Corps and other entities regarding the ARC and the proposed LWD. Keeping Southwestern updated on planning and construction activities of the proposed LWD, and other ARC efforts, will greatly enhance coordination among the agencies.

We appreciate the opportunity to provide comments concerning the Draft Report. Because of our serious concerns with the Draft Report and the NER plan proposed actions in the ARC including the construction of the LWD, we request a meeting with the Corps to discuss our concerns as soon as possible. Please contact Tyler Gipson at 918-595-6685 or Tyler.Gipson@swpa.gov if you have any questions regarding our comments and to coordinate a discussion meeting.

Sincerely,



Fritha Ohlson
Director
Division of Resources and Rates

cc:

Colonel Christopher A. Hussin
Commander and District Engineer
Tulsa District, U.S. Army Corps of Engineers

Andrea L. Murdock-McDaniel
Chief, Operations and Regulatory Division
Southwestern Division, U.S. Army Corps of Engineers

Nicki Fuller
Executive Director
Southwestern Power Resources Association

**Southwestern Power Administration
Specific Comments on
Arkansas River Corridor Feasibility Report
Draft Report**

Prepared by: U.S. Army Corps of Engineers Tulsa District, 06 February 2017

(Note: Paragraphs are numbered from the beginning of the referenced section or sub-section. Line numbers are provided where present in the Draft Report.)

1. General. The Arkansas River Corridor (ARC) Master Plan of 2005 refers to the existing and proposed river structures below Keystone Dam as “low water dams”. Congress referred to the 2005 ARC Master Plan as the guidance for Section 3132 of the Water Resources Development Act of 2007. The “Arkansas River Corridor Feasibility Report – Draft Report, Prepared by: U.S. Army Corps of Engineers Tulsa District, 06 February 2017” (Draft Report) is the first document Southwestern Power Administration (Southwestern) has reviewed that uses the term “pool control structures” instead of “low water dams”. Suggest replacing all instances of “pool control structure” with “low water dam” to stay consistent with the Congressional legislation and multiple past reports. If “pool control structure” is the correct term, please define why this term was used and how that may affect the past reports and/or Congressional legislation.
2. General. The Draft Report states that habitat that will be created with the 1,000 cubic feet per second (cfs) flow provided by the proposed low water dam (LWD), and recommends an alternative, the National Ecosystem Restoration (NER) plan, that will create 2,144 acres of riverine habitat. Southwestern is concerned with the proposed creation of riverine habitat in areas that will be weekly (if not daily) inundated by hydropower releases, and even further so by flood control releases. The Tulsa District Regulatory Branch has historically not considered the ARC land located below bankfull elevation to be habitat due to the expected regular inundation by hydropower and flood releases, and that approach has governed their issuance of Section 404 permits. Southwestern is unclear how Corps regulatory policy will be affected by creating habitat in areas that the Corps has never considered to be habitat. Southwestern requests clarification from the Corps on its policy regarding habitat in the Arkansas River, and whether the proposed NER plan for the ARC and the LWD presented in the Draft Report represent a change to current policy.
3. Page i. (line 8), Section “Executive Summary”, paragraph 1, sentence 3. Vensel Creek is located on the east side of the Arkansas River in Tulsa, not in Jenks.
4. Page i. (line 19-23), Section “Executive Summary”, paragraph 3, sentences 3-6. Suggest replacing the four sentences with the following, as the current statements do not correctly reflect Southwestern’s authority, marketing, or operations: “The Southwestern Power Administration (SWPA), as the region’s Power Marketing Administration, is authorized to market the hydropower generated at Keystone Dam. When the Keystone Lake level is in the flood pool, hydropower generation is used as the first method of flood control release as part of the USACE flood risk management. When the lake level is in the conservation pool, SWPA schedules and calls on Keystone Dam hydropower generation to meet electricity demand needs of Federal hydropower customers in a six-state region. Keystone Dam hydropower generation is operated as part of a system of numerous Federal hydropower projects in the

region to meet that electricity demand. Generation schedules are tentative and subject to change at any time due to a variety of factors.”

5. Page i. (lines 27-28), Section “Executive Summary”, paragraph 4, sentence 3. Suggest changing the sentence to say “During hydropower generation, the hydropower units can release an estimated 6,000 cfs (1 unit) or 12,000 cfs (2 units) of water that flows through the river reach throughout the study area.”
6. Page i. (lines 28-29), Section “Executive Summary”, paragraph 4, sentence 4. Suggest removing this sentence. Flood control releases are typically made through the hydropower units, in addition to normal hydropower releases. The only time when flood releases would be made with no hydropower would be if the hydropower units are unavailable for generation.
7. Page i. (lines 29-32), Section “Executive Summary”, paragraph 4, sentences 5-6. These sentences incorrectly generalize seasonal weather patterns and lake levels that have only occurred four times in the last 20 years. Additionally, the sentences neglect the water supply purpose. Suggest modifying the sentences to state: “During periods of low precipitation, water levels behind the dam drop into the conservation pool. Once in the conservation pool, the only water released downstream is to meet hydropower or, occasionally, water supply demand, which is typically released via the hydropower units.”
8. Page i. (lines 35-38), Section “Executive Summary”, paragraph 4, sentence 9. The sentence refers to “stagnant isolated pools”, but on Page 11 (line 19), Chapter 2, Water Resources, Water Quality, paragraph 5, sentence 2, the 2011 INCOG report is referenced as saying “...all wastewater treatment plants within the project area are performing well, and even under the extreme summer conditions of 2011 there still was a residual base flow in the river of around 100 cfs that likely prevented stagnation of pools and the consequent collection of organic materials.” Please clarify why the Draft Report refers to “stagnant isolated pools” while the INCOG report says that river pools were not stagnant even during the 2011 drought and near record 44 days of 100+ degree Fahrenheit temperatures in the Tulsa area.
9. Page i. (lines 42-44), Section “Executive Summary”, paragraph 4, sentence 12. Suggest revising the sentence, as contrary to the statement “flooding and drought conditions are exacerbated”, prior to construction of Keystone Dam the ARC experienced significantly larger flows during times of flood and longer periods of drier conditions during times of drought.
10. Page ii. (lines 10-18), Section “Executive Summary”, paragraph 6. Suggest removal of this paragraph. The paragraph is a mischaracterization of the interior least tern (ILT) and the operations regarding ILT. The Draft Report needs to be revised throughout to correctly reflect the status of the ILT and the actions that are routinely taken to address the concerns with the ILT. Southwestern has been in consultation with the Corps and the U.S. Fish and Wildlife Service (USFWS) since 1986 regarding the ILT, and Southwestern and the Corps have been operating Keystone Dam under the provisions of the 1998, 2005, and 2013 Biological Opinions. In 2002, the ILT committee was established and created guidelines for the dam operations of Tulsa District and Southwestern. The ILT committee has conducted weekly or bi-weekly meetings during the ILT nesting season every year since 2002. During these meetings, the results of the ILT surveys are discussed, and actions are taken to prevent land

bridging of nesting islands, to protect low elevation nests from flooding, and to provide flows that allow the ILT surveyors to conduct the surveys by boat, to the extent possible. As a member of the ILT committee, Southwestern fully cooperates and coordinates with the Corps and USFWS, even when the consensus recommended actions are detrimental to hydropower. Southwestern is concerned that the Draft Report describes impacts to the ILT that are addressed every year by the ILT committee, but makes no mention of the ILT committee and the successes achieved through its cooperative operations. The Draft Report also fails to acknowledge that Keystone Dam hydropower and flood releases will still be the controlling factor in ILT nesting in the ARC even if the proposed LWD is constructed, as the LWD release of 1,000 cfs will have relatively little to no effect on ILT habitat and nesting.

11. Page ii. (line 19), Section "Executive Summary", paragraph 7, sentence 1. The sentence refers to "shallow, isolated pools." Please refer to Comment #8 regarding INCOG's report which contradicts this sentence.
12. Page ii (lines 19-21), Section "Executive Summary", paragraph 7, sentence 1. Note that desiccation would occur for longer periods of time in the ARC if Keystone Dam did not provide water releases during periods of low precipitation, as is provided by typical hydropower operations.
13. Page iii. (lines 22-24), Section "Executive Summary", paragraph 11, sentence 1. Please remove the reference to a "more natural river flow", as truly natural flow prior to any dam structures on the Arkansas River would involve more extreme flooding and longer dry spells than experienced today with the operation of Keystone Dam. Suggest revising the sentence to state "With the implementation of the NER plan, a more consistent low regulated flow would be provided to 42 river miles of the Arkansas River within the study area during certain periods between releases from Keystone Dam."
14. Page iii. (lines 22-30), Section "Executive Summary", paragraph 11. The paragraph contains a reference to the "1,000 cfs" that the recommended alternative will provide in the ARC. However, 1,000 cfs is much less flow than the hydropower releases of 6,000 cfs and 12,000 cfs that occur regularly. It is unclear how 1,000 cfs will support habitat if regular hydropower releases inundate all the shoreline created by 1,000 cfs.
15. Page iii. (lines 22-30), Section "Executive Summary", paragraph 11. The paragraph makes two references to "wetlands" created by the recommended alternative. However, only one wetland (Prattville Creek) is mentioned in the Draft Report. As stated in the previous Comment #14, wetlands will not be created in the riverbed from the 1,000 cfs flow because hydropower releases will regularly inundate the wetlands and prevent them from establishment. Please clarify if the expectation of the recommended alternative is to create multiple wetlands or only the Prattville Creek wetland, and how the wetland(s) will be maintained.
16. Page iii. (lines 33-35), Section "Executive Summary", paragraph 12, sentence 3. Please correct the misstatement that the alternative will "provide a continuous river flow" as there will still be times of no water flow from Keystone Dam longer than will be able to be compensated for by the storage behind the proposed LWD. Suggest using the term "more consistent river flow".

17. Page iv. (lines 14-15), Section "Executive Summary", paragraph 14, sentence 1. See Comment #16 above regarding correction of the term "continuous river flow".
18. Page iv. (line 18), Section "Executive Summary", paragraph 14, sentence 5. The sentence mentions the shoreline habitat created by the 1,000 cfs flow. However, as stated previously in Comment #14, it is unclear how shoreline habitat will be created when hydropower releases will frequently inundate the shorelines.
19. Page v. (lines 1-18), Section "Executive Summary". Southwestern is concerned that the recommended plan does not fulfill the 11 bullets listed and that there are too many deficiencies in the plan to issue a Finding of No Significant Impact (FONSI). Specifically:
 - The Draft Report does not provide adequate information on how plan restores biological and environmental resources that were present prior to the construction of Keystone. As stated in Comment #13, the NER plan does not restore natural river flow but rather provides for more consistent low regulated flow. Additionally, as stated in Comments #14 and #15, it is unclear how wetland or shoreline habitat will be established or maintained from the proposed LWD 1,000 cfs flow, with the frequent inundation by regular hydropower and flood control releases.
 - Southwestern has several serious concerns with how the NER plan co-exists effectively with the hydropower purpose of Keystone Dam, which are enumerated in these comments.
 - Because of concerns raised by resource agencies at a September 12, 2016 meeting hosted by the Corps Tulsa District regarding the Jenks/South Tulsa LWD, Southwestern would like to see more information on the USFWS and ODWC support of the proposed Sand Springs LWD presented in the Draft Report.
 - Southwestern questions whether it is appropriate to state that the ARC recommended plan has "widespread local support" as historically Tulsa County voters have defeated multiple ballot measures (2007, 2012) funding ARC LWD projects.
20. Page 1 (lines 30-31), Chapter 1: Introduction, Study Purpose and Need, Study Need, paragraph 1, sentence 1. The sentence states that "...historical alterations have degraded the watershed conditions and masked the river's potential." Suggest defining the "river's potential".
21. Page 1 (lines 35-38 and 40-43), Chapter 1: Introduction, Study Purpose and Need, Study Need, paragraph 1, sentences 4 and 6. Only hydropower operations and releases are referred to when discussing releases from Keystone Dam. Suggest including flood control as well as water supply releases in these statements.
22. Page 1 (lines 38-40), Chapter 1: Introduction, Study Purpose and Need, Study Need, paragraph 1, sentence 5. Suggest modifying the sentence to state "...as climate change in this region of North America is forecasted to result in more frequent and more intense droughts, heat waves, intense thunderstorms, and flash flooding."
23. Page 2 (line 26), Chapter 1: Introduction, Study Location, paragraph 1, sentence 1. The Arkansas River meets the Mississippi River in Arkansas, not Louisiana. Please correct.
24. Page 2 (line 29), Chapter 1: Introduction, Study Location, paragraph 1, sentence 3. Vensel Creek is located on the east side of the Arkansas River in Tulsa, not in Jenks. Please correct.

25. Page 2 (lines 30-32), Chapter 1: Introduction, Study Location, paragraph 1, sentence 5. The sentence states that all tributaries were evaluated to elevation 638.0 feet. Suggest revising the statement to clarify that only tributaries above the proposed LWD were evaluated to 638.0 feet.

26. Page 2 (line 31), Chapter 1: Introduction, Study Location, paragraph 1, sentence 5. This is the first mention of the proposed LWD elevation of 638.0 feet. It should be noted that Keystone Dam's tailwater elevation during periods of no generation, and no significant conduit or tainter gate releases, is 637.6 feet. There is a riffle complex approximately a half mile downstream of Keystone Dam that controls the tailwater elevation during those periods. Also, the Arkansas River bed drops from 9.0 to 17.0 feet in elevation from Keystone Dam tailwater to the proposed LWD location. While the proposed LWD may not affect Keystone Dam tailwater elevation in periods of light generation of less than six hours per day, the proposed LWD will likely impact the tailwater elevation in periods of heavy generation of more than six hours per day. Six hours of generation per day is significant because that is the estimated amount of generation required to fill the pool of the proposed LWD assuming it is completely empty. Southwestern requests that the Corps conduct a hydraulic study on the effects of the higher tailwater on hydropower operations. Southwestern believes that replacing the downward slope of the Arkansas River with a static LWD pool that is above the current non-release tailwater elevation will impact Keystone Dam operations. A rise in tailwater will reduce the head differential (difference in elevation between the lakeside and the tailwater), which will affect the available capacity, energy production, and efficiency of hydropower generation.

27. Page 4 (lines 39-43), Chapter 1: Introduction, Problem Identification, Ecosystem Losses in the Study Area, paragraph 1, sentences 3-6. Suggest replacing the four sentences with the following, as the current statements do not correctly reflect Southwestern's authority, marketing, or operations: "The Southwestern Power Administration (SWPA), as the region's Power Marketing Administration, is authorized to market the hydropower generated at Keystone Dam. When the Keystone Lake level is in the flood pool, hydropower generation is used as the first method of flood control release as part of the USACE flood risk management. When the lake level is in the conservation pool, SWPA schedules and calls on Keystone Dam hydropower generation to meet electricity demand needs of Federal hydropower customers in a six-state region. Keystone Dam hydropower generation is operated as part of a system of numerous Federal hydropower projects in the region to meet that electricity demand. Generation schedules are tentative and subject to change at any time due to a variety of factors."

28. Page 5 (lines 2-3), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 2, sentence 3. Suggest changing the sentence to say "During hydropower generation, the hydropower units can release an estimated 6,000 cfs (1 unit) or 12,000 cfs (2 units) of water that flows through the river reach throughout the study area."

29. Page 5 (lines 3-4), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 2, sentence 4. Suggest removing the sentence. Flood control releases are typically made through the hydropower units, in addition to normal hydropower releases. The only time when flood releases would be made with no hydropower would be if the units are unavailable for generation.

30. Page 5 (lines 4-7), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 2, sentences 5-6. These sentences incorrectly generalize seasonal weather patterns and lake levels that have only occurred four times in the last 20 years. Additionally, the sentences neglect the water supply purpose. Suggest modifying the sentences to state: "During periods of low precipitation, water levels behind the dam drop into the conservation pool. Once in the conservation pool, the only water released downstream is to meet hydropower or, occasionally, water supply demand, which is typically released via the hydropower units."
31. Page 5 (lines 11-13), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 2, sentence 9. See Comment #8 regarding isolated pools and INCOG's report.
32. Page 5 (lines 17-19), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 2, sentence 12. Consider revising the sentence, as contrary to the statement "flooding and drought conditions are exacerbated", prior to construction of Keystone Dam the ARC experienced significantly larger flows during times of flood and longer periods of drier conditions during times of drought.
33. Page 5 (lines 28-35), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 4, sentences 2-6. Please remove of all these sentences. The sentences are a mischaracterization of the ILT and the operations regarding ILT, as previously stated in Comment #10. The Draft Report needs to be revised to correctly reflect the status of the ILT and the actions that are routinely taken to address the concerns with the ILT.
34. Page 5 (lines 36-38), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 5, sentence 1. See Comment #8 and revise accordingly regarding "isolated pools" as this conflicts with INCOG's study.
35. Page 6 (lines 8-9), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 7, sentence 1. Note that desiccation would occur for longer periods of time in the ARC if Keystone Dam did not provide water releases during periods of low precipitation, as is provided by typical hydropower operations.
36. Page 6 (lines 15-18), Chapter 1, Problem Identification, Flood Risk Management, paragraph 1, sentence 2. In multiple past meetings as well as in Hydrologic Engineering Center (HEC) guidance, the Corps has stated that HEC-RAS experiences instability issues at low flows in a large channel. Also, the Corps uses the U.S. Geological Survey (USGS) Tulsa Gage for calibration of the HEC-RAS model at low flows, but the USGS has rated 28 of its last 30 low flow measurements (1,000 cfs or less) as fair (8 measurements) or poor (20 measurements). It should be noted in the Draft Report that modeling and measuring low flows in the ARC is highly subject to error.
37. Page 7 (lines 10-12) Chapter 2: Existing Conditions and Future Without Project Conditions, paragraph 2, sentence 2. See Comment #8 and revise accordingly regarding "stagnant, isolated pools".
38. Page 11 (lines 18-22), Chapter 2, Water Resources, Water Quality, paragraph 5, sentence 2. INCOG states that "...there still was a residual base flow in the river of around 100 cfs that likely prevented stagnation of pools and the consequent collection of organic materials."

Refer to Comment #8 as this statement conflicts with multiple mentions of “stagnant, isolated pools” in the Draft Report.

39. Page 12 (line 6), Chapter 2, Hydrology and Floodplains, River Hydrology, paragraph 2. Suggest adding a statement at the end of the paragraph about the uncertainty in flow measurement on the Arkansas River due to large channel width and lack of available flow calibration measurements during high flow.
40. Page 12 (lines 15-19), Chapter 2, Hydrology and Floodplains, River Hydrology, paragraph 4, sentences 1-4. Suggest rewording these sentences for clarity. The maximum discharge of Keystone Dam is 989,000 cfs during the probable maximum flood. The downstream regulating discharge at Tulsa gage is estimated 105,000 cfs. As written, the sentences are currently unclear as to what the maximum discharge of Keystone Dam is. Additionally, the statement “regulating discharge normally expected from Keystone Lake” is misleading; there is no “normally expected” flood control discharge from Keystone Dam. Suggest removing any reference to “normally expected” flood control discharge.
41. Page 12 (lines 30-31), Chapter 2, Hydrology and Floodplains, River Hydrology, paragraph 5, sentence 6. The sentence mentions Arkansas City gage which is in Kansas above Kaw Lake. Please clarify if this is the correct gage.
42. Page 12 (lines 34-37), Chapter 2, Hydrology and Floodplains, River Hydrology, paragraph 6, sentences 1-2. The channel capacity of the ARC through Tulsa is 105,000 cfs. The maximum hydropower release of 12,000 cfs fills 11% of the channel capacity and is a normal, regularly occurring function of the Keystone project as authorized and designed. Suggest rewording the statements in sentences 1 and 2 to reflect the minor increase in channel capacity utilized that occurs during the hydropower generation.
43. Page 14 (lines 19-21), Chapter 2, Riverine Resources, Wetlands, paragraph 3, sentence 1. A hydropower release of 12,000 cfs fills 11% of the channel capacity. Suggest removing the word “extreme” as it is a subjective descriptor.
44. Page 14 (lines 45-47), Chapter 2, Riverine Resources, Open Water, paragraph 1, sentence 9. The sentence states that “Water quality within the more persistent pools is typically low due to stormwater inputs and little to no mixing with other surface waters.” Refer to Comment #8 as INCOG’s report is in conflict with this statement.
45. Page 15 (lines 4-5), Chapter 2, Riverine Resources, Open Water, paragraph 2, sentence 3. The sentence mentions “...and temporary and permanent isolated pools.” Refer to Comment #8 as INCOG makes no mention of isolated or permanent pools.
46. Page 15 (lines 24-26), Chapter 2, Riverine Resources, Riverine Sandbars, paragraph 2, sentence 6. The sentence states that “The majority of the riverbanks are steep to near vertically sloped with areas that are sloughing and/or eroding...” It is understood that these steep riverbanks are the reason for the disconnected floodplain and the river. However, the Draft Report later makes multiple mentions of 1,000 cfs flow allowing the floodplain to reconnect to the river. Please clarify if the steep banks do cause the disconnected floodplain, and please explain how 1,000 cfs will reconnect floodplain through a near vertical cut bank.

47. Page 17 (lines 8-10), Chapter 2, Threatened and Endangered Species, Interior Least Tern, paragraph 2, sentence 3. The USACE has monitored ILT below Keystone since 1990, and the most recent Biological Opinion of the USFWS was finalized in 2013 and revised in 2016. Suggest revising the sentence to reflect the above dates.
48. Page 17 (lines 24-34), Chapter 2, Threatened and Endangered Species, Interior Least Tern, paragraphs 5-6. Refer to Comment #10 as the statements in these paragraphs do not reflect the last 15 years of Keystone Dam operations since the ILT committee was created. Additionally, the USFWS completed a 5-Year Review of the ILT in 2013 which found that the ILT is biologically recovered, and recommended delisting after completion of a rangewide population model, a conservation plan, and a monitoring plan. Since 2013, Federal agencies across the ILT population range put a significant amount of effort into completing all three of these objectives, without considering the effect of the NER plan recommended in the Draft Report.
49. Page 20 (lines 8-11), Chapter 2, Cultural Resources, paragraph 3, sentence 2-4. Refer to Comment #26 concerning the impact of elevation 638.0 feet on Keystone Dam operations.
50. Page 20 (lines 8-11), Chapter 2, Cultural Resources, paragraph 3, sentence 2-4. The sentence states that the proposed LWD elevation will vary between 635.0 and 638.0 feet, but later in the document [page 90 (lines 25-26), Chapter 5, Hydrology and Floodplains, TSP Alternative – Arkansas River Flows, paragraph 1, sentence 3] there is the statement that “...the full pool volume...” (~628.0 to 638.0) will be needed to provide 1,000 cfs for 3.4 days. Please clarify if the pool will only use three feet of its storage or the full volume.
51. Page 25 (lines 32-33), Chapter 2, Socioeconomics and Visual Aesthetics, Visual Esthetics, paragraph 1, sentence 4. The sentence states that “...the visual and esthetic character of the study area has been substantially changed due to its long history of use for navigation and trade.” Please clarify how navigation and trade affected the study area.
52. Page 33 (lines 8-10), Chapter 3, Problems and Opportunities, paragraph 1, sentence 1. The sentence is misleading. First, while Keystone Dam certainly altered the flow regime and resulting aquatic structure of the Arkansas River in the study area, the ability to store water and regulate flow has resulted in the overall reduction of flow extremes. Prior to construction of Keystone Dam, the study area experienced significantly larger flows during times of flood and drier conditions during times of drought. Additionally, the more “severe” flows from Keystone Dam are flood control releases, not hydropower releases. The maximum hydropower release of 12,000 cfs fills only 11% of the channel capacity and should not be considered “severe”. Please revise the sentence to correctly characterize the flow regime pre- and post-Keystone Dam construction, and how the aquatic structure has changed.
53. Page 33 (lines 19-21), Chapter 3, Problems and Opportunities, Problem Statements, bullet 1. Note that “extreme low to no-flow conditions” would occur more often in the ARC if Keystone Dam were not able to provide water releases during periods of low precipitation.
54. Page 33 (lines 24-27), Chapter 3, Problems and Opportunities, Problem Statements, bullet 3. “Extreme high flow pulses associated with hydropower” is a mischaracterization since the maximum hydropower release fills only 11% of the channel capacity, and is a normal, regularly

occurring function of the Keystone project as authorized and designed. Please remove the word "Extreme".

55. Page 33 (lines 32-34), Chapter 3, Problems and Opportunities, Opportunity Statements, bullet 1. It is misleading to state that an increase in more consistent water flow is the "restoration of a more natural flow regime", as a truly natural flow regime prior to any dam structures on the Arkansas River would involve more extreme flooding and longer dry spells than experienced today with the operation of Keystone Dam. Suggest modifying the statement to state "Provision of a more consistent low flow regime which helps sustain..."
56. Page 33 (lines 32-34), Chapter 3, Problems and Opportunities, Opportunity Statements, bullet 1. This is the first mention of the USACE-Nature Conservancy Sustainable Rivers Memorandum of Understanding (MOU). The previous mentions of ILT state that the Corps is addressing the requirements of the Endangered Species Act. Please clarify if the Corps' ILT actions are to coordinate with the USFWS to comply with the Endangered Species Act or to comply with the Nature Conservancy Sustainable Rivers MOU. If both, suggest introducing the Nature Conservancy Sustainable Rivers MOU earlier in the Draft Report.
57. Page 35 (lines 30-32), Chapter 3, Initial Screening of Measures, Reallocation, paragraph 2, sentence 7. Suggest revising the sentence to say: "Further, SWPA estimates an increase in need for reliable renewable energy over the period of analysis, not a reduction, so the impact would likely increase." Southwestern cannot have an increase in demand as all the hydropower capacity has already been marketed from Keystone; however, there is an increase in need for reliable renewable energy in the region.
58. Page 38 (after line 22), Chapter 3, Final Array of Management Measures, Table 9, Problem Statement 1. Note that "extreme low to no-flow conditions" would occur more often in the ARC if Keystone Dam were not able to provide water releases during periods of low precipitation.
59. Page 38 (prior to line 23), Chapter 3, Final Array of Management Measures, Table 9, Problem Statement 2, Floodplain Connectivity. Please refer to Comment #46 regarding the effect of 1,000 cfs on floodplain connectivity.
60. Page 39 (prior to line 1), Chapter 3, Final Array of Management Measures, Table 9, Problem Statement 3. Please refer to Comment #10 regarding operations for ILT in the ARC.
61. Page 39 (prior to line 1), Chapter 3, Final Array of Management Measures, Table 9, Problem Statement 4. Please refer to Comment #46 regarding the effect of 1,000 cfs on floodplain connectivity.
62. Page 39 (lines 7-8), Chapter 3, Description of Each Measure Carried Forward, Flow Regime Management – Pool Control Structure (2 candidate locations), paragraph 1, sentence 3. Please remove the reference to a "natural flow regime", as a truly natural flow regime prior to any dam structures on the Arkansas River would involve more extreme flooding and longer dry spells than experienced today with the operation of Keystone Dam.
63. Page 40 (lines 12-16), Chapter 3, Description of Each Measure Carried Forward, Flow Regime Management – Pool Control Structure (2 candidate locations), paragraph 1, sentence 10.

Please include calculations and/or additional information to demonstrate how 1,000 cfs was chosen as the pre-Keystone minimum flow in the ARC.

64. Page 40-42, Chapter 3, Description of Each Measure Carried Forward, Pool Structure at River Mile 531 (Old reregulation dam site) and Pool Structure at River Mile 530 (Below Hwy. 97 Bridge). There are multiple mentions of maximum elevation of the proposed LWD as 638.0 feet. Refer to Comment #26 regarding the impact of this elevation on Keystone Dam operations.
65. Page 41 (line 1), Chapter 3, Description of Each Measure Carried Forward, Pool structure at River Mile 530 (Old reregulation dam site), Figure 3. The figure shows a water elevation of 638.0 feet; however, the water elevation appears to stop about 300 feet short of the powerhouse and dam. Since the non-release tailwater of Keystone Dam is approximately 637.6 feet, the figure should show water elevation all the way to the powerhouse and stilling basin. Please add a note to the caption indicating why the water elevation is not shown to the powerhouse and stilling basin.
66. Page 42 (line 9), Chapter 3, Description of Each Measure Carried Forward, Pool structure at River Mile 530 (Below Hwy. 97 Bridge), Figure 4. The figure shows a water elevation of 638.0 feet; however, the water elevation appears to stop about 300 feet short of the powerhouse and dam. Since the non-release tailwater of Keystone Dam is approximately 637.6 feet, the figure should show water elevation all the way to the powerhouse and stilling basin. Please add a note to the caption indicating why the water elevation is not shown in the tailrace and stilling basin.
67. Page 47 (lines 7-8), Chapter 3, Alternative Comparison, Array of Partially-formed Alternatives, paragraph 1, sentence 2. The Jenks/South Tulsa LWD is assumed to be included in the Future With Project Condition. However, as of this time, the Jenks/South Tulsa LWD is lacking the Creek Nation funding support that is required to move forward with the project. Also, on September 12, 2016, the Corps hosted a resource agency meeting regarding the Jenks/South Tulsa LWD, and there were multiple issues expressed by multiple resource agencies (Environmental Protection Agency, Southwestern, ODWC, Oklahoma Department of Environmental Quality) that were not adequately addressed by the Tulsa County representatives in the meeting. It may be useful to do the analysis both with and without the Jenks/South Tulsa LWD.
68. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? – Alternative 1 (No Action), paragraph 1, sentence 3. Please refer to Comment #46 regarding 1,000 cfs effect on floodplain connectivity.
69. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth It? – Alternative 1 (No Action), paragraph 1, sentence 3. Please refer to the Comment #10 regarding ILT nesting success and ILT committee actions.
70. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? – Alternative 2, paragraph 1, sentence 3. Please correct the misstatement that the alternative “restores a more natural pre-dam flow regime” as more consistent water flow is not the natural state of the Arkansas River and therefore providing for more consistent flow is not restorative.

71. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth It? – Alternative 2, paragraph 1, sentence 5-6. Refer to Comment #8 as INCOG’s report is in conflict with this statement.
72. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? – Alternative 2, paragraph 2, sentence 4. Please correct the misstatement that the alternative “restores continuous water flow” as 1) continuous water flow is not the natural state of the Arkansas River and therefore providing for continuous flow is not restorative and 2) the alternative does not actually provide for continuous water flow, as there will still be times of no water flow from Keystone Dam longer than will be able to be compensated for by the storage behind the proposed LWD. Suggest using the term “more consistent water flow”.
73. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? – Alternative 2, paragraph 2, sentence 5. Please refer to Comment #46 regarding 1,000 cfs effect on floodplain connectivity.
74. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? – Alternative 2, paragraph 2, sentence 5. Please revise the statement referring to “restoring more natural flows” as previously addressed in Comments #70 and #72.
75. Page 58, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? – Alternative 3, paragraph 1, sentence 2. Refer to Comment #8 regarding “stagnant isolated pools as INCOG’s report is in conflict with this statement.
76. Page 59, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? – Alternative 3, paragraph 1, sentence 7. The sentence states that additional storage capacity allows “...greater flow capabilities regarding both flow and duration by adding flexibility to adapt flow management to a wider range of environmental conditions.” It is correct that the additional storage capacity will allow for extending the duration of lower flows, but it is unclear how the storage will add “...flexibility to adapt flow management to a wider range of environmental conditions.” The storage in the proposed LWD will be almost entirely dependent on Keystone Dam releases for its operation with little to no flexibility.
77. Page 59, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? – Alternative 3, paragraph 1, sentences 8-11. These sentences regarding the proposed LWD’s operational flexibility in response to forecasted precipitation and other release settings based on anticipated Keystone Dam operations reflect incorrect assumptions and/or a lack of understanding of the Corps’ Arkansas River water management plan and in particular Keystone Dam operations, including hydropower scheduling and releases. Southwestern suggests that operational considerations and flexibilities of the proposed LWD must be properly vetted with and approved by Southwestern and Corps water management personnel.
78. Page 59, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? – Alternative 3, paragraph 3, sentence 2. Please define “...restored riverine acres upstream...”.

79. Page 62, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 1, sentence 2. A new ILT island in the ARC has not been discussed in recent years of the ILT committee. However, USFWS and other members have mentioned the effectiveness of ILT islands on the MKARNS downstream of Muskogee, Oklahoma. This statement of an ARC ILT island being critical to the delisting of the ILT should be verified with the USFWS.
80. Page 62, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of the National Ecosystem Restoration Plan, paragraph 1, bullet 5. Presumably, the bullet should read "...an incremental cost per incremental output of \$29,900..." Please correct "out of" to "output of" if necessary.
81. Page 65, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 16, sentence 2. The Draft Report states that the LWD will not impact or require Keystone Dam operation changes. However, Southwestern is concerned that the LWD structure itself, as well as the expectation set forth by its installation, could indeed impact hydropower operations from Keystone Dam. Southwestern strongly reiterates that the proposed LWD should not affect existing Keystone Dam operations. To ensure there is not impact to existing Keystone Dam operations, any operational or "adaptive management" plans need to be thoroughly vetted and approved by all involved resource agencies, including Southwestern, and appropriate Corps personnel (i.e., hydropower, water management, regulatory) before development of the NER plan and construction of the proposed LWD.
82. Page 66, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 18, sentence 4. Hydropower releases regularly occur on weekends during times that Keystone Lake is in the flood pool, and even when the lake is in the conservation pool weekend generation can occur due to high electricity demand or other factors. Suggest revising the sentence as follows: "However, when Keystone Lake is in the conservation pool (elevation 723.0 feet and below), hydropower releases typically do not occur on weekends as demand for electricity is much greater during weekdays."
83. Pages 66-67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 22, sentences 1 and 3. It is misleading to state that the proposed LWD provides for restoration of natural flows. Natural flows, prior to the existing dam structures in the Arkansas River, were characterized by far more extreme flooding as well as longer dry spells than what is experienced today with the capability to regulate those extremes through storage and controlled releases. Suggest removing statements referring to the restoration of "natural flows" and revising the sentences to accurately portray the intention of the proposed LWD, which is to provide more consistent flow.
84. Pages 66-67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 22. The statements made reflect a misunderstanding of the operations managed by the ILT committee to address ILT habitat and nesting needs as previously discussed in Comment #10. Any potential high flows that sweep away lower laying ILT nests would be significant flood control releases that

would not be attenuated by the proposed LWD. Regular hydropower releases are managed such that ILT habitat with active nests are not inundated. Suggest modifying the paragraph to reflect how the proposed LWD would impact ILT operations as coordinated by the ILT committee.

85. Page 67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 24. The paragraph's description of the proposed LWD's operational flexibility in response to forecasted precipitation and other release settings based on anticipated Keystone Dam operations reflect incorrect assumptions and/or a lack of understanding of the Corps' Arkansas River water management plan and in particular Keystone Dam operations, including hydropower scheduling and releases. Southwestern suggests that operational considerations and flexibilities of the proposed LWD must be properly vetted and approved by Southwestern and Corps water management personnel.
86. Page 67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 24, sentences 1-2. Please revise the misleading statements regarding restoring natural flows as indicated in Comment #83.
87. Page 67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 24, sentence 4. Suggest modifying the sentence to state "...as climate change in this region of North America is forecasted to result in more frequent and more intense droughts, heat waves, intense thunderstorms, and flash flooding."
88. Page 67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 25, sentence 6. Please remove the word "restores" from the sentence, as it is misleading to state the proposed LWD provides for restoration of natural flows. Suggest modifying the sentence to state "The more consistent flows naturally suppress..."
89. Page 67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 25, sentence 6. Southwestern is unaware of the Corps or any resource agencies spending "...millions in the mechanical and herbicidal treatment of Salt-cedar." Additionally, it is unclear how 1,000 cfs will suppress salt cedar growth.
90. Page 68, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 27, sentence 1. During the September 12, 2016 resource agency meeting hosted by the Corps concerning the Jenks/South Tulsa LWD, ODWC stated that a change in monitoring technique has allowed them to count increased numbers of shovelnose sturgeon that were not previously believed to be present in the study area. Please verify with ODWC if the statement about shovelnose sturgeon being "...largely absent..." still applies.
91. Page 68, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 28, sentence 1.

Please revise the misleading statement regarding restoring natural flows as indicated in Comment #83.

92. Page 68, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 30, sentence 7. The ARC is already a consistent source of nesting habitat for ILTs. Additionally, it is unclear what “a consistent source population” is. Suggest modifying the sentence to state “...the ARC can continue to be a consistent source of nesting habitat for Least Terns.”
93. Page 68, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 30, sentence 8. It is unknown whether providing additional habitat in the ARC will lessen the burden of other nesting locations in the same region. In the past, the ILT Committee has found that nesting success can vary widely between islands in the Arkansas River each season.
94. Page 68, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 30, sentence 8. It is unclear how the new habitat provided for ILT nesting will protect the species from environmental disasters.
95. Page 68, Chapter 3, Alternative Comparison, Is it Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 30, sentence 8. This is the first mention of “contamination” affecting ILT populations. Please explain how contamination has affected ILT populations in the ARC.
96. Page 69, (lines 2-3), Chapter 4: Recommended Plan, paragraph 1, sentence 2. Please remove the reference to a “more natural river flow”, as truly natural flow prior to any dam structures on the Arkansas River would involve more extreme flooding and longer dry spells than experienced today with the operation of Keystone dam. Suggest revising the sentence to state “With the implementation of the NER plan, a more consistent low regulated flow would be provided to 42 river miles of the Arkansas River within the study area during certain periods between releases from Keystone Dam.”
97. Page 69 (lines 4-7), Chapter 4: Recommended Plan, paragraph 1, sentence 3. Please see Comment #46 regarding disconnected floodplain.
98. Page 69, (lines 34-36), Chapter 4, Description of the Recommended Plan, Restoration Features, Pool Structure below Hwy. 97 Bridge, paragraph 1, sentence 2. Refer to Comment #26 concerning the impact of elevation 638.0 feet on Keystone Dam operations.
99. Page 69 (lines 42-44), Chapter 4, Description of the Recommended Plan, Restoration Features, Pool Structure below Hwy. 97 Bridge, paragraph 1, sentence 6. Please see Comment #63 regarding how 1,000 cfs was chosen for pre-Keystone flow.
100. Page 71 (lines 12-14), Chapter 4, Benefits Gained for Nationally, Regionally, and Locally Significant Resources, paragraph 1, sentence 3. Please correct the misstatement that the alternative will “provide a continuous river flow” as 1) continuous water flow is not the natural state of the Arkansas River and therefore providing for continuous flow is not restorative and 2) the alternative does not actually provide for continuous water flow, as

there will still be times of no water flow from Keystone Dam longer than will be able to be compensated for by the storage behind the proposed LWD. Suggest using the term “more consistent river flow”.

101. Page 71 (lines 12-14), Chapter 4, Benefits Gained for Nationally, Regionally, and Locally Significant Resources, paragraph 4, sentence 1. Please see Comment #100 above regarding correction of the term “continuous river flow”.
102. Page 72 (lines 19-21), Chapter 4, Benefits Gained for Nationally, Regionally, and Locally Significant Resources, Scarcity, sentence 4, sentence 1. It is misleading to state that the Arkansas River will be restored to a more natural state, as a “more natural state” would be characterized by far more extreme flooding as well as longer dry spells than what is experienced today with the capability to regulate those extremes through storage and controlled releases. Suggest modifying the sentence to state “Providing more consistent flows to this section of the Arkansas River promotes the proliferation of...”
103. Page 72 (lines 23-26), Chapter 4, Benefits Gained for Nationally, Regionally, and Locally Significant Resources, Representativeness, paragraph 1, sentence 1. The sentence states that species “...continue to persevere in small numbers in the altered conditions.” However, ODWC and Oklahoma State University personnel stated in the September 12, 2016 resource agency meeting hosted by the Corps concerning the Jenks/South Tulsa LWD that species were “adapting and thriving” in the ARC. Please confirm with ODWC whether or not species are diminishing or thriving.
104. Page 72 (lines 32-35), Chapter 4, Benefits Gained for Nationally, Regionally, and Locally Significant Resources, Representativeness, paragraph 2, sentences 5-6. Refer to Comment #10 regarding ILT nesting.
105. Page 74 (lines 19-23), Chapter 4, Benefits of the Recommended Plan to Other Federal Goals and Objectives, paragraph 1, sentence 4. The sentence states that the 1,000 cfs would promote “...dilution of pollutants...”. The “dilution of pollutants” cannot occur when the recommended plan does not increase the volume of flow from Keystone Dam. As there is to be no change of or impact to existing Keystone Dam operations, suggest removing the reference to “dilution of pollutants”.
106. Page 75 (lines 20-24), Chapter 4, Benefits of the Recommended Plan to Other Federal Goals and Objectives, paragraph 4, sentence 1. Please revise the misleading statement regarding restoring natural flows as indicated in Comment #83.
107. Page 75 (lines 25-28), Chapter 4, Benefits of the Recommended Plan to Other Federal Goals and Objectives, paragraph 5, sentence 1. This is the first mention of fish kills in the Draft Report. Please document the occurrence and magnitude of fish kills due to Keystone Dam operations, and there should be some discussion of water quality in the shallow water of the proposed LWD pool when Keystone Dam goes without releases for several days in hot, sunny weather.
108. Page 76 (lines 27-29), Chapter 4, Project Implementation, Pre-Construction Engineering and Design, paragraph 3, sentence 3. The proposed LWD design should be completed earlier in the process than the Pre-Construction Engineering and Design phase. The LWD designs for

Zink and Jenks/South Tulsa resulted in a myriad of concerns from resource agencies that have yet to be addressed.

109. Page 79 (line 43), Chapter 4, Project Implementation, Monitoring and Adaptive Management, paragraph 1. Please define “adaptive management”. This phrase is used throughout the document, but it is never clearly defined. It should be noted that the pool of the proposed LWD will offer little to no opportunities for reacting to issues upstream or downstream of the LWD. While the Draft Report states that there will be no change in operation of Keystone Dam due to the NER plan and the proposed LWD, Southwestern is deeply concerned that any adaptive management plan will ultimately rely on changes to existing Keystone Dam operations to meet expectations or correct any issues with operation of the proposed LWD. To ensure the Congressionally-authorized purposes of the Keystone project are not impacted, Southwestern strongly reiterates that the proposed LWD, and the National Ecosystem Restoration (NER), should not affect existing Keystone Dam operations. To ensure there is no impact to existing Keystone Dam operations, any operational or “adaptive management” plans need to be thoroughly vetted and approved by all involved resource agencies, including Southwestern, and applicable Corps personnel (hydropower, water management, regulatory, etc.) before development of the NER plan and construction of the proposed LWD.
110. Page 81 (line 18), Chapter 4, Project Implementation, Views of the Resource Agencies, paragraph 1, sentence 1. Based on the September 12, 2016 resource agency meeting hosted by the Corps, it is clear several resource agencies have significant issues with the Jenks/South Tulsa LWD. Some of these issues would also be applicable for the proposed LWD at Sand Springs. The Corps should plan on hosting a resource agency meeting as soon as practical to discuss the proposed LWD and address the applicable issues.
111. Page 84 (lines 7-10), Chapter 4, Conclusions, The Arkansas River Corridor Ecosystem Restoration Project Recommended plan, bullet 12. There was no discussion of the Arkansas River sinuosity, slope gradient, or velocity in the Draft Report. If the plan does restore these features in the Arkansas River, the plan should discuss them throughout the Draft Report and provide data supporting these claims.
112. Page 84, Chapter 4, Conclusions, The Arkansas River Corridor Ecosystem Restoration Project Recommended plan, bullet 13. It is a mischaracterization to say that this plan has widespread local support as historically Tulsa County voters have defeated multiple ballot measures (2007, 2012) funding ARC LWD projects.
113. Page 90, Chapter 5, Hydrology and Floodplains, TSP Alternative – Arkansas River Flows, paragraph 1, sentences 1 and 4. It is misleading to state that the proposed LWD provides for restoration of natural flows. Natural flows, prior to the existing dam structures in the Arkansas River, were characterized by far more extreme flooding as well as longer dry spells than what is experienced today with the capability to regulate those extremes through storage and controlled releases. Suggest removing statements referring to the restoration of “natural flows” and revising the sentences to accurately portray the intention of the proposed LWD, which is to provide more consistent flow.
114. Page 90 (lines 25-26), Chapter 5, Hydrology and Floodplains, TSP Alternative – Arkansas River Flows, paragraph 1, sentence 3. The sentence states that the proposed LWD “full pool

volume" (~628.0 to 638.0) will be needed to provide 1,000 cfs for 3.4 days. Elsewhere in the Draft Report it is stated that the LWD elevation will vary between 635.0 and 638.0 feet. Please clarify if the pool will only use three feet of its storage or the full volume.

115. Page 120, Chapter 5, Recommendation. Southwestern is concerned that potential impacts the proposed LWD will have on the existing operations of Keystone Dam have not been fully addressed, as indicated in these detail comments. Until those concerns are addressed, a FONSI may be pre-mature.

116. Page CXXII, Chapter 5, Draft Finding of No Significant Impact. See Comment #115.

Note: Because the Appendices contain information that is already expressed in the main Draft Report, Southwestern will only address new comments in the Appendices.

117. Appendix A, Page 23, HEP Analysis, HEC-RAS. Suggest adding a run at 6,000 cfs and 12,000 cfs for acreage and habitat comparison, as these release volumes will occur frequently even with the construction of one of the proposed LWDs.

118. Appendix A, Attachment 3, Page 54, Table, "River Flow" row. The Draft Report states (Page 62, Chapter 3: Plan Formulation, Selection of the National Ecosystem Restoration Plan, paragraph 3, sentence 1) that the proposed LWD is "...critical to the restoration of the ARC and all other measures depend on restored river flow to be successful." The table contained in the Monitoring and Adaptive Management Plan only addresses the river flow one time, and the adaptive management plan for river flow is "Alter pool structure operations/design to achieve 1,000 cfs river flow." As stated earlier in the report, the entire volume of the proposed LWD will be drained in 3.4 days at 1,000 cfs. It appears that there is little flexibility in providing 1,000 cfs that does not include a change to existing Keystone Dam operations. Please revise the Monitoring and Adaptive Management Plan to include specifics and details of how the proposed LWD can be altered to provide 1,000 cfs flow without making any changes to existing Keystone Dam operations.

119. Appendix B, Page 1-6, 1.3 Project Alternatives, paragraph 3, sentence 1. The location of the original re-regulation dam downstream of Keystone is listed incorrectly. Please correct.

120. Appendix B, Page 1-6, 1.3 Project Alternatives, paragraph 4, Item 2. The Draft Report uses a LWD height of 638.0 feet rather than 638.5 feet used in Appendix B. The flow and duration values (1000 cfs for 1.65 days) provided by the calculations in Appendix B are lower than the flow and duration values (1000 cfs for 3.4 days) cited in the main Draft Report, despite the dam being higher (0.5 feet). Also, the storage cited in the Draft Report (6,730 ac-ft) is nearly double the storage in Appendix B (3,269 ac-ft) despite the dam being lower in the Draft Report. Please explain the difference.

121. Appendix I, Page 20, LIST OF RECIPIENTS- draft working copy August 23, 2016, Agency/Entity – Southwestern Power Administration. The list of recipients indicates that Southwestern should have received a draft working copy of the Draft Report [Southwestern recipients listed as Mr. Scott Carpenter, Administrator, and Ms. Frieda Olsen – please correct this Southwestern contact to Fritha Ohlson, Director, Division of Resources and Rates]. However, Southwestern does not receive and does not have any evidence of having received an earlier version of the Draft Report prior to the current publication for public comment, and therefore Southwestern

has not previously provided general or specific written comments on this phase of the ARC feasibility study. Southwestern was aware of the development of the Draft Report, and was included in several meetings in 2016 with the Corps to discuss the ARC feasibility study. Those meetings focused on the ARC feasibility study preliminary assessment of reallocation of storage at Keystone and the impacts that alternative would have on the Keystone Federal hydropower purpose. Eventually, as stated in the Draft Report, reallocation was screened out as an alternative, and Southwestern supports that conclusion. Regardless, on numerous occasions in the past, either in meetings concerning the Corps' ARC efforts or in written comments regarding other projects downstream of Keystone Dam, Southwestern has always emphasized concern for the impact to existing Keystone Dam operations and the Federal hydropower purpose. Any operational change at Keystone Dam that negatively impacts Federal hydropower will not only directly influence Southwestern's ability to fulfill Federal contractual obligations for providing power to Federal hydropower customers, but will also affect Southwestern's statutory requirement to repay the Federal investment allocated to the hydropower purpose with revenues received from that sale of power.

<u>Comment ID</u>	<u>Comment Type</u>	<u>Comment</u>	<u>Response</u>
A	Concern	<p>Foremost, Southwestern is concerned that the Sand Springs low water dam (LWD) proposed in the Draft Report, and the expectations set forth by its installation, will directly affect Keystone Dam operations. First, Southwestern is concerned about the use of the term "adaptive management " to address the unknowns of the proposed LWD. The Draft Report states the proposed LWD will release 1,000 cubic feet per second (cfs) and empty the full volume of the LWD pool in 3.4 days with no Keystone Dam releases. The contributing watershed above the proposed LWD and below Keystone Dam is less than 40 square miles; however, the contributing watershed above Keystone Dam is 22,351 square miles. As such, the proposed LWD is almost entirely dependent on Keystone Dam generation and flood releases for its inflow. Because of the lack of flexibility in the operation of the proposed LWD, Southwestern is concerned that the "adaptive management" plan will depend upon significant changes to current Keystone Dam operations. Southwestern strongly reiterates that the proposed LWD, and the National Ecosystem Restoration (NER) plan, should not affect existing Keystone Dam operations. To ensure there is no impact to Keystone Dam operations, any operational or "adaptive management" plans need to be thoroughly vetted by all involved resource agencies, including Southwestern, and appropriate Corps personnel (i.e., hydropower, reservoir management, regulatory) before development of the NER plan and construction of the proposed LWD.</p>	<p>The proposed NER was developed with no expectations or requirements in change of operations from Keystone Dam and Hydropower production. Reallocation options were explored early in the planning process and were screened out for numerous reasons. The adaptive management referenced in the report refers to the proposed pool structure, not Keystone Dam or hydropower operations. The flexibility in the proposed structure will come from operable gates that will adjust to releases from Keystone/Hydropower releases. When water releases are continuous, water will not be stored for later release. When Keystone releases are intermittent, the gates will be operated to maintain river flow.</p>
B	Concern	<p>Another operational concern is the impact of the proposed LWD on the Keystone Dam tail water and consequently on the head differential (difference in elevation between the lakeside and the tailwater) at Keystone Dam. The top of the proposed LWD is elevation 638.0 (638.5 feet in Appendix B). The elevation of Keystone Dam tail water during periods of no generation, and no significant conduit or tainter gate releases, is approximately 637.6 feet. There is a riffle complex approximately a half mile downstream of Keystone Dam that controls the tail water elevation during those periods. While the proposed LWD may not affect Keystone Dam tail water elevation in periods of light generation of less than six hours per day, the proposed LWD will likely impact the tail water elevation in periods of heavy generation of more than six hours per day. Six hours of generation per day is significant because that is the estimated amount of generation required to fill the pool of the proposed LWD assuming it is completely empty. Southwestern expects that the Corps will complete a hydraulic study that will demonstrate the effect of the proposed LWD on Keystone Dam tailwater. A rise in tailwater will reduce the head differential, which will affect the available capacity, energy production, and efficiency of hydropower generation.</p>	<p>The pool structure will be operated so that when hydropower releases are being made, water will not be stored or pooled into the tail water of Keystone Dam. As hydropower generation concludes, water will be stored and releases from the pool structure will begin to maintain downstream river flow. Water levels will be well below the tail water of Keystone Dam prior to the next hydropower generation cycle.</p>
C	Concern	<p>Additionally, Southwestern is concerned with the proposed creation of riverine habitat that will be inundated weekly (if not daily) by hydropower releases, and even further so by flood control releases. The Corps Tulsa District Regulatory Branch has historically not considered the ARC land located below bank full elevation to be habitat due to the expected regular inundation by hydropower and flood releases, and that approach has governed their issuance of Section 404 permits. Southwestern is unclear how Corps regulatory policy will be affected by creating habitat in areas that the Corps has never considered to be habitat. Southwestern requests clarification from the Corps on its policy regarding habitat in the Arkansas River, and whether the proposed NER plan for the ARC and the LWD presented in the Draft Report represents a change to current policy.</p>	<p>There will be no impact to USACE regulatory policy. The riverine habitat being restored is within existing river channel. One of the key problems identified that the proposed NER aims to address is that this habitat experiences frequent bouts of wet and dry periods. The NER will maintain connected river habitat between the larger hydropower and flood pool releases to maintain riverine function.</p>

<u>Comment ID</u>	<u>Comment Type</u>	<u>Comment</u>	<u>Response</u>
D	Content	<p>Furthermore, Southwestern is concerned with the mischaracterization of the Interior Least Tern (ILT) nesting in the ARC. Southwestern has been in consultation with the Corps and the U.S. Fish and Wildlife Service (USFWS) since 1986 regarding the ILT, and Southwestern and the Corps have been operating Keystone Dam under the provisions of the 1998, 2005, and 2013 Biological Opinions. In 2002, the ILT committee was established and created guidelines for the dam operations of Tulsa District and Southwestern. The ILT committee has conducted weekly or biweekly meetings during the ILT nesting season every year since 2002. During these meetings, the results of the ILT surveys are discussed, and actions are implemented to prevent land bridging of nesting islands, to protect low elevation nests from flooding, and to provide flows that allow the ILT surveyors to conduct the surveys by boat, to the extent feasible. As a member of the ILT committee, Southwestern fully cooperates and coordinates with the Corps and USFWS, even when the consensus recommended actions are detrimental to hydropower. Southwestern is concerned that the Draft Report describes impacts to the ILT that are addressed every year by the ILT committee, but makes no mention of the ILT committee and the successes achieved through its cooperative operations. The Draft Report also fails to acknowledge that Keystone Dam hydropower and flood releases will still be the controlling factor in ILT nesting in the ARC even if the proposed LWD is constructed, as the LWD release of 1,000 cfs will have relatively little to no effect on ILT habitat and nesting. Additionally, Southwestern believes the Draft Report overestimates the importance of the NER plan in the delisting activities for the ILT. The USFWS completed a 5-Year Review of the ILT in 2013 which found that the ILT is biologically recovered, and recommended delisting after completion of a range wide population model, a conservation plan, and a monitoring plan. Since 2013, Federal agencies across the ILT population range put a significant amount of effort into completing all three of these objectives, without considering the effect of the NER plan recommended in the Draft Report. In fact, Southwestern expects that the strategies for habitat maintenance included in the Draft Outline of the Conservation Plan for the Southwestern Division of the Corps will not only be significantly less expensive than the NER plan, but also yield more favorable nesting results.</p>	<p>Agreed, the ILT committee has went to great lengths to promote ILT habitat, the report will be edited accordingly. Yet river flow in the study area still experiences frequent periods of low flow that is not conducive for ILT nesting, fish populations, or overall ecosystem health.</p>
E		<p>Southwestern was also disappointed in the mischaracterization throughout the Draft Report of Keystone Dam hydropower operations, as hydropower is a Congressionally-authorized purpose of the Keystone project and is one of the Corps' missions. The Draft Report labels hydropower releases from Keystone Dam as "severe" and "extreme," often without also referencing the much higher flows caused by flood control releases. In actuality, the maximum hydropower release fills only 11 % of the Arkansas River channel capacity and is a normal, regularly occurring function of the Keystone project as authorized and designed. The construction of Keystone Dam allowed for storage and regulation of what were previously truly extreme flows in times of flood. Conversely, in times of drought, hydropower releases, in addition to providing clean, renewable electricity to the region, provide for downstream flow without which the Arkansas River would experience more extended dry conditions.</p>	<p>Agreed, Keystone Dam and hydropower provides clean energy, but not without consequence. Dams and hydropower impacts to river health are well documented. USACE and SWPA regularly operate to minimize those impacts, yet the river still experiences intermittent low flow. The NER can fill a critical gap in river flow.</p>
F		<p>Finally, as Southwestern plays a significant role in the operation of Keystone Dam, Southwestern should be made aware of all project developments, including meetings between the Corps and other entities regarding the ARC and the proposed LWD. Keeping Southwestern updated on planning and construction activities of the proposed LWD, and other ARC efforts, will greatly enhance coordination among the agencies.</p>	<p>Agreed, ARC PDT members and SWPA recently had a teleconference to discuss their major concerns. SWPA was pleased to know that the NER was developed with no required changes or impacts to their operations.</p>

<u>Comment ID</u>	<u>Comment Type</u>	<u>Comment</u>	<u>Response</u>
1	Terminology	General. The Arkansas River Corridor (ARC) Master Plan of 2005 refers to the existing and proposed river structures below Keystone Dam as "low water dams". Congress referred to the 2005 ARC Master Plan as the guidance for Section 3132 of the Water Resources Development Act of 2007. The "Arkansas River Corridor Feasibility Report- Draft Report, Prepared by: U.S. Army Corps of Engineers Tulsa District, 06 February 2017" (Draft Report) is the first document Southwestern Power Administration (Southwestern) has reviewed that uses the term "pool control structures" instead of "low water dams". Suggest replacing all instances of "pool control structure" with "low water dam" to stay consistent with the Congressional legislation and multiple past reports. If "pool control structure" is the correct term, please define why this term was used and how that may affect the past reports and/or Congressional legislation.	
2	Concern	2. General. The Draft Report states that habitat that will be created with the 1,000 cubic feet per second (cfs) flow provided by the proposed low water dam (LWD), and recommends an alternative, the National Ecosystem Restoration (NER) plan, that will create 2,144 acres of riverine habitat. Southwestern is concerned with the proposed creation of riverine habitat in areas that will be weekly (if not daily) inundated by hydropower releases, and even further by flood control releases. The Tulsa District Regulatory Branch has historically not considered the ARC land located below bankfull elevation to be habitat due to the expected regular inundation by hydropower and flood releases, and that approach has governed their issuance of Section 404 permits. Southwestern is unclear how Corps regulatory policy will be affected by creating habitat in areas that the Corps has never considered to be habitat. Southwestern requests clarification from the Corps on its policy regarding habitat in the Arkansas River, and whether the proposed NER plan for the ARC and the LWD presented in the Draft Report represent a change to current policy.	USACE regulatory policy will not be impacted. The ARC NER will not create additional habitat, rather the intent is to increase/restore ecological function in the study area by primarily increasing the minimum river flow to 1,000 cfs. Currently, the frequency of wetting & drying cycle is exacerbated by flood and power releases. The 2,144 acres represent the area of river that would be maintained by the operation of the pool structure. Flood and hydropower releases exceed the flow capabilities of the pool structure, however those releases are not consistent. The pool structure would work to fill in the gaps in river flow to maintain aquatic life.
3	Editorial	3. Page i. (line 8), Section "Executive Summary", paragraph 1, sentence 3. Vensel Creek is located on the east side of the Arkansas River in Tulsa, not in Jenks.	Editorial. Edits will be made.
4	Editorial	4. Page i. (line 19-23), Section "Executive Summary", paragraph 3, sentences 3-6. Suggest replacing the four sentences with the following, as the current statements do not correctly reflect Southwestern's authority, marketing, or operations: "The Southwestern Power Administration (SWPA), as the region's Power Marketing Administration, is authorized to market the hydropower generated at Keystone Dam. When the Keystone Lake level is in the flood pool, hydro power generation is used as the first method of flood control release as part of the USACE flood risk management. When the lake level is in the conservation pool, SWPA schedules and calls on Keystone Dam hydropower generation to meet electricity demand needs of Federal hydropower customers in a six-state region. Keystone Dam hydropower generation is operated as part of a system of numerous Federal hydropower projects in the region to meet that electricity demand. Generation schedules are tentative and subject to change at any time due to a variety of factors."	Editorial. Edits will be made.
5	Editorial	5. Page i. (lines 27-28), Section "Executive Summary", paragraph 4, sentence 3. Suggest changing the sentence to say "During hydropower generation, the hydropower units can release an estimated 6,000 cfs (1 unit) or 12,000 cfs (2 units) of water that flows through the river reach throughout the study area."	Editorial. Edits will be made.
6	Editorial	6. Page i. (lines 28-29), Section "Executive Summary", paragraph 4, sentence 4. Suggest removing this sentence. Flood control releases are typically made through the hydropower units, in addition to normal hydropower releases. The only time when flood releases would be made with no hydro power would be if the hydro power units are unavailable for generation.	Editorial. Edits will be made.
7	Editorial	7. Page i. (lines 29-32), Section "Executive Summary", paragraph 4, sentences 5-6. These sentences incorrectly generalize seasonal weather patterns and lake levels that have only occurred four times in the last 20 years. Additionally, the sentences neglect the water supply purpose. Suggest modifying the sentences to state: "During periods of low precipitation, water levels behind the dam drop into the conservation pool. Once in the conservation pool, the only water released downstream is to meet hydropower or, occasionally, water supply demand, which is typically released via the hydropower units."	Editorial. Edits will be made.

<u>Comment ID</u>	<u>Comment Type</u>	<u>Comment</u>	<u>Response</u>
8	Editorial	8. Page i. (lines 35-38), Section "Executive Summary", paragraph 4, sentence 9. The sentence refers to "stagnant isolated pools", but on Page 11(line19), Chapter 2, Water Resources,Water Quality, paragraph 5, sentence 2, the 2011 INCOG report is referenced as saying " ... all wastewater treatment plants within the project area are performing well, and even under the extreme summer conditions of 2011 there still was a residual base flow in the river of around 100 cfs that likely prevented stagnation of pools and the consequent collection of organic materials." Please clarify why the Draft Report refers to "stagnant isolated pools" while the INCOG report says that river pools were not stagnant even during the 2011 drought and near record 44 days of 100+ degree Fahrenheit temperatures in the Tulsa area.	Isolated, stagnant pools were identified in the HEC-RAS outputs. Large pools may provide refuge for aquatic species, however smaller pools are more subject to higher temps, and lower DO. The report does not imply or state organic material/contaminant/odor issues during low flow conditions. Stagnant was meant to reflect the pool's non-flowing state. Edits will be made.
9	Editorial	9. Page i. (lines 42-44), Section "Executive Summary", paragraph 4, sentence 12. Suggest revising the sentence, as contrary to the statement "flooding and drought conditions are exacerbated", prior to construction of Keystone Dam the ARC experienced significantly larger flows during times of flood and longer periods of drier conditions during times of drought.	The intent of this statement is to show that the frequency of wetting & drying cycle is exacerbated by the impacts of drought and flooding.
10	Content	10. Page ii. (lines 10-18), Section "Executive Summary", paragraph 6. Suggest removal of this paragraph. The paragraph is a mischaracterization of the interior least tern (ILT) and the operations regarding ILT. The Draft Report needs to be revised throughout to correctly reflect the status of the ILT and the actions that are routinely taken to address the concerns with the ILT. Southwestern has been in consultation with the Corps and the U.S. Fish and Wildlife Service (USFWS) since 1986 regarding the ILT, and Southwestern and the Corps have been operating Keystone Dam under the provisions of the 1998, 2005, and 2013 Biological Opinions. In 2002, the ILT committee was established and created guidelines for the dam operations of Tulsa District and Southwestern. The ILT committee has conducted weekly or bi-weekly meetings during the ILT nesting season every year since 2002. During these meetings, the results of the ILT surveys are discussed, and actions are taken to prevent land bridging of nesting islands, to protect low elevation nests from flooding, and to provide flows that allow the ILT surveyors to conduct the surveys by boat, to the extent possible. As a member of the ILT committee, Southwestern fully cooperates and coordinates with the Corps and USFWS, even when the consensus recommended actions are detrimental to hydropower. Southwestern is concerned that the Draft Report describes impacts to the ILT that are addressed every year by the ILT committee, but makes no mention of the ILT committee and the successes achieved through its cooperative operations. The Draft Report also fails to acknowledge that Keystone Dam hydropower and flood releases will still be the controlling factor in ILT nesting in the ARC even if the proposed LWD is constructed, as the LWD release of 1,000 cfs will have relatively little to no effect on ILT habitat and nesting.	A brief description of SWPA's efforts, as part of the ILT committee, will be noted. While the ILT is a resource of national significance in the study area, the NER benefits all aquatic resources in the study area.
11	Editorial	11. Page ii. (line 19), Section "Executive Summary", paragraph 7, sentence 1. The sentence refers to "shallow, isolated pools." Please refer to Comment #8 regarding INCOG's report which contradicts this sentence.	Isolated, stagnant pools were identified in the HEC-RAS outputs. Large pools may provide refuge for aquatic species, however smaller pools are more subject to higher temps, and lower DO. The report does not imply or state organic material/contaminant/odor issues during low flow conditions. Stagnant was meant to reflect the pool's non-flowing state. Edits will be made.
12	Content	12. Page ii (lines 19-21), Section "Executive Summary", paragraph 7, sentence 1. Note that desiccation would occur for longer periods of time in the ARC if Keystone Dam did not provide water releases during periods of low precipitation, as is provided by typical hydropower operations.	Edits will be made.
13	Editorial	13. Page iii. (lines 22-24), Section "Executive Summary", paragraph 11, sentence 1. Please remove the reference to a "more natural river flow", as truly natural flow prior to any dam structures on the Arkansas River would involve more extreme flooding and longer dry spells than experienced today with the operation of Keystone Dam. Suggest revising the sentence to state "With the implementation of the NER plan, a more consistent low regulated flow would be provided to 42 river miles of the Arkansas River within the study area during certain periods between releases from Keystone Dam."	Recommend that the statement be revised to: "With the implementation of the NER plan, a more consistent low regulated flow would be provided to 42 miles of the Arkansas River within the study area during certain periods between hydropower releases from Keystone Dam."

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14	Editorial	14. Page iii. (lines 22-30), Section "Executive Summary", paragraph 11. The paragraph contains a reference to the "1,000 cfs" that the recommended alternative will provide in the ARC. However, 1,000 cfs is much less flow than the hydropower releases of 6,000 cfs and 12,000 cfs that occur regularly. It is unclear how 1,000 cfs will support habitat if regular hydropower releases inundate all the shoreline created by 1,000 cfs.	The 1,000 cfs is also more flow than existing river flows that occur between flood and hydropower releases. The 1,000 cfs is intended to maintain aquatic life and expand ecosystem function beyond the existing low flow conditions.
15	Content	15. Page iii. (lines 22-30), Section "Executive Summary", paragraph 11. The paragraph makes two references to "wetlands" created by the recommended alternative. However, only onewetland (Prattville Creek) is mentioned in the Draft Report. As stated in the previous Comment #14, wetlands will not be created in the riverbed from the 1,000 cfs flow because hydropower releases will regularly inundate the wetlands and prevent them from establishment. Please clarify if the expectation of the recommended alternative is to create multiple wetlands or only the Prattville Creek wetland, and how the wetland(s) will be maintained.	The 1,000 cfs will likely provide some connectivity to backwater/side channel habitat. Providing the additional water will help sustain backwater/wetland/side channel habitat.
16	Editorial	16. Page iii. (lines 33-35), Section "Executive Summary", paragraph 12, sentence 3. Please correct the misstatement that the alternative will "provide a continuous river flow" as there will still be times of no water flow from Keystone Dam longer than will be able to be compensated for by the storage behind the proposed LWD. Suggest using the term "more consistent riverflow".	Editorial. Edits will be made.
17	Editorial	17. Page iv. (lines 14-15), Section "Executive Summary", paragraph 14, sentence 1. See Comment #16 above regarding correction of the term "continuous river flow".	Editorial. Edits will be made.
18	Editorial	18. Page iv. (line 18), Section "Executive Summary", paragraph 14, sentence 5. The sentence mentions the shoreline habitat created by the 1,000 cfs flow. However, as stated previously in Comment #14, it is unclear how shoreline habitat will be created when hydropower releases will frequently inundate the shorelines.	Without river flow, shoreline habitat degrades. The NER does not create shoreline habitat, only restore connectivity as the 1,000 cfs meanders through the existing shorelines. However, the 1,000 cfs profile, between inundation cycles, would provide shoreline habitat for various aquatic organisms that would exceed the current low flow shoreline quantity and quality.
19	Concern	19. Page v. (lines 1-18), Section "Executive Summary". Southwestern is concerned that the recommended plan does not fulfill the 11 bullets listed and that there are too many deficiencies in the plan to issue a Finding of No Significant Impact (FONSI). Specifically: <ul style="list-style-type: none"> • The Draft Report does not provide adequate information on how plan restores biological and environmental resources that were present prior to the construction of Keystone. As stated in Comment #13, the NER plan does not restore natural river flow but rather provides for more consistent low regulated flow. Additionally, as stated in Comments #14 and #15, it is unclear how wetland or shoreline habitat will be established or maintained from the proposed LWD 1,000 cfs flow, with the frequent inundation by regular hydropower and flood control releases. • Southwestern has several serious concerns with how the NER plan co-exists effectively with the hydropower purpose of Keystone Dam, which are enumerated in these comments. • Because of concerns raised by resource agencies at a September 12, 2016 meeting hosted by the Corps Tulsa District regarding the Jenks/South Tulsa LWD, Southwestern would like to see more information on the USFWS and ODWC support of the proposed Sand Springs LWD presented in the Draft Report. • Southwestern questions whether it is appropriate to state that the ARC recommended plan has "widespread local support" as historically Tulsa County voters have defeated multiple ballot measures (2007, 2012) funding ARC LWD projects. 	<ul style="list-style-type: none"> • Restoration efforts cannot return the river flow to pre-Keystone Dam conditions, however by improving the minimum flow, existing ecological function/output may improve. The 1,000 cfs provides connectivity to tributaries, backwaters, wetlands that the existing flow conditions do not. • The pool structure will be designed and operated to not impact or require a change in operations from Keystone Dam or SWPA. • The proposed LWDs downstream are not part of this federal project and their intent is not ecosystem restoration. Thus, this project's design and operation will likely be vastly different. Coordination has been ongoing with USFWS and ODWC to develop design and operations criteria. Coordination documentation will be added to final report. • Other proposed LWDs had different objectives than the proposed project. Based on public comments and discussions thus far, the Tulsa area community appears to be in support of the project.
20	Editorial	20. Page 1 (lines 30-31), Chapter 1: Introduction, Study Purpose and Need, Study Need, paragraph 1, sentence 1. The sentence states that "... historical alterations have degraded the watershed conditions and masked the river's potential." Suggest defining the "river's potential".	Editorial. Edits will be made.

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21	Editorial	21. Page 1 (lines 35-38 and 40-43), Chapter 1: Introduction, Study Purpose and Need, Study Need, paragraph 1, sentences 4 and 6. Only hydropower operations and releases are referred to when discussing releases from Keystone Dam. Suggest including flood control as well as watersupply releases in these statements.	Editorial. Edits will be made.
22	Editorial	22. Page 1 (lines 38-40), Chapter 1: Introduction, Study Purpose and Need, Study Need, paragraph 1, sentence 5. Suggest modifying the sentence to state " ... as climate change in this region of North America is forecasted to result in more frequent and more intense droughts, heatwaves, intense thunderstorms, and flash flooding."	Editorial. Edits will be made.
23	Editorial	23. Page 2 (line 26), Chapter 1: Introduction, Study Location, paragraph 1, sentence 1. The Arkansas River meets the Mississippi River in Arkansas, not Louisiana. Please correct.	Editorial. Edits will be made.
24	Editorial	24. Page 2 (line 29), Chapter 1: Introduction, Study Location, paragraph 1, sentence 3. Vensel Creek is located on the east side of the Arkansas River in Tulsa, not in Jenks. Please correct.	Editorial. Edits will be made.
25	Editorial	25. Page 2 (lines 30-32), Chapter 1: Introduction, Study Location, paragraph 1, sentence 5. The sentence states that all tributaries were evaluated to elevation 638.0 feet. Suggest revising the statement to clarify that only tributaries above the proposed LWD were evaluated to 638.0 feet.	Editorial. Edits will be made.
26	Concern	26. Page 2 (line 31), Chapter 1: Introduction, Study Location, paragraph 1, sentence 5. This is the first mention of the proposed LWD elevation of 638.0 feet. It should be noted that Keystone Dam's tailwater elevation during periods of no generation, and no significant conduit ortainter gate releases, is 637.6 feet. There is a riffle complex approximately a half mile downstream of Keystone Dam that controls the tailwater elevation during those periods. Also, the Arkansas River bed drops from 9.0 to 17.0 feet in elevation from Keystone Dam tailwater to the proposed LWD location. While the proposed LWD may not affect Keystone Dam tailwater elevation in periods of light generation of less than six hours per day, the proposed LWD will likely impact the tailwater elevation in periods of heavy generation of more than six hours per day. Six hours of generation per day is significant because that is the estimated amount of generation required to fill the pool of the proposed LWD assuming it is completely empty. Southwestern requests that the Corps conduct a hydraulic study on the effects of the higher tailwater on hydro power operations. Southwestern believes that replacing the downward slope of the Arkansas River with a static LWD pool that is above the current non-release tailwater elevation will impact Keystone Dam operations. A rise in tailwater will reduce the head differential (difference in elevation between the lakeside and the tailwater), which will affect the available capacity, energy production, and efficiency of hydropower generation.	Final design parameters have not been determined. Preliminary design information was utilized, but will be further evaluated. However, as noted earlier, the pool structure design and operation will not impact Keystone Dam or hydropower operations.
27	Editorial	27. Page 4 (lines 39-43), Chapter 1: Introduction, Problem Identification, Ecosystem Losses in the Study Area, paragraph 1, sentences 3-6. Suggest replacing the four sentences with the following, as the current statements do not correctly reflect Southwestern's authority, marketing, or operations: "The Southwestern Power Administration (SWPA), as the region's Power Marketing Administration, is authorized to market the hydropower generated at Keystone Dam. When the Keystone Lake level is in the flood pool, hydropower generation is used as the first method of flood control release as part of the USACE flood risk management. When the lake level is in the conservation pool, SWPA schedules and calls on Keystone Dam hydropower generation to meet electricity demand needs of Federal hydropower customers in a six-state region. Keystone Dam hydropower generation is operated as part of a system of numerous Federal hydropower projects in the region to meet that electricity demand. Generation schedules are tentative and subject to change at any time due to a variety of factors."	Editorial. Edits will be made.
28	Editorial	28. Page 5 (lines 2-3), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 2, sentence 3. Suggest changing the sentence to say "During hydropower generation, the hydropower units can release an estimated 6,000 cfs (1 unit) or 12,000 cfs (2 units) of water that flows through the river reach throughout the study area."	Editorial. Edits will be made.

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29	Editorial	29. Page 5 (lines 3-4), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 2, sentence 4. Suggest removing the sentence. Flood control releases are typically made through the hydropower units, in addition to normal hydropower releases. The only time when flood releases would be made with no hydro power would be if the units are unavailable for generation.	Editorial. Edits will be made.
30	Editorial	30. Page 5 (lines 4-7), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 2, sentences 5-6. These sentences incorrectly generalize seasonal weather patterns and lake levels that have only occurred four times in the last 20 years. Additionally, the sentences neglect the water supply purpose. Suggest modifying the sentences to state: During periods of low precipitation, water levels behind the dam drop into the conservation pool. Once in the conservation pool, the only water released downstream is to meet hydropower or, occasionally, water supply demand, which is typically released via the hydropower units.	Editorial. Edits will be made.
31	Editorial	31. Page 5 (lines 11-13), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 2, sentence 9. See Comment #8 regarding isolated pools and INCOG's report.	See comment 8 response.
32	Editorial	32. Page 5 (lines 17-19), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 2, sentence 12. Consider revising the sentence, as contrary to the statement flooding and drought conditions are exacerbated, prior to construction of Keystone Dam the ARC experienced significantly larger flows during times of flood and longer periods of drier conditions during times of drought.	Editorial. Edits will be made.
33	Editorial	33. Page 5 (lines 28-35), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 4, sentences 2-6. Please remove of all these sentences. The sentences are a mischaracterization of the ILT and the operations regarding ILT, as previously stated in Comment # 10. The Draft Report needs to be revised to correctly reflect the status of the ILT and the actions that are routinely taken to address the concerns with the ILT.	Editorial. Edits will be made. See comment #10
34	Editorial	34. Page 5 (lines 36-38), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 5, sentence 1. See Comment #8 and revise accordingly regarding "isolated pools" as this conflicts with INCOG's study.	Editorial. See comment #8.
35	Editorial	35. Page 6 (lines 8-9), Chapter 1, Problem Identification, Ecosystem Losses in the Study Area, paragraph 7, sentence 1. Note that desiccation would occur for longer periods of time in the ARC if Keystone Dam did not provide water releases during periods of low precipitation, as is provided by typical hydropower operations.	Editorial. Edits will be made.
36	Content	36. Page 6 (lines 15-18), Chapter 1, Problem Identification, Flood Risk Management, paragraph 1, sentence 2. In multiple past meetings as well as in Hydrologic Engineering Center (HEC) guidance, the Corps has stated that HEC-RAS experiences instability issues at low flows in a large channel. Also, the Corps uses the U.S. Geological Survey (USGS) Tulsa Gage for calibration of the HEC-RAS model at low flows, but the USGS has rated 28 of its last 30 lowflow measurements (1,000 cfs or less) as fair (8 measurements) or poor (20 measurements). It should be noted in the Draft Report that modeling and measuring low flows in the ARC is highly subject to error.	Modeling low flow conditions is challenging. Detailed terrain data improves the ability to model the system. River systems are constantly changing as flows move sediment and erode the streambed. Discussion can be added to the H&H appendix regarding model challenges. Measuring low flows in a large channel is challenging. Low flows are generally not highly subject to error as a low flow is generally shallow and spread across the river channel.
37	Editorial	37. Page 7 (lines 10-12) Chapter 2: Existing Conditions and Future Without Project Conditions, paragraph 2, sentence 2. See Comment #8 and revise accordingly regarding "stagnant, isolated pools".	See comment 8 response.

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38	Editorial	38. Page 11 (lines 18-22), Chapter 2, Water Resources, Water Quality, paragraph 5, sentence 2. INCOG states that " ... there still was a residual base flow in the river of around 100 cfs that likely prevented stagnation of pools and the consequent collection of organic materials." Refer to Comment #8 as this statement conflicts with multiple mentions of "stagnant, isolatedpools" in the Draft Report.	See comment 8 response.
39	Content	39. Page 12 (line 6), Chapter 2, Hydrology and Floodplains, River Hydrology, paragraph 2. Suggest adding a statement at the end of the paragraph about the uncertainty in flow measurement on the Arkansas River due to large channel width and lack of available flow calibration measurements during high flow.	Release data from Keystone Dam is a large piece portion of the flow data at the Tulsa gage. Rating curves are developed and gage information is utilized to estimate flow at the gages.
40	Content	40. Page 12 (lines 15-19), Chapter 2, Hydrology and Floodplains, River Hydrology, paragraph 4, sentences 1-4. Suggest rewording these sentences for clarity. The maximum discharge of Keystone Dam is 989,000 cfs during the probable maximum flood. The downstream regulating discharge at Tulsa gage is estimated 105,000 cfs. As written, the sentences are currently unclear as to what the maximum discharge of Keystone Dam is. Additionally, the statement regulating discharge normally expected from Keystone Lake is misleading; there is no normally expected flood control discharge from Keystone Dam. Suggest removing any reference to "normally expected" flood control discharge.	Will revise statement to clarify the releases from Keystone. Revise "normally expected" in terms of flood control releases. Current release range is 0 to PMF release near 1,000,000 cfs.
41	Editorial	41. Page 12 (lines 30-31), Chapter 2, Hydrology and Floodplains, River Hydrology, paragraph 5, sentence 6. The sentence mentions Arkansas City gage which is in Kansas above Kaw Lake. Please clarify if this is the correct gage.	
42	Content	42. Page 12 (lines 34-37), Chapter 2, Hydrology and Floodplains, River Hydrology, paragraph 6, sentences 1-2. The channel capacity of the ARC through Tulsa is 105,000 cfs. The maximum hydropower release of 12,000 cfs fills 11% of the channel capacity and is a normal, regularly occurring function of the Keystone project as authorized and designed. Suggest rewording the statements in sentences 1 and 2 to reflect the minor increase in channel capacity utilized that occurs during the hydropower generation.	Flows in the river of 60 cfs during no hydropower to 6,000 hydropower generation - two orders of magnitude within a short timeframe. The wetting and drying cycle occurs regardless of the percent of channel capacity utilized.
43	Content	43. Page 14 (lines 19-21), Chapter 2, Riverine Resources, Wetlands, paragraph 3, sentence 1. A hydropower release of 12,000 cfs fills 11% of the channel capacity. Suggest removing the word "extreme" as it is a subjective descriptor.	Extreme is used to describe the current water regime relative to the resources within the study area. Flows in the river of 60 cfs during no hydropower to 6,000 hydropower generation - two orders of magnitude within a short timeframe. The wetting and drying cycle occurs regardless of the percent of channel capacity utilized.
44	Editorial	44. Page 14 (lines 45-47), Chapter 2, Riverine Resources, Open Water, paragraph 1, sentence 9. The sentence states that "Water quality within the more persistent pools is typically low due to stormwater inputs and little to no mixing with other surface waters." Refer to Comment #8 as INCOG's report is in conflict with this statement.	Editorial. Edits will be made.
45	Editorial	45. Page 15 (lines 4-5), Chapter 2, Riverine Resources, Open Water, paragraph 2, sentence 3. The sentence mentions " ... and temporary and permanent isolated pools." Refer to Comment #8 as INCOG makes no mention of isolated or permanent pools.	Editorial. Edits will be made.
46	Content	46. Page 15 (lines 24-26), Chapter 2, Riverine Resources, Riverine Sandbars, paragraph 2, sentence 6. The sentence states that "The majority of the riverbanks are steep to near vertically sloped with areas that are sloughing and/or eroding ... " It is understood that these steep riverbanks are the reason for the disconnected floodplain and the river. However, the Draft Report later makes multiple mentions of 1,000 cfs flow allowing the floodplain to reconnect to the river. Please clarify if the steep banks do cause the disconnected floodplain, and please explain how 1,000 cfs will reconnect floodplain through a near vertical cut bank.	While the banks are steep, The 1,000 cfs will provide more water over a longer period to support the riparian communities, backwater habitats, etc when compared to the existing low flow conditions.
47	Editorial	47. Page 17 (lines 8-10), Chapter 2, Threatened and Endangered Species, Interior Least Tern, paragraph 2, sentence 3. The USACE has monitored ILT below Keystone since 1990, and the most recent Biological Opinion of the USFWS was finalized in 2013 and revised in 2016. Suggest revising the sentence to reflect the above dates.	Editorial. Edits will be made.

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48	Content	48. Page 17 (lines 24-34), Chapter 2, Threatened and Endangered Species, Interior Least Tern, paragraphs 5-6. Refer to Comment #10 as the statements in these paragraphs do not reflect the last 15 years of Keystone Dam operations since the ILT committee was created. Additionally, the USFWS completed a 5-Year Review of the ILT in 2013 which found that the ILT is biologically recovered, and recommended delisting after completion of a rangewide population model, a conservation plan, and a monitoring plan. Since 2013, Federal agencies across the ILT population range put a significant amount of effort into completing all three of these objectives, without considering the effect of the NER plan recommended in the Draft Report.	See comment 10 response.
49	Content	49. Page 20 (lines 8-11), Chapter 2, Cultural Resources, paragraph 3, sentence 2-4. Refer to Comment #26 concerning the impact of elevation 638.0 feet on Keystone Dam operations.	The purpose of the proposed LWD is not to maintain a full pool, but to hold back and release water at a lower flow rate during Keystone Dam's periods of no generation and no significant release to maintain river flow. When Keystone Dam is operating at heavy generation, the proposed pool structure will be opened and to allow higher flows to resume downstream. Therefore, it is not anticipated that the water elevation behind the LWD and directly below Keystone Dam would exceed 638 feet, resulting to no new impacts to cultural resources
50	Content	50. Page 20 (lines 8-11), Chapter 2, Cultural Resources, paragraph 3, sentence 2-4. The sentence states that the proposed LWD elevation will vary between 635.0 and 638.0 feet, but later in the document (page 90 (lines 25-26), Chapter 5, Hydrology and Floodplains, TSP Alternative -Arkansas River Flows, paragraph 1, sentence 3) there is the statement that " ... the full pool volume ... " (~628.0 to 638.0) will be needed to provide 1,000 cfs for 3.4 days. Please clarify if the pool will only use three feet of its storage or the full volume.	Between regular hydropower generation, roughly only the top 3ft of the pool will be needed to maintain the 1,000 cfs between power generation cycles. The full pool will be used to maintain river flow when no releases are being made from Keystone (i.e. weekends). A full pool can maintain 1,000 cfs for up to approximately 3.4 days.
51	Editorial	51. Page 25 (lines 32-33), Chapter 2, Socioeconomics and Visual Aesthetics, Visual Esthetics, paragraph 1, sentence 4. The sentence states that " ... the visual and esthetic character of the study area has been substantially changed due to its long history of use for navigation and trade." Please clarify how navigation and trade affected the study area.	Edits will be made.
52	Content	52. Page 33 (lines 8-10), Chapter 3, Problems and Opportunities, paragraph 1, sentence 1. The sentence is misleading. First, while Keystone Dam certainly altered the flow regime and resulting aquatic structure of the Arkansas River in the study area, the ability to store water and regulate flow has resulted in the overall reduction of flow extremes. Prior to construction of Keystone Dam, the study area experienced significantly larger flows during times of flood and drier conditions during times of drought. Additionally, the more "severe" flows from Keystone Dam are flood control releases, not hydropower releases. The maximum hydropower release of 12,000 cfs fills only 11% of the channel capacity and should not be considered "severe". Please revise the sentence to correctly characterize the flow regime pre and post-Keystone Dam construction, and how the aquatic structure has changed.	Extreme is used to describe the current water regime relative to the resources within the study area. Flows in the river of 60 cfs during no hydropower to 6,000 hydropower generation - two orders of magnitude within a short timeframe. The wetting and drying cycle occurs regardless of the percent of channel capacity utilized.
53	Content	53. Page 33 (lines 19-21), Chapter 3, Problems and Opportunities, Problem Statements, bullet 1. Note that "extreme low to no-flow conditions" would occur more often in the ARC if Keystone Dam were not able to provide water releases during periods of low precipitation.	Extreme is used to describe the current water regime relative to the resources within the study area. Flows in the river of 60 cfs during no hydropower to 6,000 hydropower generation - two orders of magnitude within a short timeframe. The wetting and drying cycle occurs regardless of the percent of channel capacity utilized.
54	Content	54. Page 33 (lines 24-27), Chapter 3, Problems and Opportunities, Problem Statements, bullet 3. Extreme high flow pulses associated with hydropower is a mischaracterization since the maximum hydro power release fills only 11% of the channel capacity, and is a normal, regularly occurring function of the Keystone project as authorized and designed. Please remove the word "Extreme".	Extreme is used to describe the current water regime relative to the resources within the study area. Flows in the river of 60 cfs during no hydropower to 6,000 hydropower generation - two orders of magnitude within a short timeframe. The wetting and drying cycle occurs regardless of the percent of channel capacity utilized.

<u>Comment ID</u>	<u>Comment Type</u>	<u>Comment</u>	<u>Response</u>
55	Editorial	S5. Page 33 (lines 32-34), Chapter 3, Problems and Opportunities, Opportunity Statements, bullet1. It is misleading to state that an increase in more consistent water flow is the "restoration of a more natural flow regime", as a truly natural flow regime prior to any dam structures on the Arkansas River would involve more extreme flooding and longer dry spells than experienced today with the operation of Keystone Dam. Suggest modifying the statement to state Provision of a more consistent low flow regime which helps sustain ...	Edits will be made.
56	Content	S6. Page 33 (lines 32-34), Chapter 3, Problems and Opportunities, Opportunity Statements, bullet1. This is the first mention of the USACE-Nature Conservancy Sustainable RiversMemorandum of Understanding (MOU). The previous mentions of ILT state that the Corps is addressing the requirements of the Endangered Species Act. Please clarify if the Corps' ILT actions are to coordinate with the USFWS to comply with the Endangered Species Act or to comply with the Nature Conservancy Sustainable Rivers MOU. If both, suggest introducing theNature Conservancy Sustainable Rivers MOU earlier in the Draft Report.	The NER helps move the existing study area conditions to those of a more sustainable ecosystem. As a federal agency, USACE is required to comply with the ESA. Edits will be made to clarify.
57	Editorial	S7. Page 35 (lines 30-32), Chapter 3, Initial Screening of Measures, Reallocation, paragraph 2,sentence 7. Suggest revising the sentence to say: "Further, SWPA estimates an increase in need for reliable renewable energy over the period of analysis, not a reduction, so the impact would likely increase." Southwestern cannot have an increase in demand as all the hydropower capacity has already been marketed from Keystone; however, there is an increase in need for reliable renewable energy in the region.	Revise to state "an increase in need"
58	Editorial	S8. Page 38 (after line 22), Chapter 3, Final Array of Management Measures, Table 9, Problem Statement 1. Note that "extreme low to no-flow conditions" would occur more often in the ARC if Keystone Dam were not able to provide water releases during periods of low precipitation.	Edits will be made.
59	Content	S9. Page 38 (prior to line 23), Chapter 3, Final Array of Management Measures, Table 9, Problem Statement 2, Floodplain Connectivity. Please refer to Comment #46 regarding the effect of1,000 cfs on floodplain connectivity.	See response #46.
60	Content	60. Page 39 (prior to line 1), Chapter 3, Final Array of Management Measures, Table 9, Problem Statement 3. Please refer to Comment #10 regarding operations for ILT in the ARC.	See response to comment #10.
61	Content	61. Page 39 (prior to line 1), Chapter 3, Final Array of Management Measures, Table 9, Problem Statement 4. Please refer to Comment #46 regarding the effect of 1,000 cfs on floodplain connectivity.	See response to comment #46.
62	Editorial	62. Page 39 (lines 7-8), Chapter 3, Description of Each Measure Carried Forward, Flow Regime Management - Pool Control Structure (2 candidate locations), paragraph 1, sentence 3. Please remove the reference to a "natural flow regime", as a truly natural flow regime prior toany dam structures on the Arkansas River would involve more extreme flooding and longer dry spells than experienced today with the operation of Keystone Dam.	Edits will refer to more cyclical flows associated with hydropower generation.
63	Content	63. Page 40 (lines 12-16), Chapter 3, Description of Each Measure Carried Forward, Flow RegimeManagement - Pool Control Structure (2 candidate locations), paragraph 1, sentence 10. Please include calculations and/or additional information to demonstrate how 1,000 cfs was chosen as the pre-Keystone minimum flow in the ARC.	Will in clude information on how 1000 cfs was derived in the H&HN appendix. Will clarify in the text of the report that 1,000 cfs is not considered the pre Keystone flow, but rather the minimum required to maintain ER in the exisiting condition.
64	Concern	64. Page 40-42, Chapter 3, Description of Each Measure Carried Forward, Pool Structure at River Mile 531 (Old reregulation dam site) and Pool Structure at River Mile 530 (Below Hwy. 97Bridge). There are multiple mentions of maximum elevation of the proposed LWD as 638.0 feet. Refer to Comment #26 regarding the impact of this elevation on Keystone Dam operations.	Final design parameters have not been determined. Preliminary design information was utilized, but will be further evaluated. However, as noted earlier, the pool structure design and operation will not impact Keystone Dam or hydropower operations.

<u>Comment ID</u>	<u>Comment Type</u>	<u>Comment</u>	<u>Response</u>
65	Content	65. Page 41 (line 1), Chapter 3, Description of Each Measure Carried Forward, Pool structure at River Mile 530 (Old reregulation dam site), Figure 3. The figure shows a water elevation of 638.0 feet; however, the water elevation appears to stop about 300 feet short of the powerhouse and dam. Since the non-release tailwater of Keystone Dam is approximately 637.6 feet, the figure should show water elevation all the way to the powerhouse and stilling basin. Please add a note to the caption indicating why the water elevation is not shown to the powerhouse and stilling basin.	Inundation based on available LiDAR survey data. The 638 elevation would only be briefly reached at the end of hydropower generation. The pool structure would then begin releasing water. Water levels would be below the powerhouse and stilling basin prior to the next cycle of hydropower generation.
66	Content	66. Page 42 (line 9), Chapter 3, Description of Each Measure Carried Forward, Pool structure at River Mile 530 (Below Hwy. 97 Bridge), Figure 4. The figure shows a water elevation of 638.0 feet; however, the water elevation appears to stop about 300 feet short of the powerhouse and dam. Since the non-release tailwater of Keystone Dam is approximately 637.6 feet, the figure should show water elevation all the way to the powerhouse and stilling basin. Please add a note to the caption indicating why the water elevation is not shown in the tail race and stilling basin.	Inundation based on available LiDAR survey data. The 638 elevation would only be briefly reached at the end of hydropower generation. The pool structure would then begin releasing water. Water levels would be below the powerhouse and stilling basin prior to the next cycle of hydropower generation.
67	Content	67. Page 47 (lines 7-8), Chapter 3, Alternative Comparison, Array of Partially-formed Alternatives, paragraph 1, sentence 2. The Jenks/South Tulsa LWD is assumed to be included in the Future With Project Condition. However, as of this time, the Jenks/South Tulsa LWD is lacking the Creek Nation funding support that is required to move forward with the project. Also, on September 12, 2016, the Corps hosted a resource agency meeting regarding the Jenks/South Tulsa LWD, and there were multiple issues expressed by multiple resource agencies (Environmental Protection Agency, Southwestern, ODWC, Oklahoma Department of Environmental Quality) that were not adequately addressed by the Tulsa County representatives in the meeting. It may be useful to do the analysis both with and without the Jenks/South Tulsa LWD.	The Jenks/South Tulsa LWD was included in the FWP condition so that the proposed project would not overstate benefits. Because the Jenks/South Tulsa LWD is downstream of both of the pool structure location options, it affects them both equally, thus had no further impact on plan formulation. The issues associated with downstream LWD are likely tied to its intent to create a river lake. The proposed NER will be designed and operated to maintain riverine conditions.
68	Content	68. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? - Alternative 1 (No Action), paragraph 1, sentence 3. Please refer to Comment #46 regarding 1,000 cfs effect on floodplain connectivity.	See response to comment #46.
69	Content	69. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth It? - Alternative 1 (No Action), paragraph 1, sentence 3. Please refer to the Comment #10 regarding ILT nesting success and ILT committee actions.	See response to comment #10.
70	Editorial	70. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? - Alternative 2, paragraph 1, sentence 3. Please correct the misstatement that the alternative "restores a more natural pre-dam flow regime" as more consistent water flow is not the natural state of the Arkansas River and therefore providing for more consistent flow is not restorative.	Edits will be made. The "natural pre-dam flow regime" is in reference to a smoother flow, not the low flow to 12,000 cfs swings that can occur now.
71	Editorial	71. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth It? - Alternative 2, paragraph 1, sentence 5-6. Refer to Comment #8 as INCOG's report is in conflict with this statement.	See response to comment #8
72	Editorial	72. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? - Alternative 2, paragraph 2, sentence 4. Please correct the misstatement that the alternative "restores continuous water flow" as 1) continuous water flow is not the natural state of the Arkansas River and therefore providing for continuous flow is not restorative and 2) the alternative does not actually provide for continuous water flow, as there will still be times of no water flow from Keystone Dam longer than will be able to be compensated for by the storage behind the proposed LWD. Suggest using the term "more consistent water flow".	Edits will be made. The "natural pre-dam flow regime" is in reference to a smoother flow, not the low flow to 12,000 cfs swings that can occur now.
73	Content	73. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? - Alternative 2, paragraph 2, sentence 5. Please refer to Comment #46 regarding 1,000 cfs effect on floodplain connectivity.	See response to comment #46.
74	Editorial	74. Page 57, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? - Alternative 2, paragraph 2, sentence 5. Please revise the statement referring to "restoring more natural flows" as previously addressed in Comments #70 and #72.	See responses to comments #70.

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75	Editorial	75. Page 58, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? -Alternative 3, paragraph 1, sentence 2. Refer to Comment #8 regarding "stagnant isolated pools as INCOG's report is in conflict with this statement.	See response to comment #8
76	Content	76. Page 59, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? -Alternative 3, paragraph 1, sentence 7. The sentence states that additional storage capacity allows " ... greater flow capabilities regarding both flow and duration by adding flexibility to adapt flow management to a wider range of environmental conditions." It is correct that the additional storage capacity will allow for extending the duration of lower flows, but it is unclear how the storage will add " ... flexibility to adapt flow management to a wider range of environmental conditions." The storage in the proposed LWD will be almost entirely dependent on Keystone Dam releases for its operation with little to no flexibility.	The additional storage capacity and flow management comparison being made was in reference to the two options for a pool structure. Both of which depend on releases from Keystone.
77	Editorial	77. Page 59, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? -Alternative 3, paragraph 1, sentences 8-11. These sentences regarding the proposed LWD's operational flexibility in response to forecasted precipitation and other release settings based on anticipated Keystone Dam operations reflect incorrect assumptions and/or a lack of understanding of the Corps' Arkansas River water management plan and in particular Keystone Dam operations, including hydropower scheduling and releases. Southwestern suggests that operational considerations and flexibilities of the proposed LWD must be properly vetted with and approved by Southwestern and Corps water management personnel.	Coordination with SWPA and Water Management would be a necessary maximize ecosystem benefits and not impact Keystone or SWPA operations.
78	content	78. Page 59, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Is It Worth it? -Alternative 3, paragraph 3, sentence 2. Please define " ... Restored riverine acres upstream ... ".	These acres are in reference to those upstream of the pool structure.
79	Content	79. Page 62, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 1, sentence 2. A new ILT island in the ARC has not been discussed in recent years of the ILT committee. However, USFWS and other members have mentioned the effectiveness of ILT islands on the MKARNS downstream of Muskogee, Oklahoma. This statement of an ARC ILT island being critical to the delisting of the ILT should be verified with the USFWS.	This project alone does not impact listing status. Creation/conservation of sandbar island habitat is vital to the long term survival of ILT. The NER helps fulfill that goal.
80	Editorial	80. Page 62, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of the National Ecosystem Restoration Plan, paragraph 11 bullet 5. Presumably, the bullet should read 11••• an incremental cost per incremental output of \$29,900 ... " Please correct 11out of' to 11 output of' if necessary.	Edits will be made.
81	Content	81. Page 65, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 16, sentence 2. The Draft Report states that the LWD will not impact or require Keystone Dam operation changes. However, Southwestern is concerned that the LWD structure itself, as well as the expectation set forth by its installation, could indeed impact hydropower operations from Keystone Dam. Southwestern strongly reiterates that the proposed LWD should not affect existing Keystone Dam operations. To ensure there is not impact to existing Keystone Dam operations, any operational or adaptive management" plans need to be thoroughly vetted and approved by all involved resource agencies, including Southwestern, and appropriate Corps personnel (i.e., hydro power, water management, regulatory) before development of the NER plan and construction of the proposed LWD.	Coordination with SWPA and Water Management would be a necessary maximize ecosystem benefits and not impact Keystone or SWPA operations.
82	Editorial	82. Page 66, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 18, sentence 4. Hydropower releases regularly occur on weekends during times that Keystone Lake is in the flood pool, and even when the lake is in the conservation pool weekend generation can occur due to high electricity demand or other factors. Suggest revising the sentence as follows: However, when Keystone Lake is in the conservation pool (elevation 723.0 feet and below), hydropower releases typically do not occur on weekends as demand for electricity is much greater during weekdays."	Edits will be made.

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83	Editorial	83. Pages 66-67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 22, sentences 1 and 3. It is misleading to state that the proposed LWD provides for restoration of natural flows. Natural flows, prior to the existing dam structures in the Arkansas River, were characterized by far more extreme flooding as well as longer dry spells than what is experienced today with the capability to regulate those extremes through storage and controlled releases. Suggest removing statements referring to the restoration of "natural flows" and revising the sentences to accurately portray the intention of the proposed LWD, which is to provide more consistent flow.	Reword this to state "more continuous flows" or "more consistent regulated low flows"
84	Content	84. Pages 66-67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 22. The statement made reflect a misunderstanding of the operations managed by the ILT committee to address ILT habitat and nesting needs as previously discussed in Comment #10. Any potential high flows that sweep away lower laying ILT nests would be significant flood control releases that would not be attenuated by the proposed LWD. Regular hydropower releases are managed such that ILT habitat with active nests are not inundated. Suggest modifying the paragraph to reflect how the proposed LWD would impact ILT operations as coordinated by the ILT committee.	Coordination with SWPA and Water Management would be a necessary maximize ecosystem benefits and not impact Keystone or SWPA operations.
85	Content	85. Page 67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 24. The paragraph's description of the proposed LWD's operational flexibility in response to forecasted precipitation and other release settings based on anticipated Keystone Dam operations reflect incorrect assumptions and/or a lack of understanding of the Corps' Arkansas River water management plan and in particular Keystone Dam operations, including hydropower scheduling and releases. Southwestern suggests that operational considerations and flexibilities of the proposed LWD must be properly vetted and approved by Southwestern and Corps water management personnel.	Coordination with SWPA and Water Management would be a necessary maximize ecosystem benefits and not impact Keystone or SWPA operations.
86	Editorial	86. Page 67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 24, sentences 1-2. Please revise the misleading statements regarding restoring natural flows as indicated in Comment #83.	Reword this to state "more continuous flows" or "more consistent regulated low flows"
87	Editorial	87. Page 67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 24, sentence 4. Suggest modifying the sentence to state " ... as climate change in this region of North America is forecasted to result in more frequent and more intense droughts, heat waves, intense thunderstorms, and flash flooding."	Edits will be made
88	Editorial	88. Page 67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 25, sentence 6. Please remove the word "restores" from the sentence, as it is misleading to state the proposed LWD provides for restoration of natural flows. Suggest modifying the sentence to state "The more consistent flows naturally suppress ..."	Edits will be made to reflect the proposed pool structures operation to restore more continuous river flow.
89	Content	89. Page 67, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 25, sentence 6. Southwestern is unaware of the Corps or any resource agencies spending " ... millions in the mechanical and herbicidal treatment of Salt-cedar." Additionally, it is unclear how 1,000 cfs will suppress salt cedar growth.	Numerous federal and state agencies commit considerable resources to combat the spread of salt cedar. In 2009, USACE SWT utilized helicopter application of herbicide as a more cost effective method to controlling vegetation on sandbar islands within the MKARNS. Water level management can be used to either maintain river flow to flush seeds or temporarily inundate seedlings.
90	Editorial	90. Page 68, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 27, sentence 1. During the September 12, 2016 resource agency meeting hosted by the Corps concerning the Jenks/South Tulsa LWD, ODWC stated that a change in monitoring technique has allowed them to count increased numbers of shovel nose sturgeon that were not previously believed to be present in the study area. Please verify with ODWC if the statement about shovel nose sturgeon being " ... largely absent..." still applies.	Edits will be made to reflect shovel nose sturgeon status.

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91	Editorial	91. Page 68, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 28, sentence 1. Please revise the misleading statement regarding restoring natural flows as indicated in Comment #83.	Reword this to state "more continuous flows" or "more consistent regulated low flows"
92	Content	92. Page 68, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 30, sentence 7. The ARC is already a consistent source of nesting habitat for ILTs. Additionally, it is unclear what a consistent source population is. Suggest modifying the sentence to state " ... the ARC can continue to be a consistent source of nesting habitat for Least Terns."	Source and sink populations can exist within the overall distribution of a species. Source populations contribute individuals, sink populations do not. The NER furthers the ARC's ability to provide elevated nesting habitat, additional foraging opportunities for the ILT, among other species.
93	Content	93. Page 68, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 30, sentence 8. It is unknown whether providing additional habitat in the ARC will lessen the burden of other nesting locations in the same region. In the past, the ILT Committee has found that nesting success can vary widely between islands in the Arkansas River each season.	Agreed. Habitat conditions vary drastically year to year. The NER includes a proposed sandbar island that will provide nesting habitat up to 20,000 cfs. While only adding a few acres of nesting habitat, this sandbar will also be kept vegetation free to provide the best possible nesting habitat allowed by the river elevation.
94	Content	94. Page 68, Chapter 3, Alternative Comparison, Is It Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 30, sentence 8. It is unclear how the new habitat provided for ILT nesting will protect the species from environmental disasters.	By restoring higher ecological function in the ARC, it provides additional habitat for ILT, among other species, that may be experiencing flooding, drought, etc in other regions within their distribution.
95	Content	95. Page 68, Chapter 3, Alternative Comparison, Is it Worth It Analysis on Final Array of Alternatives, Selection of National Ecosystem Restoration Plan, paragraph 30, sentence 8. This is the first mention of "contamination" affecting ILT populations. Please explain how contamination has affected ILT populations in the ARC.	
96	Content	96. Page 69, (lines 2-3), Chapter 4: Recommended Plan, paragraph 1, sentence 2. Please remove the reference to a "more natural river flow", as truly natural flow prior to any dam structures on the Arkansas River would involve more extreme flooding and longer dry spells than experienced today with the operation of Keystone dam. Suggest revising the sentence to state "With the implementation of the NER plan, a more consistent low regulated flow would be provided to 42 river miles of the Arkansas River within the study area during certain periods between releases from Keystone Dam."	Reword this to state "more continuous flows" or "more consistent regulated low flows." Also note, more natural river flow also refers to flow on a more local scale regarding the up and down flows (low-12,000 cfs+) currently occurring in the ARC.
97	Editorial	97. Page 69 (lines 4-7), Chapter 4: Recommended Plan, paragraph 1, sentence 3. Please see Comment #46 regarding disconnected floodplain.	See response to comment #46.
98	Content	98. Page 69, (lines 34-36), Chapter 4, Description of the Recommended Plan, Restoration Features, Pool Structure below Hwy. 97 Bridge, paragraph 1, sentence 2. Refer to Comment #26 concerning the impact of elevation 638.0 feet on Keystone Dam operations.	Final design parameters have not been determined. Preliminary design information was utilized, but will be further evaluated.
99	Content	99. Page 69 (lines 42-44), Chapter 4, Description of the Recommended Plan, Restoration Features, Pool Structure below Hwy. 97 Bridge, paragraph 1, sentence 6. Please see Comment #63 regarding how 1,000 cfs was chosen for pre-Keystone flow.	See response to comment #63.
100	Editorial	100. Page 71 (lines 12-14), Chapter 4, Benefits Gained for Nationally, Regionally, and Locally Significant Resources, paragraph 1, sentence 3. Please correct the misstatement that the alternative will "provide a continuous river flow" as 1) continuous water flow is not the natural state of the Arkansas River and therefore providing for continuous flow is not restorative and 2) the alternative does not actually provide for continuous water flow, as there will still be times of no water flow from Keystone Dam longer than will be able to be compensated for by the storage behind the proposed LWD. Suggest using the term "more consistent river flow".	Report will be edited to reflect a more continuous flow with the proposed NER.
101	Editorial	101. Page 71 (lines 12-14), Chapter 4, Benefits Gained for Nationally, Regionally, and Locally Significant Resources, paragraph 4, sentence 1. Please see Comment #100 above regarding correction of the term "continuous river flow".	Report will be edited to reflect a more continuous flow with the proposed NER.

<u>Comment ID</u>	<u>Comment Type</u>	<u>Comment</u>	<u>Response</u>
102	Editorial	102. Page 72 (lines 19-21), Chapter 4, Benefits Gained for Nationally, Regionally, and Locally Significant Resources, Scarcity, sentence 4, sentence 1. It is misleading to state that the Arkansas River will be restored to a more natural state, as a "more natural state" would be characterized by far more extreme flooding as well as longer dry spells than what is experienced today with the capability to regulate those extremes through storage and controlled releases. Suggest modifying the sentence to state "Providing more consistent flows to this section of the Arkansas River promotes the proliferation of ... "	Report will be edited to reflect a more continuous flow with the proposed NER.
103	Content	103. Page 72 (lines 23-26), Chapter 4, Benefits Gained for Nationally, Regionally, and Locally Significant Resources, Representativeness, paragraph 1, sentence 1. The sentence states that species "... continue to persevere in small numbers in the altered conditions." However, ODWC and Oklahoma State University personnel stated in the September 12, 2016 resource agency meeting hosted by the Corps concerning the Jenks/South Tulsa LWD that species were adapting and thriving in the ARC. Please confirm with ODWC whether or not species are diminishing or thriving.	Updated species population trends will be provided.
104	Editorial	104. Page 72 (lines 32-35), Chapter 4, Benefits Gained for Nationally, Regionally, and Locally Significant Resources, Representativeness, paragraph 2, sentences 5-6. Refer to Comment #10 regarding ILT nesting.	See response #10.
105	Content	105. Page 74 (lines 19-23), Chapter 4, Benefits of the Recommended Plan to Other Federal Goals and Objectives, paragraph 1, sentence 4. The sentence states that the 1,000 cfs would promote "... dilution of pollutants ...". The "dilution of pollutants" cannot occur when the recommended plan does not increase the volume of flow from Keystone Dam. As there is to be no change of or impact to existing Keystone Dam operations, suggest removing the reference to "dilution of pollutants".	Section will be updated.
106	Editorial	106. Page 75 (lines 20-24), Chapter 4, Benefits of the Recommended Plan to Other Federal Goals and Objectives, paragraph 4, sentence 1. Please revise the misleading statement regarding restoring natural flows as indicated in Comment #83.	See response to comment #83
107	Content	107. Page 75 (lines 25-28), Chapter 4, Benefits of the Recommended Plan to Other Federal Goals and Objectives, paragraph 5, sentence 1. This is the first mention of fish kills in the Draft Report. Please document the occurrence and magnitude of fish kills due to Keystone Dam operations, and there should be some discussion of water quality in the shallow water of the proposed LWD pool when Keystone Dam goes without releases for several days in hot, sunny weather.	The proposed pool structure will be designed to minimize the creation of any low water areas, as the full volume of the pool will be available for release. Although depressions and low lying areas likely exist in the area upstream of the proposed pool structure. Fish kills have occurred to varying magnitudes within the Arkansas River, above and below the ARC. Public comments received also noted local fish kills in the ARC.
108	Content	108. Page 76 (lines 27-29), Chapter 4, Project Implementation, Pre-Construction Engineering and Design, paragraph 3, sentence 3. The proposed LWD design should be completed earlier in the process than the Pre-Construction Engineering and Design phase. The LWD designs for Zink and Jenks/South Tulsa resulted in a myriad of concerns from resource agencies that have yet to be addressed.	Ongoing coordination will continue with resource agencies to ensure restoration objectives are met while not impacted by Keystone Dam operations.

<u>Comment ID</u>	<u>Comment Type</u>	<u>Comment</u>	<u>Response</u>
109	Concern	109. Page 79 (line 43), Chapter 4, Project Implementation, Monitoring and Adaptive Management, paragraph 1. Please define "adaptive management". This phrase is used throughout the document, but it is never clearly defined. It should be noted that the pool of the proposed LWD will offer little to no opportunities for reacting to issues upstream or downstream of the LWD. While the Draft Report states that there will be no change in operation of Keystone Dam due to the NER plan and the proposed LWD, Southwestern is deeply concerned that any adaptive management plan will ultimately rely on changes to existing Keystone Dam operations to meet expectations or correct any issues with operation of the proposed LWD. To ensure the Congressionally-authorized purposes of the Keystone project are not impacted, Southwestern strongly reiterates that the proposed LWD, and the National Ecosystem Restoration (NER), should not affect existing Keystone Dam operations. To ensure there is no impact to existing Keystone Dam operations, any operational or "adaptive management" plans need to be thoroughly vetted and approved by all involved resource agencies, including Southwestern, and applicable Corps personnel (hydropower, water management, regulatory, etc.) before development of the NER plan and construction of the proposed LWD.	Adaptive management is used to describe ability of the proposed pool structure to alter configuration from slowing down and prolonging river flow to allowing flow to pass either over, under, or through the structure depending on the design. The pool structure concepts were developed knowing no changes in release schedules by Keystone Dam would be made to accomate the pool structure. As such, there may be periods of dry river, however, the intent of the pool structure is to reduce the frequency of that occurring. Ongoing coordination with resource agencies, SWPA, and USACE water control will be necessary to ensure restoration objectives are met withouth impacting current Keystone operations.
110	concern	110. Page 81 (line 18), Chapter 4, Project Implementation, Views of the Resource Agencies, paragraph 1, sentence 1. Based on the September 12, 2016 resource agency meeting hosted by the Corps, it is clear several resource agencies have significant issues with the Jenks/South Tulsa LWD. Some of these issues would also be applicable for the proposed LWD at Sand Springs. The Corps should plan on hosting a resource agency meeting as soon as practical to discuss the proposed LWD and address the applicable issues.	Ongoing coordination will continue with resource agencies to ensure restoration objectives are met while not impacted Keystone Dam operations.
111	Content	111. Page 84 (lines 7-10), Chapter 4, Conclusions, The Arkansas River Corridor Ecosystem Restoration Project Recommended plan, bullet 12. There was no discussion of the Arkansas River sinuosity, slope gradient, or velocity in the Draft Report. If the plan does restore these features in the Arkansas River, the plan should discuss them throughout the Draft Report and provide data supporting these claims.	Brandon/David: greatest practicable sinuosity, slope gradient, velocity, and sediment transport... I'm not sure what the basis is for this statement. What is the greatest practicable sinuosity, slope gradient, velocity, and sediment transport? Not sure that the regulated flows impact the all of these parameters.
112	Content	112. Page 84, Chapter 4, Conclusions, The Arkansas River Corridor Ecosystem Restoration Project Recommended plan, bullet 13. It is a mischaracterization to say that this plan has wide spread local support as historically Tulsa County voters have defeated multiple ballot measures (2007, 2012) funding ARC LWD projects.	Other proposed LWDs had different objectives than the proposed project. Based on public comments and discussions thus far, the Tulsa area community appears to be in support of the project.
113	Editorial	113. Page 90, Chapter 5, Hydrology and Floodplains, TSP Alternative -Arkansas River Flows, paragraph 1, sentences 1 and 4. It is misleading to state that the proposed LWD provides for restoration of natural flows. Natural flows, prior to the existing dam structures in the Arkansas River, were characterized by far more extreme flooding as well as longer dry spells than what is experienced today with the capability to regulate those extremes through storage and controlled releases. Suggest removing statements referring to the restoration of natural flows and revising the sentences to accurately portray the intention of the proposed LWD, which is to provide more consistent flow.	Reword this to state "more continuous flows" or "more consistent regulated low flows"
114	Editorial	114. Page 90 (lines 25-26), Chapter 5, Hydrology and Floodplains, TSP Alternative -Arkansas River Flows, paragraph 1, sentence 3. The sentence states that the proposed LWD "full pool volume" (~628.0 to 638.0) will be needed to provide 1,000 cfs for 3.4 days. Elsewhere in the Draft Report it is stated that the LWD elevation will vary between 635.0 and 638.0 feet. Please clarify if the pool will only use three feet of its storage or the full volume.	Between regular hydropower generation, roughly only the top 3ft of the pool will be needed to maintain the 1,000 cfs between power generation cycles. The full pool will be used to maintain river flow when no releases are being made from Keystone (i.e. weekends). A full pool can maintain 1,000 cfs for up to approximately 3.4 days.
115	Concern	115. Page 120, Chapter 5, Recommendation. Southwestern is concerned that potential impacts the proposed LWD will have on the existing operations of Keystone Dam have not been fully addressed, as indicated in these detail comments. Until those concerns are addressed, a FONSI may be pre-mature.	Ongoing coordination will continue to address concerns. The FONSI is a draft copy and will not be signed until later in the study process.
116	non-comment	116. Page CXXII, Chapter 5, Draft Finding of No Significant Impact. See Comment #115. Note: Because the Appendices contain information that is already expressed in the main Draft Report, Southwestern will only address new comments in the Appendices.	No response

<u>Comment ID</u>	<u>Comment Type</u>	<u>Comment</u>	<u>Response</u>
117	Content	117. Appendix A, Page 23, HEP Analysis, HEC-RAS. Suggest adding a run at 6,000 cfs and 12,000 cfs for acreage and habitat comparison, as these release volumes will occur frequently even with the construction of one of the proposed LWDs.	Additional analyses using 6,000 and 12,000 cfs will not impact plan formulation. The amount of restoration achieved is the difference between the low flow condition and the future with project. While 6,000-12,000 cfs obviously provide more habitat, it is only for a brief period. The ability of an ecosystem to provide habitat is based on its limiting condition. In most riverine systems, the reoccurring lack of water and river flow can be considered the limiting condition. This assumption was made for the ARC and used to model measure benefits.
118	Content	118. Appendix A, Attachment 3, Page 54, Table, "River Flow" row. The Draft Report states (Page 62, Chapter 3: Plan Formulation, Selection of the National Ecosystem Restoration Plan, paragraph 3, sentence 1) that the proposed LWD is " ... critical to the restoration of the ARC and all other measures depend on restored river flow to be successful." The table contained in the Monitoring and Adaptive Management Plan only addresses the river flow one time, and the adaptive management plan for river flow is "Alter pool structure operations/design to achieve 1,000 cfs river flow." As stated earlier in the report, the entire volume of the proposed LWD will be drained in 3.4 days at 1,000 cfs. It appears that there is little flexibility in providing 1,000 cfs that does not include a change to existing Keystone Dam operations. Please revise the Monitoring and Adaptive Management Plan to include specifics and details of how the proposed LWD can be altered to provide 1,000 cfs flow without making any changes to existing Keystone Dam operations.	Adaptive management is used to describe ability of the proposed pool structure to alter configuration from slowing down and prolonging river flow to allowing flow to pass either over, under, or through the structure depending on the design. The pool structure concepts were developed knowing no changes in release schedules by Keystone Dam would be made to accommodate the pool structure. As such, there may be periods of dry river, however, the intent of the pool structure is to reduce the frequency of that occurring. Ongoing coordination with resource agencies, SWPA, and USACE water control will be necessary to ensure restoration objectives are met without impacting current Keystone operations. If no additional releases are made from Keystone Dam, the river will continue to dry as it does now.
119	Editorial	119. Appendix B, Page 1-6, 1.3 Project Alternatives, paragraph 3, sentence 1. The location of the original re-regulation dam downstream of Keystone is listed incorrectly. Please correct.	Concur, River Mile 531 is location of Original Rereg structure
120	Editorial	120. Appendix B, Page 1-6, 1.3 Project Alternatives, paragraph 4, Item 2. The Draft Report uses a LWD height of 638.0 feet rather than 638.5 feet used in Appendix B. The flow and duration values (1000 cfs for 1.65 days) provided by the calculations in Appendix B are lower than the flow and duration values (1000 cfs for 3.4 days) cited in the main Draft Report, despite the dam being higher (0.5 feet). Also, the storage cited in the Draft Report (6,730 ac-ft) is nearly double the storage in Appendix B (3,269 ac-ft) despite the dam being lower in the Draft Report. Please explain the difference.	Between regular hydropower generation, roughly only the top 3ft of the pool will be needed to maintain the 1,000 cfs between power generation cycles. The full pool will be used to maintain river flow when no releases are being made from Keystone (i.e. weekends). A full pool can maintain 1,000 cfs for up to approximately 3.4 days. Storage volumes will be verified.

<u>Comment ID</u>	<u>Comment Type</u>	<u>Comment</u>	<u>Response</u>
121	Concern	<p>121. Appendix I, Page 20, LIST OF RECIPIENTS- draft working copy August 23, 2016, Agency/Entity Southwestern Power Administration. The list of recipients indicates that Southwestern should have received a draft working copy of the Draft Report [Southwestern recipients listed as Mr.Scott Carpenter, Administrator, and Ms. Frieda Olsen - please correct this Southwesterncontact to Fritha Ohlson, Director, Division of Resources and Rates]. However, Southwestern does not receive and does not have any evidence of having received an earlier version of the Draft Report prior to the current publication for public comment, and therefore Southwestern has not previously provided general or specific written comments on this phase of the ARC feasibility study. Southwestern was aware of the development of the Draft Report, and was included in several meetings in 2016 with the Corps to discuss the ARC feasibility study. Those meetings focused on the ARC feasibility study preliminary assessment of reallocation of storage at Keystone and the impacts that alternative would have on the Keystone Federal hydropower purpose. Eventually, as stated in the Draft Report, reallocation was screened out as an alternative, and Southwestern supports that conclusion. Regardless, on numerous occasions in the past, either in meetings concerning the Corps' ARC efforts or in written comments regarding other projects downstream of Keystone Dam, Southwestern has always emphasized concern for the impact to existing Keystone Dam operations and the Federal hydropower purpose. Any operational change at Keystone Dam that negatively impacts Federal hydropower will not only directly influence Southwestern's ability to fulfill Federal contractual obligations for providing power to Federal hydropower customers, but will also affect Southwestern's statutory requirement to repay the Federal investment allocated to thehydropower purpose with revenues received from that sale of power.</p>	<p>Coordination efforts with SWPA will continue to ensure the ARC NER does not impact Keystone Dam or SWPA's operations.</p>