ARKANSAS RIVER CORRIDOR

Appendix L: Clean Water Act Compliance

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.

Section 404(b)(1) Analysis

Arkansas River Corridor Feasibility Report

U.S. Army Corps of Engineers,
Tulsa District

December 2017

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Project Description

1.1 Location

The Recommended Plan is located along the banks and within the mainstem of the Arkansas River in Tulsa County, Oklahoma. The study area is comprised of the 42-mile long Arkansas River Corridor (ARC) in Tulsa County that begins below Keystone Lake Dam and continues downstream east and south to the Wagoner County line (Figure 1-1). Key tributary streams in the study area include, but are not limited to, Prattville Creek at Sand Springs, Crow Creek in Tulsa, and Vensel Creek at Jenks, Oklahoma.

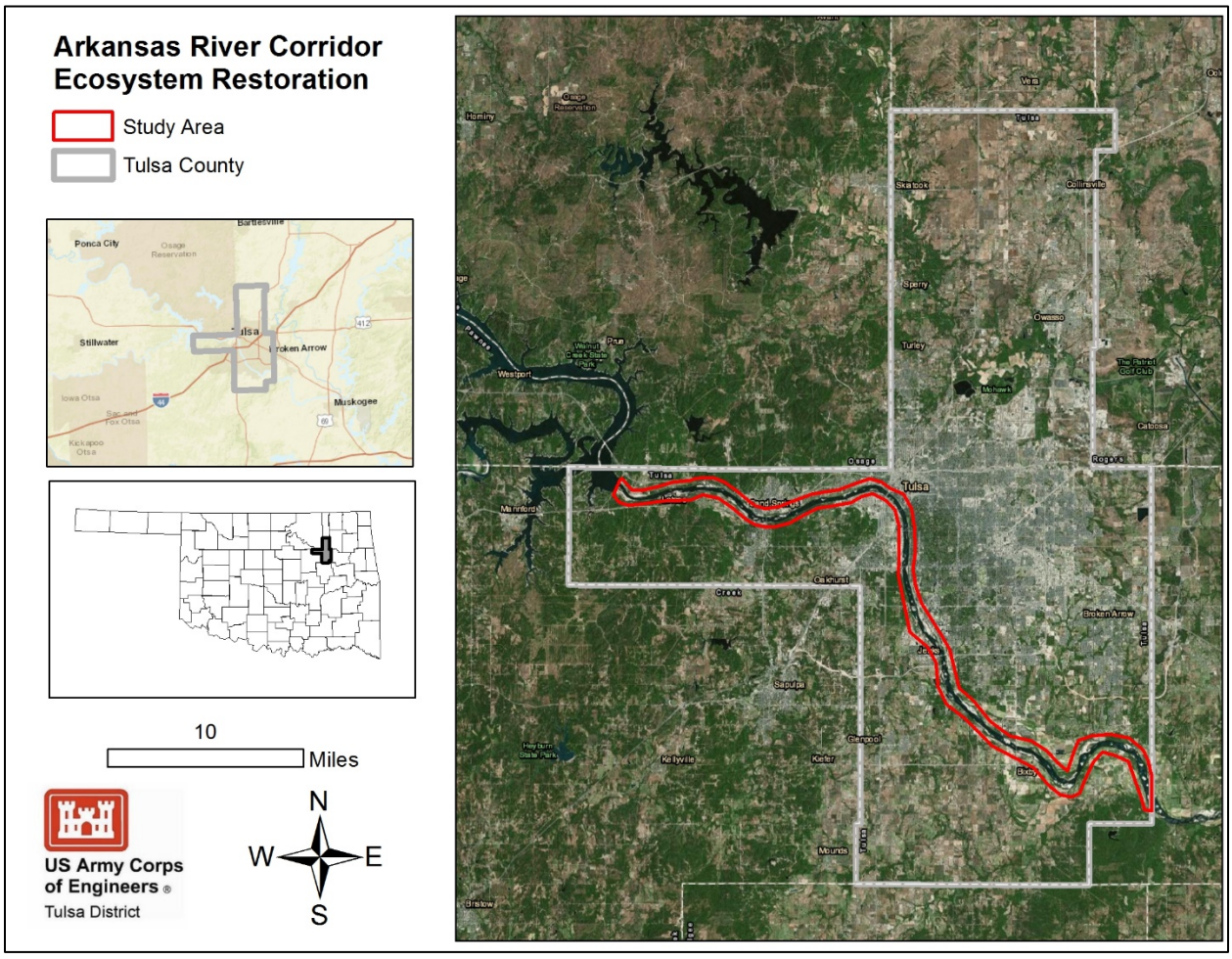

Figure 1-1. Arkansas River Corridor Study Area

1.2 General Description

While the Arkansas River has long been a significant natural resource for the surrounding land and its inhabitants, historical alterations have degraded watershed conditions and masked the river's potential. The 1964 construction of Keystone Dam for flood risk management significantly changed the natural hydrology and sediment transport patterns of the Arkansas River.

Additionally, growth and development associated with the Tulsa metropolitan area and intensive land use practices have led to stream bank erosion, destruction of riverine wetlands, increased stormwater runoff and sedimentation to the river, and impaired riverine ecosystems. The adverse impacts resulting from Keystone Dam operations for flood risk management, water supply and hydropower operations along with impacts from urbanization, flood risk management measures (levee system), constructed banks and erosion, and active sand-mining have degraded/reduced aquatic systems. These ecosystems would continue to decline 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. Within the ARC, the Arkansas River only receives water from Keystone Dam during flood pool releases and peak demand hydropower generation. Between these operations the lack of river flow can last hours to days, extended droughts can prolong these periods of exposed river bed and isolated river reaches.

The need for increased minimum river flow in the study area is paramount to restoration success. Native fish life histories, floodplain vegetation, and sandbar island habitat ideal for Interior Least Tern nesting are all dependent on river flow in the ARC.

The flexibility of the pool structure to adapt to environmental conditions is key to restoring the ecological functions of the ARC. When water is abundant, particularly during the monsoon season, the pool structure would allow river flow, fish and fish egg passage, and sediment transport through full height gates maintaining riverine habitat above and below the pool structure. The remaining components of the structure, partial height gates and support structures, would provide instream structure and velocity refuge.

Outside of flood pool releases from Keystone Dam, peak demand hydropower generation provides roughly six hours of river flow between 6,000 and 12,000 cfs on weekdays. The pool structure would increase minimum river flow, through temporary storage and rereleasing water, from approximately 100 cfs to 1,000 cfs between flood pool and hydropower generation. The construction and operation of the pool structure for the primary purpose of ecosystem restoration would increase the riverine habitat in the study area from 1,591 acres currently being supported by minimum flows to 3,735 acres that would be maintained by the 1,000 cfs release target. Additionally, 5.34 acres of backwater wetlands would be restored at the confluence of Prattville Creek and the Arkansas River using rock riffles and native wetland plantings along with five acres of sandbar island creation, three of which, would provide nesting habitat at flows up to 20,000 cfs.

This 404(b)(1) analysis addresses restoration alternatives considered for the recommended Arkansas River Corridor (ARC) project, the design concepts, and the most appropriate methods for achieving the purpose and need as well as the project objectives of environmental restoration. The Project alternatives analysis considered various ecosystem restoration methods in multiple locations within the Arkansas River Corridor (ARC) in Tulsa County, and siting with differing design concepts.

In recent years, citizens of Tulsa County have recognized both the potential of the Arkansas River as a resource and the need to address its unnatural flow regime, disconnected and degraded floodplain, declining water quality and loss or degradation of aquatic habitats.

The ARC has multiple resources of National Significance including the Interior Least Tern (referred to as Least Tern), Paddlefish, migratory waterfowl, songbirds, and other migratory birds, native riverine fishes and the McClellan-Kerr Arkansas River Navigation System.

1.3 Purpose and Authority

The purpose of the study is to evaluate the components of the October 2005 Arkansas River Corridor Master Plan and determine if there is a Federal interest that aligns with the U.S. Army Corps of Engineers (USACE) mission areas, i.e. flood risk management, ecosystem restoration, and navigation. Initially, this study assessed the ARC Master Plan for potential flood risk

management and recreation elements in addition to ecosystem restoration. Early in the study process the scope was narrowed to only include formulation for potential ecosystem restoration opportunities. Therefore, the purpose of the Feasibility Study is to investigate, evaluate, and propose, if appropriate, measures to restore the degraded ARC ecosystem structure, function, and dynamic processes to a less degraded, sustainable, more natural condition.

In response to multi-community support for the 2005 Master Plan concepts, the U.S. Congress created special authorization language in Section 3132 of the Water Resources Development Act (WRDA) 2007. Section 3132 authorized construction of ecosystem restoration, recreation, and flood risk management components identified in the Master Plan. The ARC study is authorized in the WRDA of 2007, Section 3132 as quoted below:

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.

1.4 Need

The basic project need is to mitigate the extreme flow variability, particularly the reoccurring no to low flow, downstream of Keystone Dam. The Recommended Plan is necessary to provide increased minimum river flow and improved overall ecosystem health and ecological functions of aquatic habitats within the ARC.

The need for the Recommended Plan is based on the following problem statements described further in the Feasibility Study:

- The reoccurring low to no river flow conditions between flood pool releases and hydropower operations creates numerous hydrologically disconnected river segments and aquatic ecosystem structure degradation and loss.
- Critical seasonal riverine functions have been altered causing degradation of habitat and loss of life requisites for native aquatic dependent species.
- Low to high river flow pulses associated with flood pool releases and hydropower operations create erosive forces that affect numerous components of the riverine environment (aquatic and terrestrial). Many of these degraded riverine components are associated with successful breeding, nesting, and brooding for the Interior Least Tern.
- The Arkansas River within the study area has been constrained to the point of having limited association with or connection to the floodplain component of the riverine ecosystem.

1.5 Project Goals

The USACE has further identified specific goals of the Project as follows:

- Restoration of a more natural flow regime which helps sustain Least Tern habitat is consistent with and supported by the USACE-Nature Conservancy Sustainable Rivers Project Memorandum of Understanding (USACE Institute for Water Resources {IWR} 2016).

- Restoration of the Arkansas Riverine ecosystem supports the ecosystem component of the America's Great Watershed Initiative.

- Restoration of the riverine ecosystem along the Arkansas River within the study area would support the larger community vision of the citizens of Tulsa County and surrounding communities.

Alternatives Evaluation

The alternatives were identified and evaluated by the USACE in an iterative process that considered a variety of factors. Avoidance and minimization of impacts to aquatic environment and other ecosystems, flood risk management, and hydropower generation were a critical consideration throughout the project planning processes, and would remain so throughout the design, construction and operational phases of the project. In all cases, alternatives were evaluated for their ability to meet the project's purpose and need.

2.1 Management Measures

Initially, discrete management measures were identified for target Arkansas River corridor areas and then alternative plans developed from sets of one or more management measures functioning together. Table 2-1 summarizes the management measures that were considered by function and geographic area.

Table 2-1. Management Measures

Management Measure Purpose and Area	Management Measure Type
Flow Regime	Pool structure located at former site of the Keystone Lake Project reregulating dam (river mile 531)
	Pool structure located at river mile 530 (Sand Springs)
Prattville Creek	Rock Riffle Structures
	Rock Riffle Structures + Wetland Plantings
	Rock Riffle Structures + Riparian Planting
	Rock Riffle Structures + Wetland Plantings + Riparian Plantings
I-44/Riverside	Rock Riffles Structures
	Rock Riffles Structures + Wetland Plantings
	Rock Riffles Structures + Riparian Plantings
	Rock Riffles Structures + Wetland Plantings + Riparian Plantings
Nesting Habitat	Constructed Least Tern Island

For each of the management measures shown in Table 2-1, alternative locations were considered as part of the evaluation and a number of sites were eliminated as not being practicable. For example, sites further downstream from the river mile (RM) 530 location were screened out as suitable pool structure locations due to potential Hazardous Toxic Radiologic Waste (HTRW) concerns along the river bank. Potential sites upstream of RM 531 were screened out because they could not provide the storage needed to maintain downstream flows. Locations between these two sites were screened out as unsuitable due to the proximity of bridges close to the river bank, which would constrain construction of a pool structure.

Potential ecosystem restoration locations for riffled stabilization and plantings, such as Franklin Creek, Joe Creek, Fred Creek and Vensel Creek tributaries, were eliminated because they would be incompatible with local plans for future recreation and economic development features near these sites. In a few cases, sites were eliminated from further consideration because mitigation or restoration is already being planned by other parties. Restoration at the Cherry Creek tributary was considered but then eliminated because it was previously riprapped, likely

to result in low plant survival rates, and would produce only relatively small benefits to a limited number of species.

Least Tern nesting habitats were similarly constrained. Upstream portions of the study area closer to the Keystone Dam are subject to higher erosive forces associated with Keystone Dam water releases and consequently are less suitable for stable sandbar formation. In contrast, downstream areas of the study area closer to the Tulsa County line are in proximity to existing nesting sites which enhances opportunities for Least Tern nesting.

2.2 Alternatives

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 the Cost Effectiveness and Incremental Cost Analyses (CE/ICA), which provides a measure of environmental restoration benefits (increase in with-project AAHUs) and annual costs (expressed in thousands of dollars).

CE/ICA analysis results identified 22 cost-effective plans with eight (including the No Action plan) being classified as “Best Buy” plans, or plans with the least incremental cost per incremental output or benefit gain.

The alternatives best buy plans are:

- Alternative 1: No Action
- Alternative 2: Pool structure located at Lake Keystone Project reregulating dam (RM 531).
- Alternative 2a: Pool structure located at RM 530 + Prattville Creek Rock Riffles and Wetland Plantings + New Least Tern Island
- Alternative 3: Pool structure located at RM 530 (Sand Springs)
- Alternative 4: Alternative 3 + Prattville Creek Rock Riffles and Wetland Plantings
- Alternative 5: Alternative 4 + New Least Tern Island.
- Alternative 6: Alternative 5 + Riverside/I44 Rock Riffles and Wetland Plantings
- Alternative 7: Alternative 6 + Riverside/I44 Riparian Plantings
- Alternative 8: Alternative 7 + Prattville Riparian Plantings

Upon reviewing the best buy array, the Project Delivery Team (PDT) decided an additional cost effective measure should be evaluated alongside of the best buy array in the “is it worth it” analysis. In order for a plan to be considered a National Ecosystem Restoration (NER) plan, it must be cost effective, but does not have to be a best buy plan. In reviewing the best buy plans, it was noted that only one plan included the pool structure at RM 531. This occurs because the two pool structures are mutually exclusive. Therefore, once the ICA model moves to the pool structure at RM 530, there is no further consideration of any plan that includes the upstream structure. In this case, the PDT felt that restricting the array of plans to only best buy plans could leave some of the planning objectives and benefits unaddressed. Therefore, they decided to add a cost effective plan labeled Alternative 2a, which consisted of the upstream pool structure at RM 531, rock riffles and wetland plantings at Prattville, and the new Least Tern sandbar island. This meets the requirements of a National Ecosystem Restoration (NER) Plan.

Figure 2-1 displays the incremental cost per incremental output for each alternative.

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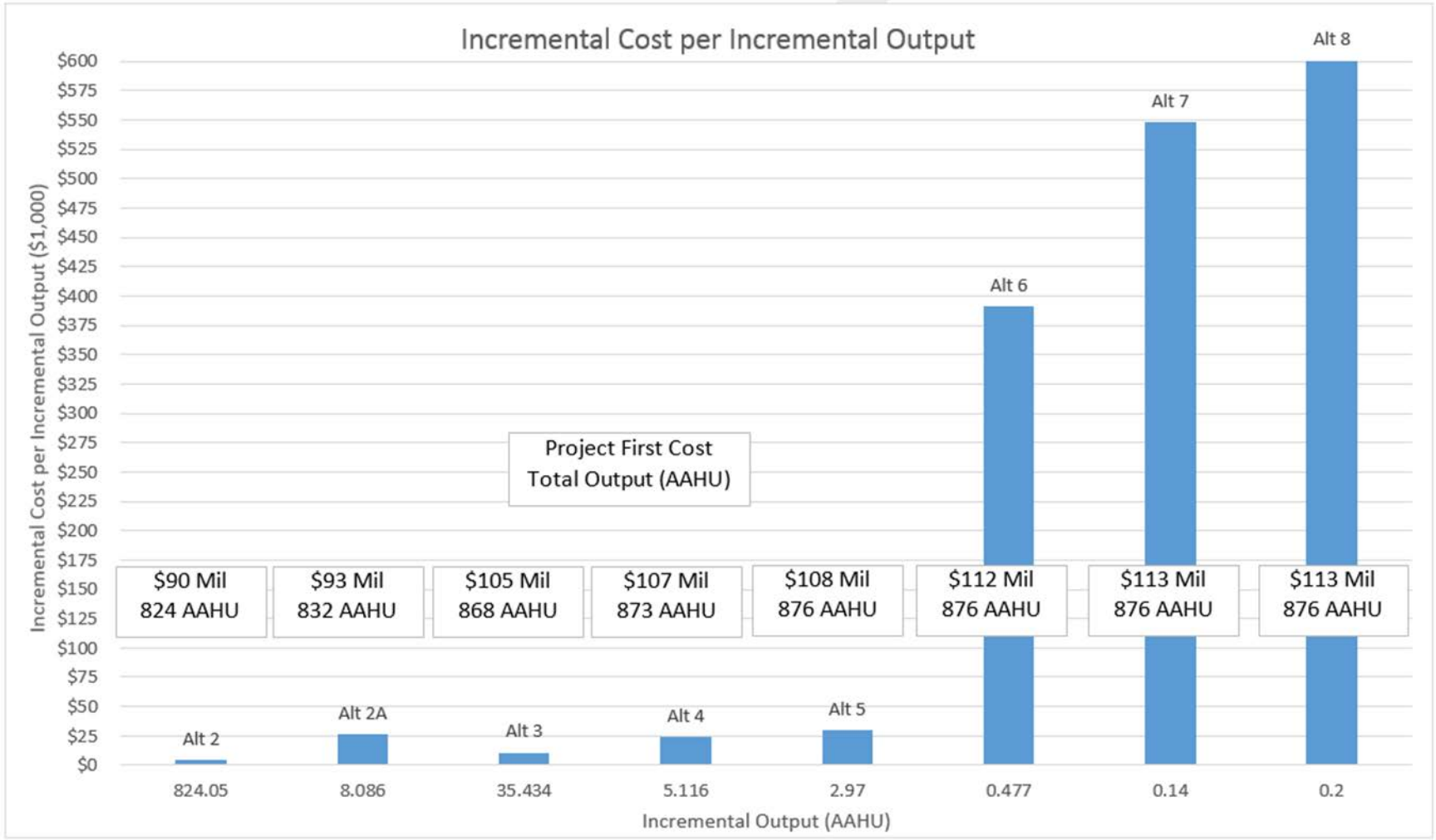

Figure 2-1: Comparison of the Final Array of Alternatives

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2.3 Impacts to Jurisdictional Wetlands/Waters of the U.S.

As part of the alternatives evaluation process, a semi-quantitative assessment of permanent impacts to jurisdictional wetlands and waters of the U.S. was conducted for the No-Action and eight best buy or cost-effective alternatives to allow for a relative comparison of impacts. Impacts that were considered included the permanent placement of fill material in jurisdictional boundaries such as the pool structure footprint, rock riffles, and rock chevrons. For purposes of the analysis, jurisdictional features were defined as any aquatic resource below the historic high bank of the Arkansas River which included riverine sandbars, open water, wetlands, and riparian forests.

The specific type and quality of specific habitat impacts were not evaluated for this analysis. Habitat types that would be affected by installation of management measures are expected to be primarily vegetated and non-vegetated riverine sandbars, various degraded wetland habitats, and open water. The dynamic nature of the Arkansas River, and shifting of habitat types over time, precludes a precise determination. Thus, each jurisdictional aquatic resource was estimated to have the same functional value on an aerial basis, i.e., 1 acre wetland is considered equivalent to 1 acre of riverine sandbar habitat in terms of functions they provide within the river corridor. Available U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) online mapping data for wetlands in the ARC were reviewed and determined too inaccurate based on previous project experience and current aerial imagery, and were not used for this analysis. Increased inundation of aquatic resources in the modeled pool areas upstream of the low water pool structure locations were not considered permanent impacts as these habitats are already periodically inundated during higher flow regimes. The difference in functional value of the conversion of habitat types in these areas was not considered for this analysis.

Aerial footprints of structures associated with each management measure were referenced or estimated from information provided in previous project associated documents. These provide an estimate of fill areas. Jurisdictional impacts by management measure and alternative are summarized in Tables 2-2 and 2-3. Based on the analysis, the estimated impact to jurisdictional areas from the permanent placement of fill materials is 2.89 acres for Alternatives 2a and 5, which is approximately 0.09 acres more than Alternative 2 (Table 2-4). By comparison, Alternative 5, increases the overall restoration area and the AAHUs and is the Recommended Plan.

Table 2-2 Estimated Impact Area by Management Measure

Management Measure	Length (feet)	Width (feet)	Area (square feet)	Total Area (acres)
Pool structure Footprint (RM 530 or RM 531)[a]			121,968	2.8
Prattville Creek Riffle[b]	80[c]	33	2,640	0.06
Riverside I-44 Wing Deflectors[b]	250[d]	26	6,500	0.45
	250[d]	26	6,500	
	250[d]	26	6,500	
Riverside I-44 Rock Riffle[b]	80[c]	33	2,640	0.11
	70[c]	33	2,310	
Least Tern Island Footprint [b]	43	10	430	0.03

56	10	560
36	10	360

Source:
[a] Arkansas River Low Water Dams and Public Access/Recreational Improvements Schematic Design and Cost Estimates (CH2M, 2015)
[b] Arkansas River Corridor Ecosystem Restoration Feasibility Report (USACE, 2015)
[c] Length estimated using Google Earth imagery
[d] Length calculated as 1/5th of the river width at this location

Table 2-3. Summary of Impacts to Jurisdictional Areas (Acres) by Alternative

Management Measures	Alternatives								
	1	**2**	**2a**	**3**	**4**	**5**	**6**	**7**	**8**
No Action	0.00								
Flow Regime									
Pool Structure at RM 531 (former reregulation dam site)		2.8	2.8						
Pool Structure at RM 530				2.8	2.8	2.8	2.8	2.8	2.8
Prattville Creek									
Prattville Creek Rock Riffle			0.06		0.06	0.06	0.06	0.06	0.06
I-44/Riverside									
Riverside/I-44 Rock Riffle							0.56	0.56	0.56
Nesting Habitat									
New Least Tern Island			0.03			0.03	0.03	0.03	0.03
Estimated Total Impact (acres)	**0.00**	**2.80**	**2.89**	**2.80**	**2.86**	**2.89**	**3.45**	**3.45**	**3.45**

Assumptions: Jurisdictional features include any aquatic resource below the high bank of the Arkansas River (sand bars, open water, wetlands). Each aquatic resource has the same value on an aerial basis (1 acre wetland = 1 acre riverine sandbar).

2.4 Least Environmentally Damaging Practicable Alternative (LEDPA) Analysis

Alternatives 2a and 5 were determined by the PDT to represent the two least environmentally damaging practicable alternatives for restoration, as both would provide restoration of three of the four targeted habitat types in the study area (riverine, wetland, and sandbar island) so they better meet the Project's purpose and need. In addition, the area of impact associated with

dredge and fill activities would be the same (2.89 acres) with implementation of either alternative. They both restore river flow and downstream floodplain connectivity through the construction and operation of a pool structure. In addition, both alternatives entail constructing a sandbar island to support Least Tern nesting with suitable habitat remaining available at flows up to 20,000 cubic feet per second (cfs). Finally, both include wetland restoration at the confluence of Prattville Creek and the Arkansas River. The only difference between the two alternatives is the location of the pool structure, with the Alternative 5 pool structure being one mile downstream from the pool structure in Alternative 2a.

An additional comparison of the two final alternatives was conducted to evaluate sustainability, which is the goal of any restoration project. The only difference between Alternatives 2a and 5 is the location of the pool structure. Table 2-4 illustrates the differences between the No Action, Alternative 2a and Alternative 5. The downstream structure at RM 530 (Alternative 5) allows for a synergistic effect with the other key restoration measures to ensure a sustainable riparian ecosystem within the corridor. Alternative 5 would not only restore threatened and endangered species habitat, and the larger ecosystem on which they depend, but can provide the 1,000 cfs flow through the weekend, whereas Alternative 2a cannot, due to the larger pool capacity of the pool structure location at RM 530. Providing river flow over the weekend, between hydropower generation, is crucial as no loss of ecosystem function would occur.

Table 2-4. Comparison of No Action, Alternative 2a, and Alternative 5

Component	No Action	Alternative 2a	Alternative 5
Constructability	Downstream HTRW	No further HTRW Risk	Potential further HTRW Risk
Operationally	Keystone Dam	4,860 ac-ft storage	6,730 ac-ft storage
Adaptability	N/A	High & Low Flows	High & Low Flows
Climate Change	No Change	~2.5 days @1,000 cfs (at full capacity)	~3.5 days @1,000 cfs (at full capacity)
Ecologically	Deteriorating	+3,614 restored river acres	+3,735 restored river acres
Sustainability	No Change	No weekend flow	Weekend flow

*Ac-ft = acre-foot

In summary, Alternative 5:

- Restores river flow
- Targets 99.8% of total acreage identified for restoration within the study area - 3,740 acres
- Improves three of the four targeted habitat types
- Increases habitat value--876 AAHU of output
- Provides resilient nesting habitat for the federally endangered Least Tern
- Provides river and floodplain connectivity throughout the 42-RM study corridor
- Is estimated to have a first cost of $108 million, with an annual cost of $4.6 million

Recommended Plan

3.1 Project Description

The Recommended Plan includes the construction of three measures: a flow regime measure (pool control structure) at RM 530 on the Arkansas River near Sand Springs, wetland restoration near RM 530 (Prattville Creek), and sandbar island restoration (new Least Tern Island) near Broken Arrow (Figures 3-1, 3-2, and 3-3).

Flow Regime Measure Construction at RM 530 on the Arkansas River near Sand Springs

The Flow Regime Measure (also referred to as a pool structure) on the Arkansas River in the City of Sand Springs is approximately 1,500 feet downstream of the Highway 97 Bridge just upstream from the confluence of Prattville Creek and the Arkansas River (Figure 3-1). The design and operation of the recommended structure would temporarily capture and re-release hydropower and Keystone Dam releases to maintain more consistent minimum river flow of 1,000 cubic feet per second (cfs) throughout the study area. For comparison, 100 cfs was used as the current minimum river flow between hydropower and flood pool releases can drop to nearly no river flow (Figures 3-1A, and 3-1B). In order to maintain riverine conditions above and below the pool structure, the design and operation of full and partial height gates would provide sediment passage, and at a minimum, seasonal fish passage and spawn/fry movement downstream. The pool structure would re-release water between releases associated with Keystone Dam to fill in the river flow gaps that currently hamper ecosystem health.

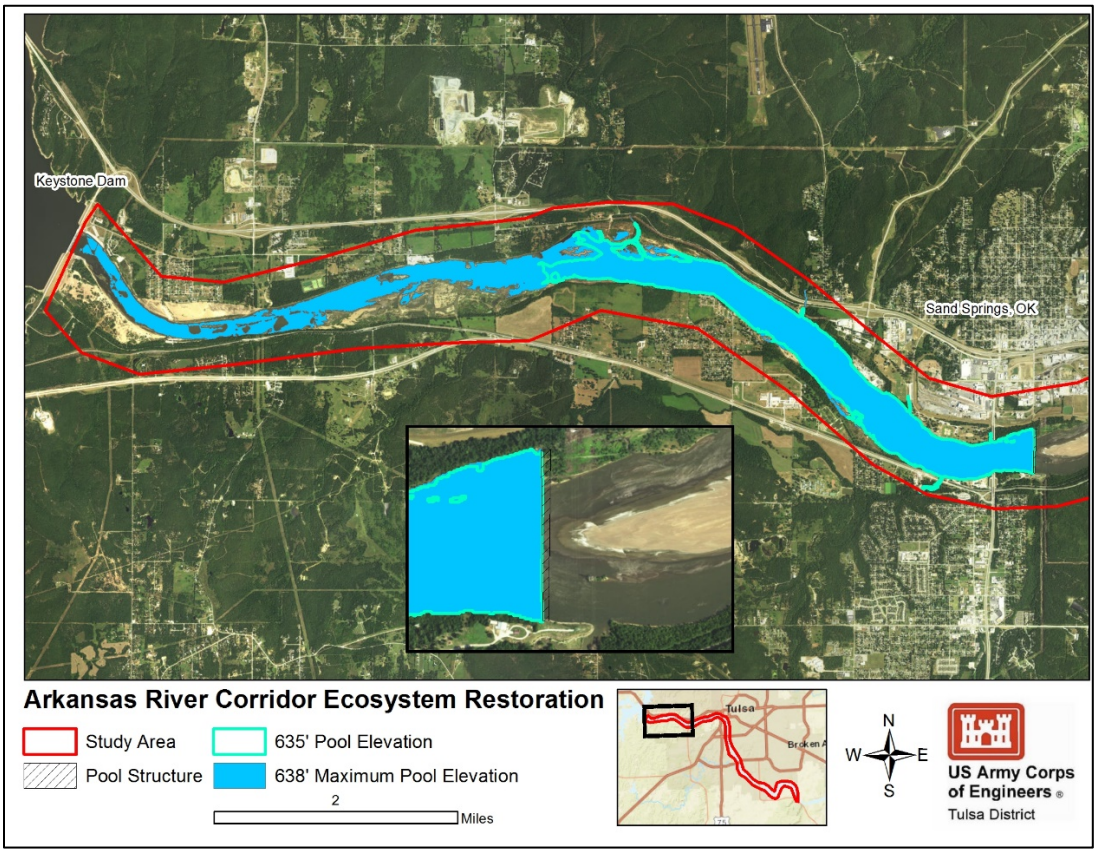

Figure 3-1. Recommended Pool Structure at RM 530

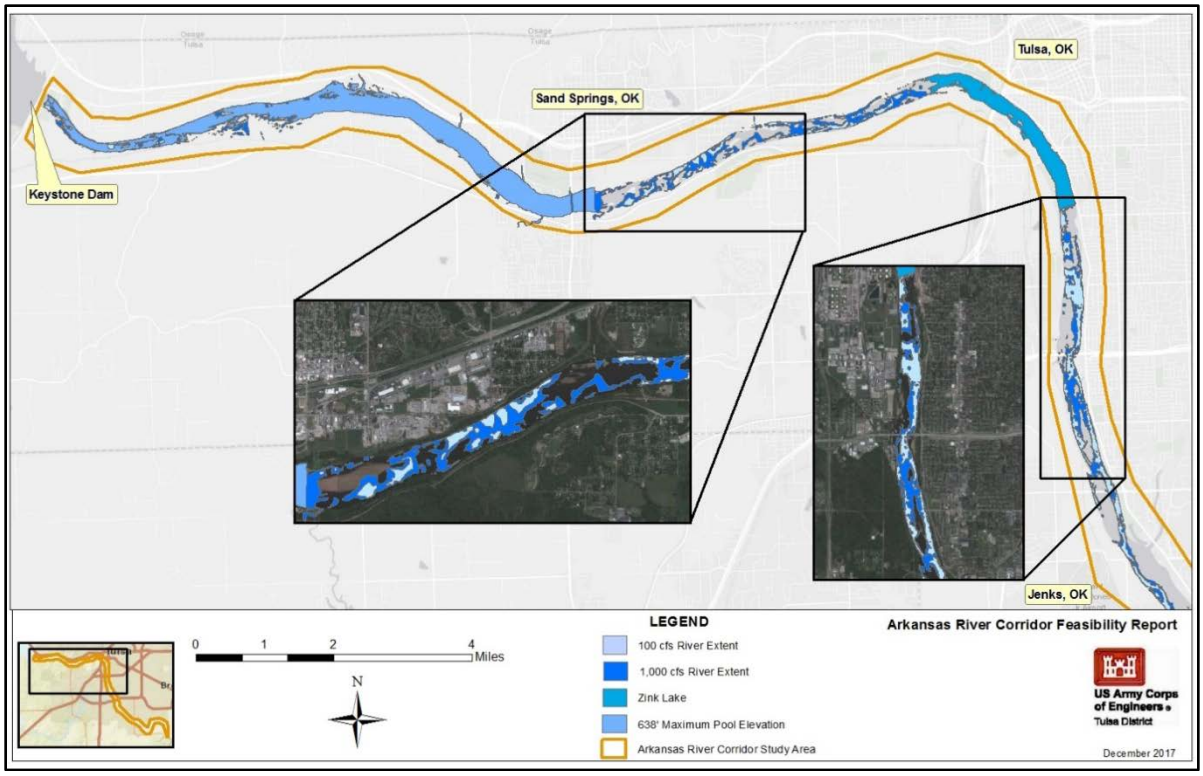

Figure 3-1A. A comparison of FWOP and FWP water surface area in the ARC (upper region).

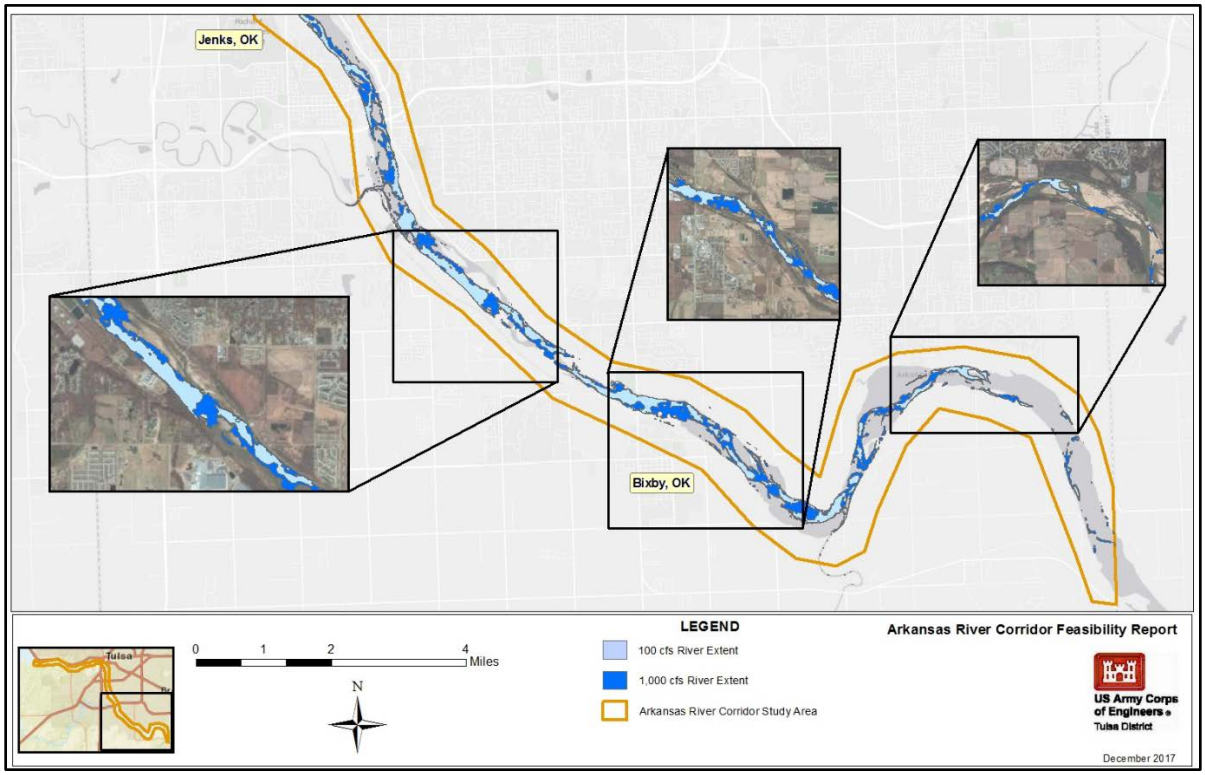

Figure 3-1B. A comparison of FWOP and FWP water surface area in the ARC (lower region).

The potential impacts from the construction of the pool control structure would include significant, long-term positive impacts from the increase in riverine habitat throughout the study area. Currently, low flow conditions provides 1,422 acres of riverine habitat. With the recommended pool structure, 3,735 acre of riverine habitat would be supported. The river reach

upstream of RM 530 would fluctuate frequently, as it currently does with reoccurring water releases, down to the 635 foot elevation between weekday hydropower generation cycles as it releases water to maintain river flow downstream. Use of the full pool storage would also occur during weekends when no hydropower or flood pool releases are made in order to maintain minimum. Downstream of the flow regime measure, temporary riverine habitats would become more persistent and increase in acreage throughout the study area from the increases in minimum river flow to 1,000 cfs. The increase in acreage and higher average daily flows would provide increased connection of riverine habitats to other surface waters, wetlands, and riverine sandbars. The increase in permanent open water acreage would promote increases in fish abundance and biomass in the study area. The more persistent flows would help to stabilize aquatic food webs that become established in these habitats. Migratory waterfowl, shorebirds, and wading birds would have increased resting and foraging habitats.

The construction of the pool structure would result in excavations at the structure site and the placement of fill material within the river channel along the sides of the river. The estimated area of dredge and fill in jurisdictional areas associated with the pool structure is 2.8 acres.

Ecosystem Restoration Measure near RM 530 (Prattville Creek)

Prattville Creek is a right-bank tributary to the Arkansas River downstream of the Highway 97 Bridge at Sand Springs, Oklahoma (Figure 3-2). An engineered rock riffle would be placed at the mouth of Prattville Creek at its confluence with the Arkansas River to create a 5.34-acre wetland. The rock riffle would impound flows from Prattville Creek and be over-topped by high flows in the Arkansas River. The wetland increases the area of open water and would also restore low flows in the original Prattville Creek channel, which parallels the right bank of the Arkansas River to the original confluence, approximately 1 mile east (downstream) of the current mouth. The rock riffle structure is a prerequisite for the wetland plantings. Wetland plantings around the perimeter of the created wetland (approximately 3,000 ft. excluding the rock riffle) include rushes and bulrushes. The plantings would help stabilize banks of the wetland area and provide forage and cover for insects, amphibians, and waterfowl.

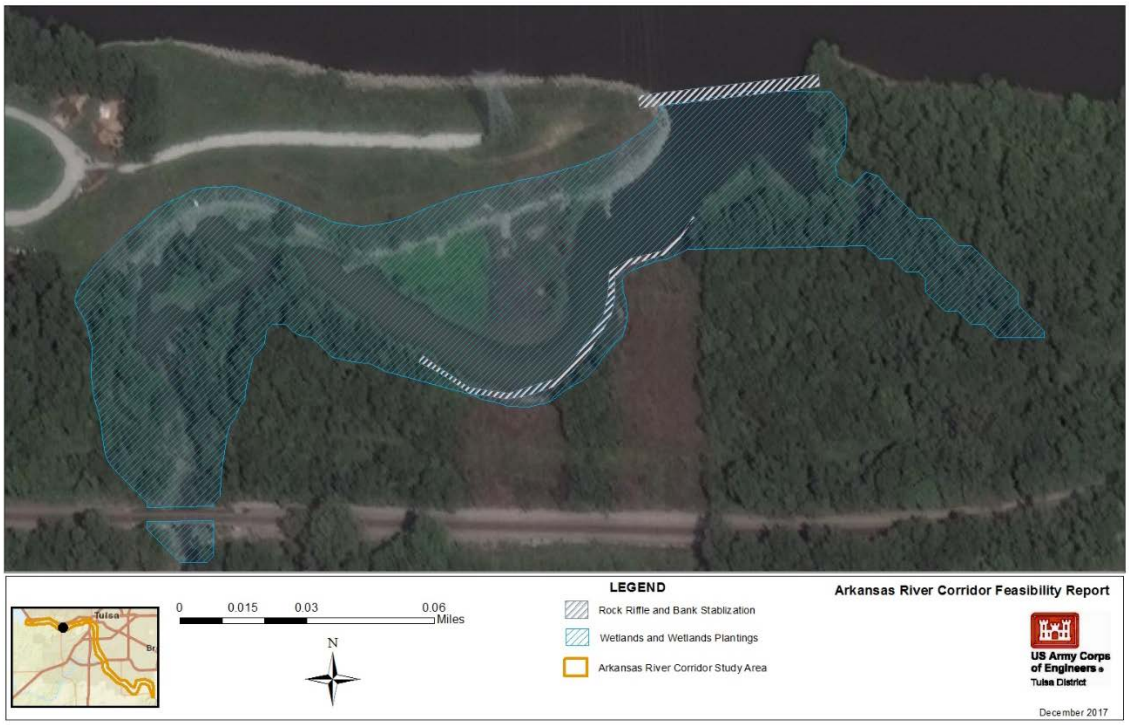

Figure 3-2. Prattville Creek Wetland Restoration

The creation of a rock riffle and wetland habitat feature at the mouth of Prattville Creek would create a small permanent pool behind the rock riffle. The pool would provide a small increase in local open water habitats along with increases in fish and macroinvertebrate abundance and biomass. There would also be localized minor habitat increases for migratory, wading, and shore birds. Water from Prattville Creek would be directed downstream towards the historic mouth of Prattville Creek and provide increased localized surface water availability. The creation of the permanent pool at the mouth of Prattville Creek would provide minor, long-term, positive impacts to riverine habitats in the study area.

Construction of the rock riffle structure would involve the placement of 6 inch thick aggregate bedding followed by a layer of 24 inch size riprap. The southern bank would be lined with a layer of 12-inch size riprap to protect the bank from erosive forces. The estimated area of fill associated with the rock riffle in jurisdictional areas is 0.06 acres.

Ecosystem Restoration Measure (New Least Tern Island) at Broken Arrow

This management measure would increase nesting habitat for the Interior Least Tern by providing a sandbar island isolated by river flows (Figure 3-3). The constructed sandbar would be approximately five acres with a nesting area (available area when river flows reach 20,000 cfs) of approximately three acres. The nesting area would be circular to oblong in shape with maximum surface area and have a surface height above water to exceed 18-inches at nest initiation that is usually in May or June. The nesting substrates for the constructed island would consist of well-drained particles ranging in size from fine sand to small stones.

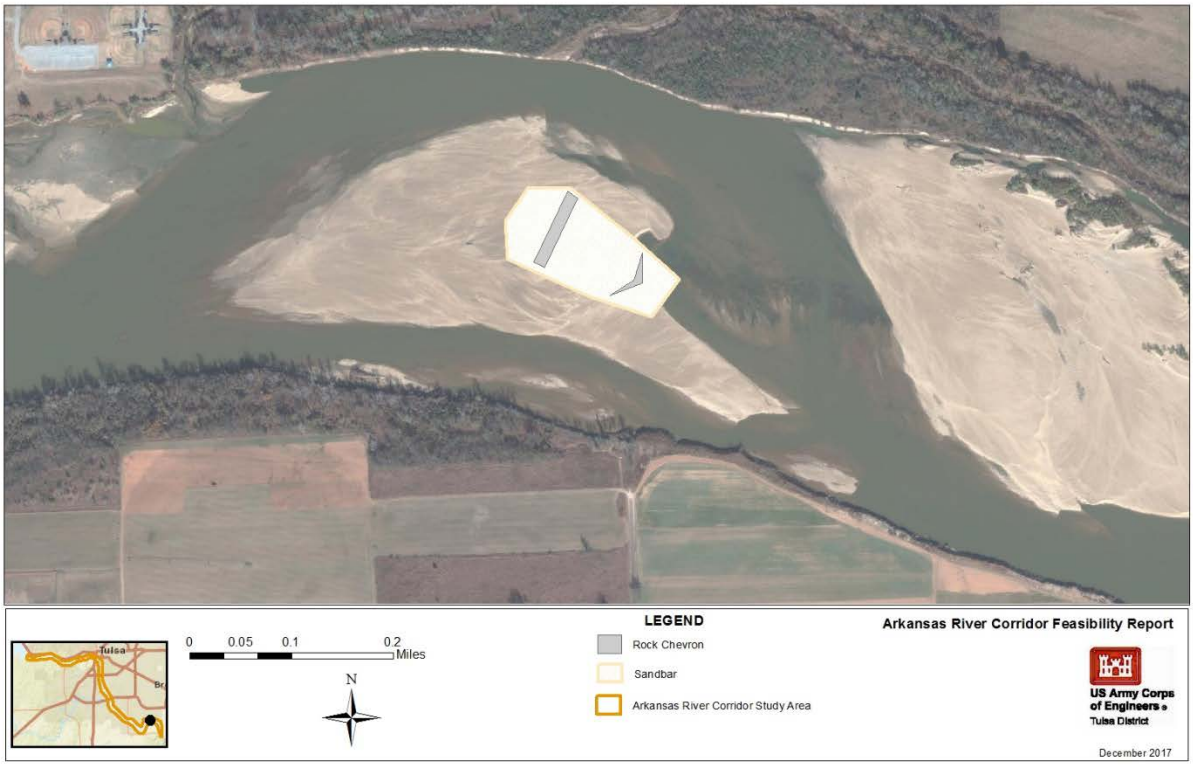

Figure 4-3. Constructed Least Tern Island

The anticipated design would be modeled after one developed by Oklahoma State University for the USACE, Tulsa District in May 2003. This 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 would promote sandbar development about the riprap structures, and provide scour to limit vegetative growth on sandbars when developed.

The estimated area of fill associated with rock placement in jurisdictional areas is 0.03 acres.

Based on consultation with the USFWS 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. USFWS Oklahoma Ecological Services, with similar least tern habitat construction projects in the ARC, has recommended the island be placed in the active channel of the Arkansas River. This provides distance from the streambank and increased water flows, thus preventing any land bridging to the island. The new habitat location would be designed to have near-neutral hydraulic impacts. The current recommended location is in the Arkansas River just south of the Indian Springs Sports Complex in Broken Arrow, Oklahoma.

The island would be constructed away from any tall structures or vegetation. A recommended distance of 600 ft. to tall vertical structures or vegetation would be incorporated into the final design. The island would be posted to deter human disturbance. Tall vegetation would be removed during the non-nesting season (September–April) and be part of the adaptive management monitoring plan.

3.2 General Description of Dredged or Fill Material

3.2.1 General Characteristics of Material

Based on available data, subsurface conditions at the pool structure location at RM 530 are interbedded alluvial silt, clay, and sand overburden overlying shale bedrock. In some locations, residual clay soils are found overlying the shale. The loose, erodible, and relatively highly permeable nature of the overburden makes it unsuitable for supporting the recommended pool structure and it would be dredged and removed. Fill material for the pool structure would be concrete with some minimal reinforcement. Based on other designs for low water dams on the river, the pool structure would be concrete, or other material with similar density. The stepped face could be constructed of mass concrete, grouted riprap, anchored stone blocks, and would depend on hydraulic determinations.

Construction of the rock riffle structure at Prattville would involve the placement of 6-inch thick aggregate bedding followed by a layer of 24-inch size riprap. The southern bank would be lined with layer of 12-inch size riprap to protect the bank from erosive forces.

Construction of the Least Tern island would involve placement of 30-inch stones at the upstream and downstream ends. The middle of the island is anticipate to fill in with natural sediment in the recommended sandbar location.

3.2.2 Quantity of Material

Based on conceptual designs approximately 49,782 cubic yards of unsuitable material would need to be excavated at the pool structure location at RM 530 and replaced with 21,898 cubic yards of concrete. No excavation of material would be required at the rock riffle construction site, just some grading of existing soils and then placement of approximately 6,200 cubic yards of various sizes of aggregate and riprap. At the construction site for the Least Tern island, no excavation would take place, just placement of roughly 5,200 cubic yards of 30-inch stones.

3.2.3 Source of Material

The source for the concrete, aggregate, riprap, and 30-inch stones has not been determined, but the materials would be tested by USACE field construction engineers to verify it meets the specifications as required by the design and specifications in the construction contract prior to it being used in the construction of the various features. Therefore, it is anticipated that the materials would be free of any contaminants.

3.3 Description of the Recommended Discharge Site(s)

3.3.1 Location

The discharge sites include the location for construction of the pool structure from bank to bank across the Arkansas River, 1500 feet downstream of the Highway 97 Bridge. The engineered rock riffle would be placed at the mouth of Prattville Creek at its confluence with the Arkansas River to create a 5.34-acre wetland and the recommended location for the Least Tern island is in the Arkansas River just south of the Indian Springs Sports Complex in Broken Arrow, Oklahoma.

3.3.2 Size

Approximately 2.8, 0.06, and 0.03 acres would be permanently affected by fill associated with restoration activities at the pool structure at RM 530, the Prattville Creek riffle structure, and the Least Tern island, respectively.

3.3.3 Type(s) of Sites

In the case of the Recommended Plan all sites are considered riverine.

3.3.4 Type(s) of Habitat

As discussed previously, riverine, wetland and sandbar habitats to be affected by restoration activities are degraded with a hydrology that varies from a flowing river to stagnant isolated pools and a disconnected floodplain lasting from several hours during the week to several days over the weekend. Because of the inconsistent, unnatural flow regime, all aquatic and riparian habitat types as well as the flora and fauna throughout the study area have been affected.

The site of the recommended pool structure is riverine with degraded wetland, and sandbar habitat. 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 down cutting. The portion of the river where the recommended Least Tern island is sited experiences low flows where the river bed is exposed and the sandbar islands become connected to the shoreline. This fluctuating flow cycle coincides with peak Interior 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.

3.3.4.1 Waters/Wetlands

All of the waters within the footprint of the Recommended Plan construction elements are considered jurisdictional. Because of the severe degradation of the riverine habitat types, i.e. wetlands, sandbars, riparian vegetation, in the study area as identified in the need section of this analysis (Section 1.4), all 2.89 acres of impacted jurisdictional waters are considered open waters and degraded wetlands, and sandbars.

3.3.5 Timing and Duration of Discharge

Construction of each of the restoration measures would be timed to occur during low flow periods to minimize impacts to the aquatic system. A more detailed schedule would be developed during design and bid stages of implementation.

3.4 Description of Disposal Method

Heavy construction vehicles and equipment would be needed to construct the project components described above, including excavation, backfilling, and installing berms and riprap. The vehicles and equipment would operate above the high bank of the Arkansas River in upland

areas and outside of riparian buffer habitats (within 50 ft. of the top of bank) to the extent possible. They would also need to operate below the high bank of the Arkansas River within riverine sandbar habitats for access to construction areas. While below the high bank of the River, heavy vehicles and equipment would avoid delineated wetland habitats where possible.

An assortment of wheeled and tracked equipment necessary to handle large loads of rock, such as backhoes, track hoes, bulldozers, dump trucks, and front end loaders, would be used for construction. All suitable onsite material excavated, along with stone brought in from off-site, would be used as fill material for the construction of the project's restoration features. Unsuitable or excess materials would be hauled off and disposed of properly. Project work would take place during safe and low flow conditions.

The temporary staging and storage of construction materials and vehicles would be sited in areas that are currently disturbed or are recommended to be cleared from the construction of the project components described above. All staging and storage areas would be outside of jurisdictional wetlands. Best management practices (BMPs) in staging areas would include erosion control and spill prevention measures.

3.5 Factual Determinations

3.5.1 Physical Substrate Determinations

3.5.1.1 Substrate Elevation and Slope

The existing substrate elevation for Arkansas River within the project area is approximately 615 - 620 feet above mean sea level (msl) with an average bank slope of approximately 3H:1V at the pool structure site. The rock riffle structure and nesting island would be located on the river bed which is generally flat-bottomed. The elevation and slope of the river would remain the same under the Recommended Plan.

3.5.1.2 Sediment Type

The Choska-Severn soil series is the predominant soil series in the area, according to the Natural Resources Conservation Service (NRCS) Soil Survey of Tulsa County, Oklahoma. These soils are characterized as deep, well-drained sandy to silty loam overlying loamy and sandy floodplain alluvium.

Widespread bank erosion is evident throughout the river corridor along the study area. The river banks throughout and upstream of the study area are generally sandy and highly erodible. The channel downstream of Keystone Dam has experienced incision and bank erosion as it has been scoured of sediment to regain the sediment load of the river that is trapped upstream in Keystone Lake. The rapid fluctuation in river flow has reduced and degraded native wetland habitats, has reduced the stability of rooted vegetation along river banks, and increased erosion. This erosion would likely continue until the banks of the channel are armored.

3.5.1.3 Dredge/Fill Material Movement

Since the excavated material at the pool structure site would be replaced with a concrete structure that is designed to tie into the river banks as part of the recommended project construction, no movement of dredge or fill material is anticipated once construction is complete. For the rock riffle structure, the size of the riprap selected for placement would be based on that needed to maintain a stable structure under most flow events of the Arkansas River within the project area. Finally, the anticipated design for the nesting island, developed by Oklahoma State University for the U.S. Army Corps of Engineers, Tulsa District, 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 would promote sandbar

development about the riprap structures, and provide scour to limit vegetative growth on sandbars when developed.

3.5.1.4 Physical Effects on Benthos

Under the Recommended Plan, unavoidable impacts to aquatic habitats would be created from the placement of concrete fill material used for the construction of the pool structure and the placement of riprap associated with the rock riffle and nesting island structures. Once the construction is completed, benthos from the surrounding undisturbed sediments would be expected to quickly colonize the sediments around the new in-stream structures. During construction, erosion and sedimentation Best Management Practices (BMPs) would be utilized to minimize impacts to benthos downstream of the recommended project area.

3.5.1.5 Other Effects

Temporary impacts to aquatic organisms and fish could occur during construction from the earthmoving activities with the potential for temporary sedimentation and water quality degradation of downstream habitats during construction.

3.5.1.6 Actions Taken to Minimize Impacts

Impacts would be minimized to the extent possible by scheduling construction to coincide with low flow periods and coordinating operational releases from the Keystone Dam. Cofferdams would be used to divert flows from construction areas, and silt fences and geotextile filters would be placed to minimize sediment transport downstream. Staging and construction access areas would avoid wetlands and aquatic habitats to the extent possible to minimize temporary disturbances and provide distance between aquatic habitats and exposed sediments. Best management practices would be detailed as designs for the different elements of the Recommended Plan are prepared. Thus, the existing aquatic organisms and fish found at the construction sites would be temporarily affected during construction and expected to then recover and improve post construction.

3.5.2 Water Circulation. Fluctuation and Salinity Determinations

3.5.2.1 Salinity

The project would not impact salinity of the Arkansas River. The design and operation of the structure to maintain river flow would not concentrate sediment, nutrient, or minerals. The reoccurring flood pool and hydropower releases coupled with routine maintenance of the pool capacity would ensure salinity levels are maintained within acceptable ranges.

3.5.2.2 Water Chemistry (pH. etc.)

The project would not impact water chemistry of the Arkansas River.

3.5.2.3 Clarity

Temporary disruption to water clarity is expected during construction. After the in-stream construction is completed and disturbed areas on the banks revegetated, water clarity would be the same as it is currently.

3.5.2.4 Color

No changes in color are anticipated following construction.

3.5.2.5 Odor

No changes in odor would occur following construction.

3.5.2.6 Taste

Implementation of the Recommended Plan elements would not affect the water’s taste following completion of the construction.

3.5.2.7 Dissolved Gas Levels

No change in dissolved gas levels would occur following construction.

3.5.2.8 Nutrients

No change in nutrient levels would occur following construction.

3.5.2.9 Eutrophication

No changes as a result of implementation of the Recommended Plan would impact eutrophication of the aquatic system of the Arkansas River.

3.5.3 Current Patterns and Circulation

3.5.3.1 Current Patterns and Flow

The Arkansas River originates from headwaters near Leadville, Colorado, and flows 1,450 miles through Colorado, Kansas, Oklahoma, and Arkansas to the confluence with the Mississippi River near Rosedale, Mississippi. The Arkansas River was once an uncontrolled prairie river but over the past century has been affected by anthropogenic activities. With completion of Keystone Dam in 1964, river dynamics below the dam changed.

Based on USGS daily average discharge data following the construction of Keystone Dam in 1964, the median daily average flow is approximately 4,000 cubic feet per second (cfs) at the Tulsa gage (located on the 11th Street Bridge near downtown Tulsa), and approximately 5,200 cfs at the Haskell gage (located on the State Highway 104 Bridge near Haskell, Oklahoma). The annual mean flow at these locations is approximately 8,400 and 10,100 cfs, respectively.

Monthly mean flows in the Arkansas River are typically higher during the spring and summer months compared to the fall and winter. From March through July, the long-term average monthly mean flows exceed 10,000 cfs at both Tulsa and Haskell. From August through February, the long-term average monthly mean flows are less than 8,000 cfs.

A significant effect of Keystone Dam on the Arkansas River has been a reduction in the downstream sediment supply. The mean annual suspended sediment concentration decreased by 82 percent from 1,970 mg/L (1931-1964) to 350 mg/L (1965-1995) at the Tulsa gage. Similarly, the mean annual suspended sediment flux decreased by 73 percent from 14.7 to 4.0 megatons after completion of the dam. The Haskell gage station exhibited a similar post-dam pattern of annual fluxes.

The Pool Structure at RM 530 would create a fluctuating riverine pool that extends upstream from the structure nearly 9 miles to Keystone Dam, this river reach encompasses at least 13 perennial or intermittent tributaries. Downstream of the pool structure, the increase in minimum river flow from 100 cfs to 1,000 cfs between flood pool and hydropower releases would expand riverine habitat within the existing Arkansas River channel. As such, the water depth at the confluence with these tributaries would be more stable, and when the Arkansas River flows are low, the water depths would be greater. The magnitude of the water depth change imparted by the construction of the flow regime measure is within the historical range of water depths that have occurred within the Arkansas River; so, this change is not likely to impart any negative morphological impacts on the mainstem channel or tributaries upstream or downstream of the structure.

3.5.3.2 Velocity

The Federal Emergency Management Agency (FEMA) Flood Insurance Study for Tulsa County and incorporated areas lists several peak discharges associated with a probability of occurrence in any given year for the Arkansas River in the Tulsa area. These peak discharges are:

- 10-percent (10-year event): 90,000 cfs

- 2-percent (50-year event): 155,000 cfs
- 1-percent (100-year event): 205,000 cfs
- 0.2-percent (500-year event): 490,000 cfs

The 10-year event of 90,000 cfs is equal to the maximum lake regulating discharge normally expected from Keystone Lake. The channel capacity downstream of Keystone Dam is currently estimated at 105,000 cfs. The current release range from Keystone is 0 to 105,000 cfs. However, releases may be modified to meet requirements of the Arkansas River system operating plan. Implementation of the Recommended Plan would not change the velocity of flows in the river within the study area.

3.5.3.3 Stratification

Stratification in the project area does not occur now nor would it occur following project implementation.

3.5.3.4 Hydrologic Regime

Over the long-term, the Recommended Plan would help restore a more natural flow regime in the Arkansas River through the study area by providing timed releases of water of approximately 1,000 cfs to supplement flows between hydropower generation releases. The structure would have a pool volume capacity of approximately 6,730 acre-feet, surface area of 1,321 acres, and stretch nearly 9 miles upstream to Keystone Dam. 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. The flow regime measure would help attenuate flow peaks, which would also contribute to restoring a more natural flow regime therefore providing long-term, moderate positive effects. The flow attenuating effect would be expected to decrease as the flows reached the higher magnitude flows, but attenuation of the more frequent flow peaks would be expected. Because the pool structure be would located a relatively short distance downstream from Keystone Dam; and, because there would be a means to control flow through the structure; the potential for significant sediment accumulation within the pool is anticipated to be low.

Impacts to hydrology resulting from the measures at Prattville Creek are considered to be minor, but long-term, given the relatively small surface area and volume of the target backwater effect needed to create the wetland habitat. The final design and construction would need to account for the local hydraulic changes induced by the riffle to ensure any increased scour or erosion potential under high-flow conditions within Prattville Creek were accounted for in the design. Protective measures such as bank toe rock and bioengineering would be implemented as necessary.

To ensure the downstream segment of the remnant Prattville Creek can receive water from the active channel, a topographic survey of the project site would be necessary. The survey would be used to measure the existing active channel invert elevation as well as the remnant channel invert elevation. The final elevation of the engineered rocked riffle would need to be capable of elevating the water surface elevation under desired flow conditions sufficiently enough to allow water to flow into the remnant channel.

There would be no changes to hydrology associated with the Constructed Sandbar Island, therefore no impacts to hydrology are anticipated.

3.5.3.5 Normal Water Level Fluctuations

A significant characteristic of the river hydraulics in the study area are high-frequency, large amplitude flow fluctuations resulting from the operation of Keystone Dam. Flows within the study area regularly fluctuate from little to no water released from Keystone Dam between flood pool releases and hydropower generation.

3.5.3.6 Salinity Gradients

No changes to salinity gradient would occur.

3.5.3.7 Actions That Will Be Taken to Minimize Impacts

Appropriate BMPs would be utilized to minimize erosion and sedimentation during construction. Vegetation would be reestablished to help stabilize the channel banks disturbed by construction activities.

3.5.4 Suspended Particulate/Turbidity Determinations

3.5.4.1 Expected Changes in Suspended Particulates/Turbidity Levels in Vicinity of Disposal Site

Only minor temporary increases in suspended particulates and turbidity levels would likely occur during construction of Recommended Plan. A Stormwater Pollution Prevention Plan (SPPP) would be prepared, which would outline site-specific BMPs to minimize erosion and the potential for sediment to enter receiving waters during construction activities. The potential for suspended sediments would be further reduced using measures like a cofferdam, so that in-water construction would not occur. Therefore, except for a large storm event that might occur during project construction, most fill would occur within areas in a dry state. BMPs, such as silt curtains, would be used to reduce impacts. Surplus material that cannot be used for restoration activities passage would be disposed of appropriately. Over the long-term, reduced variability in discharges from the Keystone Dam and more stable river flow conditions resulting from the pool structure at RM 530 would decrease erosion and the associated suspended particles in the river.

3.5.4.2 Effects (degree and duration) on Chemical and Physical Properties of the Water Column

Light Penetration: Changes to light penetration would occur during construction associated with minor turbidity increases. Appropriate erosion and sedimentation controls would be implemented to reduce impacts to downstream waters. After project completion and stabilization, the clarity of the stream would return to preconstruction levels.

Dissolved Oxygen: Temporary lowering of dissolved oxygen could occur during construction, but would be very temporary in both time and extent. Following construction the operation of the flow regime measure would facilitate more stable downstream flow conditions reducing periods of low flows and support improved dissolved oxygen (DO) conditions in the Arkansas River. Although the current Oklahoma Department of Environmental Quality (ODEQ) 303(d) listings indicate that the river is meeting the DO standards, the Recommended Plan would support the maintenance and improvement of DO conditions in the river.

Toxic Metals and Organics: No water testing was conducted in the immediate recommended project area. The recommended project would not result in the introduction of additional toxics into the Arkansas River or its sediments over those that currently exist in the watershed. Businesses on the lands surrounding the study area, include oil and petroleum industries, utilities, and manufacturing, recycling, and concrete services, in addition to the usual automobile service centers, tire shops, and gasoline service stations that can be found in any community. In accordance with Resource Conservation and Recovery Act (RCRA), facilities that generate, transport, treat, store, or dispose of hazardous waste must provide information about their activities to state environmental agencies. There were over 100 waste sites identified by EnviroMapper located adjacent to Arkansas River within the project area generated by the businesses listed above. Most of the sites were identified as RCRA sites. According to the 2014 Toxics Release Inventory (TRI), there were 19 RCRA facilities that had releases in 2014. There were two facilities, Petroleum Electronics Mfg, Inc. and Power Electronics Mfg. Inc., which were identified by EnviroMapper as Superfund facilities. Both facilities are located approximately 3.5 miles upstream of the Zink Dam.

In the vicinity of recommended pool control structure and Prattville Creek restoration measures is the Webco Industry Star Center (pipe bending and fabrication) (permitted facility) with an individual National Pollutant Discharge Elimination System permit for noncontact cooling water that is in compliance (USACE Tulsa, 2016). The Mohawk Material-Ready-Mixed Concrete is also upstream from the site but doesn't have surface water discharges. There are several secondary nonferrous metal fabrication facilities north of the recommended pool control structure and Prattville Creek restoration sites such as Sheffield Steel and GERDAU AMERISTEEL but none have permitted discharges to the river or storm drains.

The recommended project would not result in the introduction of additional HTRW wastes into the Arkansas River over those that currently exist through runoff of the surrounding lands. The project sponsor would be responsible to ensure the site is not contaminated prior to construction and would be responsible for reclamation, if necessary.

Pathogens: No pathogens would be added to the water column as a result of this project.

Others as Appropriate: No other effects to water column are anticipated

3.5.4.3 Effects on Biota

Displacement of local biota would occur during construction as mobile species would emigrate to adjacent habitats. Although sessile species would be impacted during construction activities, over time and upon project completion, it is anticipated that biota would recolonize the project site at the same diversity and density as currently present under pre-project conditions.

Primary Production, Photosynthesis: The vegetation at the recommended pool structure, rock riffle, and nesting island consists of limited aquatic vegetation. As a result, little aquatic vegetation would be lost from the project site during implementation of the recommended project. Vegetation loss would be minimized to the extent possible by using BMPs. Also additional wetlands plants would be added to the 5.34 acre wetland created by construction of the rock riffle structure following implementation. While there would be a temporary loss of primary producers as a result of project implementation, the loss is considered less than significant and is anticipated to be improved under post construction conditions.

Suspension/Filter Feeders: The presence of suspension/filter feeders in the river at the locations for the Recommended Plan construction are limited as the severe flow regime fluctuations resulting from Keystone Dam and associated flood risk management and hydropower operations have altered the aquatic structure of the Arkansas River within the study area. This degraded aquatic structure has resulted in severely degraded and in some cases almost complete loss of aquatic functions necessary to sustain a riverine ecosystem. Therefore, there would be limited impact to suspension/filter feeders as a result of implementation of the recommended project within the project area and very limited to no impacts to the Arkansas River itself. Any suspension/filter feeders that are located within the water of the river channel would simply disperse to undisturbed areas. BMPs would be established to control erosion and sedimentation downstream that may otherwise impact filter feeders. Once the relocated pool structure and other restoration features are constructed, suspension and filter feeders would repopulate to the current level. There would be very limited loss of suspension/filter feeders as a result of project construction, but the loss would be less than significant.

Sight Feeders: Sight feeders would be temporarily displaced during construction activities. BMPs would be established to control erosion and sedimentation downstream that may otherwise impact sight feeders. Once the construction is complete, sight feeders would

repopulate to the current extent. No net loss of sight feeders is anticipated as the result of the Recommended Plan.

3.5.4.4 Actions taken to Minimize Impacts

BMPs would be established to control erosion and sedimentation to minimize impacts to biota in the Arkansas River during construction.

3.5.5 Contaminant Determinations

According to the Arkansas River Corridor Study HTRW Initial Survey, Sand Springs Petrochemical Complex was included in the National Priority List (NPL), Superfund, site in 1986 and is located adjacent to the north bank of the Arkansas River roughly one mile below Highway 97. In 1995, potentially responsible parties dug up, stabilized and disposed of petroleum waste material in an onsite landfill. EPA removed the site from the NPL in 2000. Operation and maintenance activities at the site continue. Fencing has been placed around the landfill. A portion of the north bank of the Arkansas River has also been rip-rapped (rock used to armor shorelines) to prevent erosion by the Arkansas River.

The construction of the pool structure at RM 530 could directly affect the Sand Springs Petrochemical Complex if any excavations or changes in river flow were to reveal previously undiscovered hazardous waste. Although the site is downstream of the flow regime measure, as a precaution, the Project sponsor (Tulsa County) would conduct a Phase I Environmental Site Assessment (ESA) as part of the Recommended Plan to confirm that no undiscovered hazardous waste sources exist in proximity to the impacted area. As part of the BMPs, the area would be avoided and not be disturbed or excavated. Potential for negligible short-term impact from spill of fuel or oil associated with construction equipment. Low risk of exposure of hazardous substances if excavation would occur in the Superfund Site.

The recommended project would not result in the introduction of additional toxicants into the Arkansas River over those that currently exist. The project sponsor would be responsible to ensure the site is not contaminated prior to construction and would be responsible for reclamation, if necessary.

3.5.6 Aquatic Ecosystem and Organism Determinations

As described in Section 2, the Recommended Plan was selected after an extensive review of possible environmental restoration alternatives to meet the Project's purpose and need, as well as to be most practicable implementable project. The emphasis on the best buy alternatives, with the least incremental cost per incremental output or benefit, resulted in alternatives with primarily beneficial effects. Accordingly, long-term impacts associated with the Recommended Plan were determined to have moderately to significantly positive effects on water resources, hydrology, the floodplain, threatened and endangered species, land use, recreation, and transportation (Table 3-1). The only resources experiencing minor negative long-term effects were cultural resources, hazardous or toxic substances, and geology and soils. Given the magnitude of beneficial effects, the following sections would focus on short-term impacts and the minor negative long term effects to aquatic resources.

3.5.6.1 Effects on Plankton and Nekton

Plankton and nekton that current occupy the sediments and water columns in the existing sites of the Recommended Plan features would be adversely impacted by fill activities, but it is anticipated that the impact would be temporary and short-term as these species would recolonize the sites once construction is complete.

3.5.6.2 Effects on Benthos

No additional effects other than those previously discussed were identified.

3.5.6.3 Effects on Aquatic Food Web

Temporary disruptions to the food web would occur during construction. However, following construction it is anticipated that limited species at all levels of the food web would return to the same level as currently exists. Therefore, no net loss of species or negative impacts to trophic levels are anticipated as the result of the Recommended Plan.

Table 3-1. Evaluation for Long-term Environmental Acceptability

Arkansas River Corridor Feasibility Study Project Environmental Assessment

Alternative Number	Features	Potential Long Term Impacts to:					
		Water Resources, Hydrology or Floodplains	**Threatened and Endangered Species**	**Cultural Resources**	**Land Use, Recreation or Transportation**	**Hazardous or Toxic Substances**	**Geology, Seismicity and Soils**
No Action		-	-				
Alternative 2	Pool Structure at RM 531 (former reregulation dam site)	●	◕		◕		
Alternative 2A	Pool Structure at RM 531 (former reregulation dam site) plus: • Prattville Creek Rock Riffle with Wetland Plantings • New Least Tern Island	●	●		◕		
Alternative 3	Pool Structure at RM 530	+	◕	◔	◕	◔	◔
Alternative 4	Pool Structure at RM 530 and Prattville Creek Rock Riffle with Wetland Plantings	+	●	◔	+	◔	◔
Alternative 5	Pool Structure at RM 530 plus: • Prattville Creek Rock Riffle with Wetland Plantings • New Least Tern Island	+	●	◔	+	◔	◔
Alternative 6	Alternative 5 features plus Riverside/I-44 Rock Riffle with Wetland Plantings	+	+	◔	+	◔	◔
Alternative 7	Alternative 6 features plus Riverside/I-44 Riparian Plantings	+	+	◔	+	◔	◔
Alternative 8	Alternative 7 features plus Prattville Riparian Plantings	+	+	◔	+	◔	
Long-term Impact Criteria Legend:							
	-	○	◔		◕	●	+
NEPA Environmental Impact Factors	Significant Negative Effect	Moderate Negative Effect	Minor Negative Effect	No Impact	Minor Positive Effect	Moderate Positive Effect	Significant Positive Effect

1

3.5.6.1 Effects on Special Aquatic Sites

Sanctuaries and Refuges: No fish and wildlife sanctuaries or refuges occur within the project area.

Wetlands: The potential impacts from the Pool Structure at RM 530 on wetlands could include the expansion of riverine habitats from the construction of the pool structure and improved floodplain connectivity to shoreline wetlands within the outer footprint of the riverine pool. The degraded wetlands that currently exist within the vicinity of the pool structure could be temporarily disturbed during construction as a result of scour or sedimentation from stormwater runoff from construction areas. The use of appropriate BMPs, would be implemented to minimize impacts.

The attenuation of flows downstream of the pool structure would provide consistent daily hydrology for wetland habitats which would promote increased stability for further habitat development. The increase in hydrologic stability would promote a moderate, long-term increase in wetland acreage within the study area downstream of the flow regime measure, which would in turn increase available habitats for fish, macroinvertebrates, amphibians, reptiles, birds, and stabilize food webs. Increases in wetland acreages in the short-term would primarily be from the development of additional early successional emergent wetland habitats at lower elevations. The connectivity of wetland habitat types to other habitats such as riverine and riparian corridors would increase as wetland acreages increase. Overall the pool structure would provide moderate, long-term positive impacts to wetland habitats within the study area.

The potential impacts from the implementation of grade control and creation of wetland habitat at Prattville Creek would include a minor, long-term positive increase in available wetland and open water habitats and stabilized banks at this location. The stable wetland habitat would create permanent habitat for wildlife such as fish, macroinvertebrates, amphibians, reptiles, and birds and in turn serve to stabilize the local aquatic food web. Increased long-term water quality benefits from reduced sedimentation and pollutant transport downstream would be localized and therefore relatively minor. The wetland would also serve as a source for the downstream transport of organic detritus benefiting downstream food webs. The armoring of banks and directing of surface water towards the original mouth of Prattville Creek downstream, would provide additional surface water for aquatic communities in that location.

No impacts (negligible) on wetlands habitats are anticipated from the creation of the Constructed Sandbar Island. Short-term localized reductions in water quality in wetlands immediately downstream may result from construction activities. All practicable measures, including the use of appropriate BMPs, would be implemented to minimize impacts. The location selected for the construction of the Least Tern nesting island would be within existing riverine sandbar habitat and areas of wetland habitat would be avoided.

Mud Flats: No mud flats were observed in the area to be impacted by the project.

Vegetated Shallows: No vegetated shallows were observed in the area to be impacted by the project.

Coral Reefs: No coral reefs occur within the project area.

Riffle and Pool Complexes: There are degraded riffle and pool complexes in the project area, but the highly variable flows from Keystone Dam due to lake operations and hydropower generation activities has adversely impacted their habitat value within the project area.

Riverine Sand Bars: The potential impacts from the pool structure on riverine sandbars would include the permanent loss of some habitats from the construction of the low water pool structure and conversion of periodically inundated sandbar habitat to riverine habitats within the footprint of the associated riverine pool. With the Recommended Plan, riverine sandbar habitat would continue to be a common habitat type within the study area, furthermore the occurrence of land-bridged sandbars would be reduced. Downstream of the pool structure, the attenuation

of high flows would be negligible, allowing normal beneficial sandbar scouring to continue. Stable non-vegetated sandbars would provide increased nesting habitat for Interior Least Terns. Therefore, the construction of the flow regime measure would provide moderate, long-term positive impacts to riverine sandbar habitats.

Some minor, temporary impacts may occur to riverine sandbars in the vicinity of the Prattville Creek restoration efforts from access by heavy vehicle equipment during construction. These impacts are considered negligible within the study area and would be considered to have no impact. Potential impacts from the construction of the Least Tern nesting island would include temporary impacts to riverine sand bar habitats in the vicinity of the construction area from the access of heavy equipment during construction. No other impacts to riverine sandbars in the study area would be anticipated. The creation of the Least Tern nesting island would expand existing nesting habitat in conjunction with the construction of the flow regime measure and the riverine pool. The overall impacts are considered negligible within the study area and would be considered to have no impact.

Threatened and Endangered Species: Long-term impacts are expected to be beneficial to Least Terns. Short-term negative impacts would be insignificant and mostly avoided by construction activities occurring during the non-breeding season. There are no potential impacts to other listed species such as the Piping Plover, Red Knot, Whooping Crane, and Northern Long-eared Bat as these species rarely occur in the study. No impacts are expected to the American Burying Beetle as the dredge and fill material would be in hydric soils and within frequently inundated areas considered not suitable habitat.

Other Wildlife: Wildlife inhabiting the aquatic and riparian habitats within the project reach would be temporarily displaced during construction. Mobile species would migrate to adjacent habitats. Although sessile species would be impacted during construction activities, they would be expected to return to suitable habitat areas following construction.

The potential impacts from the construction of the pool control structure on wildlife within the study area are expected to provide significant, long-term positive effects from the increase in daily flows and stabilization and increase of available habitats. Some alternation of riverine sandbar habitat would occur from the construction of the flow regime measure but wildlife displaced during construction would have access to habitats in the vicinity of the structure. The creation of the riverine pool and the sustained river flow it would be used for would significantly increase riverine habitats upstream and downstream of the structure, which would promote an increase in abundance and biomass of fish, including forage species of the Least Tern. Recreational fishing would increase in the area of the riverine pool but a net benefit to fisheries would be realized. The flow regime measure 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.

Downstream of the pool control structure, the increase in the acreage, stability, and connectivity of available habitats would benefit fish, invertebrates, reptiles, amphibians, and birds. Increases in more 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. 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 creation of the ecosystem restoration measures at Prattville Creek would include localized benefits to wildlife from the creation of wetland and open water habitats. The created wetland and permanent pool would provide a nursery for juvenile fishes and habitat for invertebrates. The planted wetland vegetation would increase foraging and nesting opportunities for wading birds and shorebirds. Amphibians and wildlife would also

benefit from the shoreline habitat structures which would provide refuges and nesting opportunities. Therefore, there would be a minor, long-term positive impact on wildlife within the study area from the ecosystem restoration measures at Prattville Creek.

No impacts (negligible) are anticipated for biological resources within the study area from the construction of the Constructed Sandbar Island. The potential for some temporary sedimentation and water quality degradation of downstream habitats during construction would occur but would be reduced to the extent possible through implementation of best management practices. The potential impacts of this ecosystem restoration measure would focus on Least Tern habitat and are described in the subsequent section.

3.5.6.2 Other Effects

Land Use: Over the long-term, construction of the Pool Structure at RM 530 would directly affect land use within a 1,500-ft. corridor transecting the Arkansas River with tie-ins near South Main Street on the north side and approximately 1,000 ft. upstream of the Prattville Creek on the south side. Lands impacted include the open water of the Arkansas River and the adjacent shoreline and riparian areas. These lands are currently zoned for agricultural or industrial purposes. The Recommended Plan would result in this limited area being developed for the flow regime measure such that it would be considered an industrial or institutional/utilities use in the future and therefore would have a minor, negative effect on land use.

Transportation: The construction of the ecosystem restoration measures would result in minor benefits. There would be no effect to transportation networks.

Utilities: Utilities also would be temporarily affected during construction of the pool structure at RM 530 while the three outfalls below the recommended pool elevation of the pool structure are relocated or retrofitted. The balance of the construction and operation would not affect the existing wastewater treatment plants, gas pipelines, nor the existing PSO electrical transmission corridor crossing the river just east of the bridge near the confluence of Prattville Creek. The wetland plantings associated with the Prattville Creek Ecosystem Restoration Measure would generally be under 15 feet in height at maturity to limit the potential for vegetation to interfere with the operation of the line. Accordingly, there would be only short-term minor negative effect on utilities.

Cultural Resources: There are four known cultural resources at or near the current river elevation that would be directly affected by the construction footprints (34TU-197 and 34TU-200) or inundated by raising the water levels (34TU-121 and the “1831 Ranger Camp”). They were either determined to be ineligible for the National Register of Historic Places (NRHP) due to a lack of integrity, or the absence of being formally recorded or evaluated. No known impacts to buildings listed, eligible for listing, or potentially eligible for listing on the NRHP were identified in the project area and no known impacts to Native American Traditional Cultural Properties would be expected from implementation of the Recommended Plan.

There are currently no known resources within the area recommended for rock riffle (grade control) to generate a semi-permanent wetland area near RM 530 (Prattville Creek) and no know resources within the area identified for the creation of a new Least Tern island.

Although impacts from the current Recommended Plan would only have a minimal negative impact based on known resources, if resources are identified during a standing structure and archaeological survey the conclusions may change. According to Agency Coordination, the State Historic Preservation Officer (SHPO), USACE, and the non-federal sponsor have entered into a Programmatic Agreement to avoid, minimize, and mitigate any potential impacts to cultural resources.

3.5.7 Recommended Disposal Site Determinations

3.5.7.1 Mixing Zone Determination

Most fill would occur within areas of the channel while in a dry state and only minimal mixing would occur unless a large storm event occurs during project construction. BMPs, such as silt curtains, would be implemented to lower impacts. Disposal of surplus material would occur at an offsite location that is not within waters of the United States.

3.5.7.2 Determination of Compliance with Applicable Water Quality Standards

Potential impacts on water quality may occur during construction and post-construction operation of the Pool Structure at RM 530 and the other ecosystem restoration measures. During the construction phase, stormwater runoff would have the potential to transport sediment and other pollutants to receiving waters. However, implementation of standard construction BMPs (e.g., silt fences, coffer dams) during construction and revegetation following construction would minimize the risk. The ODEQ stormwater permit (National Pollutant Discharge Elimination System construction permit) would establish practices to be implemented to protect water quality. As result, the potential for adverse impacts on water quality during construction would be short-term and minor.

Longer term, the operation of the flow regime measure would facilitate more stable downstream flow conditions reducing periods of low flows and support improved dissolved oxygen (DO) conditions in the Arkansas River. Although the current Oklahoma Department of Environmental Quality (ODEQ) 303(d) listings indicate that the river is meeting the DO standards, the Recommended Plan would support the maintenance and improvement of DO conditions in the river.

Installation of the recommended bank restoration and wetland habitat on Prattville Creek would reduce the rate of erosion in this reach of the river, thus reducing turbidity/sediment loading. In addition, the wetland vegetation would provide an additional level of treatment of stormwater runoff in the Prattville Creek watershed before entering the Arkansas River. Therefore, the Recommended Plan could result in moderate positive impacts to water quality*.*

3.5.7.3 Potential Effects on Human Use Characteristics

Municipal and Private Water Supply: Municipal and private water supplies in the action area rely on surface water from area reservoirs. While the project area is not located in the vicinity of any of these reservoirs, there are downstream reservoirs on the Arkansas River that serve as water supply for downstream communities. However, implementation of the Recommended Plan would have no impact on local water supply.

Recreational and Commercial Fisheries: The creation of the riverine pool and the increased river flow would significantly increase open water habitats upstream and downstream of the structure, which would promote an increase in abundance and biomass of fish, including forage species of the Least Tern. Recreational fishing would increase in the area study but a net benefit to fisheries would be realized. The flow regime measure's design and operation would maintain at least seasonal 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.

Water Related Recreation: No additional effects to water related recreation are anticipated. Currently, the river experiences frequent bouts of zero flow, which does not support numerous outdoor water based recreation activities. With the pool structure in place and associated river flow, increased opportunities would be available for river based recreation. River access already exists up and downstream of the pool structure location, therefore no areas of the river would be cutoff. Boat, canoe, kayak and other watercraft passage through the structure would be

considered during the detailed design phase but would ultimately be determined based on life safety.

Aesthetics: Implementation of the Recommended Plan features could have a short-term, temporary impact on aesthetics during construction. While visual and aesthetic preferences are unique to each individual, implementation of the Recommended Plan could have a significant positive effect on the visual esthetics as the pool control structure would provide impressive views of downtown Tulsa to the east while views to the west from River City Park would be of the more natural, wooded areas along both the north and south banks of the river.

Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Areas, and Similar Preserves: During construction, the Recommended Plan would have minor adverse impacts on the Sand Springs River City Park and Case Community Center; however, minor positive effects would occur over the long term due to expanded recreational opportunities and the public access they could provide.

3.6 Determination of Cumulative Effects on the Aquatic Ecosystem

Five known projects were identified and considered to have potential cumulative effects, mostly due to the overlapping region of influence (ROI) in the study area. They include maintenance dredging below Zink Lake, land-based park development along the east bank of the Arkansas River, reconstruction of the existing low water dam and recreational improvements in Zink Lake, Tulsa levee system improvements, and the recommended Jenks/South Tulsa Low Water Dam.

There would be no significant negative cumulative effects on the aquatic environment. The Recommended Plan in combination with other planned projects, either recently completed, ongoing, or proposed within the project area of the ARC, are not expected to add significant cumulative effects to natural, physical or human environments with the majority of effects being moderately to significantly positive. Cumulative aquatic impacts would be limited to a continued reduction of riverine sandbar habitat in the study area as it is converted to open water. These aquatic impacts would be compensated by the addition of sandbar habitat in the form of the Least Tern island, and offset by overall improvements in the quality of wetland, riverine, and floodplain habitats and reductions in established invasive plant species at lower elevations due to inundation.

3.7 Determination of Secondary Effects on the Aquatic Ecosystem

BMPs to minimize impacts associated with construction activities have been identified and would be refined during design activities, as would construction timing considerations. BMPs are expected to include schedules of activities, prohibitions of practices, maintenance procedures, structural controls, local ordinances, and other management practices to prevent or reduce the discharge of pollutants. BMPs also include treatment requirements, operating procedures, and practices to control construction site runoff, spills or leaks, waste disposal, or drainage from raw material storage areas. BMPs such as cofferdams, turbidity curtains, and appropriate dewatering measures would be implemented for in-water work. Additional erosion control and stabilization practices may include but are not limited to: establishment of temporary or permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of existing vegetation, temporary velocity dissipation devices, flow diversion mechanisms, silt fencing, sediment traps, and the prompt revegetation of disturbed areas. These measures would reduce potential impacts to water quality. Implementation of sediment and erosion controls during construction activities would maintain runoff water quality at levels comparable to existing conditions.

An adaptive management plan would be developed to monitor and assess functionality of components of the recommended ecosystem restoration project informing adaptive management strategies to ensure success in meeting goals of the project. An Operation, Maintenance, Repair, Replacement, Rehabilitation (OMRR&R) plan would be developed to ensure the structural integrity of the pool structure, Prattville rock riffle structures, and Least Tern sandbar island structures are maintained, that vegetation associated with the rock riffle structures survives, and that excess sediment and debris is removed and dislodged or broken riprap or rock is replaced at the pool structure.

The Constructed Sandbar Island would impart changes to the local flow velocity and water surface elevation in the Arkansas River channel. Hydraulic computations would be needed to ensure the island does not result in erosive near-bank shear stresses or velocities along the existing Arkansas River banks, or a significant rise in the base flood flow event.

The 3,743 acres of ecosystem restoration provided by the Recommended Plan would more than offset the 2.89 acres of permanent riverine and wetland habitat loss that would be associated with construction of the Recommended Plan.

3.8 Summary of 404(b)(1) Analysis

Section 404 (b)(1) of the Clean Water Act of 1972 requires that any recommended discharge of dredged or fill material into waters of the United States must be evaluated using the guidelines developed by the Administrator of the U.S. Environmental Protection Agency (EPA) in conjunction with the Secretary of the Army. These guidelines are located in Title 40, Part 230 of the Code of Federal Regulations. The Section 404 (b)(1) evaluation in this Appendix analyzes all activities associated with the Recommended Plan that involve the discharge of dredged or fill material into waters of the United States.

Under the 404(b)(1) guidelines, no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the recommended discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. 40 CFR 230.10(a)(2).

A comprehensive alternatives analysis was done as part of the Feasibility Study and Integrated Environmental Assessment. The study determined there were two practicable alternatives, as discussed in Section 2.1 and 2.2, above (Alternatives 2a and 5). Only these alternatives sufficiently meet the overall project purposes (summarized as low flow riverine ecosystem restoration) to be considered practicable. Both of these alternatives would have essentially the same environmental impact. See Table 2.3 and Section 2.4 above. However, Alternative 5 would be more environmentally beneficial and sustainable. Accordingly, Alternative 5 was determined to be the least environmentally damaging practicable alternative. Alternative 5 was determined to be the Recommended Plan for this Feasibility Study.

While implementation of the Recommended Plan would involve the placement of fill material within the project footprint and would impact 2.89 acres of jurisdictional wetlands and waters of the U.S., this disposal would not violate established State water quality standards or the Toxic Effluent Standards of Section 307 of the Clean Water Act of 1977, as amended, nor harm any endangered species or their critical habitat. Implementation of the Recommended Plan would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. Appropriate steps to minimize potential adverse impacts of discharge in aquatic systems include use of suitable erosion control technologies together with the implementation of procedures to protect against erosion and sedimentation during and after construction.

Implementation of the Recommended Plan meets the conditions of Nationwide Permit (NWP) 27- Aquatic Habitat Restoration, E for Ecosystem Restoration, Enhancement, and Establishment Activities. Mitigation for impacts to 2.89 acres of waters of the U.S. and wetlands is not required, as per NWP 27. In addition, the creation of 5.34 acres of wetlands with implementation of the rock riffle project feature would offset any adverse impacts to existing wetlands.

SCOTT A. THOMPSON
Executive Director

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

MARY FALLIN
Governor

February 13, 2018

Mr. Douglas Sims, RPA
Chief, Environmental Compliance Branch
Fort Worth District
U.S. Army Corps of Engineers
P.O. Box 17300
Fort Worth, Texas 76012-0300

RE: Arkansas River Corridor Ecosystem Restoration Study

Dear Mr. Sims:

The Department of Environmental Quality (DEQ) has received your request for a Water Quality Certification under Section 401 of the Federal Clean Water Act [33 U.S.C. §1251 et seq. (1972)], for activities in the Arkansas River in Tulsa County, Oklahoma.

The purpose of the proposed action is to mitigate the extreme flow variability downstream of Keystone Dam and improve overall ecosystem health and ecological functions of aquatic habitats within the Arkansas River between Keystone Dam and the Tulsa/Wagoner County line. Specifically, the goals of the project are to build a flow regime measure near Sand Springs, restore 5.34 acres of wetland on Prattville Creek, and restore 3 acres of sandbar island near Broken Bow. The flow regime measure or pool structure will result in restoration of 3,725 acres of riverine habitat. The study area includes 42-mile long segment of the Arkansas River in Tulsa County that begins below Keystone Dam and continues downstream east and south to the Wagoner County line.

The Arkansas River in the study area is assigned the following beneficial uses through the Oklahoma Water Quality Standards (WQS): Emergency Water Supply, Warm Water Aquatic Community, Agriculture: Livestock and Irrigation, Secondary Body Contact Recreation, Navigation and Aesthetics (OAC 785:45 Appendix A, Table 1). To obtain a copy of the most recent version of the Oklahoma WQS, please go online to http://www.owrb.ok.gov/util/rules/pdf_rul/current/Ch45.pdf or contact the Oklahoma Water Resources Board at (405) 530-8800.

DEQ has reviewed the *Section 404(b)(1) Analysis Arkansas River Corridor Feasibility Report* dated December 2017 and *Arkansas River Feasibility Report* dated February 2017 prepared by the U.S. Army Corps of Engineers, Tulsa District. Based on our evaluation of the information contained in the

documents, DEQ certifies that there is reasonable assurance that the project as proposed will not violate Oklahoma's water quality standards.

If you have any questions concerning this matter, please contact Elena Jigoulina at 405-702-8200 or by e-mail Elena.Jigoulina@deq.ok.gov.

Sincerely,

Joe A. Long, Environmental Programs Manager
Watershed Planning Section
Water Quality Division

cc: Brandon Wadlington, Biologist, Coastal Section, Environmental Compliance Branch Regional Planning and Environmental Center US Army Corps of Engineers
J.D. Strong, Director, Oklahoma Department of Wildlife Conservation
Bill Cauthron, Chief, Water Quality Programs Division, Oklahoma Water Resources Board
Brooks Tramell, Monitoring, Assessment and Wetlands Programs, Oklahoma Conservation Commission
Lauren Poulos, EPA Region 6 (6WQ-EM)
Julie Bays, Public Protection Unit Chief, Attorney General of Oklahoma