C.3

Biological Assessment

BIOLOGICAL ASSESSMENT
ADDRESSING

SIXTEEN FEDERALLY LISTED THREATENED OR ENDANGERED SPECIES ON THE ARKANSAS, CANADIAN, AND RED RIVERS; ARKANSAS, OKLAHOMA, AND TEXAS; AND ON THE MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM ARKANSAS AND OKLAHOMA

U.S. Army Corps of Engineers
Tulsa and Little Rock Districts

November 2003

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ADDRESSING
SIXTEEN FEDERALLY LISTED SPECIES ON THE
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MCKELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM
ARKANSAS AND OKLAHOMA

EXECUTIVE SUMMARY

This Biological Assessment (BA) provides the information required pursuant to the Endangered Species Act (ESA) and its implementing regulations. It documents and incorporates new and additional information not previously provided by the U.S. Army Corps of Engineers (USACE), and describes all the current and proposed actions of the USACE to comply with the ESA.

Since issuance of a Biological Opinion (BO) by the USFWS dated March 16, 1998, which established "take " for the Interior least tern on the Arkansas River in Oklahoma, the USACE has been operating the Kaw and Keystone reservoirs under the provisions of the 1998 BO and the established levels of "take".

In August 1998, the USFWS requested the USACE to initiate consultation efforts on the Canadian River below Eufaula Lake and the Red River below Denison Dam with respect to the Interior least tern, and the USACE agreed. Biological Assessments concluding a "may affect" were subsequently prepared and furnished to the USFWS. After several meetings and review of operating conditions for the Arkansas River with respect to nesting success and "take" levels established in the 1998 BA, it was decided to reinitiate consultation on the Arkansas River and combine it with the two separate ongoing consultations on the Red and Canadian rivers. This combined Section 7 consultation would result in the preparation of a comprehensive BA and BO covering all three-river systems.

Also, the existing 1998 consultation covered only one species, the Interior least tern. Due to the presence of two other species, the bald eagle (*Haliaeetus leucocephalus*) and the American burying beetle (*Nicrophorus americanus*), which were not addressed in the previous BA, both agencies mutually agreed to include these species in the comprehensive consultation as well.

The USACE is also conducting two additional studies along the McClellan-Kerr Arkansas River Navigation System (MCKARNS) that could have potential impacts on Federally listed species. The first study is the Arkansas River Navigation Feasibility Study, which consists of two phases. Phase I will address system operations of the MCKARNS, and Phase II will address proposed channel modifications. The second study involves revising the Dredge Material Disposal Management Plan for the Oklahoma portion of the MCKARNS. Since

cumulative effects must be addressed as a component of the BA, it was deemed prudent to include these proposed actions in the comprehensive BA as well.

Recently, Tulsa District initiated a reallocation study on Lake Texoma. This study will address reallocating 300,000 acre-feet of existing hydropower storage into water supply storage. The potential impacts of the proposed reallocation will also be considered in this BA and addressed as cumulative impacts.

Since issuance of the 1998 BO, additional information has become available that supports preparation of this BA and the USFWS request for re-initiation of consultation. Additional surveys have been conducted on the three river systems, and the results of these surveys need to be addressed in the BA and considered in a new BO. Also, the USACE formed a multi-agency Least Tern Committee in 2002 to develop and provide comprehensive guidelines for management and protection of Interior least terns nesting below USACE water resource projects on the Arkansas, Canadian, and Red rivers. These management guidelines and strategies have been implemented by the USACE and need to be considered and addressed in a new BO.

PROPOSED ACTION

The proposed action is to prepare a comprehensive BA addressing all Federally listed species for those portions of the Arkansas River, Red River, and Canadian River impacted by operation and maintenance of USACE projects while taking into consideration other Congressionally authorized uses of the river and cumulative impacts. The proposed action will evaluate the impacts of operating the following projects on Federally listed species:

- Arkansas River System Operations
- Arkansas River Navigation Study, Phases I and II
- MCKARNS Dredge Material Disposal Management Plan
- Canadian River Operations
- Red River Operations

This BA will address sixteen (16) endangered species with respect to the following areas, USACE studies, and operational and management activities on projects within these areas:

- The main stem of the Arkansas River from below Kaw Lake to Muskogee, Oklahoma, and the MCKARNS, and the impacts of 11 operational Oklahoma lakes associated with releases into the MCKARNS downstream to the mouth of the White River in Arkansas and then to the Mississippi River. These lakes include Keystone Lake, Oologah Lake, Grand Lake, Lake Hudson, Fort Gibson Lake, Tenkiller Ferry Lake, Eufaula Lake, Kaw Lake, Hulah Lake, Copan Lake, and Wister Lake.

- A total of 27 miles of the Canadian River from below Eufaula Dam to the confluence of the MCKARNS.

- Lake Texoma and approximately 240 miles of the Red River from below Denison Dam to Index, Arkansas.

LISTED SPECIES AND CRITICAL HABITAT

The species listed under the ESA that are addressed in this BA include:

- American alligator (*Alligator mississippiensis*)
- Gray bat (*Myotis grisescens*)
- Indiana bat (*Myotis sodalis*)
- Ozark big-eared bat (*Corynorhinus townsendii ingénues*)
- American burying beetle (*Nicrophorus americanus*)
- Whooping crane (*Grus americana*)
- Bald eagle (*Haliaeetus americana*)
- Pink mucket pearly mussel (*Lampsilis abrupta*)
- Scaleshell mussel (*Leptodea leptodon*)
- Arkansas River shiner (*Notropis girardi*)
- Piping plover (*Charadrius melodius*)
- Pallid sturgeon (*Scaphirhynchus albus*)
- Interior least tern (*Sterna antillarum)*
- *Geocarpon minimum* (No common name)
- Western prairie fringed orchid (*Platanthera praeclara*)
- Harperella (*Ptilimnium nodosum*)

ANTICIPATED EFFECTS OF THE PROPOSED ACTION

Continued operation of the Red River, Arkansas River, and Canadian River projects for their authorized project purposes and denoted studies were evaluated, and the anticipated effects of the proposed actions and cumulative impacts were determined in accordance with the ESA. The potential direct, indirect, and cumulative impacts identified with respect to the listed species and proposed actions area summarized as follows:

1) It was determined that the proposed actions would have "no affect" on the American alligator, Gray bat, Indiana bat, Ozark big-eared bat, whooping crane, pink mucket pearly mussel, scaleshell mussel, piping plover, Arkansas River shiner, *Geocarpon minimum*, and Harperella. The finding of "no affect" was determined based on the fact that the range of many of these species is not associated with the projects, the species are no longer found in the project area, suitable habitat is not present on project lands, or the impacts were considered to be inconsequential.

2) There is a potential for the proposed actions to have an "adverse affect" on the American burying beetle and its habitat if it is found to occur on project lands located within its range. Indirectly, operation of the 11 supporting reservoirs may also have an indirect adverse impact on this species through implementation of land use changes associated with operational activities.

3) The proposed actions were determined to have both positive and negative impacts on the Interior least tern. Continued operation of operational projects for their authorized project purposes would adversely affect nesting Interior least terns and their habitat on the Arkansas, Canadian, Red rivers, and the MCKARNS. Implementation of the proposed Dredge Material Disposal Management Plan and Arkansas River Navigation Project may create additional nesting habitat for this species, which have a positive impact on the species. Also, operation of projects for flood control and hydropower can have a positive affect on this species from the fact that the USACE has some control on flows.

4) The bald eagle occurs throughout all the proposed action areas. Most of the proposed actions were determined to have "no affect" on this species. However, implementation of the Dredge Material Disposal Management Plan and Phase II of the Arkansas River Navigation Study have the potential to negatively impact this species directly by removal and loss of habitat, and indirectly by disturbing sediments that may contain contaminants.

5) No records exist for occurrence of the pallid sturgeon in either the Arkansas or White rivers. However, since this species has been collected from the Mississippi River near the mouth of the White River, it is reasonable to assume that at times it could be found in the lower White River. Consequently, implementation of the Arkansas River Navigation Study, Phase II, Channel Modification, could have an "adverse affect" on the species if it is found to occur in this area. Additional seasonal surveys would be required to confirm the presence of this species.

TABLE OF CONTENTS

Page

INTRODUCTION 1

NEED FOR BIOLOGICAL ASSESSMENT 1

CHRONOLOGY 3

SPECIES TO BE ADDRESSED IN BIOLOGICAL ASSESSMENT 4
- Section 1 Description of Proposed Action 6
- Section II Description of Action Areas 7
  - A. Action Area I, Arkansas River (Kaw Lake to Muskogee, Oklahoma) 7
  - B. Action Area II, Arkansas River Navigation Study (Verdigris and Arkansas Rivers, Oklahoma-Arkansas, Phases I and II 7
  - C. Action Area III, MCKARNS Dredge Disposal Management Plan (Verdigris and Arkansas Rivers, Oklahoma) 9
  - D. Action Area IV, Canadian River, Oklahoma 10
  - E. Action Area V, Red River Below Denison Dam to Index, Arkansas; Texas; and Oklahoma 10
- Section III Description of Existing Conditions/Current Operations 14
  - A. Arkansas River Basin 14
    - 1. Arkansas River 14
      - a. Topography 14
      - b. Geology 15
      - c. Soils 16
  - B. McClellan-Kerr Arkansas River Navigation System 17
    - 1. Locks and Dams 19
    - 2. Other In-River Structures 25
    - 3. Reservoirs 25
      - a. Keystone Lake 28
      - b. Oologah Lake 28
      - c. Grand (Pensacola) Lake 28
      - d. Lake Hudson 29
      - e. Fort Gibson Lake 29
      - f. Tenkiller Ferry Lake 29
      - g. Eufaula Lake 29
      - h. Kaw Lake 30
      - i. Hulah Lake 30
      - j. Copan Lake 31
      - k. Wister Lake 31
    - 4. Floodplains 31

TABLE OF CONTENTS

Page

5. Land Use/Land Cover 31
6. Vegetation 32

C. Other USACE Studies and Proposals Relevant to the Project Area(s) 33
1. MCKARNS Dredge Material Disposal Management Plan 33
2. Arkansas River McClellan-Kerr Navigation Feasibility Study ..43
a. Phase I 43
b. Phase II 48

D. Canadian River Basin 50

E. Red River Basin 52
1. Lake Texoma 53
2. Red River Downstream of Denison Dam to Index, Arkansas 55
3. Other Reservoirs 58
a. McGee Creek 58
b. Pat Mayse Lake 58
c. Sardis Lake 58
d. Hugo Lake 59

Section IV Description of Species and Status Within the Proposed Action Areas With Respect to Corps of Engineers Operations 60

A. American Alligator 60
1. Description of Species 60
2. Distribution of Species 60
3. Habitat 60
4. Cause of Decline 60
5. Status of Species 60

B. Gray Bat 60
1. Description of Species 61
2. Distribution of Species 61
3. Habitat 61
4. Cause of Decline 61
5 Status of Species 62

C. Indiana Bat 62
1. Description of Species 62
2. Distribution of Species 62
3. Habitat 62
4. Cause of Decline 63
5. Status of Species 63

D. Ozark Big-eared Bat 63
1. Description of Species 63
2. Distribution of Species 63

TABLE OF CONTENTS

Page

3. Habitat 63
4. Cause of Decline 64
5. Status of Species 64

E. American Burying Beetle 64
1. Description of Species 64
2. Distribution of Species 64
3. Habitat 65
4. Cause of Decline 66
5. Status of Species 66

F. Whooping Crane 66
1. Description of Species 66
2. Distribution of Species 67
3. Habitat 67
4. Cause of Decline 67
5. Status of Species 67

G. Bald Eagle 68
1. Description of Species 68
2. Distribution of Species 68
3. Habitat 69
4. Cause of Decline 69
5. Status of Species 70

H. Pink Mucket Pearly Mussel 72
1 Description of Species 72
2. Distribution of Species 72
3. Habitat 72
4. Cause of Decline 72
5. Status of Species 72

I. Scaleshell Mussel 72
1. Description of Species 72
2. Distribution of Species 73
3. Habitat 73
4. Cause of Decline 73
5. Status of Species 73

J. Piping Plover 74
1. Description of Species 74
2. Distribution of Species 74
3. Habitat 74
4. Cause of Decline 74
5. Status of Species 74

K. Arkansas River Shiner 75
1. Description of Species 75

TABLE OF CONTENTS

Page

2. Distribution of Species 75
3. Habitat 75
4. Cause of Decline 76
5. Status of Species 76

L. Pallid Sturgeon 76
1. Description of Species 76
2. Distribution of Species 76
3. Habitat 77
4. Cause of Decline 77
5. Status of Species 77

M. Interior Least Terns 78
1. Description of Species 78
2. Distribution of Species 78
3. Habitat 81
4. Cause of Decline 81
5. Status of Species 81
a. Oklahoma 82
(1) Arkansas River 82
(2) Canadian River 83
(3) Red River 84
b. Arkansas 85
c. Texas 86
d. Other Areas in Region 86

N. *Geocarpon minimum* 86
1. Description of Species 86
2. Distribution of Species 87
3. Habitat 87
4. Cause of Decline 87
5. Status of Species 87

O. Harperella 87
1. Description of Species 87
2. Distribution of Species 87
3. Habitat 88
4. Cause of Decline 88
5. Status of Species 88

P. Western Prairie Fringed Orchid 88
1. Description of Species 88
2. Distribution of Species 88
3. Habitat 89
4. Cause of Decline 89
5. Status of Species 89

TABLE OF CONTENTS

Page

Section V Operational Activities Potentially Affecting Federally Listed Species Within the Action Area....90
A. Action Area I, Arkansas River (Kaw Lake to Muskogee, Oklahoma....90
1. Existing Operations/Impacts....90
B. Action Area II, Arkansas River Navigation Study (Verdigris and Arkansas Rivers, Oklahoma)....92
1. Phase I, Total System Operations....92
2. Phase II, Proposed Channel Modifications....97
C. Action Area III, MCKARNS Dredge Disposal Management Plan (Verdigris and Arkansas Rivers, Oklahoma)....102
D. Action Area IV, Canadian River, Oklahoma....106
E. Action Area V, Red River Below Denison Dam to Index, Arkansas; Texas; and Oklahoma....109
Section VI Summary of Direct, Indirect, and Cumulative Effects of the Proposed Federal Action(s)....113
A. Interior Least Tern....113
B. Bald Eagle....113
C. American Burying Beetle....114
D. Pallid Sturgeon....114
Section VII Other Non-USACE Activities Occurring in the Action Areas Potentially Impacting Federally Listed Species....117
Section VIII Determination....118

BIBLIOGRAPHY....120

TABLE OF CONTENTS

Page

LIST OF TABLES

1. Federally Listed Species Occurring in Proposed Action Areas 5
2. Navigation Pools of the MCKARNS 18
3. Lock and Dam Structures of the MCKARNS 20
4. Characteristics of Flood Control Reservoirs in the Upper MCKARNS 27
5. 20-Year Dredge Disposal Plan Summary 42
6. Annual Changes in Number of Days At or Above A Given Flow at Van Buren, Arkansas, Compared With No Action Alternative (Alternative 1) 45
7. Seasonal Changes in Number of Day At or Above a Given Flow (Van Buren, Arkansas) Compared With No Action Alternative (Alternative 1) 46
8. Annual Changes in the Number of Days Reservoirs are Expected to be Above Conservation Pool Compared to Existing Conditions (No Action Alternative) 47
9. Change in the Number of Days Reservoirs are Expected to be Less Than 8 Feet Above Conservation Pool and Greater Than 8 Feet Above Conservation Pool Compared to Existing Conditions (No Action Alternative) 47

10 Pertinent Data For Deepening the Channel to 12 Feet and Widening the Verdigris River 49

11. Land Use/Land Cover Potentially Impacted by the Maximum Target Flow at Van Buren, Arkansas, Under Each Alternative 93
12. Summary of Potential Impacts on Federally Listed Species Occurring in the Proposed Action Area 115

TABLE OF CONTENTS

Page

LIST OF FIGURES

1. Arkansas River Basin Action Areas 7
2. Canadian River Action Area 11
3. Red River Basin Action Areas 13
4. McClellan Kerr Arkansas River Navigation System Lock Lift 19
5. Typical Minimum Channel Section 48
6. Recommended Regulation of Flows From Denison Dam 56
7. The Red River Basin From Denison Dam to Index, Arkansas, and Its Major Tributaries 57
8. Distribution of American Burying Beetle in Oklahoma 65
9. Midwinter Bald Eagle Surveys for Oklahoma 68
10. Midwinter Bald Eagle Counts for Lower MCKARNS 71
11. Historic Distribution of the Interior Least Tern 79
12. Current Distribution of the Interior Least Tern 80
13. Arkansas River Interior Least Tern Survey Results 83
14. USACE Canadian River Least Tern Surveys 84
15. USACE Lower Red River Interior Least Tern Surveys 85
16. USACE Lower Arkansas River Interior Least Tern Surveys 86
17. Summary of Surveys 111

LIST OF APPENDICES

1 Correspondence

INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, requires that,

"*Each Federal agency shall, in consultation with and with the assistance of the secretary, insure that any action authorized, funded, or carried out by such agency…. is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species…*".

This Biological Assessment (BA) provides the information required pursuant to the ESA and implementing regulations (50 CFR 402.14), to comply with the ESA.

NEED FOR BIOLOGICAL ASSESSMENT

In February 1987, the U.S. Army Corps of Engineers (USACE) initiated informal Section 7 consultation with the U.S. Fish and Wildlife Service (USFWS) under the ESA for operation of Kaw and Keystone dams on the main stem of the Arkansas River in Oklahoma with respect to the Interior least tern (*Sterna antillarum*). This culminated in issuance of a Biological Opinion (BO) by the USFWS dated March 16, 1998, which established "take " for this species. The USACE has been operating the two reservoirs since 1998 under the provisions of the 1998 BO and the established levels of "take".

In August 1998, the USFWS requested the USACE to initiate consultation efforts on the Canadian River below Eufaula Lake and the Red River below Denison Dam with respect to the Interior least tern, and the USACE agreed. Biological Assessments concluding a "may affect" were subsequently prepared and furnished to the USFWS. After several meetings and review of operating conditions for the Arkansas River with respect to nesting success and "take" levels established in the 1998 BA, it was decided to reinitiate consultation on the Arkansas River and combine it with the two separate ongoing consultations on the Red and Canadian rivers. This combined Section 7 consultation would result in the preparation of a comprehensive BA and BO covering all three river systems.

Also, the existing consultation covered only one species, the Interior least tern. Due to the presence of two other species, the bald eagle (*Haliaeetus leucocephalus*) and American burying beetle (*Nicrophorus americanus*), which were not addressed in the original BA, both agencies mutually agreed to include these species in the comprehensive consultation as well.

The USACE is also conducting two additional studies along the McClellan-Kerr Arkansas River Navigation System (MCKARNS) that could have potential impacts on Federally listed species. The first is the Arkansas River Navigation Feasibility Study, which consists of two phases. Phase I will address system operations of the MCKARNS, and Phase II will address proposed channel modifications. The second study involves revising the Dredge Material Disposal Management Plan for the Oklahoma portion of the MCKARNS. Since cumulative

effects must be addressed as a component of the BA, it was deemed prudent to include these proposed actions in the comprehensive BA as well.

Recently, Tulsa District initiated a reallocation study on Lake Texoma. This study will address reallocating 300,000 acre-feet of existing hydropower storage into water supply storage. The potential impacts of the proposed reallocation will also be considered in this BA and addressed as cumulative impacts.

By letter dated July 30, 2003, to the USFWS, the USACE requested an official list of Federally listed species for all the designated action areas. The USFWS replied by letter dated August 28, 2003, which updated the list of species furnished to the USACE in a planning assistance report for the Arkansas River Navigation Study dated April 2, 2001. The total number of species to be addressed in this BA is 16 and includes the American alligator, gray bat, Indiana bat, Ozark big-eared bat, American burying beetle, whooping crane, bald eagle, pink mucket pearly mussel, scaleshell mussel, piping plover, Arkansas River shiner, pallid sturgeon, Interior least tern, *Geocarpon minimum*, western prairie fringed orchid, and Harperella.

Since issuance of the 1998 BO, additional information has become available that supports preparation of this BA and the USFWS request for reinitiation of consultation. Additional surveys have been conducted on the three river systems, and the results of these surveys need to be addressed in the BA and considered in the BO. Also, the USACE formed a multi-agency Least Tern Committee in 2002 to develop and provide comprehensive guidelines for management and protection of Interior least terns nesting below USACE water resource projects on the Arkansas, Canadian, and Red rivers. These management guidelines and strategies have been implemented by the USACE and need to be considered and addressed in the BO.

This BA will address the 16 noted species with respect to the following areas, USACE studies, and operational and management activities on projects within these areas:

- The main stem of the Arkansas River from below Kaw Lake to Muskogee, Oklahoma, and the MCKARNS, and the impacts of 11 operational Oklahoma lakes associated with releases into the MCKARNS downstream to the mouth of the White River in Arkansas and then to the Mississippi River. These lakes include Keystone Lake, Oologah Lake, Grand Lake, Lake Hudson, Fort Gibson Lake, Tenkiller Ferry Lake, Eufaula Lake, Kaw Lake, Hulah Lake, Copan Lake, and Wister Lake.

- A total of 27 miles of the Canadian River from below Eufaula Dam to the confluence of the MCKARNS.

- Lake Texoma and approximately 240 miles of the Red River from below Denison Dam to Index, Arkansas.

CHRONOLOGY

A chronology of previous Section 7 consultation activities with respect to the Interior least tern on the Arkansas River system in Oklahoma can be found in the USFWS BO dated March 16, 1998. This information provides a history of all activities and correspondence from the start of informal consultation in 1986 to issuance of the BO in 1998 and is included in Appendix 1. Following is an update of all events and issues with respect to monitoring nesting Interior least terns and "take" since issuance of the 1998 BO for the Arkansas River:

August 11, 1998. USFWS letter to USACE requesting USACE initiate consultation efforts to minimize adverse effects on the Interior least tern at USACE projects on the Canadian River and Red River.

November 6, 1998. USACE letter to USFWS agreeing that USACE would survey Red and Canadian rivers in 1999 and use the information to prepare a BA.

March 13, 2001. USACE study plan for nesting island habitat evaluation furnished to USFWS. This study plan would initiate implementation of Reasonable and Prudent Measure No. 5 of the 1998 BO.

March 15, 2001. USACE letter to USFWS informing them that the Tulsa District has and will assume responsibility for any future consultation on the operation of Kaw and Keystone per Memorandum of Understanding (MOU) dated July 23, 1980, signed by the Administrator, Southwestern Power Administration (SWPA) and the USACE Division Engineer, Southwestern Division. The MOU states, " The administrator recognizes the Corps responsibility to operate the projects to serve all authorized functions including power."

April 20, 2001. Interagency meeting between USFWS, USACE, SWPA, and Department of Interior (DOI), Office of the Field Solicitor. The meeting was conducted to resolve agency differences with respect to Section 7 consultation agency requirements and to improve communications among agencies.

May 31, 2001. USFWS letter notifying USACE and SWPA that they should avoid and minimize "take" related to operation of projects on the Canadian and Red rivers.

July 02, 2001. USACE submitted a "may affect" BA to USFWS on the effects of operating Denison Dam on the Red River and requested initiation of formal Section 7 consultation.

August 14, 2001. USFWS letter stating they had reviewed the BA for the operation of Denison Dam on the Red River and concurred in the findings. The USFWS requested additional information on the Corps proposed actions to allow an accurate assessment of potential take and to develop recommendations to avoid or minimize take.

December 18, 2001. USACE submittal of BA to USFWS concerning the effect of operating Eufaula Dam for its Federally authorized purposes on the Interior least tern and request for initiation of formal Section 7 consultation.

USACE, Little Rock Chronology

After a meeting with the U.S. Department of the Interior, Fish and Wildlife Service in 1985, the Little Rock District entered into a formal review as per Section 7 of the Endangered Species Act for the portion of the McClellan-Kerr Arkansas River Navigation System. Mr. Fred Bagley of the Jackson, Mississippi, Area Office of Region IV was the USFWS point of contact on this review. Mr. Clyde Gates represented the U.S. Army Corps of Engineers, Little Rock District. The review was entered into because the Arkansas River had been a historic nesting area for an unknown population of the Interior least tern *(Sterna antillarum athalasso)* prior to construction of the navigation system. The navigation system consisted of a series of locks and dams, two lakes, and various revetments to better maintain a navigational channel. As a result of a jeopardy opinion from the USFWS, Mr. Gates developed a management plan that would protect and enhance nesting populations of the least tern on the navigation system in Arkansas. The management plan was coordinated with the Arkansas Department of Natural Heritage, the Arkansas Game and Fish Commission, and the Jackson Area office. The management plan has been in effect since 1986.

SPECIES TO BE ADDRESSED IN BIOLOGICAL ASSESSMENT

In a Planning Assistant report dated April 2, 2001, the USFWS furnished a list of 12 Federally listed threatened and or endangered species that could possibly be occurring in association with all the Arkansas River Navigation projects. By letter dated July 30, 2003, the USACE requested an official list of species from the USFWS for all the proposed action areas. The USFWS responded by letter dated August 28, 2003, and added an additional four species. A total of 16 species will be addressed in this BA and are shown in Table 1 along with their status and range.

TABLE 1. FEDERALLY LISTED SPECIES OCCURRING IN PROPOSED ACTION AREAS

Species Listings	Status	Range	
		OK	AR
Alligator, American (*Alligator mississippiensis*)	T (S/A)	X	X
Bat, Gray (*Myotis grisescens*)	E	X	X
Bat, Indiana (*Myotis sodalis*)	E	X	X
Bat, Ozark big-eared (*Corynorhinus townsendii ingénues*)	E	X	X
Beetle, American burying (*Nicrophorus americanus*)	E	X	X
Crane, whooping (*Grus americana*)	E	X	X
Eagle, bald (*Haliaeetus leucocephalus*)	T	X	X
Mucket, pink (*Lampsilis abrupta*)	E	-	X
Mussel, scaleshell (*Leptodea leptodon*)	E	X	X
Plover, piping (*Charadrius melodius*)	T	X	-
Shiner, Arkansas River (*Notropis girardi*)	T	X	X
Sturgeon, pallid (*Scaphirhynchus albus*)	E	-	X
Tern, least (*Sterna antillarum athalasso*)	E	X	X
Geocarpon minimum *(no common name)*	T	-	X
Orchid, western prairie fringed (*Platanthera praeclara*)	T	X	-
Harperella (*Ptilimnium nodosum*)	E	-	X

A copy of the correspondence with the USFWS relative to these species is included in Appendix 2.

SECTION I. DESCRIPTION OF PROPOSED ACTION

The proposed action (PA) is to prepare a comprehensive BA addressing all Federally listed species for those portions of the Arkansas River, Red River, and Canadian River impacted by operation and maintenance of USACE projects while taking into consideration other Congressionally authorized uses of the river and cumulative impacts. The proposed action will evaluate the impacts on Federally listed species of operating the following projects:

- Arkansas River System Operations
- Arkansas River Navigation Study, Phases I and II
- MCKARNS Dredge Material Disposal Management Plan
- Canadian River Operations
- Red River System Operations

SECTION II. DESCRIPTION OF ACTION AREAS

A. Action Area I, Arkansas River (Kaw Lake to Muskogee, Oklahoma)

Kaw Lake is a main stem impoundment on the Arkansas River located at river mile 653.7. It was constructed by the USACE for flood control, water supply, water quality, recreation, and fish and wildlife and became operational in May 1976. Keystone Lake is also a main stem impoundment bisecting the Arkansas River at river mile 538.8, about 15 miles west of Tulsa, Oklahoma. It was constructed by the USACE for flood control, water supply, hydroelectric power, navigation, and fish and wildlife and became operational on May 21, 1968. Water releases from Kaw and Keystone dams in the form of regulated flood flows, water quality, and hydropower releases contributes to main stem flows on the Arkansas River and will be the basis for assessing impacts to Federally listed species in this BA. Action Area I is shown on Figure 1. Reaches within Action Area I to be considered and evaluated in this BA are defined as follows:

- The 114.9-mile stretch of the Arkansas River from below Kaw Lake to Keystone Dam.
- The 58-mile stretch of the main stem of the Arkansas River from below Keystone Dam to its confluence with the Verdigris River and the MCKARNS at navigation mile 395.

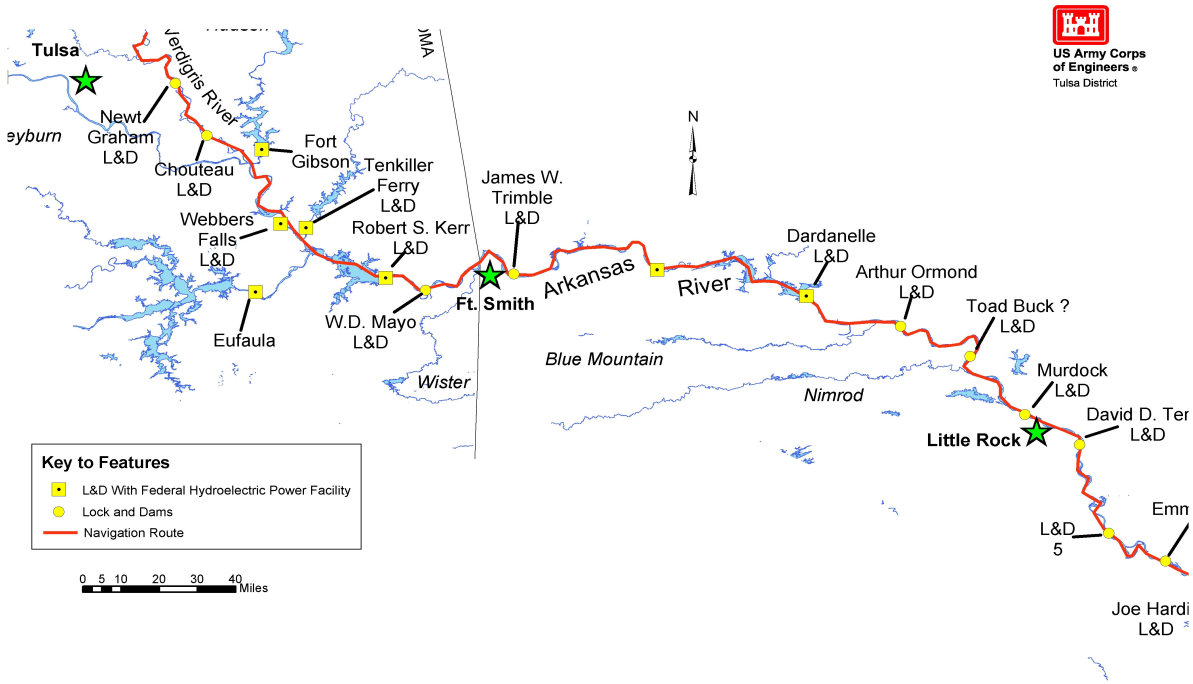


Figure 1 - Arkansas River Basin Action Areas

B. Action Area II. Arkansas River Navigation Study (Verdigris and Arkansas Rivers, Oklahoma-Arkansas, Phases I and II)

The USACE, Tulsa District and Little Rock District are conducting a combined study effort for the Arkansas River Navigation Feasibility Study consisting of two phases. Phase I was to develop and evaluate alternatives for implementing solutions to problems resulting from sustained high flows on the MCKARNS. Phase I examined a variety of project alternatives, including operational changes to the existing reservoirs as well as construction of additional lakes or levees along the Arkansas River for navigational flow management. Alternative 4, the Operations Only Plan, is the recommended plan and would increase the number of days in which longer tows of barges could navigate the system. The Operations Only Alternative is defined as the existing operating plan with a modified 60,000 cfs bench in place of the 75,000 cfs bench beginning at 3% lower system storage except during June 15 through October 1. Modeling analysis estimates there would be an approximately 14-day reduction in flows above 60,000 cfs at Van Buren, and a 2-day increase in flows above 100,000 cfs at Van Buren compared to the existing operation plan. It also showed essentially no change at 137,000 cfs (channel capacity). Under Alternative 4, flood control and recreation impacts would not change from current operation plans.

Phase II is examining the feasibility of increasing the channel depth along the entire MCKARNS and widening the Verdigris River portion of the system to allow tows to pass at almost any location on the Verdigris River. Ongoing activities of Phase II include a detail survey of the navigation channel from the juncture of the system with the Mississippi River to the Port of Catoosa at the head of the navigation channel. Proponents of the navigation system are interested in the feasibility of increasing the depth of the navigation system in Arkansas and Oklahoma from 9 feet to 12 feet.

Currently, the USACE is authorized to maintain the MCKARNS at a 9-foot channel depth. Due to ongoing maintenance dredging of the existing navigation channel and natural stream scour, approximately 80-90% of the system is already 12-feet deep over a portion of the channel width. Changing the authorized channel depth 10 to 12-feet would allow tow drafts on the MCKARNS to match those of the lower Mississippi River system. A number of private and public ports on the system can currently only accommodate tow and barges capable of operating in a 9-foot channel. These ports will have to modify their facilities to accommodate barges with drafts deeper than those allowed by a 9-foot channel.

Current MCKARNS channel widths are 300 feet on the White River Entrance Channel, Arkansas Post Canal, and Lake Langhofer; 250 feet on the Arkansas River; 150 feet on the Verdigris River; and 225 feet on Sans Bois Creek. For most of the MCKARNS, channel width is sufficient to allow tows to pass each other at any location, but passing on the Verdigris River is restricted to only certain wider locations. Increasing the width of the Verdigris River to 300 feet would ease congestion by allowing tows to pass at almost any location on that portion of the system.

Currently, the USACE, Tulsa District and Little Rock District cooperatively control flows in the Arkansas River system in Kansas, Oklahoma, and Arkansas. The action area for the Arkansas River Navigation study includes the MCKARNS from the Port of Catoosa near Tulsa, Oklahoma, downstream to the confluence of the Mississippi River in southeastern Arkansas as well as 11 reservoirs in Oklahoma that influence river flow within the MCKARNS. The MCKARNS action area (Figure 1) is approximately 445 miles in length and consists of a series of 18 locks and dams (17 existing and 1 presently under construction). Action Area II reaches to be considered and evaluated in this BA are defined as follows:

- A 50-mile reach of the Verdigris River from the Port of Catoosa to Muskogee (navigation miles 445-394),
- Lower Arkansas River, which comprises 375 miles of the MCKARNS (navigation miles 394 to 19),
- The Arkansas Post canal, a 9-mile canal connecting the Arkansas River to the lower portion of the White River (navigation miles 19 to 10),
- The lower 10 miles of the White River (navigation miles 10 to 0)
- The lower Arkansas River downstream of Dam 2 (not formally part of the MCKARNS). This portion of the Arkansas River is included in the Arkansas River Navigation Study project area because MCKARNS river flows may also influence this segment of the river.

- Eleven reservoirs in Oklahoma that may influence flows on the upper Arkansas River when operated for flood control, water supply, hydroelectric power, fish and wildlife, recreation, and other benefits. These include Keystone Lake, Oologah Lake, Pensacola (Grand) Lake, Lake Hudson, Fort Gibson Lake, Tenkiller Ferry Lake, Eufaula Lake, Kaw Lake, Hulah Lake, Copan Lake, and Wister Lake.

C. Action Area III, MCKARNS Dredge Material Disposal Management Plan (Verdigris and Arkansas Rivers, Oklahoma)

The Oklahoma portion of the MCKARNS includes approximately 140 navigation miles of channel. Channel widths vary throughout, including 250 feet along the Arkansas River, 150 feet along the Verdigris and Poteau rivers, and 225 feet along the Sans Bois Creek. Depths of the navigation channel run approximately 9 feet throughout the MCKARNS. There are five locks and dams within the Oklahoma portion of MCKARNS, including W. D. Mayo (Lock & Dam 14), Robert S. Kerr (Lock & Dam 15), Webbers Falls (Lock & Dam 16), Chouteau (Lock & Dam 17), and Newt Graham (Lock & Dam 18).

The operation and maintenance program for the Oklahoma portion of the MCKARNS is addressed in a Final Environmental Statement dated September 1974. This EIS included the locations of dredge disposal areas. Operation of the MCKARNS and disposal of dredged materials has occurred at the locations addressed in the final EIS. As part of the ongoing operations and management program, the USACE, Tulsa District is evaluating a future 20-year plan for dredging operations for the Oklahoma portion of the MCKARNS. Preliminary findings indicate that additional disposal areas may be required to meet the projected 20-year dredging requirements for the Oklahoma portion of the MCKARNS. Consequently, the Dredge Material Disposal Management Plan and any new recommended sites will be evaluated for impacts associated with Federally listed species and included in this BA. The limits of the MCKARNS Dredge Material Disposal Management Plan are shown in Figure 1. The reaches of Action Area III to be considered and evaluated in this BA are defined as follows:

- Along either side of the MCKARNS from the head of navigation on the Verdigris River at Catoosa, Oklahoma, navigation mile 445.2, to the lower limits of the Oklahoma portion of the MCKARNS at navigation mile 308.5.

D. Action Area IV, Canadian River, Oklahoma

The Canadian River originates in Colfax County, New Mexico, and flows southeasterly through New Mexico and easterly through the Texas Panhandle. It enters Oklahoma and forms the boundary between Ellis and Roger Mills counties. The river then travels eastward some 410 miles across the state of Oklahoma and joins the Deep Fork River and North Canadian River to form Eufaula Lake. Eufaula Lake was constructed by the USACE on the Canadian River at mile 27.0, and became operational in September 1964. It was constructed for flood control, water supply, hydroelectric power, and navigation (sediment control). The Canadian River exits

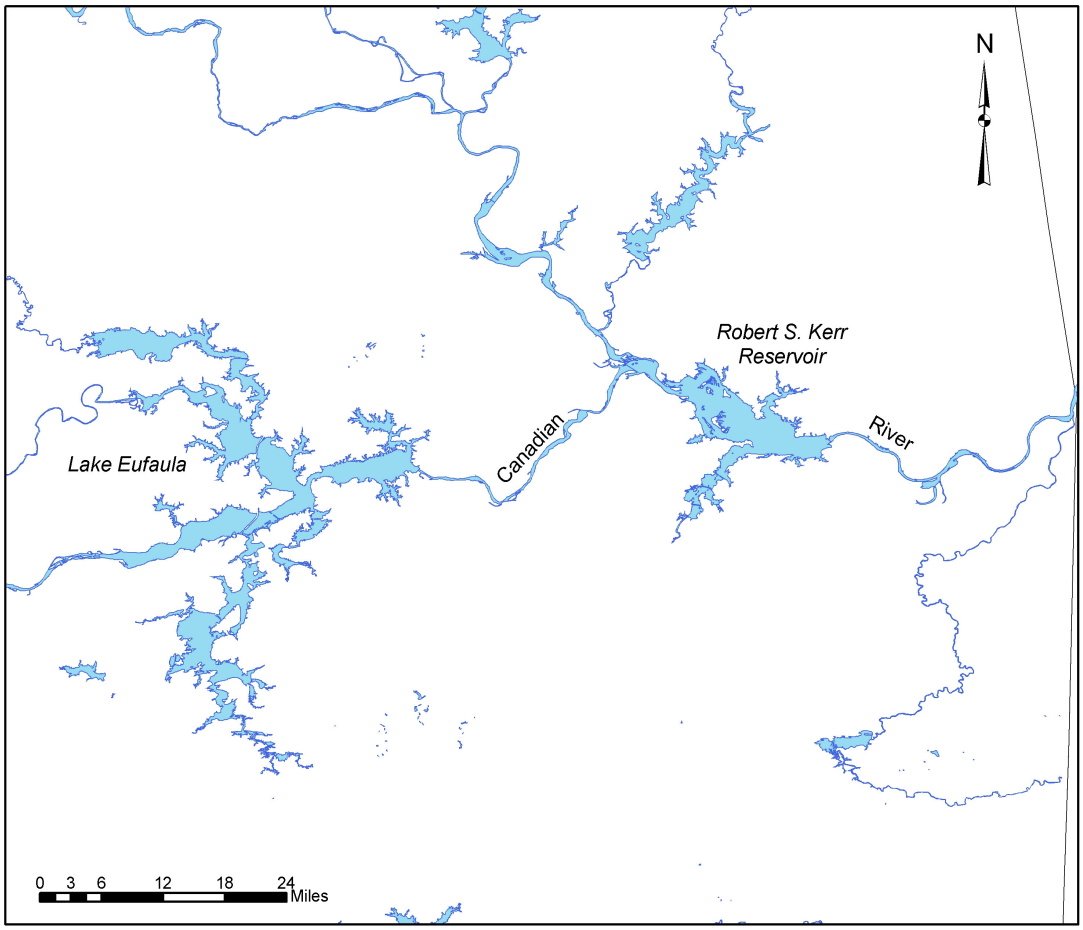
Eufaula Dam and flows eastward to its confluence with the MCKARNS near navigation mile 357 and the Haskell County and Muskogee County line.

In December 2001, the USACE submitted a "may affect" BA to the USFWS with respect to operations of Eufaula Dam on the lower Canadian River for the Interior least tern, but a BO on the assessment has not been issued by the USFWS. It is the intent of this BA to update the findings of the 2001 BA and expand it to include all Federally listed threatened and endangered (T&E) species. A map depicting Action Area IV is shown in Figure 2. For assessment purposes, this component of the BA is defined as follows:

- The 27-mile stretch of the main stem of the Canadian River downstream of Eufaula Dam to its confluence with the MCKARNS at navigation mile 359.3.

E. Action Area V, Red River Below Denison Dam to Index Arkansas; Texas; and Oklahoma

The Red River is one of the two major river systems in Oklahoma. It originates from small streams in eastern New Mexico and gradually runs eastward approximately 517 miles to the Oklahoma-Arkansas State line in southwestern Arkansas. In its extreme western reaches it is composed of the Prairie Dog Town Fork of the Red River, which flows southeasterly to loosely form the southern border of Oklahoma. At the confluence of the Prairie Dog Town Fork of the Red River with the Salt and North Forks of the Red River, it continues as the State's southern border but is referred to as simply the Red River. In Oklahoma, there are 22,791 square miles of contributing drainage area to the Red River.



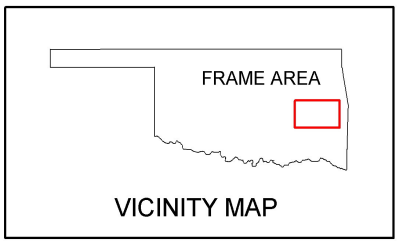


Figure 2 - Canadian River Action Area

At river mile 725.9, the main stem of the Red River is bisected by Denison Dam (Lake Texoma), which was constructed by the USACE for flood control, water supply, hydroelectric power, regulating flows, and improving navigation. Upon exiting Denison Dam, the river flows approximately 240 miles to Index, Arkansas, which is the eastern limit of the USACE, Tulsa District. In July 2002, the USACE submitted a "may affect" BA to the USFWS on operations of Denison Dam on the lower Red River to Index, Arkansas, with respect to the Interior least tern, but a BO has not been issued by the USFWS. This BA will update the findings of the 2002 BA and will be expanded to include all Federally listed T&E species. The scope of the BA will also be expanded into a single comprehensive BA for all the noted action areas. For assessment purposes, this BA will assess the impacts of operating Lake Texoma on all Federally listed species on the Red River to the eastern limits of the Tulsa District. The limits of Action Area V are shown in Figure 3 and defined as follows:

- Lake Texoma
- The 240-mile reach of the Red River below Denison Dam to Index, Arkansas

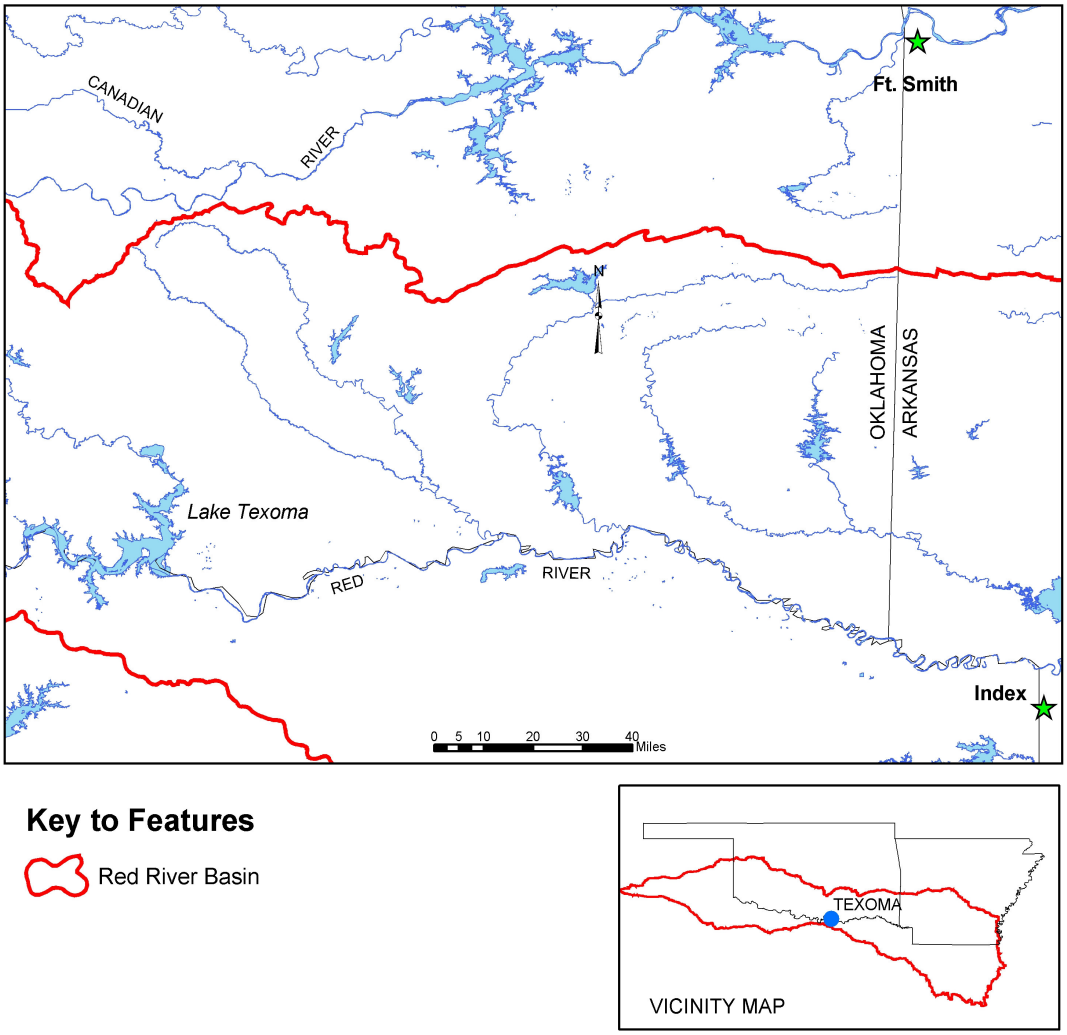


Figure 3 - Red River Basin Action Areas

SECTION III. DESCRIPTION OF EXISTING CONDITIONS/CURRENT OPERATIONS

A. Arkansas River Basin

1. Arkansas River. The Arkansas River is one of the two major river basins in Oklahoma. The river is the fourth longest river in the United States and the sixteenth longest in the world. Many major tributaries flow into the Arkansas River, including the Cimarron, Canadian, Neosho, Grand (formed by the confluence of the Neosho and Spring rivers) Verdigris, and White rivers. Minor tributaries include the Currant and Big Sandy rivers in Colorado; the Pawnee, Walnut, Rattlesnake, and Little Arkansas Rivers in Kansas; the Salt Fork, Illinois, and Poteau rivers in Oklahoma.

From its source in the Rocky Mountains near Leadville, Colorado, it flows in a southeasterly direction through the State of Kansas and enters Kay County, Oklahoma, just south of Arkansas City, Kansas, at the upper limits of Kaw Lake. It then runs in a southerly direction through Kaw Lake where it forms the county line between Osage, Noble and Pawnee counties. Kaw Dam bisects the Arkansas at river mile 653.7. After leaving Kaw Dam, it continues in a southeasterly direction where Keystone Dam bisects it approximately 15 miles west of Tulsa, Oklahoma. It continues in a southeasterly direction through Tulsa County and forms the boundary between Wagoner and Muskogee counties. In Muskogee County, it converges with the Verdigris and Grand rivers at the upper limits of Webbers Falls Lock and Dam. At this point near Muskogee, Oklahoma, it becomes part of the MCKARNS. It continues southeasterly through Webbers Falls and Robert S. Kerr lakes and forms the county line between Sequoyah and LeFlore counties. It leaves the state of Oklahoma at navigation mile 361 below W.D. Mayo Lock and Dam where it flows into the State of Arkansas. From this point, it flows southeasterly through the State of Arkansas and a series of 13 locks and dams and reservoirs to its confluence with the White River near navigation mile 10. From its confluence with the White River, it continues its southeasterly flow to its confluence with the Mississippi River in Desha County, Arkansas, at navigation mile 0.

a. Topography. The difference in elevation from the beginning of the MCKARNS at the Port of Catoosa to the confluence with the Mississippi River is 420 feet. Because the elevation of the Arkansas River through Tulsa is 100 feet higher than the Verdigris at Catoosa, the USACE channeled up the Verdigris River from Muskogee to Catoosa rather than the Arkansas River. The MCKARNS study area traverses many physiographic regions in Arkansas and Oklahoma. The major physiographic provinces include the Ouachita Province, the Ozark Plateau Province and the Mississippi Alluvial Plain.

The Ouachita Province is divided into the Ouachita Mountains Section in the southern portion of the province and the Arkansas Valley Section in the northern portion. The Ouachita Mountains Section is distinguished by ridge and valley topography rising in some areas to more than 2,000 feet above sea level. The Arkansas Valley Section includes lower elevation plains (300-600 feet above sea level) with smaller east-west ridges generally no more than 1,000 feet above sea level. Normal MCKARNS navigation pool elevation in the Arkansas Valley

Section varies from over 500 feet above sea level in eastern Oklahoma to approximately 250 feet above sea level near Little Rock, Arkansas.

The Ozark Plateau Province is north of the Ouachita Province and is separated into the Boston Mountains Section to the south of the Province and the Salem and Springfield Plateaus to the north. The Boston Mountains Section occurs along the northern portion of the Arkansas River Valley in northwestern Arkansas and northeastern Oklahoma. This 35-mile-wide section is a deeply dissected plateau region characterized by flat-crested ridges that generally range from 1,900 to 2,500 feet above sea level. The valleys are generally v-shaped and are cut 300 to 1,000 feet below the ridges.

Downstream of Little Rock, Arkansas, the topography transitions to the Mississippi Alluvial Plain that generally consists of low floodplains, and floodplain terraces. Crowley's Ridge in Arkansas is the most prominent topographic feature of the Mississippi Alluvial Plain. It is thought that this ridge is in part a north-south outlier of older, underlying Coastal Plain rocks.

b. <u>Geology</u>. The rocks that underlie the Ouachita and Ozark Provinces are Paleozoic (Cambrian to Pennsylvanian) in age. The Ouachita Province bedrock is fractured, faulted, and folded shale, sandstone, limestone and cherty-novaculite rocks, whereas the Ozark Province consists of well-consolidated, flat lying to south dipping, fractured carbonate and clastic rocks. The Mississippi Alluvial Plain consists of alluvial deposition with underlying material similar to the Coastal Plain - Mesozoic to Cenozoic (Jurassic to Quaternary) in age.

The Ouachita Province rock is mostly a thick sequence of shale and sandstone deposited during the Cambrian to early Pennsylvanian time within an elongating subsiding Ouachita trough. Rifting along a late Precambrian-early Paleozoic continental margin formed the trough. The Ouachita trough contains depositional deep-water sediments. The trough was closed during the late Pennsylvanian time by compressional tectonic forces. These forces created an intensely folded structure with north and south directed thrust faults. The thrust faults occur in folded structures and result in the rocks above the fracture depositing over the rocks below. Normal faults are common in the areas north of the Arkansas River, and thrust faults are present south of the river in the Ouachita Mountains.

The Ozark Plateau Province consists of rocks of Ordovician to Pennsylvanian age that are underlain by dolomite and sandstone beds of Cambrian Age that formed at the basal part of the Paleozoic sequence. The Ozark uplift, centered in southern Missouri, affects the structural attitude of Paleozoic rocks in northern Arkansas. In general, outcrop rocks in northern Arkansas result from annular bands around the Ozark uplift. Rocks of Ordovician to Mississippian age in the Ozark Plateau Province that dip gently southward from northern Arkansas are dominated by shallow-water carbonate-shale sequences with some deltaic sandstones. These were deposited on a cretonic shelf in the Precambrian. The Boston Mountains Section of this province consists mostly of Pennsylvanian sedimentary rocks of sandstone and shale deposited in deltaic, open marine, coastal, and swamp environments.

The Mississippi Alluvial Plain contains alluvial deposition over the Coastal Plain sedimentary rock, which is of Cretaceous to early Tertiary in age, except where covered by Holocene deposition from the ancestral Mississippi River. About 12,000 years ago, a braided ancestral Mississippi River resulted from glacial melt waters carrying large volumes of course-grained sand and gravel detritus. As the sediment load lessened, the Mississippi River became a meandering river system, depositing sand, silt, and clay.

c. Soils. Within the MCKARNS, deposition and down cutting by major rivers and streams were extensive from the end of the Tertiary period to the Quaternary Period. This ongoing pattern of erosion and deposition left a series of alluvial depositions as the streams progressively lowered their beds. The more recent alluvial terraces may only be a few feet above the current floodplain. The alluvium is the most recent depositional material within the confines of the current floodplain.

In Oklahoma, the alluvium and alluvial terraces of the main stem of the Arkansas River average more than 5 miles in width and 45 feet in depth between the confluences with the Cimarron River and where the Arkansas passes Tulsa. The deposits are predominantly sand and gravel, and the water table is generally less than 20 feet below the soils.

In the northwestern portion of Arkansas where the Arkansas River enters the state through Sebastian County, the Arkansas River valley is characterized by rolling flat-topped hills, long narrow ridges, and broad valleys. The hilltops and ridges are mostly underlain by shale. The USDA (1975) as reported by USACE (2003) has indicated the following soil associations for the area:

- The mountaintops and hilltops are generally *Mountainburg-Linker* soils, which are well drained, gently sloping to steep, deep, loamy soils.
- *Enders-Mountainburg* soils are well drained, gently sloping to steep, deep and shallow, loamy soils on narrow ridges.
- The fertile bottomlands of the valleys are generally *Leadvale-Taft*, which are moderately well drained to somewhat poorly drained, level to sloping, deep, loamy soils with a fragipan. The *Wrightsville* association is similar but predominantly level on old stream terraces.

- The Arkansas River floodplain soils include the *Crevasse* association, which is excessively drained, level and nearly level, deep soils that are sandy throughout, and the *Severn-Iberia-Norwood* association, which is well drained to poorly drained, dominantly level, deep, loamy and clayey soils. These two associations frequently run parallel and adjoining each other, with the Crevasse association typically found to the north of the other.

The southeastern portion of the study area within the State of Arkansas is represented by Desha County (USDA, 1972a as reported by USACE, 2003), and limited southern portions of Arkansas County (USDA, 1972b as reported by USACE, 2003), which includes the area of the confluence of both the Arkansas and White rivers with the Mississippi River. Soils types range from loamy soils along bayou ridge tops to predominantly clay in lower elevations. The primary soil associations of the study area through this portion of the state include:

- The *Herbert-Rilla-McGee* association is level and nearly level, somewhat poorly drained to well-drained, loamy soils found along ridge tops of the bayous.
- The *Sharkey-Commerce-Coushatta* and the *Perry-Rilla-Portland* associations are generally level bottomlands along the Arkansas River, which are poorly drained to well-drained, clayey and loamy soils.
- The *Sharkey-Desha* association is level and gently undulating, poorly drained to somewhat poorly drained, predominantly clayey soils on lower broad floodplain terraces.

The transition from the mountainous physiographic of northwestern Arkansas to the deltaic characteristics of the southeastern portion of the MCKARNS occurs gradually along its southeasterly progress through the State of Arkansas, but it is most pronounced through the Little Rock area.

B. McClellan-Kerr Arkansas River Navigation System

Congress, in the River and Harbor Act of July 24, 1946, authorized the MCKARNS project. Construction of the 9-foot-deep channel occurred during the 1960's, with the system being declared open to commercial traffic on December 2, 1970. Public Law 91-649, passed by Congress in 1971, designated it as the McClellan–Kerr Arkansas River Navigation System.

The beginning of the MCKARNS is located at the confluence of the White River and the Mississippi River. The Arkansas River comprises most of the MCKARNS and is entered via the White River to the Arkansas Post Canal, then up the Arkansas River to Muskogee to the Port of Catoosa via the Verdigris near Tulsa. The total length of the MCKARNS is 445 miles, of which 375 miles is the lower Arkansas River (navigation miles 394 to19). Other MCKARNS components include approximately 50 miles of the Verdigris River (navigation miles 445 to 394); the Arkansas Post Canal, a 9-mile canal connecting the Arkansas River to the lower portion

of the White River (navigation miles 19 to 10); and the lower 10 miles of the White River (navigation miles 10 to 0).

Navigation on the lower Arkansas and the other components of the MCKARNS is controlled by a series of 18 locks and dams. The USACE maintains a minimum 9-foot channel depth on the system. Passage through MCKARNS lock chambers was configured for 8 barges, but can accommodate 15 barge tows using double lockage. Each lock chamber is 100 feet wide and 600 feet long. There are currently 17 completed locks and 1 under construction. Five of the lock and dams are located in Oklahoma beginning on the Verdigris River. The remaining locks and dams are located on the Arkansas portion of the MCKARNS.

The lock and dam structures are constructed along the waterway in a stair step pattern that gradually follows the natural elevation changes of the topography while still maintaining a navigation pool. Table 2 includes the length, surface area, capacity, location, and elevation for each navigation pool.

TABLE 2. NAVIGATION POOLS OF THE MCKARNS

Navigation Pool (NP)	Length (miles)	Surface Area[1]	Capacity[2]	Navigation Mile[3]	Elevation[4]
Oklahoma Pools					
Newt Graham NP*	23.2	1,490	2,500	421.6	532 to 511
Chouteau NP*	20.2	2,270	23,340	401.4	511 to 490
Webbers Falls Lake	32.5	11,640	170,100	368.9	490 to 460
Robert S. Kerr Lake	32.7	32,800	525,700	336.2	460 to 412
W.D. Mayo NP	16.6	1,595	15,800	319.6	412 to 392
Arkansas Pools					
Hammerschmidt Lake (J.W. Trimble)	26.8	NA	NA	292.8	392 to 372
Ozark Lake (Ozark-Jeta Taylor)	36.0	NA	NA	256.8	372 to 338
Dardanelle Lake	51.3	NA	NA	205.5	338 to 284
Rockefeller Lake (Arthur V. Ormond)	28.6	NA	NA	176.9	284 to 265
Toad Suck Ferry NP	21.0	NA	NA	155.9	265 to 249
Murray NP	30.5	NA	NA	125.4	249 to 231
David D. Terry NP	17.3	NA	NA	108.1	231 to 213
Lock & Dam No. 5 NP	21.8	NA	NA	86.3	213 to 196
Emmett Sanders NP	20.3	NA	NA	66.0	196 to 182
Joe Hardin NP	15.8	NA	NA	50.2	182 to 162
Lock No. 2 (Canal)**	36.9	NA	NA	13.3	162 to 142
Norrell (Canal)**	3.1	NA	NA	10.2	142 to WR

[1] Surface area measured in acres at top of the upper pool.
[2] Capacity is measured at the top of the upper pool in acre-feet.
[3] Navigation miles upstream from the mouth of the White River (WR).
[4] Elevation in feet above mean sea level (msl) from upper pool to lower pool.
* Verdigris River; ** Arkansas Post Canal; NA=Not available
Source: USACE, 2003.

1. Locks and Dams. Development of the waterways of the MCKARNS involved many in-stream modifications that produce stability and consistency to a naturally erratic system. Dams were created along the length of the system in order to maintain a navigation pool, typically along the old river channel, that provided a constant minimum navigation depth to the channel. This series of navigation pools from dam to dam creates a stair step profile to the waterway from pool to pool (Figure 4). This allows the system traffic to "climb" or "ascend" the system's 420-foot elevation change with a consistent navigable channel.

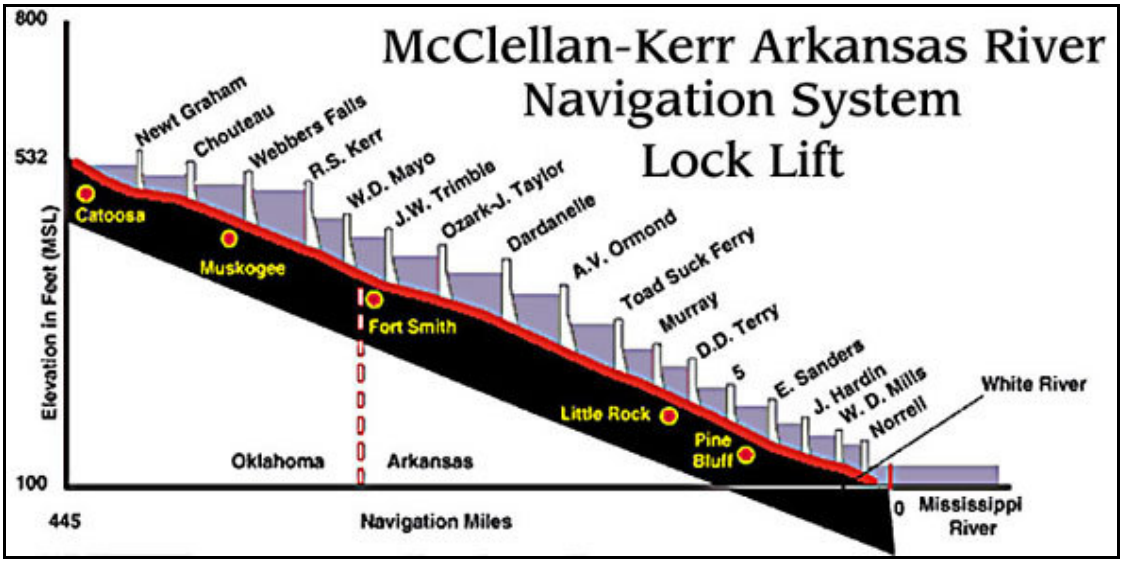


Figure 4. McClellan-Kerr Arkansas River Navigation System Lock Lift.

Passage through a dam is achieved through a "lock" chamber system that lowers downstream traffic by reducing the water level in the chamber to that of the downstream navigation pool and raising the chamber elevation for upstream traffic.

The lock and dam structures along the MCKARNS vary in design and include 13 “low-head” and 4 “high-head” locks and dams. A 14th low-head lock and dam at the mouth of the White River (Montgomery Point Lock & Dam) is currently under construction.

Additionally, the four high-head USACE-operated locks and dams are used for hydroelectric power production as well as navigation control. Hydroelectric power production occurs at additional locks and dams along the MCKARNS; however, these are not USACE-operated facilities.

Table 3 lists each of the USACE lock and dam structures located on the MCKARNS. Dams with hydroelectric power capabilities are also identified in Table 3 and discussed in more detail in the next section.

TABLE 3. LOCK AND DAM STRUCTURES OF THE MCKARNS

Lock and Dam (L & D)	Construction Dates	Navigation Mile[1]	Elevation[2]
Oklahoma Lock & Dams			
Newt Graham L & D (No. 18)*	1966 to 1970	421.6	532 to 511
Chouteau L & D (No. 17)*	1966 to 1970	401.4	511 to 490
Webbers Falls L & D (No. 16)⚡	1965 to 1970	368.9	490 to 460
Robert S. Kerr L & D (No. 15)⚡	1964 to 1970	336.2	460 to 412
W. D. Mayo L & D (No. 14)	1966 to 1970	319.6	412 to 392
Arkansas Lock & Dams			
J. W. Trimble L & D No. 13⚡	1966 to 1969	292.8	392 to 372
Ozark-Jeta Taylor L & D (No. 12)⚡	1964 to 1969	256.8	372 to 338
Dardanelle L & D (No. 10)⚡	1957 to 1969	205.5	338 to 284
Arthur V. Ormond L & D (No. 9)⚡	1966 to 1969	176.9	284 to 265
Toad Suck Ferry L & D (No. 8)	1965 to 1969	155.9	265 to 249
Murray L & D (No. 7)⚡	1965 to 1969	125.4	249 to 231
David D. Terry L & D (No. 6)	1965 to 1968	108.1	231 to 213
L & D No. 5	1965 to 1968	86.3	213 to 196
Emmett Sanders L & D No. 4	1964 to 1968	66.0	196 to 182
Joe Hardin L & D (No. 3)	1964 to 1967	50.2	182 to 162
Wilbur D. Mills Dam (No. 2)⚡	1963 to 1968	40.5[3]	162 to AR
Lock No. 2**	1963 to 1967	13.3	162 to 142
Norrell L & D (No. 1)**	1963 to 1967	10.2	142 to ~115
Montgomery Point L & D	1998 (not complete)	0.6[4]	~115

[1] Navigation miles upstream from the mouth of the White River (WR).
[2] Elevation in feet above mean sea level (msl) from upper pool to lower pool.
[3] Miles upstream from the mouth of the Arkansas River (AR) at the Mississippi River (MR).
[4] Navigation miles 0.6 of the White River Entrance Channel.
⚡ Hydroelectric power
* Verdigris River
** Arkansas Post Canal.
Source: USACE and MCKARNS, 2003.

Following are descriptions of each lock and dam structure along the MCKARNS. This does not include a description of reservoir project dams, which are included in a subsequent section.

Newt Graham Lock and Dam (No. 18). Located on the Verdigris River at navigation mile 421.6, approximately 8 miles southwest of Inola in Wagoner County, Oklahoma, the Newt Graham Lock and Dam Project was authorized by the River and Harbor Act of 1946. Construction began in 1966 and was completed and operational for navigation in 1970.

Newt Graham Dam is a 1,630-foot embankment of rolled earth fill and concrete. The spillway is a gated, concrete ogee weir with a crest elevation of approximately 506 feet above mean sea level (msl). The elevation at the top of the spillway gates is approximately 532 feet above msl. The total width of the spillway is 220 feet with a net flow width of 180 feet. The lock is a 110- x 600-foot single lift chamber with miter gates and has a normal lift of 21 feet.

Chouteau Lock and Dam (No. 17). The River and Harbor Act of 1946 authorized the creation of Chouteau Lock and Dam as part of the MCKARNS. The lock is located on the Verdigris River at navigation mile 401.4, about 4 miles northwest of Okay in Wagoner County, Oklahoma. Construction of the dam began in 1966 and was completed in 1970. The first boats traveled through the lock only a few weeks later.

The 11,690-foot dam is a combined earth fill and concrete, gravity dam. The spillway is a gated, concrete, ogee weir with a crest elevation of 485 feet above msl. The tops of the spillway gates are at 512 feet above msl. There are left and right uncontrolled overflow sections. The total width of the spillway is 386 feet, with a net flow width of 346 feet. Chouteau Lock has a 110- x 600-foot single-lift chamber with miter gates. It has a normal lift of 21 feet and a maximum lift of 24 feet.

Webbers Falls Lock and Dam (No. 16). Located at navigation mile 368.9, approximately 5 miles northwest of Webbers Falls, Oklahoma, the lock and dam were constructed for both navigation and hydroelectric power. Authorization to build the lock and dam came from the River and Harbor Act of 1946. Construction began in 1965 and the lock and dam became operational for navigation in 1970.

The Webbers Falls Lock and Dam Project is 4,370 feet long, including the spillway, powerhouse intake, and navigation lock. The dam is constructed of rolled-earth material and stands 84 feet above the streambed. The elevations from the upper and lower pools are 490 and 460 feet above msl, respectively. The spillway is a gated, concrete, ogee weir. The lock, an Ohio River-type with a normal lift of 30 feet, has a culvert and port filling system and side outlet discharge. The chamber is 110 feet wide by 600 feet long.

Robert S. Kerr Lock and Dam (No. 15). The River and Harbor Act of 1946 authorized the Robert S. Kerr Lock and Dam Project as part of the MCKARNS. The project was originally named the Short Mountain Lock and Dam. The name was changed by Public Law 88-62 (approved July 8, 1963). The lock and dam are located at navigation mile 336.2, about 8 miles

south of Sallisaw in Le Flore County, Arkansas. Construction was started in 1964 with the objectives of navigation, hydroelectric power, and recreation. Closure of the dam and navigable operation occurred in 1970.

The total length of the project is 7,230 feet, including the spillway, powerhouse intake, and navigation lock. The dam, constructed of rolled earth fill material, is 75 feet above the streambed. The gated, concrete, ogee weir-type spillway extends partly across the existing river channel and a portion of the right bank between the power improvements and the navigation lock. It is 900 feet long. The single-lift, Ohio River-type lock is located to the left of the spillway and has a culvert and port filling system. The chamber is 110 feet wide by 600 feet long and provides a normal lift of 48 feet.\

W.D. Mayo Lock and Dam (No. 14). - Located at navigation mile 319.6, approximately 9 miles southwest of Fort Smith, Arkansas, the W.D. Mayo Lock and Dam were authorized under the River and Harbor Act of 1946. Construction began in 1966 and was completed and operational in 1970.

The dam is 7,400 feet long and consists of a low concrete apron and sill. It is surmounted by twelve 60- x 21-foot tainter gates, each separated by 10-foot concrete piers. The piers hold the machinery that operates the gates. W.D. Mayo Lock has a 110- x 600-foot, single-lift chamber with miter gates. The normal and maximum lifts are 20 and 22 feet, respectively.

J.W. Trimble Lock and Dam No. 13. The J.W. Trimble Lock and Dam are located at navigation mile 292.8 about 3 miles east of Fort Smith, Arkansas. Also authorized by the River and Harbor Act of 1946, it is the first lock and dam as the Arkansas River enters the state of Arkansas. Construction began in 1966 and was completed and opened for navigation in 1969.

The spillway is composed of a low concrete apron about 1,050 feet long, surmounted by fifteen 60- x 30-foot tainter gates. The lock has a maximum lift of 22 feet.

Ozark-Jeta Taylor Lock and Dam (No. 12). Situated at navigation mile 256.8 within Franklin County, Arkansas, the Ozark-Jeta Taylor Lock and Dam are 1 mile southeast of Ozark, Arkansas. Construction activities occurred from 1964 to 1969.

The dam has a spillway elevation of 327 feet above msl. The tops of the gates are at 373.0 feet above msl. The top of the lock wall and embankment reach 382 feet above msl. Authorization to build the lock and dam came from the River and Harbor Act of 1946.

Dardanelle Lock and Dam (No. 10). Dardanelle Lock and Dam are located at navigation mile 205.5 along the border of Pope and Yell counties in Arkansas. Authorization to build the lock and dam came from the River and Harbor Act of 1946. Construction was initiated in 1957 and completed in 1969.

The spillway crest and top of the dam elevations are 300 355 feet above msl, respectively. The dam is 2,683 feet long and the spillway is 1,210 feet long. The dam has 20 gates, each of which is 50- x 39-feet is size and is located at 339 feet above msl. Dardanelle Lock has a 110 x 600 foot chamber with a maximum lift of 54 feet. The top of the lock wall is 348 feet above msl.

Arthur V. Ormond Lock and Dam (No. 9). This lock and dam project is located at navigation mile 176.9 in Conway County, Arkansas. Construction began in 1966 and was completed for navigation in 1969. Authorization to build the lock and dam came from the River and Harbor Act of 1946.

Arthur V. Ormond Dam is 1,800 feet long. The spillway is 980 feet long and consists of fourteen 60- x 35-foot gates. The elevations of the spillway crest and fully open gate lip are 253 and 313.5 feet above msl, respectively. The chamber of the Arthur V. Ormond Lock measures 110 x 600 feet. It has a 19 and 22-foot normal and maximum lift, respectively. The top of the lock wall is 297 feet above msl. The chamber floor stands at 247 feet above msl.

Toad Suck Ferry Lock and Dam (No. 8). - Toad Suck Ferry Lock and Dam are located at navigation mile 155.9 west of Conway, Arkansas. Construction began in 1965 and was completed for navigation in 1969. Authorization to build the lock and dam came from the River and Harbor Act of 1946.

The spillway is 1,120 feet long and consists of sixteen 60- x 24-foot gates. The elevations of the spillway crest and fully open gate lip are 242 and 294 feet above msl, respectively. The chamber of the Toad Suck Ferry Lock measures 110 x 600 feet and has a 16-foot normal lift. The top of the lock, guard, and guide walls stands ranges in elevation from 247 to 279 feet above msl. The lock's chamber floor ranges from 218 to 231 feet above msl.

Murray Lock and Dam (No. 7). - Murray Lock and Dam are located at navigation mile 125.4 in Pulaski County, Arkansas. Construction was authorized by the River and Harbor Act of 1946, and began in 1965. It was completed for navigation in 1969.

The spillway is 980 feet long and consists of fourteen 60- x 33-foot gates. The elevations of the spillway crest and fully open gate lip are 218 and 268 feet above msl, respectively. The chamber of Murry Lock measures 110 x 600 feet and has an 18-foot normal lift. The top of the lock, guard, and guide walls stands at 259 feet above msl. The lock's chamber floor ranges in elevation from 192 to 197 feet above msl.

David D. Terry Lock and Dam (No. 6). The David D. Terry Lock and Dam construction began in 1965 at navigation mile 108.1. The project was completed for navigation several years later in 1968. Authorization to build the lock and dam came from the River and Harbor Act of 1946.

The dam spillway section consists of seventeen gates, each 60- x 27-feet in size. The spillway itself is 1,190 feet long. The spillway crest is 206 feet above msl. The gate lip, when fully open, reaches 252 feet above msl. The David D. Terry Lock ranges in elevation from 196 feet above msl (chamber floor) to 243 feet above msl (top of lock wall). It has a single-lift chamber measuring 110 x 600 feet. The normal lift is 18 feet.

Lock and Dam No. 5. Lock and Dam No. 5 are situated at navigation mile 86.3. Construction of the lock and dam began in 1965 and was complete and operable for navigation in 1968. Authorization to build the lock and dam came from the River and Harbor Act of 1946.

The dam has fifteen 60- x 31-feet gates and a 1,050-foot spillway. The spillway crest and fully open gate lip elevations are 183 and 242 feet above msl, respectively. The lock chamber measures 110 x 600 feet in size and has a normal lift of 17 feet. The top of the lock wall is at 225 feet above msl, while the chamber floor is at 179 feet above msl.

Emmett Sanders Lock and Dam No. 4. The Emmett Sanders Lock and Dam construction began in 1964 at navigation mile 66.0. The project was completed and operable for navigation 4 years later in 1968. Authorization to build the lock and dam came from the River and Harbor Act of 1946.

The dam spillway section consists of 17 gates. Eight gates are 60- x 23-feet in size and nine gates are 60- x 28-feet in size. The spillway itself is 1,190 feet long. The spillway crests are 169 and 174 feet above msl. The gate lip, when fully open, reaches 217 feet above msl. The Emmett Sanders Lock ranges in elevation from 165 feet above msl (chamber floor) to 206 feet above msl (top of lock wall). It has a single-lift chamber measuring 110 x 600 feet in size. The normal lift is 14 feet.

Joe Hardin Lock and Dam (No. 3). Joe Hardin Lock and Dam are situated at navigation mile 50.2. Construction of the lock and dam began in 1964 and was completed by 1968. Authorization to build the lock and dam came from the River and Harbor Act of 1946.

The dam has eighteen 60- x 25-feet gates and a 1,260-foot spillway. The spillway crest and fully open gate lip elevations are 158 and 207 feet above msl, respectively. The lock chamber measures 110 x 600 feet in size and has a normal lift of 20 feet. The top of the lock wall is at 194 feet above msl, while the chamber floor is at 147 feet above msl.

***Wilbur D. Mills Dam (No. 2)*.** The Wilbur D. Mills Dam construction at river mile 40.5 (upstream from the mouth of the Arkansas River at the Mississippi River) began in 1963 and was completed for navigation several years later in 1967. Authorization to build the dam came from the River and Harbor Act of 1946.

The dam spillway section consists of sixteen gates, each 60- x 30-feet in size. The spillway itself is 1,120 feet long. The spillway crest is 134 feet above msl. The gate lip, when fully open, reaches 180 feet above msl.

Lock No. 2. Lock No. 2 is situated at navigation mile 13.3 on the Arkansas Post Canal. Construction of the lock began in 1963 and was completed in 1967. Authorization to build the lock came from the River and Harbor Act of 1946.

The lock chamber measures 110 x 600 feet in size and has a normal lift of 20 feet. The top of the lock wall is at 174 feet above msl, while the chamber floor is at 127 feet above msl.

Norrell Lock and Dam (No. 1). Norrell Lock and Dam are situated at navigation mile 10.2 on the Arkansas Post Canal. Construction of the lock and dam began in 1963 and was completed in 1967. Authorization to build the lock and dam came from the River and Harbor Act of 1946.

The dam has an ungated weir and a 227-foot spillway. The spillway crest elevation is 142 feet above msl. The lock chamber measures 110 x 600 feet in size and has a normal lift of 30 feet. The top of the lock wall is at 156 feet above msl, while the chamber floor is at 95 feet above msl.

Montgomery Point Lock and Dam. Construction of the Montgomery Point Lock and Dam, authorized by the River and Harbor Act of 1946, is currently underway. The decision to build the structure resulted from the chronic low water levels and subsequent dredging near the mouth of the White River. It is being constructed near navigation mile 0.6 of the White River Entrance Channel.

Montgomery Point will have bottom-hinged, torque-tube gates. Adjacent to a 300-foot-wide gate and weir structure will be the lock chamber, which will be approximately 670 feet long. The entire dam (except the control tower) will be submerged during high water conditions. The lock will be employed when Mississippi River elevations fall below 115 feet above msl. When river levels exceed 115 msl, the gates will be kept in a lowered position, allowing vessels to pass over them without locking procedures.

2. <u>Other In-River Structures</u>. Other river structures created for stream stability included wing dikes and revetments. Wing dikes force the water flow away from the bank from which they are built. Typically then, revetments, which strengthen and hold unstable banks from erosional forces, must …..

3. <u>Reservoirs</u>. The reservoir system of the MCKARNS is part of a larger navigation and flood control plan for the Arkansas River in Oklahoma and Arkansas. Authorization for construction of the reservoirs on the MCKARNS came principally from the passing of the various Flood Control Acts (1936, 1938, 1944, and 1962) and subsequent amendments to the original legislation. Legislation was also passed through the River and Harbor Act to incorporate upstream reservoirs in Oklahoma that have the capacity to control flows on the MCKARNS into the multipurpose plan for the system.

River flow and water storage of the MCKARNS are primarily influenced and controlled by these 11 reservoirs in Oklahoma as well as the Arkansas River upstream of its confluence with the Verdigris River (river mile 394). The 11 Oklahoma reservoirs include:

Keystone Lake	Lake Hudson	Kaw Lake
Oologah Lake	Fort Gibson Lake	Hulah Lake
Grand (Pensacola) Lake	Tenkiller Ferry Lake	Copan Lake
	Eufaula Lake	Wister Lake

The 11 reservoirs include 9 USACE (Tulsa District) reservoirs as well as 2 electric utility (Grand River Dam Authority [GRDA]) reservoirs. The reservoirs provide flood control, water supply, power generation, recreation, and water quality maintenance (through sediment trapping). Information concerning various elements of the surface water features for each reservoir is detailed below. Information regarding the water supply, hydroelectric power, and recreation resources for each reservoir are presented in subsequent sections.

The reservoirs also aid the MCKARNS by assisting in the control of water releases through spillways and power generating units. The rate of release water from each reservoir depends on many factors including available water storage, power requirements, navigation water requirements, inflow rates, river flow rates downstream, and weather conditions.

A summary of the characteristics of each reservoir is presented in Table 4, including watershed drainage area, elevation, surface area, storage capacity, and shoreline mileage. Within the reservoirs, three zones of water storage are present to assist these functions - the flood control pool, the conservation pool, and the inactive pool. The flood control pool zone is reserved for retaining floodwaters and is only utilized during flood control periods. The conservation or power pool is the middle zone that provides water for power generation, MCKARNS flow regulation, and water supply. The bottom zone or inactive pool provides water pressure for water releases and power generation as well as sediment trapping. Water storage is measured in acre-feet, which is the amount of water available to cover one acre to a depth of one foot.

TABLE 4. CHARACTERISTICS OF FLOOD CONTROL RESERVOIRS IN THE UPPER MCKARNS

Reservoir	Operated By	Drainage (Sq mi)	Elevation (Feet above msl)			Surface area (Acres)			Storage Capacity (Acre-feet)			Shoreline*
			1	2	3	1	2	3	1	2	3	
Keystone Lake	USACE	74,506	754	723	706	54,678	22,420	12,430	1,672,613 (lake total)			330
									1,167,232	278,122	227,259	
Oologah Lake	USACE	4,339	661	638	592	67,120	31,040	880	1,559,279 (lake total)			209
									1,007,060	545,284	6,935	
Pensacola (Grand) Lake	GRDA, USACE	10,298	755	745	730	46,500	NG	NG	2,197,000 (lake total)			1,300
									525,000	585,500	1,086,500	
Lake Hudson	GRDA, USACE	11,553	636	619	599	12,000	NG	NG	444,510 (lake total)			200
									244,210	151,670	48,630	
Fort Gibson Lake	USACE	12,494	582	554	551	51,000	19,900	16,950	1,284,400 (lake total)			225
									919,200	53,900	311,300	
Tenkiller Ferry Lake	USACE	1,610	667	632	594.5	20,800	12,900	NG	1,230,800 (lake total)			130
									576,700	371,000	283,100	
Eufaula Lake	USACE	47,522	597	585	565	143,700	105,500	46,100	3,826,000 (lake total)			600
									1,511,000	1,463,000	852,000	
Kaw Lake	USACE	7,250	1,044.5	1,010	978	38, 000	17,000	5,600	1,348,000 (lake total)			168
									919,400	343,500	85,100	
Hulah Lake	USACE	732	765	733	710	13, 000	5,160	3,570	289,088 (lake total)			62
									257,932	31,156	0	
Copan Lake	USACE	505	732	710	687.5	17,850	13,380	4,850	227,734 (lake total)			30
									184,318	42,820	596	
Wister Lake	USACE	993	502.5	478	450	23,366	6,700	NG	427,485 (lake total)			NG
									366,056	61,037	392	

(1) Flood control pool, (2) Conservation or power pool, (3) Inactive pool
NG=Not given
* Shoreline measured in miles.
USACE - U.S. Army Corps of Engineers
GRDA - Grand River Dam Authority
Source: USACE, 2003

a. **Keystone Lake**. Keystone Lake has two major arms including the Cimarron River arm, which is characterized by gently rolling hills, and the Arkansas River arm, which is characterized by steep, broken hills to low rolling hills and many small valleys in its upper reaches. The damming of the Arkansas River at river mile 538.8, approximately 15 miles east of Tulsa, in Tulsa County, Oklahoma, formed the lake. The terrain of the lake includes sandy beaches as well as wooded shorelines and high bluffs. Project lands surrounding the lake vary from rugged rocky terrain and forests near the dam, to gently rolling hills and grasslands in the upper reaches.

The reservoir drains a 74,506-square-mile area above the dam. The surface area for the lake is 54,678; 22,420; with 12,430 acres for the top of the flood control, conservation, and inactive pools, respectively. The lake has approximately 330 miles of shoreline. Approximately 251 miles of the shoreline is classified as protected lakeshore and 55 miles is designated for public recreation. The remaining shoreline includes 21 miles allocated for limited development and 3 miles allocated as prohibited access.

b. **Oologah Lake**. Oologah Lake lies in the Cuesta Plains subdivision of the Interior Lowlands physiographic province at the western slope of the Ozark uplift and is characterized by gently rolling hills, isolated buttes, and low east facing escarpments separated by broad valleys. The damming of the Verdigris River at river mile 90.2, approximately 2 miles southeast of Oologah, in Rodgers County, Oklahoma, formed the lake. The reservoir extends northward 35 miles into Nowata County, Oklahoma. The topography of the lake reflects the edge of the Ozark uplift and is characterized by westward dipping rocks throughout both counties and results in a long irregular shoreline that varies from moderate slopes to steep banks. The topography is characterized in the lower portion of the lake by forested hills and limestone bluffs that transition into rolling grass covered plains in the upper reaches.

The reservoir drains a 4,339-square-mile area above the dam. The surface area for the lake is 67,120; 31,040; with 880 acres for the top of the flood control, conservation, and inactive pools, respectively. Although the lake is relatively clear under normal conditions, the main river channel (the Verdigris) contributes higher turbidity during high flow periods. The lake has approximately 209 miles of shoreline with very little public development.

c. **Grand (Pensacola) Lake**. Grand Lake forms the upper portion of the boundary line between the western slope of the Ozark uplift and the Cherokee Plains, which is the flat divide between the Verdigris River and the Grand River. The area is characterized by rolling valleys on the west and ravines, bluffs, and hillsides on the east. The lake was formed by the damming of the Grand (Neosho) River at the city of Langley in Mayes County, Oklahoma. The reservoir begins at the Pensacola Dam on the Grand (Neosho) River and extends northeast upriver into Delaware and Ottawa counties, ending at the confluence of the Neosho and Spring rivers.

The reservoir drains a 10,298-square-mile area above the dam (including upstream projects). The surface area for the lake is approximately 146,500 acres and has approximately 1,300 miles of shoreline. The shoreline is available for private development.

d. **Lake Hudson**. Lake Hudson, which is also known as the Markham Ferry project, forms the middle of the boundary line between the western slope of the Ozark uplift and the Cherokee Plains, which is the flat divide between the Verdigris River and the Grand River. The area is characterized by rolling valleys on the west and ravines, bluffs, and hillsides on the east. The lake was formed by the damming of the Grand (Neosho) River at the city of Locust Grove in Mayes County, Oklahoma. The reservoir begins upstream of Fort Gibson Lake on the Grand (Neosho) River and extends northeast upriver to the Pensacola Dam (Grand Lake).

The reservoir drains an 11,553-square-mile area above the dam (including upstream projects). The surface area for the lake is approximately 12,000 acres and has approximately 200 miles of shoreline. The shoreline is available for private development.

e. **Fort Gibson Lake**. Fort Gibson Lake forms the lower 26 miles of the boundary line between the western slope of the Ozark uplift and the Cherokee Plains, which is the flat divide between the Verdigris River and the Grand River. The area is characterized by rolling valleys on the west and ravines and hillsides on the east. The lake was formed by the damming of the Grand (Neosho) River at river mile 7.7, approximately 5 miles north of Fort Gibson and 12 miles northeast of Muskogee in Mayes, Wagoner and Cherokee counties, Oklahoma. The reservoir begins 7.7 miles above the confluence of the Grand (Neosho) and Arkansas Rivers, and extends northeast upriver to the Markham Ferry (Lake Hudson).

The reservoir drains a 12,494-square-mile area above the dam (including upstream projects). The surface area for the lake is 51,000; 19,900; and 16,950 acres for the top of the flood control, conservation, and inactive pools, respectively. The lake has approximately 225 miles of shoreline. Approximately 142 miles of the shoreline is classified as protected lakeshore and 57 miles is designated for public recreation. The remaining shoreline includes 23 miles allocated for limited development and 3 miles allocated as prohibited access.

f. **Tenkiller Ferry Lake**. Tenkiller Ferry Lake is nestled in the Cookson Hills of eastern Oklahoma. The reservoir was formed by the damming of the Illinois River, which originates from the Ozark geological uplift region of northwest Arkansas. The Illinois River flows 145 miles through the low mountains of northeastern Oklahoma to its confluence with the Arkansas River; the dam is located on river mile 12.8. The reservoir is located in Cherokee and Sequoyah counties, about 7 miles northeast of Gore and about 22 miles southeast of Muskogee, Oklahoma.

The reservoir drains a 1,610-square-mile area above the dam and has a capacity of 1,230,800 acre-feet at the top of the flood control pool. The reservoir drains a 1,610-square-mile area above the dam. The surface area for the lake is 20,800 and 12,900 for the top of the flood control and power pools, respectively. The lake has approximately 130 miles of predominantly rocky, rugged shoreline. The lake is a clear rocky-bottomed reservoir with a depth of over 165 feet.

g. **Eufaula Lake**. Eufaula Lake is located in a narrow valley and was formed by the damming of the Canadian River. The project is located at river mile 27, approximately 12 miles east of Eufaula, in McIntosh County, Oklahoma. The northern shoreline

exhibits rugged, steep rocky hillsides and sharp bluffs that rise from the water on either side. The terrain of the southern portion of the lake graduates into more moderate to gently sloping shorelines with sandy beaches. The central portion of Eufaula Lake is the convergence of the Deep Fork, North Canadian, and South Canadian Rivers. The Deep Fork converges with the North Canadian approximately 7 miles north of Eufaula. The Southern Canadian, which forms the main channel for the Canadian River, enters the lake just north of Eufaula. These rivers carry heavy silt loads that form deltas at their confluence and cause decreased clarity in the lake.

The reservoir drains a 47,522-square-mile area above the dam. The surface area for the lake is 143,700; 105,500; and 46,100 acres for the top of the flood control, conservation, and inactive pools, respectively. The lake has approximately 600 miles of shoreline. Approximately 56% of the shoreline is classified as protected lakeshore and 21% is designated for public recreation. The remaining shoreline includes 22% allocated for limited development and 1% allocated as prohibited access. Over 250 housing developments are in proximity to the shoreline. Mowing and boat dock permits allow property owners to maintain shoreline areas in front of their properties.

h. **Kaw Lake**. Kaw Lake lies in a wide, flat valley and was formed by the damming of the Arkansas River. The project is located at river mile 653.7, approximately 8 miles east of Ponca City, in Kay County, Oklahoma. The northern portion of the flood control pool extends as far north as Arkansas City in Cowley County, Kansas. The Kaw Lake project lies in the Northern Limestone Cuesta Plains subdivision of the Interior Lowlands physiographic province.

The reservoir drains a 7,250-square-mile area above the dam. The surface area for the lake is 38,000; 17,000; and 5,600 acres for the top of the flood control, conservation, and inactive pools, respectively. The lake has approximately 168 miles of shoreline.

i. **Hulah Lake**. Hulah Lake lies in a relatively flat, broad valley and was formed by the damming of the Caney River, a tributary of the Verdigris River. The project is located at river mile 96.2, approximately 15 miles northwest of Bartlesville, in Osage County, Oklahoma. The upper end of the flood control pool to the north lies in Chautauqua County, Kansas. The Hulah Lake project lies in the upper reaches of the high rounded Osage Hills, which result from a gently dipping anticline fold with numerous folds superimposed upon it. This fold possesses oil deposits that include active wells around the project lands. The region surrounding Hulah Lake is typified by long, rolling, partially wooded ridges separated by broad, flat valleys.

The reservoir drains a 732-square-mile area above the dam. The surface area for the lake is 13,000; 5,600; and 3,570 acres for the top of the flood control, conservation, and inactive pools, respectively. The lake has approximately 62 miles of shoreline. Approximately 49 acres are classified as protected lakeshore and 10 miles for public recreation. The remaining shoreline includes 2 miles for limited development and 1 mile allocated as prohibited access.

j. **Copan Lake**. Copan Lake was formed by the damming of the Little Caney River, a tributary of the Caney River in the Verdigris watershed. The project is located at river mile 7.4, approximately 9 miles of Bartlesville, in Washington County, Oklahoma. The project area shoreline is generally flat and gently sloping in the northern portion of the reservoir to rolling and steep in the areas above the dam. The reservoir extends from the town of Copan Oklahoma, northward to the town of Caney in Kansas.

The reservoir drains a 505-square-mile area above the dam. The surface area for the lake is 17,850; 13,380; and 4,850 acres for the top of the flood control, conservation, and inactive pools, respectively. The lake has approximately 30 miles of shoreline.

k. **Wister Lake**. Wister Lake was formed by the damming of the Poteau River in a mountainous region with steep and rocky valley slopes in an east west trend of long parallel ridges formed by severely faulted hard sandstones of the Ouachita Mountains. The project is located at river mile 60.9 of the Poteau River, approximately 2 miles south of Wister, Oklahoma, in LeFlore County.

The reservoir drains a 993-square-mile area above the dam. The surface area for the lake is 23,366 and 6,700 acres for the top of the flood control and conservation pools, respectively.

4. **Floodplains.** The Arkansas River was once a meandering and unpredictable river, which left a wide floodplain in many areas. The accumulation of alluvial deposits in the floodplain and floodplain terraces has created fertile soils for cultivation. The study area, which includes the navigation pools created above lock and dam structures along the MCKARNS as well as the upstream reservoirs, covers much of the historic floodplain of the Arkansas River and its tributaries. Lands once cultivated by both Native Americans and settlers have now been inundated by pool and reservoir waters.

The MCKARNS has also been channelized and stabilized with dikes and revetments to improve navigation on the system. This channelization has also reduced the historic breadth of the floodplain in these areas. The placement of levees along the system to retain floodwaters and control normal flood events has also impacted the systems' historic floodplain.

5. **Land Use/Land Cover.** Along the course of the Arkansas River that comprises the MCKARNS, the land looks much as it did in pre-settlement days with rich floodplain soils well suited to cultivation. The wide bottomlands with fertile soil support many crops as well as pine and hardwood forests. Land use cover varies throughout the project area and includes the following cover types:

Urban (Residential, Commercial, and Industrial)	Water Bodies
Agricultural	Wetlands
Rangeland	Barren Land
	Forest

The land coverage of the majority of the study area consists of water bodies including the MCKARNS and its 11 associated reservoirs. Adjoining land coverage varies depending on the land use. Land cover for recreational lands that adjoin USACE projects include forests, wetlands, rangelands, and agricultural lands, depending on the location of each individual project.

Land coverage in the western portion of the MCKARNS study area includes smaller reservoirs in northern Oklahoma plains that include rangelands and agricultural areas. The study lands in northeastern Oklahoma and northwestern Arkansas, which are located in mountainous areas, include higher percentages of forested land cover. The lower MCKARNS through central Arkansas contains primarily agricultural lands. However, lowland forests associated with the White River National Wildlife Refuge and surrounding areas dominate the land coverage in the extreme lower portion of the MCKARNS. Adjoining lands to non-USACE reservoirs include more residential and commercial development.

6. Vegetation. The Arkansas River valley from Kaw Lake to the mouth of the Mississippi River encompasses a diversity of ecosystems. The entire basin lies within the 2000 Humid Temperate Domain, as described by (Bailey, 1980). The Arkansas River Basin from Kaw Lake to the State line falls within the 2500 Prairie Division. As it flows through Arkansas it passes through Bailey's 2215 Hot Continental and the 2300 Subtropical Divisions. Near Kaw Lake the river is within the 2530 Tall Grass Prairie province and shortly thereafter enters the 2512 Oak Hickory Bluestem Parkland Province and Oak–Bluestem Parkland Provinces which ends at approximately the Oklahoma–Arkansas State line. At this point, the river transitions into the 2215 Oak-Hickory Forest Province. At the center of the state, the river transitions into the 2320 Southeastern Mixed Forest Province and finally enters the 2312 Southern Floodplain Forest as it nears the White and Mississippi rivers.

In the Prairie Parkland Provinces, the topography is gently rolling plains, with steep bluffs bordering the valleys. Average annual precipitation ranges from 23 to 40 inches. Grasses are the dominant plants on the prairies. Woody vegetation is rare except along the floodplains, which are dominated by cottonwoods. Dominant plants include big and little bluestem, Indian grass, switch grass, side-oats gramma, western wheatgrass, plains muhly, panic grass, and sedges. Various species of oaks and hickories including post oak, blackjack oak, red oak, and white oak dominate upland forests. Along the floodplains and moist hillsides, there is a richer forest of deciduous trees that include elm, sycamore, bur oak, eastern cottonwood, hackberry, redbud, and buckeye.

As the river enters the State of Arkansas, the shift in vegetation occurs to a winter deciduous forest. Tall, broadleaved trees that provide a dense canopy in summer and are bare in winter dominate this forest. These temperate deciduous forests are composed of various species of oaks, beech, birch, hickory, walnut, maple, basswood, elm, ash, chestnut, and hornbean. The poorly drained areas may include forest containing alder, willow, ash, elm, and hydrophytic shrubs.

The lower section of the river travels through the 2320 Southeast Mixed Forest and 2312 Oak-Hickory–Pine Forest provinces. The average annual temperature increases to 60-70º F, and the rainfall increases from 40-60 inches per year. The climax vegetation within the Southeastern Mixed Forest Province consists of broadleaf deciduous and needle leaf evergreen trees, which may contain stands of loblolly pine, short leaf pine, or southern yellow pines. Other species present include oak, hickory, sweetgum, blackgum, red maple, and winged elm.

C. Other USACE Studies and Proposals Relevant to the Project Area(s)

1. <u>MCKARNS Dredge Material Disposal Management Plan</u>. The U.S. Army Corps of Engineers' navigation mission is to provide safe, reliable, efficient, and environmentally sustainable waterborne transportation systems (channels, harbors, and waterways) for the movement of commerce, national security needs, and recreation.

The removal or excavation, transport, and placement of dredged sediments are the primary components of the "dredging process". After the sediment has been excavated, it is transported from the dredging site to the designated disposal area. This transport operation is accomplished by the dredge itself or by using additional equipment such as barges or pipelines with booster pumps. The collected and transported dredged material is placed in either open-water, islands or upland locations. The choice of disposal alternatives involves a variety of factors related to the dredging process including environmental acceptability, technical feasibility, and economic feasibility of the chosen alternative.

The USACE, Tulsa District has developed a 20-Year Dredge Material Disposal Management Plan for the 150-mile portion of the MCKARNS it operates and maintains. A copy of this plan and maps of the disposal areas are included as Appendix 3. The purpose of this plan is to evaluate future 20-year needs relevant to dredging operations for the McClellan-Kerr Arkansas River Navigation System within the State of Oklahoma. Historical data, current and past dredging operations, site availability and access, governing regulations, and environmental considerations were evaluated to determine the most feasible locations for disposal areas. Dredge disposal sites were located as close as possible to areas along the navigation channel currently identified and/or expected dredging locations within the 20-year time frame. Detailed designs and dredging operations are not included in this document.

Twenty-three dredge disposal sites are being evaluated in the BA and are summarized in Table 5. Seven sites (18A, 18B, 17A, 17B, 16A and A1, 16B, and 16C) have been constructed. There are four new sites (16E, 16F, 15B and B1, and 13A), which are highlighted in yellow, that have not been addressed in the Operation and Maintenance Program EIS for the MCKARNS. These will require additional National Environmental Policy Act Documentation prior to their use. Open water disposal, which is highlighted in purple, and confined island disposal are proposed for site 15B and B1. The remaining sites were discussed in the existing EIS for the MCKARNS and were in compliance with the ESA at the time the EIS was prepared in1974. Most are already constructed and being used at the present time. Since 1974, no subsequent studies on T&E species or compliance activities with respect to the ESA have occurred to date

on the MCKARNS. For this BA, all 23 sites will be evaluated for potential impacts on Federally listed species. Following is a summary of each site:

- Site 18A. This site is located in Pool 18 on the left descending bank to the navigation channel between miles 444.6 and 445 down stream of Port of Catoosa (Drawing 2). This is an existing approved EIS disposal site with a constructed confined disposal dike with a minimum anticipated capacity of 300,000 cubic yards (C.Y.) for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form through a pipeline to the confined site. The quantity of estimated dredged material from the problem area (Bird Creek area mile 444.4 to 445) to 2023 is anticipated to be approximately 300,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminants in the sediment. These findings were utilized to conclude that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. No real estate acquisition is needed.

- Site 18B. This site is located in Pool 18 on the right descending bank to the navigation channel between miles 444 and 445 down stream of Port of Catoosa (Drawing 2). This is an existing approved EIS disposal site with a constructed confined disposal dike with a minimum anticipated capacity of 300,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form through a pipeline to the confined site. The quantity of estimated dredged material from the problem area (Bird Creek area mile 444.4 to 445) to 2023 is anticipated to be approximately 300,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminants in the sediment. These findings were utilized to conclude that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. No real estate acquisition is needed.

- Site 18C. This site is located in Pool 18 on the left descending bank to the navigation channel between miles 421.6 and 422.2 above Lock 18 (Drawing 3). This site is an existing unconfined approved EIS disposal site. It is projected that this site will be used for future disposal activities and that mechanical dredging such as hydraulic/ clamshell or dragline dredging will be utilized to remove debris and sediment and dispose of it into a unconfined disposal site adjacent to the channel. The estimated quantity of dredged material from the problem area (Wharf area at Lock 18) through 2023 is anticipated to be approximately 100,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminants in the sediment. Also, the fact the proposed dredging site is not near any known sources

of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. No real estate acquisition is needed.

- Site 17A. This site is located in Pool 17 on the left descending bank to the navigation channel between miles 420.8 and 421.6 below Lock 18 (Drawing 3). This site is an EIS approved disposal site and consists of a confined disposal dike with two outlets and a minimum anticipated capacity 600,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The estimated quantity of dredged material from the problem area (mile 420.7 to 421.4) through 2023 is anticipated to be approximately 500,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminants in the sediment. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. No real estate acquisition is needed.

- Site 17B. This site is located in Pool 17 on the right descending bank to the navigation channel between miles 401.6 and 402.6 above Lock 17 (Drawing 4). This is an existing approved EIS disposal site with a confined disposal dike with one single outlet and has an anticipated minimum capacity of 300,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The estimated quantity of dredged material from the problem area (mile 401.6 to 403.5) through 2023 is anticipated to be approximately 300,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminants in the sediment. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. No real estate acquisition is needed.

- Site 16A & 16A-1. This site is located in Pool 16 on the left descending bank to the navigation channel between miles 400.5 and 401 below Lock 17 (Drawing 4). This is an existing approved EIS disposal site with two confined disposal dikes, each with a single outlet and a combined anticipated minimum capacity of 600,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal sites. The estimated dredged material quantity from the problem area (mile 400 to Lock 17) through 2023 is anticipated to be approximately 400,000 C.Y. Analysis of this site was performed using the procedures found in

Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminants in the sediment. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. No real estate acquisition is needed.

- Site 16B. This site is located in Pool 16 on the right descending bank to the navigation channel between miles 395 and 395.5 in the Three Forks area (Drawing 5). This is an existing approved EIS site with a confined disposal dike with a single outlet and an anticipated minimum capacity of 400,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal sites. The estimated dredged quantity of material from the problem area (mile 395 to 395.5) through 2023 is anticipated to be approximately 600,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated no elevated contaminants in the sediment. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the site. No real estate acquisition is needed.

- Site 16C. This site is located in Pool 16 on the right descending bank of the Arkansas River at mile 395 in the Three Forks area (Drawing 5). This is an existing approved EIS disposal site. This is an unconfined disposal site with an anticipated minimum capacity of 100,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the unconfined disposal site. The estimated quantity of dredged material from the problem area (mile 394 to 395) through 2023 is anticipated to be approximately 300,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated contaminants in the sample were elevated above acceptable levels. Therefore, Tier II Analysis will be required for disposal at this site. No real estate acquisition is needed.

- Site 16D. This site is located in Pool 16 on the right descending bank to the navigation channel between miles 394 to 394.7 in the Three Forks area (Drawing 5). This is an existing approved EIS disposal site. This is an unconfined disposal site with an anticipated minimum capacity of 100,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the unconfined disposal site. The estimated quantity of dredged material from the problem area (mile 394 to 394.7) through 2023 is anticipated to be approximately 300,000 C.Y. Analysis of this site was performed using the procedures found in

Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated contaminants in the sample were elevated above acceptable levels. Therefore, Tier II Analysis will be required for disposal at this site. No real estate acquisition is needed.

- Site 16E. This site is located in Pool 16 on the left descending bank to the navigation channel between miles 393 and 394 in the Three Forks area (Drawing 5). This is a new site not constructed and is not an approved EIS site. This site will be constructed as a confined dike disposal site and will handle a capacity of 1,500,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The estimated quantity of dredged material from the problem area (mile 393 to 394) through 2023 is anticipated to be approximately 500,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated contaminants in the sample were elevated above acceptable levels. Therefore, Tier II Analysis will be required for disposal at this site. No real estate acquisition is needed.

- Site 16F. This site is located in Pool 16 on the right descending bank to the navigation channel between miles 392.8 and 393.3 at the Highway 62 Bridge (Drawing 5). This new, yet to be constructed site, is not an approved EIS site. This site will be constructed as a confined dike disposal site and will handle a capacity of 600,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The estimated quantity of dredged material from the problem area (mile 392.8 to 393.3) through 2023 is anticipated to be approximately 500,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated contaminants in the sample were elevated above acceptable levels. Therefore, Tier II Analysis will be required for disposal at this site. This site is jointly owned by the Port of Muskogee and the USACE. The total area is approximately 20 acres, and real estate action may be required to design this site. The design of the confined disposal site and EIS approval will be required. The Port of Muskogee foresees beneficial use of the dredged material for future expansion of the port.

- Site 16G. This site is located in Pool 16 on the left descending bank to the navigation channel between miles 393 and 394 in the Three Forks area (Drawing 5). This is an existing approved EIS disposal site. This site is a confined rock dike disposal site with an anticipated minimum capacity of 600,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the

confined disposal site. The estimated quantity of dredged material from the problem area (mile 393 to 394) to 2023 is anticipated to be approximately 500,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. Data from analysis of sediment sampling at this site indicated contaminants in the sample were elevated above acceptable levels. Therefore, Tier II Analysis will be required for disposal at this site. No real estate acquisition is needed.

- Sites 15A & 15A-1. These sites are located in Pool 15 between miles 353 and 356 at the Canadian River Confluence and Stoney Point (Drawing 6). The two existing islands are EIS approved sites. It is projected that these sites will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the existing islands. Each island is to be an oval or teardrop shape, approximately 4 acres in area with the length greater than the width, and about 6 feet above the normal high water mark. Each island will contain approximately 50,000 C.Y. of dredging materials and be used for Least Tern Habitats. The estimated quantity of dredged material from the problem area (mile 353 to 356) through 2023 is anticipated to be approximately 100,000 C.Y. Analyses of these sites were performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact that the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for testing of the sites. No real estate acquisition is needed. Design of confined islands with silt fences for Least Tern Habitats may be required and hydrographic surveys may be needed.

- Site 15B & 15B-1. This site is to be investigated as a designated Open Water Dredge Disposal Site (OWDDS). This site is located in Pool 15 between miles 348 and 349.5 at Sandtown Bottom area (Drawing 7). This site is not an approved EIS site. It is projected that this site will be used for future disposal activities and that hydraulic dredging using direct pipeline discharge will be utilized to place dredged material in the designated open water site. The estimated quantity of dredged material from the problem area (mile 348 to 349.5) through 2023 is anticipated to be approximately 100,000 C.Y. Analyses of these sites were performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for testing of the sites. No real estate acquisition is needed.

- Sites 15C & 15C-1. These sites are located in Pool 15 between miles 6.8SBC and 7.4SBC at Sans Bois Creek Channel (Drawing 8). The two existing islands are EIS approved sites. It is projected that these sites will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the existing islands. The estimated quantity of dredged material from the problem area (mile 6.9SBC to 7.4SBC) through 2023 is anticipated to be approximately 200,000 C.Y. Analyses of these sites were performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact that the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the sites. No real estate acquisition is needed.

- Sites 15D, 15E, &15F. These sites are located in Pool 15 between miles 8SBC and 11SBC upstream of Highway 9 to the Turning Basin on Sans Bois Creek Channel (Drawing 9). The three existing islands are EIS approved sites. It is projected that these sites will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the existing adjacent islands. The estimated quantity of dredged material from the problem area (mile 8BC to 11SBC) to 2023 is anticipated to be approximately 300,000 C.Y. Analyses of these sites were performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the sites. No real estate acquisition is needed.

- Site 13A. This site is located in Pool 13 on the right bank adjacent to the navigation channel between miles 318.3 and 319.1 below Lock 14 (Drawing 10). This new, yet to be constructed site, is not an approved EIS site. This site will be constructed as a confined disposal site to handle a minimum capacity of 500,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The existing sites are full and the estimated quantity of dredged material from the problem area (mile 317.2 to 319.6) to 2023 is anticipated to be approximately 200,000 C.Y. Analysis of the site was performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand

and gravel and is most likely to be free of contaminants. Also, the fact that the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the sites. No real estate acquisition is needed. Design of the confined dike and EIS approval will be required.

- Site 13B. This site is located in Pool 13 on the right descending bank to the navigation channel between miles 315 and 317.2 at Peno Point below Lock 14 (Drawing 11). This is an existing approved EIS unconfined disposal site. The dredged materials in this area are heavy sand and gravel and can be disposed of over the bank without use of dikes. The existing contours provide adequate containment. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the existing unconfined disposal site. The estimated dredged material quantity from the problem area (mile 315 to 317.2) to 2023 is anticipated to be approximately 500,000 C.Y. Analysis of the site was performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact that the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the sites. No real estate acquisition is needed.

- Site 13C. This site is located in Pool 13 on the right descending bank to the navigation channel between miles 311.5 and 313.9 in the Camp Creek area (Drawing 11). This is an existing approved EIS unconfined disposal site. The dredged materials in this area are heavy sand and gravel and can be disposed of over the bank without use of dikes. The existing contours provide adequate containment. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the existing site over the banks into the existing unconfined disposal site. The estimated quantity of dredged material from the problem area (mile 311.8 to 313.5) to 2023 is anticipated to be approximately 500,000 C.Y. Analyses of these sites were performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material, anticipated to be approximately 500,000 C.Y, to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Also, the fact that the proposed dredging site is not near any known sources of contamination led to the conclusion that there is no reason to believe that contaminants are present. Therefore, there is no need for further testing of the sites. No real estate acquisition is needed.

- Site 13D. This site is located in Pool 13 on the right descending bank to the navigational channel at mile 308.8 to 310 at the confluence of the Poteau River (Drawing 12). This is an existing approved EIS site. This site will handle a minimum capacity of 300,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the adjacent existing disposal site. The estimated quantity of dredged material from the problem area (from the confluence of the Poteau River to the Turning Basin, PR mile 0.0 to 2.0) through 2023 is anticipated to be approximately 300,000 C.Y. Analysis of this site was performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Therefore, there is no need for further testing of the site. No real estate acquisition is needed. Real estate easement may be needed for the use of dredge discharge pipelines across private land.

- Site 13E. This site is located in Pool 13 on the left descending bank to Poteau River Turning Basin PR mile 1.7 to 2.0 (Drawing 12). This new, yet to be constructed site, is not an approved EIS site. This site will be constructed as a confined disposal site to handle a minimum capacity of 300,000 C.Y. for the 20-year plan. It is projected that this site will be used for future disposal activities and that hydraulic dredging with discharge pipes ranging from 18 to 24 inches in diameter will be utilized to remove and transport sediment in liquid slurry form by pipeline to the confined disposal site. The estimated quantity of dredged material from the problem area (mile 1.7 to 2.0) through 2023 is anticipated to be approximately 200,000 C.Y. Analysis of the site was performed using the procedures found in Tier I of the Inland Testing Manual. The Tier I Analysis would indicate no reason to believe that testing is required based on the type of material to be dredged at these sites. Dredge material at this site is composed primarily of sand and gravel and is most likely to be free of contaminants. Therefore, there is no need for further testing of the sites. No real estate acquisition is needed. Design of the confined dike and EIS approval will be required.

TABLE 5. 20-YEAR DREDGE DISPOSAL PLAN SUMMARY

Site #	Navigation Mile	Dredging Method	Disposal Options	Design Capacity (CY x 1000)	Real Estate Acquisition (CY x 1000)	EIS Approved Site	Site Design Complete	Construction Completed	Estimated Cost ($ x 1000)
18A	444.6 L	Hydraulic/Clamshell	CD	300	Not Req.	Yes	Yes	Yes	300
18B	444.6 R	Hydraulic/Clamshell	CD	300	Not Req.	Yes	Yes	Yes	300
18C	422 L	Hydraulic/Clamshell	UOB	300	Not Req.	Yes	N/A	N/A	0
17A	421 L	Hydraulic/Clamshell	CD	600	Not Req.	Yes	Yes	Yes	600
17B	402 R	Hydraulic/Clamshell	CD	300	Not Req.	Yes	Yes	Yes	300
16A & A-1	400.8 L & 400.2 L	Hydraulic/Clamshell	CD	300 & 300	Not Req.	Yes	Yes	Yes	600
16B	395 R	Hydraulic/Clamshell	CD	400	Not Req.	Yes	Yes	Yes	400
16C	395 R	Hydraulic/Clamshell	UOB	300	Not Req.	Yes	N/A	N/A	0
16D	394.3 R	Hydraulic/Clamshell	UOB	300	Not Req.	Yes	N/A	N/A	0
16E	393.6 L	Hydraulic/Clamshell	CD	1,500	Not Req.	No	No	No	1,500
16F	393 R	Hydraulic/Clamshell	CD	500	Not Req.	No	No	No	500
16G	393.5 L	Hydraulic/Clamshell	CD, OW	600	Not Req.	Yes	Yes	Yes	0
15A & A-1	355 & 353.7	Hydraulic/Clamshell	CI	500 & 300	Not Req.	Yes	No	No	200
15B & B-1	349 & 350	Hydraulic/Clamshell	OW, CI	300 & 300	Not Req.	No	N/A, No	N/A, No	100
15C & C-1	6.8 & 7.2 SBC	Hydraulic/Clamshell	OW, CI	150 & 150	Not Req.	Yes	N/A, No	N/A, No	50
15D	9 SBC	Hydraulic/Clamshell	OW, CI	150	Not Req.	Yes	N/A, No	N/A, No	25
15E	9.9 SBC	Hydraulic/Clamshell	OW, CI	150	Not Req.	Yes	N/A, No	N/A, No	25
15F	10.5 SBC	Hydraulic/Clamshell	OW, CI	300	Not Req.	Yes	N/A, No	N/A, No	50
13A	319 R	Hydraulic/Clamshell	CD	500	Not Req.	No	No	No	500
13B	316 R	Hydraulic/Clamshell	UOB	1,000	Not Req.	Yes	N/A	N/A	0
13C	312.5 R	Hydraulic/Clamshell	UOB	1,000	Not Req.	Yes	N/A	N/A	0
13D	309 R	Hydraulic/Clamshell	UOB	1,000	Not Req.	Yes	N/A	N/A	0
13E	2 L, Poteau River	Hydraulic/Clamshell	CD	300	Req.	Yes	No	No	300

L/R Left / Right CD Confined Dike UI Unconfined Island EIS Env. Imp Stmt UOB Unconfined Overbank OW Open Water CI Confined Island SBC San Bois Creek

2. <u>Arkansas River McClellan-Kerr Navigation Feasibility Study</u>. The ongoing Arkansas River Navigation Study is developing and evaluating alternatives for implementing solutions to problems on the MCKARNS. Phase I of the study developed and evaluated alternatives for implementing solutions to problems resulting from sustained high flows that are adverse to navigation. Phase I studies have identified a recommended plan (Alternative 4). Phase II studies have just been initiated and will address the feasibility of increasing the channel depth along the entire MCKARNS and widening the Verdigris River portion of the system to allow tows to pass at almost any location on the Verdigris River

a. <u>Phase I</u>. During the Phase I studies, 23 alternatives were considered initially. This number was eventually reduced down to four that were considered in detail. Alternative 4, identified as the "Operations Only Alternative," was selected as the recommended plan. It is defined as the existing plan of operation with a modified 60,000 cfs bench in place of the 75,000 cfs bench beginning at 3% lower system storage except during June 15 through October 1.

For the recommended plan, SUPER Model analysis estimates a 14-day reduction in flows above 60,000 cfs at Van Buren. The analysis estimated a 2-day increase in flows above 100,000 cfs at Van Buren compared to the existing operation plan. It also showed essentially no change at 137,000 cfs (channel capacity). Based on the SUPER Model results, this alternative, compared to the existing regulation plan, would result in a 0.5% decrease in overall damages to crops and structures. The modeling results also indicated little change in navigation damages, pool damages, recreation losses, or power production when compared to the existing plan.

The analysis indicated less than 1% reduction in overall damages to crops and structures and navigation damages as well as a less than 1% increase in hydropower and pool damages compared to existing conditions.

Lowering the 60,000 cfs bench by 3% (except from June-October), with all other parameters remaining equal, eliminates most of the current operating plans impact on the duration of floodwater under the existing 75,000 cfs bench.

There were two primary differences between the existing conditions plan and the operations only plan (based upon the SUPER Model analysis). These differences addressed the proposed action in a positive manner: 1) the reduction of 14 days per year above 60,000 cfs (a key level for farming interest in Arkansas), and 2) an increase in days between 40,000 cfs and 60,000 cfs (key to scouring flows in the navigation system).

Because the Van Buren gauging station was used as the control point for river stages, the river flow stage at that station was used as the basis of the analysis. For the study, certain critical flow rates were defined in order to provide a frame of reference for analysis. Flow rates were designated as "optimum", "moderate", "high", and "very high" based on the flow rate's effect on commercial navigation and farming.

- Optimum Flows. Optimum river flows are defined as less than 61,000 cfs. This definition correlates to optimum conditions for commercial navigation on the MCKARNS.

- Moderate Flows. Moderate river flows are defined as those between 61,000 cfs and 100,000 cfs. Flooding of some fields along the main stem of the Arkansas River in western Arkansas begins at flows greater than 61,000 cfs.

- High Flows. High river flows are defined as those between 100,000 cfs and 175,000 cfs. The 100,000 cfs level is considered critical because any flow above 100,000 cfs renders the navigation system non-navigable for commercial barge traffic. A flow of 137,000 cfs represents bank full at Van Buren.

- Very High Flows. Very high river flows are defined as those greater than 175,000 cfs. A flow of 175,000 cfs is notable because that is the point in the modeled condition data above which no appreciable difference is shown from the baseline or between alternatives.

Modeling results were used to compare river stages and reservoir elevations at the critical river flow rates of 61,000 cfs and 100,000 cfs at Van Buren. The following paragraphs summarize the potential effects resulting from implementation of the action alternatives.

- Greater than 61,000 cfs, Effect on Agriculture. Agricultural damages have historically occurred in the Van Buren area when river flows exceed 61,000 cfs. Under all three-action alternatives, the number of days when the river is anticipated to be at or above 61,000 cfs is decreased.

- Greater than 70,000 cfs Flows, Effect on Recreational Navigation. Small craft warnings are issued when flows reach 70,000 cfs or greater.

- Greater than 100,000 cfs Flows, Effect on Commercial Navigation. Commercial navigation on the MCKARNS is not possible when flows are above 100,000 cfs and commercial barge traffic is suspended until flows decrease.

Tables 6 and 7 summarize the differences in the number of days the Arkansas River is expected to be at or above certain river flows at Van Buren for the recommended plan compared to the existing, baseline condition (represented by the No Action Alternative). In general, the expected differences in anticipated river flows for the study alternatives compared to existing conditions include the following:

- No Action Alternative (Alternative 1). No change from existing conditions.

- Operations Only Plan Alternative (Alternative 4). This alternative provides approximately 14 fewer days per year at or above 61,000 cfs. This alternative results in slightly less than two additional days per year at or above 100,000 cfs.

TABLE 6. ANNUAL CHANGES IN NUMBER OF DAYS AT OR ABOVE A GIVEN FLOW AT VAN BUREN, ARKANSAS, COMPARED WITH THE NO ACTION ALTERNATIVE (ALTERNATIVE 1)

Flow in cfs	No Action Alternative (Alternative 1)	Operations Only Plan Alternative (Alternative 4)
20,000	Baseline (0)	0.6
40,000	Baseline (0)	2.5
61,000*	Baseline (0)	-13.6
75,000	Baseline (0)	-1.8
90,000	Baseline (0)	2.1
100,000	Baseline (0)	1.7
137,000	Baseline (0)	0.0
150,000	Baseline (0)	0.0
175,000	Baseline (0)	0.0
200,000	Baseline (0)	0.0
250,000	Baseline (0)	0.0
300,000	Baseline (0)	0.0

Positive numbers represent more days; negative numbers represent fewer days than No Action Alternative (Alternative 1), i.e., the existing plan.
* Since flows greater than 61,000 cfs begin to have effects on commercial navigation and agriculture, a flow of 61,000 cfs was used for the purposes of modeling.
Source: USACE, Tulsa District and Parsons, 2003.

TABLE 7. SEASONAL CHANGES IN NUMBER OF DAYS AT OR ABOVE A GIVEN FLOW (VAN BUREN, ARKANSAS) COMPARED WITH NO ACTION ALTERNATIVE (ALTERNATIVE 1)

Flow in cfs	Operations Only Plan Alternative (Alternative 4)					
	Jan/Feb	Mar/Apr	May/June	Jul/Aug	Sep/Oct	Nov/Dec
20,000	0.0	0.0	0.2	0.2	0.1	0.1
40,000	0.6	0.0	-0.2	1.1	0.4	0.6
61,000	-2.4	-2.0	-1.9	-2.6	-1.4	-3.1
75,000	-0.3	0.7	-0.4	-0.9	-0.2	-0.8
90,000	0.4	0.4	0.3	0.2	0.3	0.5
100,000	0.3	0.2	0.2	0.3	0.3	0.5
137,000	0.1	0.1	-0.1	0.1	0.0	-0.1
150,000	0.1	0.1	0.0	0.0	0.0	-0.2
175,000	0.0	0.0	0.0	0.0	0.0	0.0
200,000	0.0	0.0	0.0	0.0	0.0	0.0
250,000	0.0	0.0	0.0	0.0	0.0	0.0
300,000	0.0	0.0	0.0	0.0	0.0	0.0

Positive numbers represent more days and negative numbers represent fewer days than No Action Alternative (Alternative 1), i.e., the existing plan.
*Since flows greater than 61,000 cfs begin to have effects on commercial navigation and agriculture, a flow of 61,000 cfs was used for the purposes of modeling.
Source: USACE, Tulsa District and Parsons, 2003.

Study alternatives are based upon changes in the operational flows of the river. Changes in river flows would be associated with changes in the storage of water in the reservoirs linked with the MCKARNS, since flows on the MCKARNS are influenced by the storage and release of water in the upstream reservoirs.

- Tables 8 and 9 summarize the differences in the number of days the major reservoirs that influence flows on the Arkansas River are expected to be above conservation pool for each alternative compared to existing conditions (No Action Alternative) within the reservoirs. In general, the expected differences in anticipated reservoir levels under each study alternative compared to existing conditions are the following:

- Alternative 4 (Operations Only Plan). This alternative would have reservoir levels very similar to existing conditions. However, under this plan it is generally anticipated that reservoir levels would be between 0 and 8 feet above conservation pool slightly more frequently than under existing conditions, and reservoir levels would be greater than 8 feet above conservation pool slightly less frequently than under existing conditions.

TABLE 8. ANNUAL CHANGES IN THE NUMBER OF DAYS RESERVOIRS ARE EXPECTED TO BE ABOVE CONSERVATION POOL COMPARED TO EXISTING CONDITIONS (NO ACTION ALTERNATIVE)

Operations Only Plan Alternative (Alternative 4)							
Storage	**0 feet**	**2 feet**	**4 feet**	**6 feet**	**8 feet**	**10 feet**	**12 feet**
Copan	0	0	0	0	0	0	0
Eufaula	1	0	0	0	0	0	0
Gibson	0	0	1	1	1	-2	-2
Grand	1	1	0	0	-1	0	0
Hudson	0	1	0	0	0	0	0
Hulah	0	0	0	0	0	0	0
Kaw	0	0	0	0	0	0	0
Keystone	1	2	3	2	2	0	0
Oologah	2	1	3	2	0	0	0
Tenkiller	2	4	2	1	1	0	0
Wister	1	1	0	0	0	0	0
Columns represent feet above reservoir conservation pool. Source: SUPER Model Report 2002, USACE, Tulsa District, and Parsons, 2003.							

TABLE 9. CHANGE IN THE NUMBER OF DAYS RESERVOIRS ARE EXPECTED TO BE LESS THAN 8 FEET ABOVE CONSERVATION POOL AND GREATER THAN 8 FEET ABOVE CONSERVATION POOL COMPARED TO EXISTING CONDITIONS (NO ACTION ALTERNATIVE)

Operations Only Alternative (Alternative 4)	**Jan-Feb**		**Mar-Apr**		**May-Jun**		**Jul-Aug**		**Sep-Oct**		**Nov-Dec**	
	< 8 feet	**8 feet +**	**< 8 feet**	**8 feet +**	**< 8 feet**	**8 feet +**	**< 8 feet**	**8 feet +**	**< 8 feet**	**8 feet +**	**< 8 feet**	**8 feet +**
Keystone	0.4	-0.1	-0.1	0.1	-0.7	0.6	-1.3	1.7	0.0	0.1	0.2	0.1
Oologah	5.0	0.0	-12.8	0.0	0.2	0.1	-1.2	1.2	0.5	-0.1	0.1	0.1
Grand	0.2	0.0	0.4	0.0	-0.3	0.0	0.1	0.0	0.1	0.0	0.3	-0.1
Hudson	0.0	0.0	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fort Gibson	0.0	0.0	-0.1	0.1	-0.3	0.2	-0.2	0.4	0.2	0.0	-0.1	0.1
Tenkiller Ferry	0.3	-0.1	0.5	0.0	0.2	0.2	-0.2	0.7	0.1	0.1	0.4	-0.3
Eufaula	0.1	0.0	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.0
Kaw	-0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
Hulah	-0.1	0.2	0.0	0.0	0.1	0.0	0.0	0.1	-1.5	0.0	0.0	0.1
Copan	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	-0.1	0.1	-0.1	0.1
Wister	0.3	-0.2	-0.3	0.2	0.0	0.0	0.9	0.0	0.3	0.0	0.0	0.0
Source: USACE, Tulsa District and Parsons, 2003.												

b. <u>Phase II</u>. Currently, the USACE is authorized to maintain the MCKARNS at a 9-foot channel depth. Due to ongoing maintenance dredging of the existing navigation channel and natural stream scour, approximately 80-90% of the system is already 12 feet deep over a portion of the channel width. It is being performed under the following planning constraints:

- Maintain all existing project purposes
- Allow all existing locks to remain in operation
- Allow no in-stream disposal in Oklahoma
- Minimize/mitigate impacts to the entire aquatic ecosystem, i.e., fisheries, wetlands, etc.
- Minimize/mitigate flood damages
- Minimize stream bank erosion
- Upstream reservoir releases will follow Phase I recommendations

Deepening would be accomplished through dredging only. No dredging would be required from the mouth of the Mississippi River to Lock and Dam No.1. To accommodate deeper draft barges, this analysis assumes a 12-foot channel (11.5-foot draft, plus 6 inches for operational fluctuations), with 3-foot advance maintenance. The total amount to be excavated in this analysis is 15 feet for the channel (from the Norrell Lock and Dam to the Port of Catoosa). The 15 feet serves as the basis of an estimate of worst-case scenario in terms of the cost of providing a channel that can consistently accommodate 11.5-foot draft traffic on the MCKARNS. A cross-section of the 12-foot channel is shown in Figure 5.

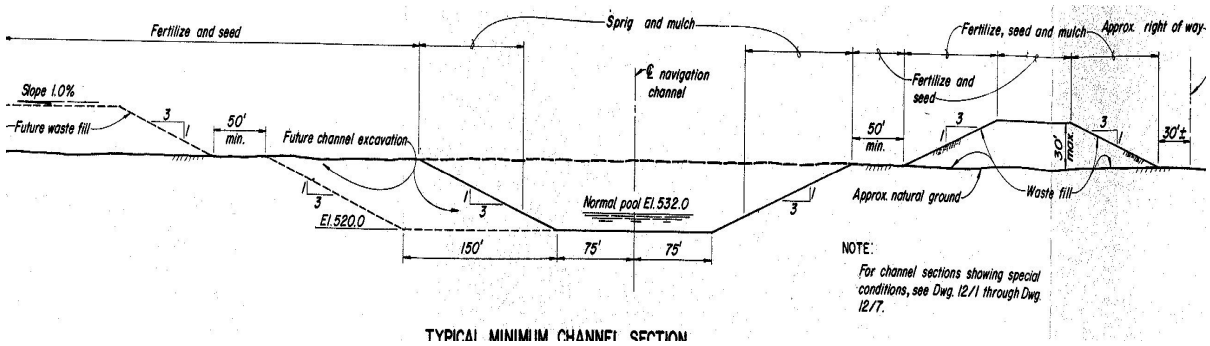


Figure 5. Typical Minimum Channel Section.

The study assumes that no modification of existing locks and dams would be required. The existing locks on the system are designed for barges that can operate on a 9-foot channel depth (the shallowest lock sills are at a depth of 14 feet) and for towboats to power through during locking procedures. The preliminary analysis will use the assumption that tows and barges using a 12-foot channel can safely navigate through the existing locks without requiring structural modification to the locks through implementation of strict towboat operating procedures. If this assumption proves to be unreliable as the Phase II study continues, the cost to increase the channel depth to 12 feet will significantly increase.

The study also assumes that river maintenance structures, such as dikes and bank stabilization revetments, are required to reduce the maintenance dredging requirements for the navigation channel. These structures help direct the flow so that bottom scouring will occur in problem areas and reduce the need to dredge in those areas. The Phase II study will include detailed sedimentation studies, which will establish the exact number, type, and location of these structures for the efficient operation of up to a 12-foot channel.

Currently, dredged material disposal areas on the Oklahoma portion of the waterway are scarce. The Tulsa District is currently reviewing and updating a long-term dredged material disposal plan for the existing 9-foot channel (See Table 5.). Initial assessments show existing disposal areas are insufficient to accommodate maintaining a 9-foot channel in the future. As part of the review, the Corps is asking the Oklahoma Department of Environmental Quality (OKDEQ) for a consensus on in-stream disposal of dredged material on portions of the system. As stated earlier, the OKDEQ considers portions of the waterway as impaired because of sediment load and because in-stream disposal would further impair water quality. As a result, the OKDEQ representative indicated that the agency would not concur with such disposal methods. Consequently, analyses for this preliminary report assumed that all Oklahoma disposal areas would be upland. Some of the upland areas, particularly on the Verdigris River, have high spoils mounds adjacent to the waterway left from materials deposited during initial construction of the waterway. Any additional cost of transporting or pumping the dredged material over the mounded areas requires more scrutiny. Dredging to accommodate a 12-foot depth will require acquisition of substantial amount of lands and related access in Oklahoma. For this preliminary analysis, only two additional disposal areas are anticipated to be required on the Arkansas portion of the system, both along the Arkansas Post Canal. Phase II studies will address acquiring private lands, environmentally sensitive areas, cultural resources, and other issues for all disposal areas.

The MCKARNS has historically had some shoaling problem areas. Shoaling may be an issue in a number of areas with the deeper channel scenario. For this analysis, 3 feet of advance maintenance dredging is assumed over the entire length of the system (see Table 10).

TABLE 10. PERTINENT DATA FOR DEEPENING THE CHANNEL TO 12 FEET AND WIDENING THE VERDIGRIS RIVER

Dredging & Rock Removal		**Cubic Yards**
L&D1 to L&D 5	Dredging	1,883,710
	Rock	0
L&D 5 to Murray	Dredging	233,380
	Rock	0
Murray to Ozark	Dredging	2,100,420
	Rock	0
Ozark to Mayo	Dredging	2,078,239
	Rock	47,000
Mayo to Chouteau	Dredging	5,036208
	Rock	0
Chouteau to Catoosa	Dredging	1,118,703
	Rock	10,000

Since specific information with respect to alignments, locations for dredge material, and widening have not been developed, the assessment of potential affects of the proposed action on the Federally listed species will be rather broad and generalized.

D. Canadian River Basin.

The Canadian River originates in Colfax County, New Mexico, and flows southeasterly through New Mexico and easterly through the Texas Panhandle. It enters Oklahoma and forms the boundary between Ellis and Roger Mills counties. It travels eastward some 410 miles across the State of Oklahoma and joins the Deep Fork River and the North Canadian River to form Eufaula Lake. Eufaula Lake was constructed by the USACE on the Canadian River at mile 27.0, and became operational in September 1964. It was constructed for flood control, water supply, hydroelectric power, and navigation (sediment control). The Canadian exits Eufaula Dam and flows eastward to its confluence with the MCKARNS near navigation mile 357 and the Haskell County and Muskogee County line.

At the top of conservation pool, the lake covers 102,500 acres. It extends up the Canadian, North Canadian, and Deep Fork rivers; Gaines Creek; and numerous minor tributaries. The lake principally lies in McIntosh, Haskell, Pittsburg and Okmulgee counties, but also extends into small areas of Muskogee and Latimer counties.

Approximately 1,470,000 acre-feet of storage in the lake are allocated for flood control, 1,481,000 acre-feet for hydropower and water supply, and 897,000 acre-feet in dead storage for power head and sediment.

The lake provides flood protection on the Canadian River downstream from the dam and contributes to downstream flood control on the Arkansas River below the confluence of the Canadian River. The maximum discharge that can occur through the outlet works without downstream flooding is 100,000 cfs.

The project lies in the Prairie Plains Homocline, which consists of a gently eastward-sloping plain with gently northwestward dipping Pennsylvanian and Permian rocks. The plain slopes from a maximum elevation of about 1, 350 feet in Oklahoma County to about 500 feet at Eufaula Lake, a slope averaging about 6.4 feet per mile. Many steep eastward-facing escarpments are capped by resistant sandstones and limestones whereas the intervening valleys have been excavated in less resistant shales. The overlying mantle consists mainly of Pleistocene terraces and Holocene or Recent alluvium. The Pleistocene deposits are mainly gravel, sand, and silty clay while an occurrence of volcanic ash is present in the alluvium.

Spring and autumn months are mild with warm days and cool pleasant nights. Summers are usually long and hot, while winters are comparatively mild and short. The average length of the growing season is 215 days.

Ecologically, the area is included in within the Oak-Hickory-Bluestem Section of the Prairie Parkland Province as described by (Bailey, 1980). The vegetation of the uplands is characterized by species such as post oak, blackjack oak, northern red oak, black hickory, shellbark hickory, shagbark hickory and winged elm. Wetter areas along the tributaries are characterized by bottomland species consisting of water oak, over cup oak, sweet gum, sycamore, cottonwood, black willow, black walnut, pecan, river birch, winged elm, hackberry, red maple, and green ash. Native grasses found in the area include little bluestem, switch grass, Indian grass, and Johnson grass.

Sport fish species found in the lake include black and white crappie; white bass, largemouth, and spotted bass; channel, blue, and flathead catfish; walleye; and striped bass/white bass hybrids. The lake is noted for its crappie and catfish fishery. Eufaula Lake also has an excellent tail water fishery for striped bass and catfish.

Big game and upland game habitat in the project areas were significantly reduced as the result of construction and operation of Eufaula Lake. Approximately 102,500 acres of habitat were inundated with the project and another 40,500 acres are periodically inundated during flood control operations. Fourteen thousand acres of habitat in the downstream floodplain have received flood protection, which has resulted in land use changes and loss of wildlife habitat. Waterfowl habitat has been increased with the project.

Important game animals in the project area include whitetail deer, bobwhite quail, fox squirrels, cottontails, swamp rabbits, raccoon, and mourning doves.

In addition to operating the lake for its authorized project purposes and routine operation and maintenance activities, the lake has a rather large real estate outgrant program. This program oversees the management of leases, easements, and other outgrants. Through this program, project lands are leased or licensed for activities such as marinas, utility easements, grazing, wildlife management, and agricultural purposes.

The powerhouse at Eufaula Lake has three 30,000-kilowatt generators with a capacity range from 60,000 to 90,000 kilowatts, depending on lake levels. The Southwestern Power Administration (SWPA) markets the total power output of the Eufaula project. The hydropower facilities are designed for generation during peak power requirement periods because of limited inflows to the lake. The base load is supplied by thermal generation. Hydroelectric power is ideal for “peaking” in that it readily available to meet sudden changes in load, and it does not contribute to air and thermal pollution.

The hydroelectric power produced at Eufaula and at seven other USACE Tulsa District projects is marketed by the SWPA. This marketing is done in accordance with contractual agreements that the SWPA has developed with various power companies or Co-Ops. The availability of water for hydroelectric power production is determined by the USACE. Power production has to be coordinated with the other project purposes. Available channel capacities, navigation flow requirements, water in storage, threatened and endangered species, and equipment condition can affect power production schedules. The SWPA has responsibility for

scheduling power within the limits of the projects and system constraints as determined by the USACE.

E. Red River Basin.

The Red River is one of the two major river systems in Oklahoma. It originates from small streams in eastern New Mexico and gradually runs eastward approximately 517 miles to the Oklahoma-Arkansas State line in southwestern Arkansas. In its extreme western reaches, it is composed of the Prairie Dog Town Fork of the Red River, which flows southeasterly to loosely form the southern border of Oklahoma. At the confluence of the Prairie Dog Town Fork of the Red River with the Salt and North Forks of the Red River, it continues as the state's southern border but is referred to as simply the Red River. In Oklahoma, there are 22,791 square miles of contributing drainage area to the Red River.

The Red River is an interstate stream which starts in the arid plains of Curry County, New Mexico, and runs east where, at latitude 34 33' 35" and longitude 100 00' 00", the south bank of the river becomes the 440-mile boundary between Texas and Oklahoma. The river turns south through Arkansas, then southeast into Louisiana where it discharges into the Mississippi and Atchafalaya rivers. The main stem of the Red River has a total length of 1,217 river miles. The Red River Basin has a total drainage area of 94,450 square miles, of which 73,671 square miles actually contribute to flows and 24,463 square miles lie within Texas. There are 29 stream segments totaling 1,616 stream miles with 32 significant reservoirs.

Geologically, the area is shale, limestone, sandstone, and sand. The river lies along the Northern Shelf, the Gulf Coastal Plain, and the Red Bed Plain geologic provinces (Hill, 1992). Lake Texoma is located in the Osage Plains section of the Central Lowland physiographic province. The bedrock strata are sedimentary rocks, mostly limestone and sandstone of Upper Paleozoic age (USACE, 1993). In the project area, the basin is underlain by limestone, clay, chalk, and sand of Cretaceous age (Red River Authority, 2000).

Summers are hot with occasional severe rainstorms. Within the project area, rainfall is 30-40 inches a year (Red River Authority, 1998). May, June, September, and October are typically the wettest months.

The project is within the Oak Woodlands/Prairie plant community of the Oak Woods and Prairie natural region as defined by TPW (Diamond et al., 1987). A mixed community of prairie grasses and woodland species characterizes this region. Perhaps more accurately referred to as a transitional zone; typical species include post oak, blackjack oak, water hickory, pecan, white ash, little bluestem, Indian grass, and swithchgrass. Pine hard wood forest comprised of short leaf pine, post oak, and southern red oak is the dominant vegetation type listed by TPW (1997) as occurring along Bowie, Red River, and Lamar counties in the project area. This same vegetation may be assumed on the Oklahoma side in Bryan, Choctaw, and McCurtain counties.

Along the river, dominant species include eastern red cedar, bois d'arc, cottonwood, sweetgum, white oak, southern red oak, common hackberry, black locust, American elm, cane),

greenbrier, lance-leaved ground cherry, wild grape *(Vitis* spp.), johnsongrass, and horse nettle (TNRCC, 2000).

The project area is located within a narrow strip of the Austroriparian province, along the eastern edge of the Texan biotic province (Blair). Blair describes the Texan biotic province as an ecotone between the eastern woodlands and the western grasslands. This diversity in biotic communities in the vicinity of the proposed project has encouraged a large variety of faunal species. According to Fields et al., most vertebrate species found in this ecotone come from either the Austroriparian province to the east or from grasslands to the west. Today, the fauna is dominated by avian species; however, prior to the introduction of agricultural practices, native mammalian species may have been more abundant and/or diverse as well. Mammalian and avian species include deer, rabbits, burrowing animals, prairie chickens, grouse, and quail.

Within the boundaries of the project area, the majority of the land has been cultivated. Although the depth of cultivation is variable, the average depth of the recent plow zone is approximately 11.8 inches below present ground surface. Currently, the project area is a mosaic of cultivated fields and pasture, interrupted by narrow bands of woodlands. Typical crops in the project area include cotton, soybeans, field corn, and a mixture of native and introduced grasses for hay. Ranching and oil and gas production are also primary land uses (Hill, 1992).

1. <u>Lake Texoma</u>. At river mile 725.9, the main stem of the Red River is bisected by Denison Dam (Lake Texoma), which was constructed by the USACE for flood control, water supply, hydroelectric power, regulating Red River flows, and improvement of navigation. Upon exiting Denison Dam, the river flows approximately 240 miles to Index, Arkansas, which is the eastern limits of the USACE, Tulsa District. Construction on the dam began in August 1939 and was completed in February 1944. The project was first available to operate for full flood control without any restrictions in January 1944. The first hydroelectric turbine was placed on line in March 1945 and the second in September 1949. The structure is a rolled earth-filled embankment with a rock-protected upstream slope. The main embankment is 15,200 feet long. The maximum height of the structures is 165 feet above the streambed. A rolled earth-filled dike 5,870 feet long and 15 feet high is located in the vicinity of Platter, Oklahoma. The outlet works consist of three 20-foot-diameter, concrete conduits through the embankment equipped with six 9-by 19-foot vertical lift gates. Capacity of the outlet works is 67,500 cfs at the top of the flood control pool and 60,120 cfs at the top of the power pool.

Flood control storage capacity is 2,580,386 acre-feet, and conservation storage is 1,570,216 acre-feet, which includes 150,000 acre-feet for water supply. The maximum release from Lake Texoma was 144,000 cfs in May 1990 during heavy flood conditions. The downstream channel capacity is 45,000 cfs to 60,000 cfs. The maximum rate of pool draw down is 1 foot per week or 3 feet per 4-week period.

Lake Texoma is regulated in conjunction with existing lakes on the Red River and tributaries for the control of floods on the Red River from Denison Dam through the project area. The stream gauges at Arthur City, Dekalb, and Index are utilized as control points for regulation of flood flows. The Red River Control/Forecasting Section of the USACE, Tulsa District makes hydrologic forecasts. These involve information on lake levels, weather, stream flow, etc.

Estimated hydrographs for control points downstream of Denison Dam combine with trial releases from the dam to achieve the desired results (USACE, 1993). Hugo Lake has a more immediate effect on the lower portion of the Red River, so it is operated to fine-tune regulated flows of the lower reaches. The low-flow seasons are primarily November through February and July through August; however, low flows can occur at any time of year. Primary flood periods are from March through June and September through October, but floods are possible any time of year (USACE, 1993).

Although the primary purpose of dam operations is flood control, Congress authorized formation of a Lake Texoma Advisory Committee (Public Law 100-71) to allow lake users, concessionaires, State and Federal agencies, and people with downstream agricultural and navigation interests to make recommendations to the Corps regarding the regulation and management of Lake Texoma.

In 1991, the Advisory Committee devised a seasonal pool plan calling for a draw down of the lake level to an elevation of 615 feet in the late winter and early spring, a rise to 619 feet during May and through the summer, a draw down to 616 feet in the late summer and early fall, and a rise to 618 feet in the late fall and early winter. The resulting regulation of flows is guided by a schedule put forth in the 1993 USACE Water Control Manual. An overview is presented in Figure 6.

Generation of power is another authorized function of the Denison Dam. The powerhouse contains two 35,000-kilowatt generators with provisions for three additional 43,000-kilowatt units. Peak flow from both hydropower units running at full power is 10,500 cfs and from one power unit is 5,300 cfs. One 20-foot-diameter, steel-lined conduit provides water for each power unit. Each of the five power conduits is equipped with two 9- by 19-foot vertical lift gates located in the intake structure. The storage in Lake Texoma between elevations 590 feet and 617 feet has been allocated for hydropower generation and water supply. Thus, when the lake level is between the bottom of the conservation pool (elevation 590 feet) and the top of the transitional pool (about 617 feet), releases are governed by power generation requirements. The storage contained in the conservation pool also contains 15,000 acre-feet for water supply as well as hydropower storage. The required flow for firm energy varies between 1,500 and 2,300 day/second/feet depending on the demands of the season. Typically demand is high from May through September. System flood control operation thus allows Lake Texoma to release flows of approximately 2,000 cfs required to generate the primary energy (429 Mwh/day) of the Texoma project in accordance with the power system demands. However, when conditions warrant, releases at Lake Texoma may be reduced below the daily average for firm power or shut off completely. The required flow for firm energy is 1,800 cfs average daily flow.

Graphic representations of existing flows versus natural flows for the months that Interior least terns are present downstream of Lake Texoma to Index, Arkansas, are shown in Appendix 4. As depicted in the graphics, construction and operation of the lake for its authorized purposes have modified the hydrology of the Red River downstream of the lake. For the period of record (1940-2000) under natural conditions at the four gauging stations, there would have been 44 events with flows exceeding 50,000 cfs. Under existing conditions for the same period of record, there have only been 26 events of flows exceeding 50,000 cfs at the four gage stations. The

magnitude of flood events on the Red River downstream of the lake is greatly diminished with operation of the lake. Under natural conditions, the larger flood events would occur and peak over a short period of time. With the project, the peaks of the larger flood events have been reduced and flows downstream are released at a lesser damaging rate over a protracted period of time. The magnitude of flood events on the Red River has been diminished with operation of the project for flood control, which is an authorized project purpose. Conversely, during July and August, monthly flows from Lake Texoma are considerably higher than what occurs under natural conditions. These conditions are probably attributable to operation of the lake for hydropower purposes.

Lake Texoma is not regulated for water supply because the withdrawal points are within the lake and well below the top of the conservation pool. The only current water supply user not withdrawing from the lake directly is the Texas Power and Light facility located 19 miles downstream of Denison Dam. They have not requested flow modifications because they have a large storage pool to cover low flow periods.

Although recreation is an authorized purpose of the Denison Dam, no storage is provided for that specific purpose and no special regulations are made for recreational activity. The lake has normally been regulated to the top of the conservation pool elevation of 617 feet. Most of the recreational users prefer elevations between 615 and 617 feet. When the lake level drops below 612 feet, most of the boat docks and marinas have to shut down. Major problems with most lake activities occur below 610 feet. Conversely, above 621 feet, many marinas, docks, and walkways have to close due to flooding, and at 630 feet, most are closed. The seasonal pool plan recommended by the Lake Texoma Advisory Committee enhances recreation by raising the normal pool elevation during the summer months of June through August.

Fish and wildlife are not identified as an authorized project purpose; therefore, no specific storage is provided. The project does, however, provide secondary benefits to fish and wildlife. The seasonal pool plan designed by the Advisory Committee in conjunction with the Oklahoma Department of Wildlife Conservation and Texas Parks and Wildlife is designed to enhance fish and wildlife management in the lake.

In 2002, the USACE, Tulsa District implemented management guidelines and strategies for operation of three USACE lakes (including Lake Texoma) to protect nesting least terns downstream of the dams. A copy of this plan is shown in Figure 6. Beginning June 1 of each year, the USACE will begin computing 2-week average inflows for Lake Texoma. These flows can be compared with median inflows to predict a trend. This process is then repeated every 2 weeks through the end of the nesting period. The data are used to forecast pool draw downs due to minimum flow requirement for the terns as well as hydropower generation. This process identifies the maximum release rates, which will not exceed the draw down limits identified for Lake Texoma.

In 2003, the management plan was used to establish special operations of hydropower releases for least terns below Denison Dam. It was necessary to schedule generation at times that would protect birds around Highway 78 from ATV's during daylight hours beginning on the fourth of July holiday and weekend days through July 13th.

2. <u>Red River Downstream of Denison Dam to Index, Arkansas</u>. From Denison Dam to Arkansas (Figure 7), the river flows between high banks about 1,000 feet apart. Unlike the Arkansas River, which has been intensely modified for navigation, the low water channel is poorly defined and is subject to continual shifting from fluctuations in stream flow. The banks

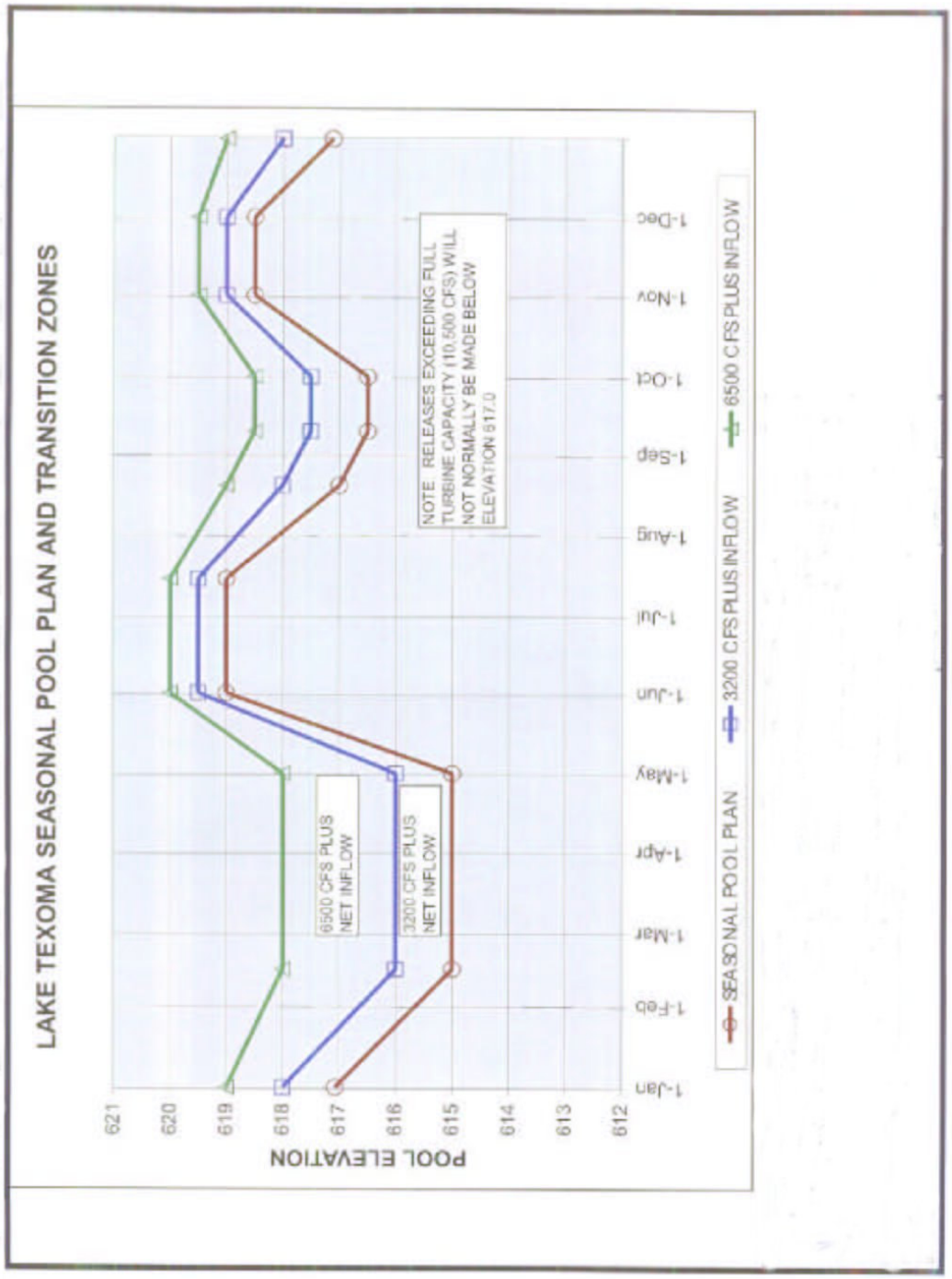


Figure 6. Recommended Regulation of Flows From Denison Dam.

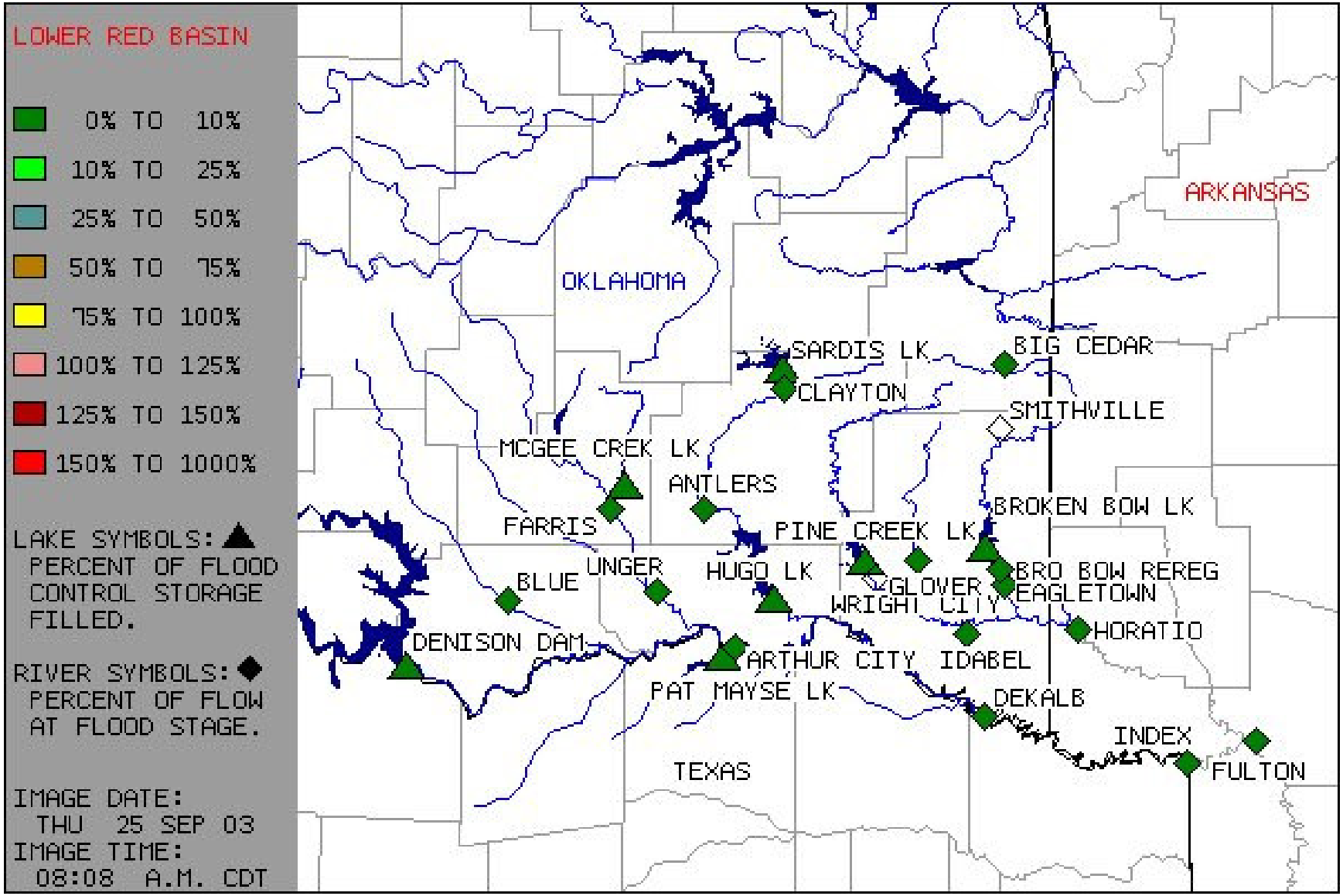


Figure 7. The Red River Basin From Denison Dam to Index, Arkansas, and Its Major Tributaries.

rise from 15 to 25 feet above the low water flow line. In the action area, the most important tributaries entering the Red River are Boggy Creek, Kiamichi River, and Little River. The channel capacity downstream of Denison Dam is in the range of 45,000 to 50,000 cfs.

Three gauges within the project area contribute to calculating necessary releases. The Arthur City gauge 07335500 is located at river mile 633.1 near the U.S. Highway 271 Bridge. The National Weather Service (NWS) flood stage at the Arthur City gauge is designated as 26 feet or 132,000 cfs. The Corps regulating flood stage is 20 feet or 73,000 cfs (1993 channel rating). The Dekalb station 07336820 is located at river mile 556.9 near the U.S. Highway 259 Bridge. The National Weather Service flood stage is designated as 24 feet or 60,800 cfs. The Corps regulating flood stage is 23.7 feet or 58,600 cfs (1993 channel rating). The Index, Arkansas, gauge 07337000 is at river mile 485.3 near the U.S. Highway 71 Bridge across the Texas-Arkansas border. The National Weather Service flood stage is designated as 25 feet or 150,600 cfs. The Corps regulating flood stage is 19.8 feet or 89,800 cfs (1993 channel rating) (USACE, 1993).

3. Other Reservoirs. The USACE, Tulsa District has completed a number of water resources control, flood control, and impoundment projects on tributaries to the main stem of the Red River and downstream of the Denison Dam to the Arkansas border. Operations of these structures have changed the water flow, quality, and/or sediment load within the main stem, and may potentially have influenced the habitat and ecology of breeding Interior least terns. Due to this extensive regulation, streams in the Red River Basin (Figure 7) constitute interdependent components of a complex system. Water flow along the project area is affected not just by operations of the Denison Dam, but, in various degrees, by all these entities and by diversions, irrigation return, agricultural withdrawals from groundwater, etc.

a. McGee Creek. McGee Creek Reservoir is located on Muddy Boggy Creek (a major Red River tributary) and was approved as a joint project with the Bureau of Reclamation in 1976. Diversion was made in 1984, and impoundment began in 1987. The total length of the dam, dike, and spillway is 7,200 feet. The spillway and the municipal outlet works consist of an intake tower with three gates spaced to allow withdrawal of the best quality of water from the reservoir. The record flood occurred in June 1945 when a peak discharge of 22,600 cfs was recorded at the McGee Creek Dam site gauge. The volume of runoff was 79,700 acre-feet, which is equivalent to 8.89 inches of runoff from the drainage area. Flood control storage is 85,340 acre-feet, and water supply storage is 107,980 acre-feet. The drainage area is 171 square miles.

b. Pat Mayse Lake. Pat Mayse Lake is located on Sanders Creek, a tributary of the Red River, approximately 1.5 miles southwest of Arthur City and 12 miles north of Paris in Lamar County, Texas. It was authorized in 1965 with the diversion completed in 1967. Flood control storage is 64,830 acre-feet and conservation storage is 114,700 acre-feet, including 109,600 acre-feet for water supply. The drainage area is 175 square miles. The record flood occurred in December 1971 with an estimated peak discharge of 30,600 cfs and a volume of 75,500 acre-feet.

c. **Sardis Lake**. Sardis Lake is located on Jackfork Creek, a tributary of the Kiamichi River (a major tributary of the Red River). Construction began in 1975 and impoundment started in 1983. Flood control storage is over 122,570 acre-feet and conservation storage is over 274,210 acre-feet. Storm studies show the record flood at the dam site occurred in May 1943 with an estimated discharge of 60,000 cfs and a volume of 80,000 acre-feet. The total volume of inflow in the April through May 1990 flood was approximately 270,000 acre-feet with a peak daily inflow of 33,600 cfs. During the 1990 flood, the peak release was 5,675 cfs. Drainage area is 635 square miles.

d. **Hugo Lake**. Hugo Lake is located on the Kiamichi River (a main tributary to the Red River) at river mile 17.6, about 7 miles east of Hugo in Choctaw County, Oklahoma. Construction began in 1968 with impoundment beginning in 1974. The dam is a rolled earth embankment, including the gate-controlled, concrete spillway, and is 10,200 feet long. Discharge at maximum pool elevation (445.2 feet) is 365,000 cfs. Flood control storage is 808,300 acre-feet and conservation storage is 121,500 acre-feet, which includes 47,600 acre-feet for water supply or 58 million gallons per day (58 mad yield) and 73,900 acre-feet for water quality control. The maximum peak inflow of 120,000 cfs occurred in May 1990. During the 1990 flood, the lake crested at elevation 439.96 with a peak release of 35,000 cfs. In December 1971, a peak inflow of 87,060 cfs occurred. The maximum volume of flow past the dam site of 1,549,500 acre-feet occurred from April through June 1957. Drainage area is 1,434 square miles. Releases from Lake Hugo are a major complement to Lake Texoma releases since they have a more direct influence on the lower reaches of the project area.

SECTION IV. DESCRIPTION OF SPECIES AND STATUS WITHIN THE PROPOSED ACTION AREAS WITH RESPECT TO CORPS OF ENGINEERS OPERATIONS

A American Alligator.

1. **Description of Species**. The American alligator (*Alligator mississippiensis*) is a large reptile inhabiting wetland areas of the southeastern United States. They have broadly rounded snouts without conspicuous upward-protruding teeth, and may attain lengths up to 15 feet. They are dark in appearance with paler cross-banding markings on the back and vertical markings on the sides. They differ from the American crocodile in having a broader snout and in not having the lower jaw tooth protruding at the end of the snout.

2. **Distribution of Species.** Alligators are found primarily in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, South Carolina, and Texas. To a lesser extent they are found in Texas, Oklahoma, and South Carolina as populations in these states are on the periphery of its range. Historically, their distribution in Oklahoma was considered to be the Red and Little River drainages in southeastern Oklahoma. Presently, they only sporadically occur along the Red River in McCurtain County, Oklahoma. In Arkansas, they are reported to occur naturally in the Little River system in Hempstead County located in southwestern Arkansas.

3. **Habitat**. They are inhabitants of rivers, swamps, estuaries, lakes, and marshes. They dig dens in riverbanks or the shorelines of lakes where they spend the winter or use during times of drought. They are generally inactive during winter months. They are opportunistic feeders and eat a variety of animals including fish, turtles, mammals, and snakes. Juveniles feed on crayfish, mollusks, small fishes, amphibians, and small mammals. Adults eat vertebrates including reptiles, mammals up to the size of deer, and fish.

4. **Cause of Decline**. The decline of this species was attributed to over harvest and destruction of habitat.

5. **Status of Species**. The alligator was originally classified by the USFWS as endangered (32 FR 4001; March 11, 1967, but was reclassified to threatened due to similarity of appearance (T S/A) in Oklahoma and Arkansas on June 4, 1987 (50 FR 21059). No critical habitat was determined for this species. The American alligator is designated as Delisted Taxon, Recovered, and Being Monitored First Five Years in the Entire Range. It was originally classified as endangered throughout its range in 1967 due to concerns over harvesting. Since its protection, it has recovered to the point where it is neither in danger of extinction nor likely to become so in the foreseeable future.

B. Gray Bat.

1. **Description of Species.** The gray bat (*myotis grisescens*) is a medium-sized bat with a wingspan of 10 to 11 inches. It has grayish-brown fur and is the only bat in its range with unicolored dorsal hairs. The fur is usually gray in color, but may be chestnut brown or russet. Other bats within its range have bi-colored or tri-colored dorsal hairs. The wing membrane of

the gray bat connects at the ankle instead of the base of the first toe as in other members of the genus. Total lengths for this species range from 80-105mm, forearm lengths range from 40-46mm, ear lengths range from 14-16mm, and wingspread is 275-300mm.

2. Distribution of Species. The distribution of this species is limited to areas of the Southeastern United States containing limestone caves. Major populations are located in Alabama, Arkansas, Kentucky, Missouri, and Tennessee. In Oklahoma, this species occurs in four counties in northeastern Oklahoma and include Adair, Cherokee, Delaware, and Ottawa. In Arkansas, it occurs in at least 16 counties, but only Pope County is within the proposed action area. In Oklahoma, Cherokee County is the only county within the proposed action area. Portions of Tenkiller Ferry Lake, Fort Gibson Lake, Grand Lake, and Markham Ferry Lake are located within the range of this species and probably contain suitable habitat for this species. However, Grand Lake and Markham Ferry Lake were constructed and operated by the Grand River Dam Authority and are outside the purview of this BA.

USACE personnel responsible for inspection of the dams and associated structures were surveyed about the occurrence of bats for all the projects associated with the proposed action areas. In Oklahoma, bats were reported to occur at only Keystone and Tenkiller lakes. The replies from the projects surveyed in Arkansas along the MCKARNS were negative with one exception. A single pipistrelle sp. was found at the Dardanelle Powerhouse.

3. Habitat. This species roosts almost exclusively in caves year-round and has very specific requirements. However, there are some reports of colonies using storm sewers and mines as roosts. Winter caves must be cold, deep, and with vertical walls. This species is very temperature sensitive, and winter roosts must range in temperature between 42 ºF and 52 ºF. Summer caves must be warm (57 ºF-77 ºF) or contain tightly restricted rooms that can trap the body heat of roosting bats. Summer caves are usually located close to rivers and lake shorelines near feeding areas. Bats are known to range up to 12 miles from their colonies to feed.

The only habitat containing suitable limestone caves for this species within the action areas for Oklahoma, and within the range of this species, include the shoreline areas around Grand Lake, Markham Ferry Lake, Tenkiller Ferry Lake, and Fort Gibson Lake. In Arkansas, the only county where this species has been reported is for Pope County. The occurrence of the gray bat in Pope County is probably more in association with the Ozark National Forest in the northern part of the county rather than the southern part of the county and the MCKARNS.

Very little, if any, suitable habitat containing caves is present for this species within the proposed action areas. Due to the feeding range and foraging habits of this species it could use the shorelines of the MCKARNS and associated lakes for feeding areas.

4. Cause of Decline. In the early 1960's, the population for this species was thought to be over 3 million, but by the 1980's it declined in abundance to approximately 1.5 million. The primary reasons for decline of this species are considered to be human disturbances of hibernacula and maternity caves, poisoning from pesticides, loss of habitat due to construction of impoundments, and commercialization of caves.

5. **Status of Species.** The gray bat was listed as Endangered by the USFWS on April 28, 1976 (41 FR 17740). No critical habitat was listed for this species. Since 1991, the range-wide population appears stable due to protection efforts.

C. Indiana Bat.

1. Description of Species. The Indiana bat (*Myotis sodalis*) is a medium-sized bat with a dull gray to chestnut colored fur dorsally, and pinkish white underparts. The basal portion of the hairs of the back is a dull gray color. The total length of the species ranges from 75-102mm, tail length 27-44mm, and a wingspread of 240-267mm. Approximately 500,000 individuals of this species still exist.

2. Distribution of Species. The Indiana bat is found primarily in the midwestern and eastern United States and has been reported from 23 states. The largest populations are in Arkansas, Indiana, Kentucky, Missouri, and Tennessee. Eastern Oklahoma represents the western limit of its range. Its present range in Oklahoma includes Adair, Delaware, LeFlore, and Pushmataha counties. In Arkansas it is listed to occur in nine counties, but none are within the proposed action areas. In Oklahoma, LeFlore County is the only county within a designated action area. Portions of Grand Lake and Markham Ferry Lake are located within the range of this species and probably contain suitable habitat for this species. However, these reservoirs were constructed and operated by the Grand River Dam Authority and are outside the purview of this BA.

USACE personnel responsible for inspection of the dams and associated structures were surveyed about the occurrence of bats for all the projects associated with the proposed action areas. In Oklahoma, bats were reported to occur at only Keystone, Eufaula, and Tenkiller lakes. The replies from the projects surveyed in Arkansas along the MCKARNS were negative with one exception. A single pipistrelle sp. was found at the Dardanelle Powerhouse.

This species is migratory with approximately 87% of the entire known population hibernating in just seven caves. If the Indiana bat utilizes any of the proposed action area, it would probably be as a summer resident. After the winter hibernation period, the colonies would disperse to summer areas, which are usually located along streams where the bats forage for flying insects.

3. Habitat. Habitat requirements are similar to the gray bat in that they need limestone caves for hibernation, and caves with pools are preferred. They require stable temperatures from 39 ºF to 46 º F and 66 to 95% humidity. Because of these requirements, this species is highly selective of hibernacula. Low cave temperatures allow the bats to maintain a low metabolic rate throughout hibernation. Consequently, only a small percentage of caves meet the specific conditions required by Indiana bats. Maternity sites are in trees. During the summer months, they can be found under bridges, in old buildings, under tree bark, or in hollow trees generally associated with streams.

4. Cause of Decline. The primary reasons for decline of this species are considered to be commercialization of roosting caves, disturbances of hibernacula caves from spelunkers or vandals, poisoning from pesticides, and loss of habitat due to channelization of streams.

5. Status of Species. The Indiana bat was listed as Endangered by the USFWS on March 11, 1967 (32 FR 4001). Critical habitat was designated for this species and consists of a few caves located in Tennessee and Kentucky.

D. Ozark Big-eared Bat.

1. Description of Species. The Ozark big-eared bat (*Corynorhinus townsendii*) is a medium-sized bat with forearms measuring 39-48mm long and weighing 7 to 12 grams. It has very large ears (over 1 inch) that connect at the base across the forehead. The snout has prominent lumps with fur that ranges in color from light to dark brown.

2. Distribution of Species. Historically this species was known from Oklahoma, Arkansas, and Missouri. It is believed to have been extirpated from Missouri. In Arkansas it is known primarily from Marion and Washington counties, but records exist for Franklin and Crawford counties, which are within the proposed action areas. The recovery plan for the species lists it as possibly occurring in Pope and Johnson counties as well. In Arkansas, only four caves are presently known to be regularly used by this species. None are within the proposed action area, although one possible use cave was listed for Crawford County. The Arkansas population is estimated to be 600 individuals while the Oklahoma population is estimated to range between 1,000-1,600 individuals, which are located in Adair County. In Oklahoma, Cherokee County is the only county where this species has been recorded that is within the proposed action area. Historically, it was found in Sequoyah, but it does not occur there presently. All the known caves currently used by this species in Oklahoma are located in either Adair or Delaware counties, which are not in the proposed action areas. Portions of Grand Lake and Markham Ferry Lake are located within the range of this species and probably contain suitable habitat for this species. However, these reservoirs were constructed and operated by the Grand River Dam Authority and are outside the purview of this BA.

USACE personnel responsible for inspection of the dams and associated structures were surveyed about the occurrence of bats for all the projects associated with the proposed action areas. In Oklahoma, bats were reported to occur at only Keystone, Eufaula, and Tenkiller lakes. The replies from the projects surveyed in Arkansas along the MCKARNS were negative with one exception. A single pipistrelle sp. was found at the Dardenelle Powerhouse.

3. Habitat. The Ozark big-eared bat is found in caves, cliffs, and rock ledges associated with oak-hickory forests of the Ozarks. They forage along the edges of upland forests for insects (primarily moths). Edge habitat between forested and open areas is the preferred foraging area. The temperature of hibernacula ranges from 40 ºF to 50 ºF, and maternity caves range from 50 ºF to 59 ºF. This species does not migrate and probably has a range of less than 20 miles. They have an affinity to return year after year to the same maternity sites and hibernacula.

4. Cause of Decline. The primary reasons for decline of this species are considered to be disturbance and vandalism of caves and roost sites and possibly predation at cave entrances. It was listed as endangered because of its small population size, reduced distribution, and vulnerability to human disturbance.

5. Status of Species. The Ozark big-eared bat was listed as endangered under the Endangered Species Act of 1973, as amended on November 30, 1979 (Federal Register, Vol.44, No. 232). No critical habitat was designated for this species.

E. American Burying Beetle.

1. Description of Species. The American burying beetle *(Nicrophorus americanus)* is the largest species of its genus in North America measuring 25-35 millimeters (mm) in length (Peck and Anderson, 1985). It has a shiny black body with smooth and shiny black elytra with bright orange-red markings. The antennae are large, abruptly clubbed, and orange at the tip. It is a member of the Family Silphidae, which are know as the carrion or burying beetles, due to their behavior of burying vertebrate carcasses which are used for brood chambers for their young.

2. Distribution of Species. This species was formerly known from much of eastern North America with its historical range described as being most of temperate eastern North America. Historically, its range included 35 states in the eastern and central United States and the southern edges of Canada. The easternmost record for the species is from Nova Scotia in Canada and the westernmost record is from central Montana. The northernmost record is from the upper peninsula of Michigan and the southernmost record is from Kingsville, Texas. More recently (since 1970), it has been documented from Arkansas, Kansas, Kentucky, Missouri, Nebraska, Oklahoma, and Rhode Island. Presently, the current distribution encompasses seven states including Nebraska, Kansas, Arkansas, Rhode Island, Massachusetts, South Dakota, and Oklahoma.

In Oklahoma, this species was originally thought to occur in only Latimer, Cherokee, Muskogee, and Sequoyah counties. More recently, it has been discovered in 17 counties in Oklahoma (Figure 8) including Bryan, Choctaw, Atoka, Coal, Johnston, Pontotoc, Cherokee, Haskell, Latimer, LeFlore, McCurtain, Muskogee, Okfuskee, Pittsburg, Pushmataha, Sequoyah, and Tulsa (USFWS, 2003).

Existing populations in Arkansas are limited to five counties in the western part of the state. Most of these occurrences are from Federal lands, such as Fort Chaffee and the Ouachita National Forest. Within the proposed action area they occur in Sebastian, Logan, and Franklin counties (Arkansas National Historic Commission, 2003).

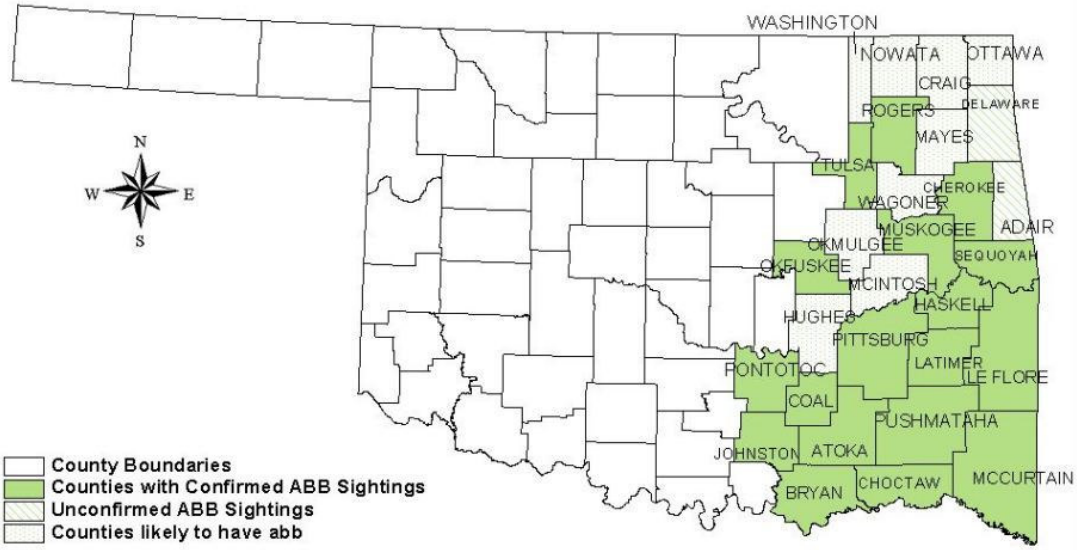


Figure 8. Distribution of American Burying Beetle in Oklahoma.
Source: Nature Serve, 2003, http://www.natureserve.org/explorer

The most stable populations occur in Arkansas, Oklahoma, and Rhode Island. In Latimer County, Oklahoma, the populations are found on private holdings. The Muskogee and Cherokee counties population occurs primarily on Federal lands licensed to the Oklahoma Army National Guard and the Oklahoma Department of Wildlife Conservation. The Arkansas populations occur on Federal lands including the Fort Chaffee Military Reservation, the Ozark National Forest, and the Ouachita National Forest. Given the mobility of this species, it is likely these represent a single population of this species.

The USACE has conducted surveys for *N. Americanus* on several projects with negative results. Surveys have been conducted at selected areas at Keystone Lake, along Mingo and Fry creeks, Hugo Lake, Wister Lake, Fall River Lake, and Robert S. Kerr Lake. However, these surveys were completed for small areas where minor construction activities were proposed and did not include a survey of the entire project.

3. **Habitat**. Very little information on the historical collection habitat of *N. americanus* exists. Walker (1957) provides the earliest published description of *N. americanus* as follows:

> " A park-like stand of large deciduous trees with little shrub layer and few small trees. Six species were prominent in the canopy--*Quercus falcate, Quercus alba, Liquidambar styraciflua, Carya ovata, Nyssa sylvatica,* and *Liriodendron tulipifera.* Hornbeam (*Carpinus caroliniana*) formed a relatively continuous tree understory, even predominating over canopy species in basal area (about 20%) and in number of stems (about 45%). There was no evidence of lumbering. Grasses and sedges were markedly dominant in the sparse ground cover."

In Oklahoma, the habitat types where populations have been documented to occur vary from deciduous and coniferous forests to open pasture. The topography includes slopes, ridge

tops and flat grasslands. In Arkansas where they are found, it is primarily open grasslands and is very similar to habitat in Oklahoma. The population in Rhode Island is found in habitat consisting of maritime shrub thickets, coastal marine grassland, and agricultural pastures (Kozol et al., 1989). In Nebraska, they have been collected from predominantly riparian deciduous forests or scrub forests along water courses (Ratcliffe et.al., 1992).

The Oklahoma Natural Heritage Inventory performed surveys in a large area of western Cherokee and eastern Muskogee counties, Oklahoma. Three different habitat types were surveyed, oak-hickory forest (second and third growth), grassland, and bottomland hardwood forest. Slightly more individuals were collected in grasslands than in oak-hickory forests and fewer still were captured in the bottomland forest. Analysis of habitat distribution data from two locations - one in Arkansas and the other in Oklahoma - indicated that the species is a "habitat generalist, " meaning that it is found in all types of habitats with only a very slight preference (Lomolino, 1993).

With the wide distributional pattern of the species with respect to habitat types, it does not appear likely that vegetation and soil type are limiting factors. It has been collected from mature virgin forests, open pastureland, and grasslands. While certain types of soil conditions are not suitable for carcass burial (such as very xeric, saturated, or loose sandy soils), the availability of appropriate carrion appears to be more of a limiting factor (Raithel, 1991).

4. **Cause of Decline**. Once widely distributed throughout eastern North America, this species has disappeared from most of its former range. At the time of listing, it was reported to occur in only three geographic areas: (1) on a small island off the New England Coast; (2) at two locations in Nebraska; and (3) at several locations in western Arkansas and eastern Oklahoma. The reasons for this decline are not known. Several theories exist concerning possible reasons for decline of this species. Some of the more widely accepted reasons include: (1) direct habitat destruction, (2) DDT and other organochlorine pesticides, (3) predation or species-specific disease, (4) interspecific *Nicrophorus* competition, (5) outdoor lighting, (6) habitat fragmentation, and (7) and changes in vertebrate species composition and density.

5. **Status of Species**. The American burying beetle, *Nicrophorus americanus,* was Federally listed as endangered on July 13, 1989, 50 CFR (Federal Register 54, No 29652-133.5). No critical habitat was designated for this species.

F. Whooping Crane.

1. **Description of Species**. The whooping crane, *Grus americana,* is a tall snowy white bird with a long neck and legs. It has red facial skin, a black wedge shaped patch on the neck, and black primaries, which are visible during flight. It is the tallest bird in North America. It can reach a height of 45 inches and has a wingspan of up to 90 inches.

2. **Distribution of Species**. The historical range of this species extended from the Arctic coast to central Mexico, and from Utah east to New Jersey, South Carolina, Georgia, and Florida (USFWS, 1992). Presently, only three wild populations of this species remain. The only self-sustaining population nests in Alberta, Canada, primarily in the Woods Buffalo National

Park and winters along the Gulf of Mexico on the Arkansas National Wildlife Refuge (NWR). This population migrates through Oklahoma during the spring and fall. Two smaller populations have been reintroduced to the wild, and are located in Florida and southeastern Idaho. These are referred to as the Florida and the Rocky Mountain populations.

Within the proposed action areas, the whooping crane would be considered a possible migrant. Most sightings in Oklahoma have been from the north-central to southwestern part of the state, well west of the project areas. Most sightings are associated with the Great Salt Plains National Wildlife Refuge in Alfalfa and Grant counties, Oklahoma, and the upper Red River in southwestern Oklahoma and Texas. However, there are some observations from Muskogee, Wagoner and Rogers counties, Oklahoma. The historical populations occurring in Arkansas are assumed to have been extirpated (USFWS, 2003).

3. **Habitat.** The nesting grounds for whooping cranes are located in poorly drained prairie areas interspersed with numerous potholes and wetlands of the Northwest Territories in Canada. The nest sites are located in emergent vegetation along the edges of marshes, potholes, or lakes. During migration, whooping cranes use a variety of habitats including croplands for feeding and isolated riverine wetlands for roosting. The wintering grounds include areas of salt flats, tidal marshes and flats, and shallow bays along the Texas Gulf Coast and the Arkansas NWR.

During the summer months, the whooping cranes feed on insects, crustaceans, and berries. Their winter diet consists of grains, insects, crustaceans, mollusks, fishes, reptiles, and marine worms (USFWS, 1980).

4. **Cause of Decline**. The listed causes for decline of this species include loss of habitat due to agricultural, human disturbance of nesting areas, and uncontrolled hunting. Collision with power lines became the major cause of death after hunting was curtailed (USFWS, 2003). Delayed sexual maturity, small clutch size, and low recruitment impact recovery of this species.

5. **Status of Species**. The whooping crane was determined to be endangered by the USFWS in accordance with the Endangered Species Act of 1973, as amended on March 11, 1967 (32 FR 4001). Critical Habitat was designated for this species on May 15, 1978 (43 FR 20938). The only critical habitat listed for this species close to the proposed action area is an area of land, water, and air space in Alfalfa County, Oklahoma. Additional critical habitat was proposed for this species, but was withdrawn on March 16, 1979 (FR Vol. 44, No. 45, 4310).

On June 2, 1970 (FR 8495), the whooping crane was designated as Experimental Population, Non-Essential in the USA (AL, AR, GA, IL, IN, IA, KY, LA, MI, MN, MS, MO, NC, OH, SC, TN, VA, WI, WV). On January 22, 1993, it was designated as Experimental Population, Non-Essential in the U.S.A. for Colorado, Idaho, Florida, New Mexico, Utah, and the western half of Wyoming).

The total population of whooping cranes is small and has not increased dramatically since listing. In 1989, the total population was reported to be 138 individuals. This number increased

to 200 individuals being reported in 1990. By 1996, the total population was reported to number 260, composed of 96 captives and 163 in the wild (USFWS, 2003).

Within the proposed action areas, this species would be considered a rare migrant along the western edge of the MCKARNS that occurs within Muskogee, Tulsa, and Rogers counties, Oklahoma. It would not be expected to occur in Arkansas.

G. Bald Eagle.

1. <u>Description of Species</u>. The bald eagle (*Haliaeetus leucocephalus*) is the only species of sea eagle native to North America. Adults are black with a snow-white head and tail. Sub adults are mottled brown and black and lack the distinctive white head and tail. Wingspan is 6 to 7 feet with females weighing between 10-14 lbs and males weighing between 8-10 lbs.

2. <u>Distribution of Species</u>. Bald eagles winter throughout the United States but are most abundant in the West and Midwest. Within the project area (Oklahoma and Arkansas), they winter around reservoirs and along major river systems. In winter, it is common for bald eagles to congregate in communal roosting sites that are generally close to water and afford protection from inclement weather and human disturbance. At Keystone Lake, Oklahoma, eagles have used a communal roost during the winter and spring (November-March) in a protected cover area for the last 20 years and are commonly seen fishing along the Arkansas River downstream of Keystone Dam during daylight hours. Annual mid-winter eagle surveys for Oklahoma are shown in Figure 9.

Bald eagles are long-lived birds and are believed to mate for life. The oldest known specimen was reported to be 28 years old (Schempf, 1997). At Eufaula Lake, Oklahoma, one pair of eagles have nested several consecutive years in a tree located within a public use area on the lake, but typically nesting within the project area is usually associated with the more remote sections of large rivers above and below impoundments. Nesting is known to occur on the Arkansas River below Kaw Dam and Keystone Dam and along the Canadian River below

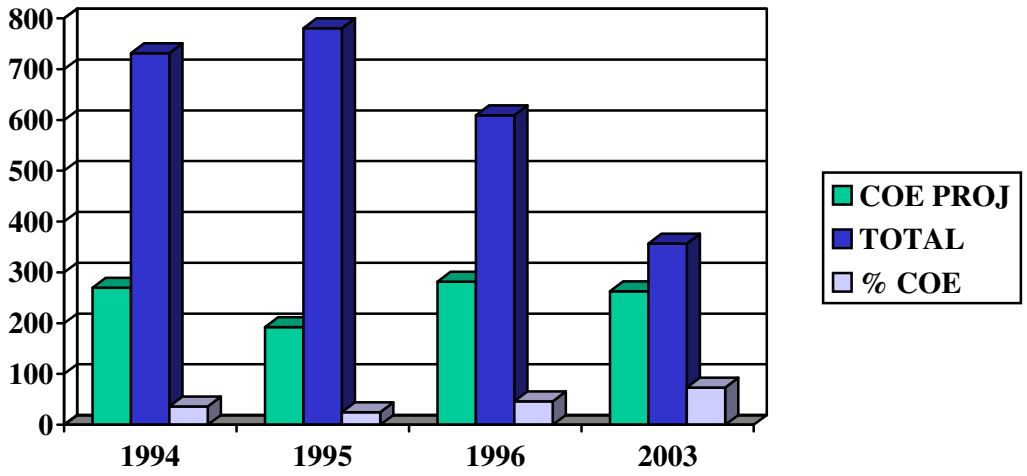
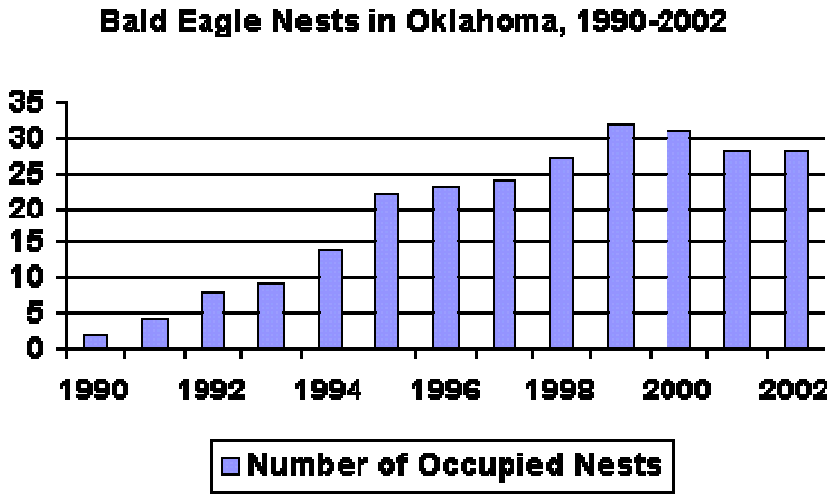


Figure 9. Midwinter Bald Eagle Surveys for Oklahoma.

Eufaula Lake. USACE and USFWS personnel conducting surveys for nesting Interior least terns have reported numerous sightings of eagle nests, immature eagles, and adults along these rivers between June and August.



Source: Sutton Avian Research Center, 2003

3. **Habitat**. The bald eagle is found throughout North America and winters near large rivers and reservoirs across this region. Their diet is mainly fish, but bald eagles are opportunistic and may feed on carrion, waterfowl, or other prey species. They typically nest in trees near water. Eagles utilize mature trees, especially cottonwoods, along rivers and lakes for nesting, roosting, and perching.

4. **Cause of Decline.** During the early part of the 19th century, bald eagle numbers were greatly reduced. These declines are attributed to loss of habitat, poisoning, trapping, and shooting. Mortality from poisoning, trapping, and shooting has been substantially reduced through protection efforts and legislation. However, loss of habitat from land development activities and encroachment on river floodplains still continues.

An as great or greater threat to the bald eagle was the use of the pesticide Dichloro diphenyl trichloroethane (DDT), which came into widespread use after World War II. This pesticide was used extensively along coastal and other wetland areas to control mosquitoes (Carson, 1962) and quickly entered the food chain. Eagles would catch and ingest fish or other prey species associated with the aquatic environment containing DDT and fail to reproduce successful. Ingestion of DDT resulted in eggshell thinning and/or embryonic mortality and the population plummeted. The use of DDT was subsequently banned in 1972, and by 1976 other pesticides such as dieldrin, heptachlor, and chlordane, were also restricted. Consequently, eagle numbers have increased significantly.

5. **Status of Species.** The bald eagle was Federally listed as endangered under the Endangered Species Act of 1966 on March 11, 1967, 50 CFR (Federal Register 32, 4001). No critical habitat was designated for this species. On February 14, 1978, 50 CFR (43 Federal

Register 6233), the species was listed as endangered in 43 states except Washington, Oregon, Minnesota, Wisconsin, and Michigan, where it was listed as threatened. On July 12, 1995, 50 CFR (60 Federal Register 36000), the eagle was reclassified as threatened in all 48 conterminous states. The USFWS has proposed to remove this species from the List of Endangered and Threatened Wildlife in the lower 48 states of the United States, 50 CFR (64 Federal Register 36454, July 6, 1999, Proposed Rules). However, until the delisting process has been completed, the protection afforded under the Endangered Species Act and requirements for consultation are still required. Bald eagles declined in numbers due to pesticide-induced reproductive failure, loss of riparian habitat, and human disturbances such as shooting, poisoning, and trapping. More recently, its numbers have recovered due to habitat protection and management actions initiated under the EAS and a reduction in levels of persistent organ chlorine pesticides such as DDT.

In 1963, there were an estimated 487 nesting pairs of bald eagles. This number has substantially increased with the 1992 nationwide midwinter survey for bald eagles reporting approximately 16,000 bald eagles. The 1993 midwinter survey reported even greater numbers with approximately 12,000 birds. By 1998, due to recovery efforts of the USFWS, eagle numbers had increased to approximately 6,000 nesting pairs that produced approximately 7,000 young.

As proposed by the USFWS, bald eagle populations have recovered to the point that they are being delisted from the threatened and endangered species list. The midwinter bald eagle surveys conducted in Oklahoma for 1994-1996 and 2003 show bald eagles counts have varied from 357 to 732 sightings (Figure 9). For the same years, counts occurring in concert with USACE operating projects have varied from 25% to 73%, which indicates wintering populations of bald eagles are closely associated with USACE projects. Other sightings during the survey found eagles at non-USACE projects and on major rivers. Large numbers of eagles were found on two reaches of the Arkansas River. The midwinter counts for Arkansas River Reach 1 vary from a low of 96 in 1989 to a high of 297 in 1986. For 1990, 1991, and 1993, the counts were 236, 242, and 244, respectively. For Arkansas River Reach 2, the counts are somewhat lower and ranged from a low of 32 in 1993 to a high of 138 in 1994.

Bald eagles also extensively use the lower part of the MCKARNS as shown in Figure 10. Midwinter bald eagle counts found birds at Pools 1-6, Toad Suck Ferry, Pools 7 and 8, Lake Dardanelle, and Pool 9. The heaviest use appears to be associated with Lake Dardanelle where numbers have ranged from a low of 51 to a high of 246. Significant numbers also occur in association with the White River National Wildlife Refuge.

Between 1984 and 1992, the Sutton Avian Research Center (SARC) raised and released 275 bald eagles in the southeastern U.S. Aerial and ground surveys in the vicinity of Oklahoma release sites show that the number of bald eagle nests in Oklahoma has increased annually. Those increases are as follows: 1990 (2), 1991 (4), 1992 (8), 1993 (9), 1994 (14), 1995 (22), 1986 (23), 1997 (24), 1998 (27), 1999 (32), and 2000 (31) (Sutton Avian Research Center, 2003). The exact location of these nests was not available for dissemination, but the reported nesting sites tripled the recovery plan goal for Oklahoma (10 nests).

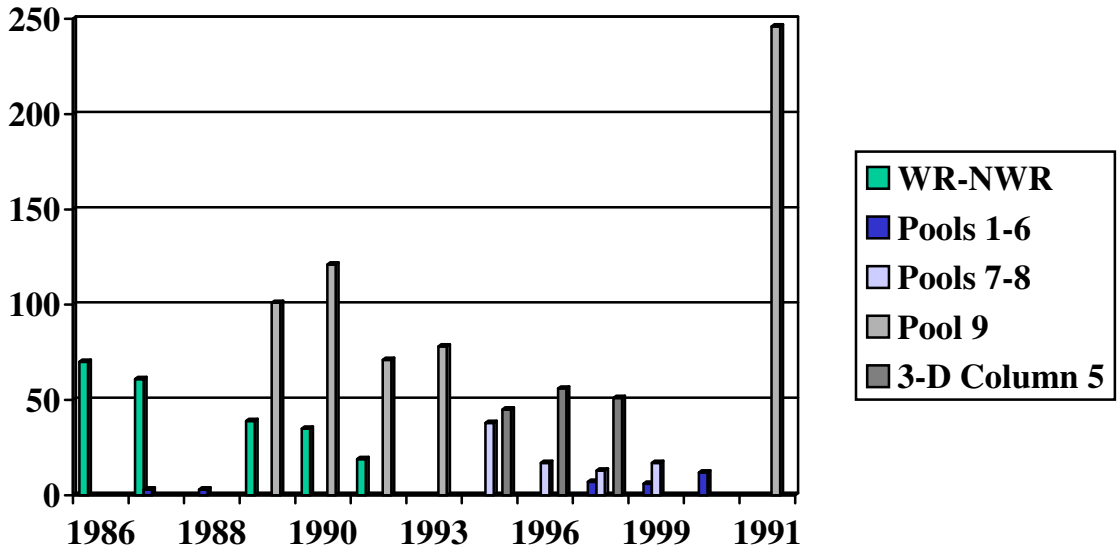


Figure 10. Midwinter Bald Eagle Counts for the Lower MCKARNS.

Representatives from the USACE and the USFWS have made numerous sightings of adult bald eagles, immature bald eagles, and nests along the Arkansas River below Kaw Dam to Keystone Lake; along the Arkansas River from Keystone Dam to Muskogee; and along the Canadian River from below Eufaula Dam to the MCKARNS. USACE personnel have not conducted eagle surveys on the Red River below Denison Dam, but it is highly probable they exist along the Red River as well. From the information obtained from the SARC, it is not known if nesting eagles have been recorded along the Red River. However, data from the midwinter bald eagle surveys indicate that eagles winter around Lake Texoma. Numbers have varied from a low of 19 in 1994 to a high of 52 reported in 1995. For this assessment, bald eagles will be considered to occur on all USACE projects associated with all the proposed actions, and nesting bald eagles will be considered to occur on all the proposed action areas for the Arkansas and Canadian River system within the action area described for the Red River below Lake Texoma to Index, Arkansas.

Trend data for the midwinter bald eagle counts from 1986-2000 show a positive trend for numbers of eagles for both Oklahoma and Arkansas. Based upon data for 12 routes and 86 surveys from 1986-2000, the trend is +0.3% for Arkansas and +0.9% for Oklahoma based on 30 routes and 277 surveys (http://ocid.nacse.org/qml/nbii/eagles/sumtrend.html).

H. Pink Mucket Pearly Mussel.

1. <u>Description of Species</u>. The pink mucket pearly mussel, *Lampsilis abrupta*, as described by Cummings (1992) has a shell that is rounded to elliptical, solid, and inflated. The anterior end is rounded and the posterior end is bluntly pointed in males. The shell is smooth and yellow to yellowish green in color with faint green rays. It can attain a length up to 4inches.

2. **Distribution of Species**. Its distribution includes the lower Mississippi and Ohio rivers and their larger tributaries. Historically, this species was found in 13 states and from 25 rivers and tributaries of the eastern United States and ranged from Missouri and Arkansas eastward to Pennsylvania and Virginia. It was scattered throughout the Mississippi, Tennessee, Ohio, and Cumberland River systems.

This species does not occur in Oklahoma, but is listed to occur in Arkansas County from the lower White River. The USFWS Recovery Plan for this species lists it as occurring in only the upper reaches of the Black River and Spring River of northeast Arkansas (USFWS, 1985). However, Harris (2003) reported that it had been collected as far downstream as Clarendon, Arkansas, on the White River. Harris et al. (1997) shows that it has been collected from 21 locations on the White River, most are from the middle and upper reaches of the White River and none are close to its confluence with the MCKARNS.

3. **Habitat.** The pink mucket is associated with riffle areas of large river systems within sand or gravel substrates and strong currents. It has been reported to survive and reproduce in river-lake conditions, but never in standing pools of water (USFWS, 1985).

4. **Cause of Decline**. The causes for decline of the species include modification of habitat (construction of dams and dredging), degradation of water quality, and over harvest by the commercial mussel industry.

5. **Status of Species**. The USFWS determined the pink pearly mucket mussel to be endangered in accordance with the Endangered Species Act of 1973, as amended on June 14, 1976 (Federal Register 41 (115) 24062-24067). Critical habitat was not determined for this species. This species has never been collected in large numbers from any one site or drainage (USFWS, 1985). Historically, it was found in 25 rivers and tributaries, but by 1990 its range had been restricted to only 16 rivers and tributaries (Matthews and Moseley, 1990). It is unlikely that this species occurs in the lower White River within the proposed action area.

I. Scaleshell Mussel.

1. **Description of Species**. The scaleshell mussel, *Leptodea leptodon*, is a thin delicately shelled species with an oblong rhomboidal shaped shell and can attain a length up to 4 inches. The dorsal margin is slightly rounded and the ventral margin is broadly rounded. Both the anterior and posterior ends are sharply rounded. Growth-rest lines sometimes produce heavily pigmented lines, usually seen as very fine concentric ridges and grooves. The epidermis is olive-colored with fine wavy rays.

2. **Distribution of Species.** The scaleshell is considered to be rare wherever it is found (Oesch, 1984). Historically, it was found in 55 streams in 13 states throughout the eastern United States. Presently, it is found in 13 streams in Arkansas Missouri, Oklahoma, Minnesota, Nebraska, and South Dakota.

In Oklahoma, this species is associated primarily with the Red River Basin in southeastern Oklahoma. It has been reported to occur in the Kiamichi, Mountain Fork, and

Lower Little Rivers; and from the Poteau River, a tributary to the Arkansas River (USFWS, 2003b). The final rule listing this species (USFWS, 2001) reported it as occurring in the Poteau River based upon a single specimen, but states that the existence of the scaleshell in the Poteau River is doubtful.

Within the State of Arkansas, this species is reported to occur in seven counties including Crawford, Fulton, Jackson, Lawrence, Perry, Sevier, and Francis (USFWS, 2003b). The USFWS final rule listing this species reports this species as having been collected from Frog Bayou, the South Fourche LaFave, and the Mulberry rivers in Arkansas. Perry and Crawford counties are within the proposed action areas. The record (s) for Perry County are associated with the Fourche LaFave River, which is a tributary to the MCKARNS at navigation mile 146.5, and Frog Bayou which is a tributary to the MCKARNS at navigation mile 277. Potential habitat for this species in Frog Bayou is restricted to the area between the town of Rudy and the MCKARNS (USFWS, 2001). Live mussels have not been found at the confluence of the Arkansas River likely due to dredging activities (Gordon, 1980).

The only scaleshell mussel record from the South Fourche LaFave River is based on a single live specimen taken in 1991 (USFWS, 2001). The occurrence of the scaleshell mussel in the Mulberry River is based upon a single specimen (USFWS, 2001), and the USFWS believes its existence in the Mulberry River is unlikely. There are no records of this species occurring in the Arkansas River (Arkansas Natural Historical Commission, 2003).

3. **Habitat**. This species inhabits larger creeks and small to medium size rivers. Oesch (1984) has described its habitat as occurring in riffles with moderate to high gradients in creeks to large rivers. It is been reported to occur in riffle areas having relatively strong currents and a substrate consisting of gravel, cobble, boulders, and occasionally mud or sand. It is restricted to rivers with good water quality (Oesch, 1995).

4. **Cause of Decline**. The primary reasons for decline of this species are listed as present or threatened destruction, modification, or curtailment of its habitat or range; over utilization for commercial, recreational, scientific, or educational purposes; disease; and predation.

5. **Status of Species.** The USFWS determined this species to be endangered over its entire range in accordance with the Endangered Species Act of 1973, as amended on October 9, 2001 (Federal Register Volume 66, No. 195). No critical habitat was determined for this species. This is a rare mussel species wherever it is found. The (USFWS, 1999) reports that in mussel surveys conducted since 1980, it has never comprised more than 0.4% of the mussels collected. Of the 13 remaining populations of scaleshell mussels, three are thought to be stable, two are declining, four are thought to be in decline, and the status of the fourth is not known (USFWS, 1999). It is unlikely this species occurs in the MCKARNS.

J. Piping Plover.

1. **Description of Species**. The piping plover, *Charadrius melodus,* is a small shorebird approximately 7 inches in length with a wingspan of approximately 15 inches and

weights from 1.5 to 2 ounces. It is sand-colored on the back with white undersides. It is distinguished from similar species by its bright orange legs. During the breeding season, the plover has a single black band across its breast and forehead, which are absent during the winter.

2. Distribution of Species. The historical breeding range of the piping plover in North America included the Atlantic coastal beaches from Newfoundland to South Carolina; beaches of the Great Lakes; and the northern Great Plains region from Alberta to Ontario and south to Nebraska (USFWS, 1988). These populations were generally reported to winter along the Gulf of Mexico, the Atlantic coast from North Carolina to Florida, eastern Mexico, and in the Caribbean Islands (Haig and Oring, 1985). This species is not reported to occur in Arkansas.

The population potentially occurring within the proposed action areas is the northern Great Plains population. It is primarily a transient migrant throughout the project area utilizing larger rivers, reservoir beaches, and mudflats. It has been recorded to nest on the Salt Plains National Wildlife Refuge in western Oklahoma. It has also been reported to use mudflats in the upper reaches of Oologah Lake during migration periods.

3. Habitat. Piping plover breeding habitat is comprised of open, sparsely vegetated areas with alkali or unconsolidated substrate (USFWS, 2000). They have been reported to nest on rangeland consisting of mid- or short-grass prairies. On rivers they nest in association with beaches, sand flats, dredge islands, and drained river floodplains where vegetative cover is usually less than 20% (Haig, 1986; Schwalbach, 1988). During migration periods, they use beaches and alkali flats. They feed mainly on freshwater, marine, and terrestrial invertebrates.

4. Cause of Decline. The primary causes for decline of this species are listed as habitat loss and degradation and human disturbance. Loss of breeding habitat has resulted from recreation and commercial development of sandy beaches on the Great Lakes, Atlantic Coast, and Gulf of Mexico. Where breeding does occur on coastal beaches, inland lakes, and river sites, reproductive success has been reduced by disturbance from humans and pets. Additional habitat has been lost due to construction and operation of reservoirs and river channelization.

5. Status of Species. The USFWS determined the piping plover to be endangered and threatened in accordance with the Endangered Species Act of 1973, as amended, on December 11, 1985 (Federal Register Volume 50, No. 238). Endangered status was determined for the plover in the watershed of the Great Lakes (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario). It was determined to be threatened in the remainder of its range: northern Great Plains (Iowa, northwestern Minnesota, Montana, Nebraska, North Dakota, South Dakota, Alberta, Manitoba, and Saskatchewan); Atlantic coast (Quebec, Newfoundland, Maritime Provinces, and states from Maine to Florida); Gulf coast (Florida to Mexico); Bahamas; and West Indies. Critical habitat was not designated for this species.

Population trend data for this species is sparse. In the early 1900's, it was generally considered to be common. Early 20th century accounts report that hunting caused the first known major decline of the piping plover along the Atlantic coast (Brent, 1929; Hall, 1960). With

passage of the Migratory Bird Treaty Act in 1918, plover populations recovered only to decline again in the recent times.

Surveys of breeding plovers in the early 1980's reported the Northern Great Plains population to be between 2,137 - 2,684 adult plovers (Haig and Oring, 1985). The 1991 breeding ground surveys estimated 3,467 adults in this population, and 1996 surveys estimated 3,284 adults for the Northern Great Plains Population (Plissner and Haig, 1997).

K. Arkansas River Shiner.

1. Description of Species. The Arkansas River shiner (*Notropis girardi)* is a small minnow less than 2 inches in length. It is sandy colored dorsally and silver colored laterally with dorsal scales lightly outlined with dark pigment. A small black chevron is usually present at the base of the tail.

2. Distribution of Species. Historically its range included western Arkansas, Kansas, Oklahoma, New Mexico, and Texas. It was once widespread throughout the western portion of the Arkansas River Basin in Kansas, New Mexico, Oklahoma, and Texas, but was probably never widespread in Arkansas. A small population may exist in the Cimarron River in Kansas.

A multi-year survey (2000-2002) funded by the USACE and conducted by Texas Tech University for this species on the North Canadian River above Canton Lake to Optima Dam failed to find this species. It is now primarily found in the South Canadian River above Eufaula Lake in Oklahoma to New Mexico. It has become widely established in the Pecos River system in New Mexico through introductions. This species is considered to be extirpated from the State of Arkansas and is no longer present in any of the proposed action areas along the Arkansas River and the MCKARNS.

3. Habitat. The preferred habitat is the main channels of large sandy-bottomed rivers and streams. It utilizes the downstream side of sand ridges in the channels where they feed on detritus and invertebrates exposed by the shifting substrate and current. Spawning occurs in July and is thought to be associated with flood events. However, there is some evidence that spawning may occur throughout May, June, and July. The eggs are buoyant and float until hatching. After hatching, the larvae move to backwater side channel areas to mature.

4. Cause of Decline. The causes for decline of this species include changes in natural stream flow patterns due to diversion of surface water and excessive groundwater pumping, habitat loss due to construction of impoundments, water quality degradation, competition from introduced species, and incidental capture during commercial harvest of bait fish (USFWS, 1998).

5. Status of Species. The USFWS determined the Arkansas River Basin population of the Arkansas River shiner to be a threatened species under the Endangered Species Act of 1973, as amended on November 23, 1998, final rule (Federal Register Volume 63, No. 225). Critical habitat was not originally listed for this species, but on June 30, 2000, the USFWS

(FR 64772) proposed critical habitat for this species. Critical habitat proposed for this species included approximately 1,160 miles of river and 300 feet of their adjacent riparian zones for portions of the Arkansas River in Kansas; the Cimarron River in Kansas and Oklahoma; the Beaver/North Canadian River in Oklahoma; and the Canadian/South Canadian River in New Mexico, Texas, and Oklahoma. None of the critical habitat is within the proposed action areas.

The Arkansas River shiner has disappeared from over 80% of its historical range within the last 35 years, and is restricted to about 500 miles of the Canadian River in Oklahoma, Texas, and New Mexico (USFWS, 1998). A small population may still exist on the Cimarron River in Kansas and Oklahoma. Historically, this species would have occurred throughout the proposed action areas. However, habitat alteration following construction of Kaw and Keystone lakes on the Arkansas River in Oklahoma and construction of the MCKARNS in 1970, the shiner is no longer believed to occur in the Arkansas River in Arkansas, Kansas, and Oklahoma (USFWS, 1998).

L. Pallid Sturgeon.

1. <u>Description of Species</u>. The pallid sturgeon, *Scaphirhynchus albus*, is also known as the white sturgeon. Pallid sturgeon can exceed 6 feet in length and weigh in excess of 80 lbs. They have a flattened, shovel-shaped snout, and a long and completely armored caudal peduncle lacking a spiracle (Smith, 1979). The mouth is positioned on the underside of the snout and is toothless and protractible. It has five rows of scutes that run the entire length of the body. It is similar in appearance and closely related to the shovelnose sturgeon, *Scaphirhynchus platorynchus*, and oftentimes hybridizes with this species.

The pallid sturgeon is a prehistoric fish evolved from an ancient group of bony fishes of the subclass Paleopterygii during the Paleozoic Era. Most species of this subclass became extinct sometime during the Mesozic Era. The living descendants of this group of fish in North America include paddlefish (Polyodontidae) and eight species of sturgeon (Acipenseridae) (USFWS, 1993).

2. <u>Distribution of Species</u>. The pallid sturgeon inhabits large turbid rivers and is endemic to the middle and lower Mississippi River; the Missouri River; and the lower reaches of the Platte, Kansas, and Yellowstone Rivers (Bailey and Cross, 1954). The pallid sturgeon was not described as a species until 1905; consequently, little is known of its historic range and abundance (Pflieger, 1975). Carlson and Pflieger (1981) state that pallid sturgeon are rare, but widely distributed in the Missouri River and in the Mississippi River downstream from the mouth of the Missouri. Since 1980, they have most frequently been reported from the Missouri River. Keenlyne (1989) reports records for the Mississippi River from its mouth upstream to its confluence with the Missouri River, the lower Yazoo/Big Sunflower and St. Francis Rivers, the lower Kansas River, the lower Plate River, and the lower Yellowstone River.

States within or bordering the range of this species includes Montana, North Dakota, South Dakota, Nebraska, Iowa, Kansas, Missouri, Illinois, Kentucky, Tennessee, Arkansas, Mississippi, and Louisiana. Within the proposed action areas, only the lower White River and possibly the lower Arkansas River would be included in the range of this species. Only two

records are known for Arkansas. One is from the Mississippi River and one is from the St. Francis River in northeastern Arkansas (Robison, 1988). There are no documented collection records of this species from either the White or Arkansas rivers.

The U.S. Army Corps of Engineers Waterways Experiment Station (ERDC) conducted limited sampling (33 samples) of the Arkansas-White River cutoff region for pallid sturgeon in June 2003, but this species was not collected. ERDC collection records on the Mississippi River (1997-2001) show pallid sturgeon have been collected from the Mississippi River between river miles 585-615, which is near the confluences of the Arkansas and White rivers (Personal Communication, Jack Kilgore, 2003).

3. Habitat. The pallid sturgeon is a fish adapted to living on the bottom of large swift, free flowing, and turbid rivers. This species evolved in the diverse constantly changing ecosystem of large river systems and their floodplains such as the Mississippi and Missouri. This system has been greatly altered by construction and operation of reservoirs for flood control, water supply, hydroelectric power, recreation, and locks and dams for navigation. These activities have resulted in the loss of riverine habitat, modification of the natural flow regimes, loss of spawning habitat, reduction in floodplains and associated nutrient input, and loss of shallow water habitat needed for nursery and feeding areas for this species.

4. Cause of Decline. The reasons for decline of this include habitat modification (construction of large dams, and channelization), commercial exploitation, pollution, and hybridization with shovelnose sturgeon (USFWS, 2003a).

5. Status of Species. The USFWS determined the pallid sturgeon to be endangered in accordance with the Endangered Species of 1973, as amended, on September 6, 1990 (55 FR 3661). This species has been reported as rare throughout its range, but numbers have declined dramatically within the last two decades. Reproduction within the Missouri River is very low and this population is being supplemented with hatchery-propagated fish. While this species has not been recorded from the proposed action area, its possible occurrence (at least at times) in the lower White or Arkansas rivers cannot be discounted.

M. Interior Least Tern.

1. Description of Species. A detailed description and discussion of this species and life history requirements can be found in the previous biological assessment for the lower Red River dated May 2001 and provided in Appendix 1. Least terns are the smallest members of the tern family and are about the size of a cardinal. They have a grayish back and wings and snowy white undersides. They can be distinguished from all other terns by their combination of a black crown, white forehead, and a black tipped bill.

Currently, there are three U.S. subspecies of *Sterna antillarum*. The Interior least tern, *Sterna antillarum athalassos,* breeds along the major tributaries of the Mississippi River Drainage and the Rio Grande. The California subspecies *(S. a. browni)* breeds from San Francisco Bay to Southern Baja, California. The eastern least tern *(S.a. antillarum)* breeds along the Atlantic-Gulf Coast from the southern tip of Texas to southern Maine. However, the three

subspecies are identical in appearance, morphology, habitat use characteristics, vocalizations, and behavior. Electrophoretic analysis of coastal versus interior subspecies revealed no genetic differences in Texas populations. Only their breeding ranges distinguish them. Because of the taxonomic uncertainty, the USFWS chose to list those populations of least terns currently occurring in the interior of the U.S. (Sidle and Harrison, 1990). The breeding range of Interior least terns is from Montana to Texas and from eastern New Mexico and Colorado to Indiana and Louisiana, mainly on interior rivers.

2. Distribution of Species. Interior least terns are migratory birds with an inland distribution along major river systems in the interior U.S. Historically, Interior least terns were distributed over the entire Great Plains between the Mississippi River and the Rocky Mountains (Figure 11). The range extended northward to Montana, south to Texas, west to New Mexico and eastern Colorado, and east to Indiana (Sidle and Harrison, 1990).

In recent years, the breeding range of Interior least tern has decreased dramatically (Figure 12). They are no longer breeding in Louisiana and most of Missouri and Iowa. Within the states where they still breed, their range is reduced, fragmented, and generally restricted to the less altered river segments. In Oklahoma, the birds occur along sandy stretches of the Canadian, Arkansas, Cimarron, and Red rivers and at the Salt Plains National Wildlife Refuge (NWR). Texas shares least terns with Oklahoma along the state boundary on the Red River (Campbell, 1995). Interior least terns also occur in Texas along the Rio Grande near Falcon, Amistad, and Lake Casa Blanca reservoirs; in the northern panhandle along the Canadian River; and in the eastern panhandle along the Prairie Dog Town Fork of the Red River. Within the Red River system, they are known to currently nest from Arkansas to as far as Highway 207 south of Claude, Texas (USACE, 2003a).

Interior least terns are seasonal migrants to Central and South America and the Caribbean. The interior populations seem to follow major river basins southward to the confluence with the Mississippi River, feeding and resting along the way. Below the Gulf of Mexico, their route is unknown (Thompson et al., 1997). In Oklahoma, migration usually begins in mid- to late August with adults and young staging at prime fishing sites along the major rivers. At this time, the juveniles' fishing skills are still inadequate and adults help with supplementing their diet. The southward fall migration of adults with young may be protracted due to differences in reproductive timing imposed by environmental conditions; migration northward into the U.S. is quite rapid (Thompson et al., 1997). The historic range of the Interior least tern is shown in Figure 11.

3. Habitat. The Interior least tern migrates through and nests within the proposed action area. It passes through the area in the spring and fall, and nests on sparsely vegetated islands or sandbars along the larger rivers and salt flats. They are piscivorous, feeding on small fish in the shallows of lakes, rivers, and ponds. Moseley (1976) believes them to be opportunistic feeders feeding on any fish within a certain size range.

4. Cause of Decline. Historical records of the interior populations of least terns date back to the journals of Lewis and Clark which described the birds in 1804 as "common and constant" in present-day Nebraska on the Platte River. Other early descriptions indicate that it

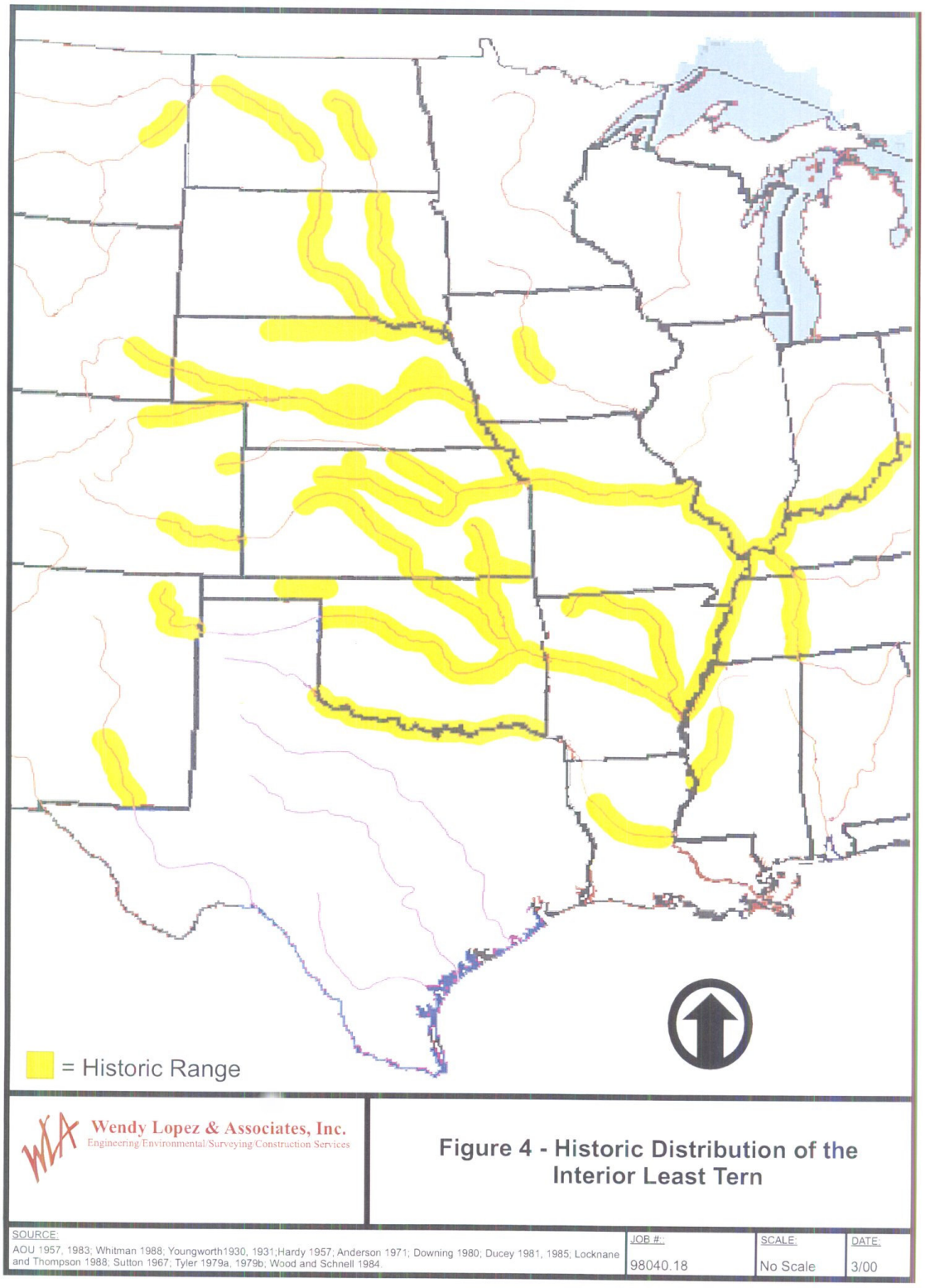


Figure 11. Historic Distribution of the Interior Least Tern.

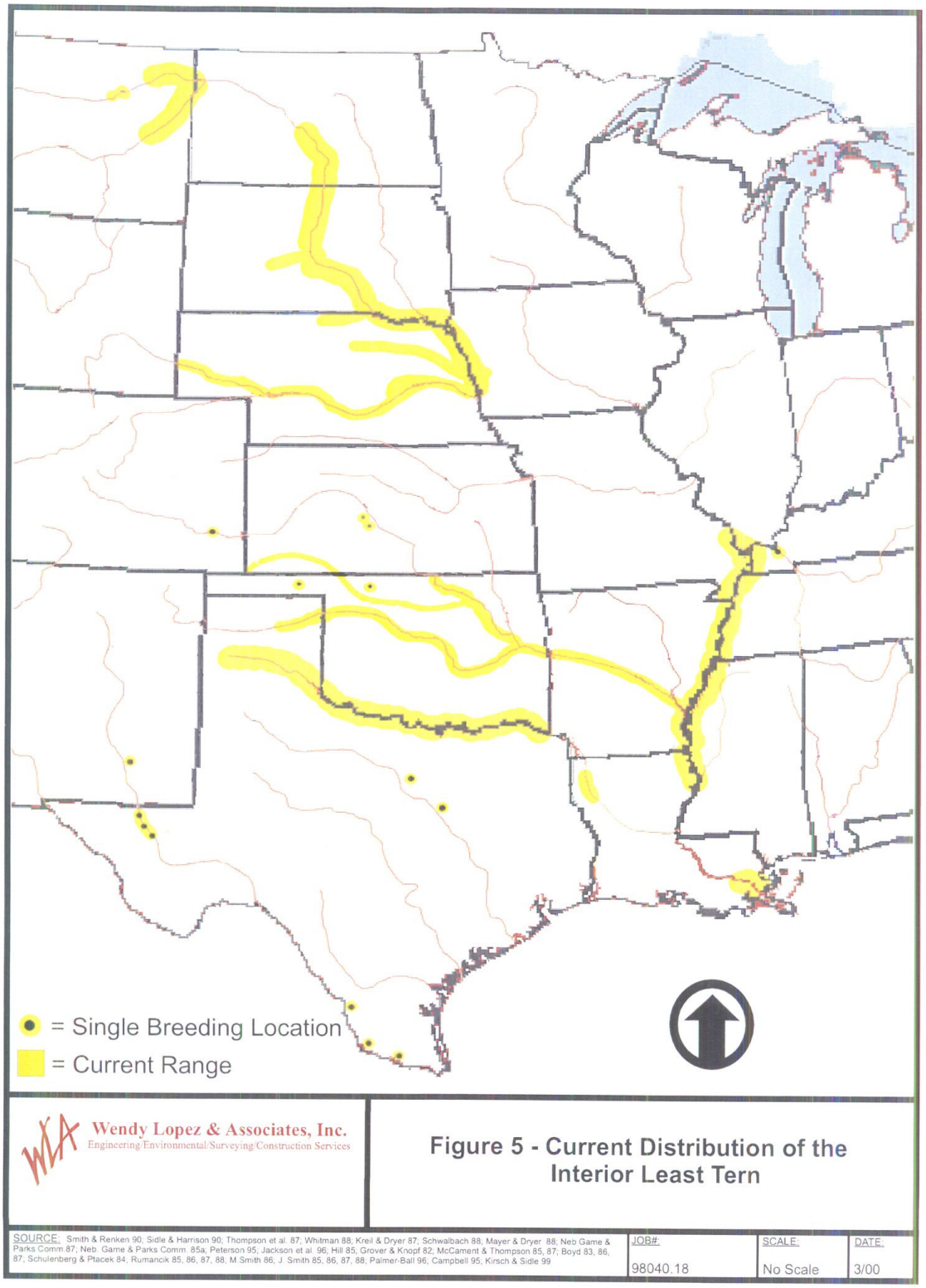


Figure 12. Current Distribution of the Interior Least Tern.

was much more common range-wide than today breeding over a larger area with a greater density of colonies.

Populations were formerly severely depleted by extensive plume hunting. The hat trade in the late nineteenth century led to serious declines of this bird with as many as 100,000 killed per year. After passage of the Migratory Bird Treaty Act in 1918, populations increased through the 1940's when dams, increased water recreation, and irrigation and housing developments began another rapid population decline (USFWS, 1990).

More recently, the major cause of decline has been attributed to the loss of nesting habitat due to reservoir construction and channelization projects, water discharge regimes associated with operation of main stem impoundments, uncontrolled vegetative growth on nesting islands, and recreational use of sandbars by humans.

5. Status of Species. The Interior least tern, *Sterna antillarum,* was Federally listed as endangered on June 27, 1985, 50 CFR (Federal Register 21, 784-21, 792). Within the area covered by this listing, this species was know to occur in Arkansas, Colorado, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana, Missouri, Mississippi, Montana, North Dakota, Nebraska, New Mexico, Oklahoma, South Dakota, Tennessee, and Texas. No critical habitat was designated for this species.

Census data indicate that in 1990 there were a total of only 5,000 birds. It breeds over a broad area of the United States along coastal beaches and on sandbar islands within the major rivers of the Mississippi River system. Once widespread and common, the terns survived the commercial hat-making trade and rebounded with the passage of bird protection laws. More recently, their populations declined as a result of channelization projects and construction of reservoir projects (USFWS, 1985). Additional impacts may result from competition with humans for recreation areas.

The recovery plan for the Interior least tern population indicates 7,000 terns as the total interior population size that must be maintained for 10 years before this species can be down listed. This number is broken down into sub-populations required in each area of the terns' interior range. The plan outlines strategies to manage and protect essential habitat and achieve this recovery goal of 7,000 birds.

Population increases were noted in 1990, 1994, and in 1995. A compilation of survey data in 1999 estimated that the total interior population had increased and exceeded 7,000 birds. However, 12 of the regional areas designated in the recovery plan had not reached corresponding objectives (Kirsch and Sidle, 1999). The increase between listing in 1985 and the 1995 census was primarily due to a tripling of numbers along a 560-mile stretch of the Lower Mississippi River (Rumancik, 1985, 1986, 1987, 1988, 1989); numbers for most breeding areas had not reached recovery levels. Kirsch and Sidle (1999) believe that the best explanation for the local increases in the interior populations is immigration surges from the coastal portion of the population, which is large and stable or increasing (Thompson, 1902; Jackson and Jackson, 1985; Thompson et al., 1997), especially since reproduction in many interior areas was not sufficient even for population maintenance. Productivity data Kirsch and Sidle analyzed from

across the range did not show highs in the years preceding the population increases noted in 1990 or 1994.

Within regional areas, there have been dramatic fluctuations in distribution and numbers (Thompson et al., 1997a; Kirsch and Sidle, 1999) perhaps reflecting changes in habitat and/or differences in immigration/emigration patterns, as well as differences in survey techniques.

a. Oklahoma. In Oklahoma, there are over 142 miles of river and over 7,000 ha of salt flats, which may contain habitat (Hill, 1993). Based upon data collected since 1993, this figure is probably low. Monitoring of Interior least tern colonies for fledging success in Oklahoma has been done sporadically on the Arkansas, Canadian, and Red rivers; at Optima Lake; at the Salt Plains NWR; and at the Little and Big Salt Plains. The USACE, Tulsa District has intensively monitored for least terns on the Arkansas River since 1990, and on the Canadian and Red rivers since 2000.

1. Arkansas River. The USACE, Tulsa District has been consulting with the USFWS with respect to the Interior least tern on the Arkansas River since 1987. The Arkansas River population has been intensively surveyed since 1990, as shown in Figure 13. Over this period of time, the adult population has varied from approximately190 to 470 birds. The Fledgling to Breeding Pair ratio (F/BR) has ranged from a high of approximately 1.9 in 1991 to a low of 0.43 in 1998. The high numbers of nesting terns and production in 1991 are believed to be in response to large flood events in 1990, which scoured islands and created additional nesting islands. The low F/BR in 1998 was not due to flood control operations, but rather lack of continuous low flow, which created extensive periods of land bridging on nesting islands. For this period of record, the USFWS requirement for a FB/R 0.05 was met except for 1998.

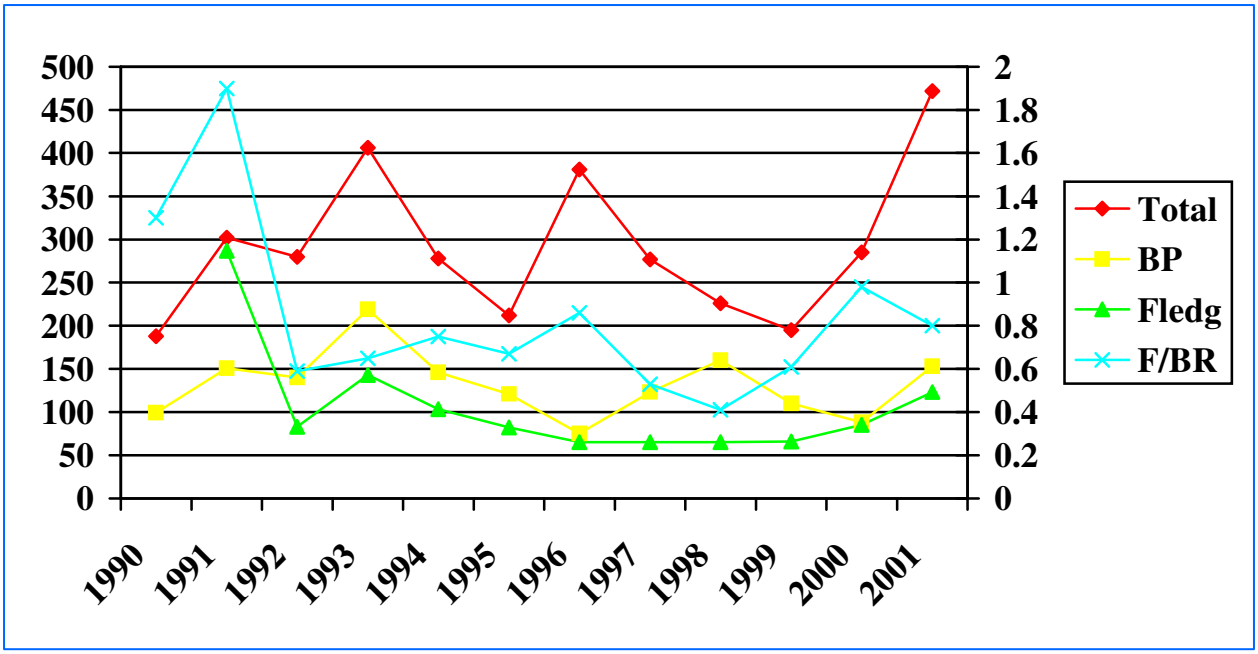


Figure 13. Arkansas River Interior Least Tern Survey Results.

The majority of least tern production occurs on the Arkansas River from Tulsa to Muskogee. However, least tern production has been increasing on the stretch from Kaw Lake to the upper end of Keystone Lake. In 2002, there were nesting colonies located approximately 2 miles below Kaw Dam and three or four colonies located further downstream near the town of Ralston, Oklahoma. Approximately 100 adult birds and 34 flying young were observed in these locations.

Very few terns nest between Keystone Dam and the I-244 Bridge in Tulsa, Oklahoma. Most of the reproduction comes from two locations in Tulsa and downstream to the Highway 69 bridge north of Muskogee, Oklahoma. In the late 1980's and early 1990's, Zink Island (manmade), located just below the I-244 Bridge, was the largest nesting site and producer for least terns on the Arkansas River. However, production at this site has steadily declined since 1998. The reason for this decline is not documented, but is thought to be the result of less desirable nesting conditions. Since the occurrence of major flood events in the late 1980's and early 1990's, the island has gradually become vegetated and lost much of its sand. A large number of Canada geese have also begun nesting on the island. USACE and USFWS personnel have worked to remove or poison the vegetation, but have had limited success. The USACE has also tried flooding the island, but the quantity and duration of flooding has not achieved the desired results. In 2002, Zink Island had only 29 nesting pairs of birds and produced only 6 fledglings.

2. <u>Canadian River</u>. The USACE, Tulsa District surveyed the Canadian River below Eufaula Lake to its confluence with the MCKARNS from 1999-2003. The results of USACE surveys (1990-2002) for the Interior least tern on the Canadian River are shown in Figure 14. On one of the trips in 1999, observers identified 106 adults but no nests or chicks were found. During the 2000 survey, observers found 80 adults, 36 nests as 71 adults, and 31 nests. During the 2001 survey, as many as 65 adults, 7 flying young, 7 chicks, and 5 nests were reported. Successful nesting in this stretch of the Canadian River has not been good due to flooding, predation, and localized thunderstorms.

In 2002, the USACE, Tulsa District and the USFWS jointly surveyed the upper Canadian River from Norman, Oklahoma, to the upper limits of Eufaula Lake. On this survey, they reported 232 adults, 7 flying young, 4 chicks, and 17 nests.

The USFWS Recovery Plan Goal for the Canadian River is 300 adults. From the limited survey information, this goal is close to being met on the upper reaches of the Canadian River. The lower reach below Eufaula Lake has been very productive to contributing to this goal.

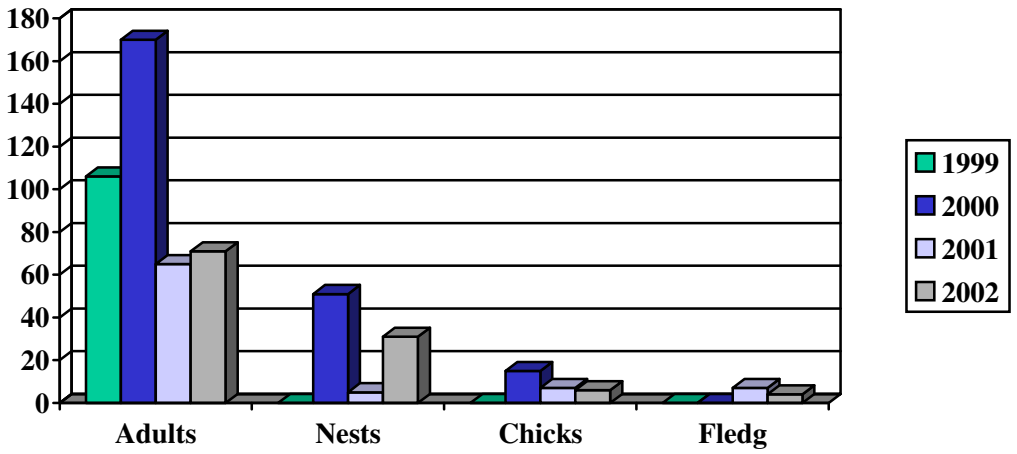


Figure 14. USACE Canadian River Least Tern Surveys.

3. **Red River**. Terns were once common in the Red River Basin; between 1910 and 1960, they were reported from most of the counties along the Texas-Oklahoma border. They were also known to occur on the Prairie Dog Town Fork of the Red River in the Texas panhandle as well as in salt flat areas. Downing (1980) surveyed 300 miles of the Red River in 1975, but found only one colony near Spanish Fort, Montague County, Texas.

Between 1984-1986, Locknane and Thompson (1988) surveyed a 448-mile stretch of the Red River upstream of the Denison Dam, mostly in the Texas Panhandle, and found only a few scattered colonies containing 35 birds. These were along the Prairie Dog Town Fork of the Red River and the Red River east to Burkburnett, Texas.

The USACE, Tulsa District and the USFWS conducted an aerial survey in July 1991 on segments of the Red River above and below Denison Dam. They counted two colonies with ten or more terns and two with four to nine terns and reported eight "potential or probable colonies" in the BLM portion of the river upstream of Lake Texoma. Below the dam, they reported six to seven colonies of ten or more birds and 12-14 sites with four to nine birds. Adults seen totaled 139-152 upstream and 323-339 downstream. The main concentration of downstream individuals and colonies was between U.S. Highway 78 and U.S. Highway 71 below Denison Dam.

The USFWS and BLM personnel surveyed the Red River upstream of Lake Texoma from the North Fork of the Red River to 79 miles downstream in July 1994. They reported over 200 adults with little evidence of nesting or chicks. The lack of nests and chicks along with the low number of immature birds seen (three) led USFWS personnel to conclude that flood flows apparently severely reduced nesting success during the 1994 season.

The USACE, Tulsa District has been conducting intensive tern nesting surveys on the lower 240-mile stretch of the Red River below Lake Texoma since 1999. A summary of these surveys is shown in Figure 15. Bird numbers for the lower Red River are consistently higher than those earlier reported by the USFWS, with the numbers of adult birds being over 600 for the years surveyed. However, reproduction in this reach has not been as great as anticipated despite efforts to manage flows in this reach for the benefit of nesting terns. An FBR of 0.5 has only been achieved in 2001, yet tern numbers appear fairly stable to increasing. The large influx of individuals in 2001 cannot be explained, but could reflect an influx of terns moving to the Red River from some other geographic region. Based on the numbers of adult birds returning since 1991, it would appear this population is growing. Presently, the numbers for the Red River system are exceeding the Recovery Plan Goal for this species.

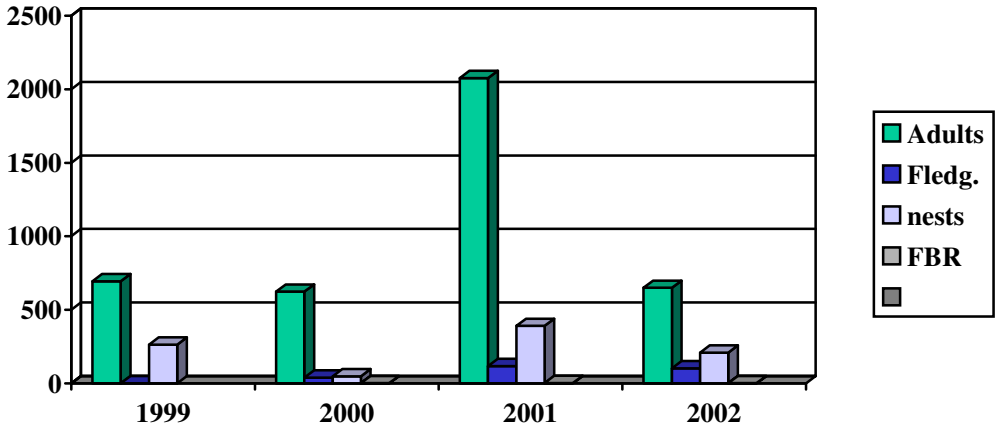


Figure 15. USACE Lower Red River Interior Least Tern Surveys.

b. **<u>Arkansas</u>.** The USACE, Little Rock District has monitored for least terns on that portion of the MCKARNS along the Arkansas River within the State of Arkansas in 1991, 1993, 1994, 2001, and 2003. Additional surveys were conducted by Urbanic (2003) who monitored this population and provided population estimates and estimates of nesting success for 2001 and 2002. Urbanic reported the breeding population to be 180 adults in 2001 and 264 adults in 2002. The USACE surveys for the MCKARNS are shown in Figure 16. The USFWS Recovery Plan Goal for the Arkansas River within the State of Arkansas is 150 adults. This goal has been met or exceeded for most years.

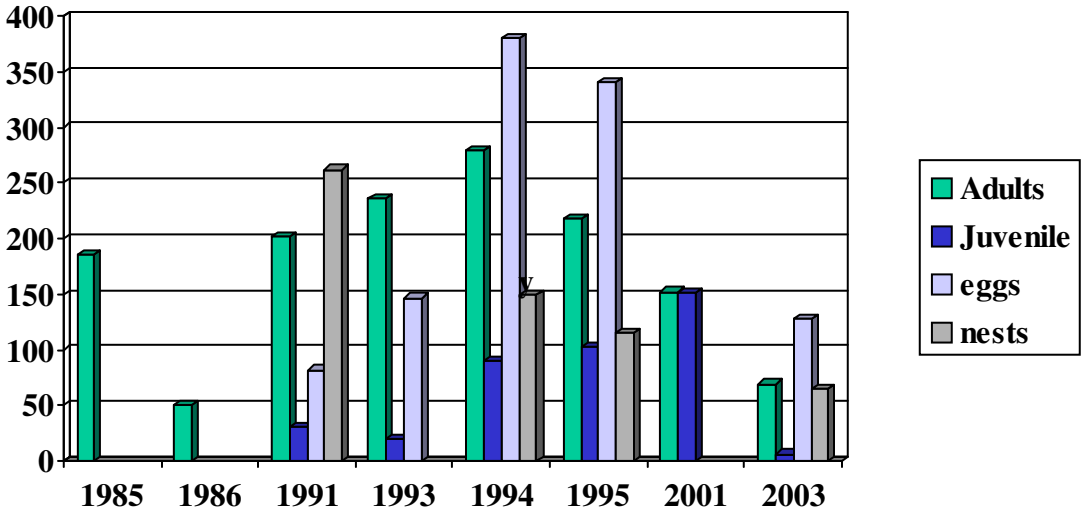


Figure 16. USACE Lower Arkansas River Interior Least Tern Surveys.

c. **Texas**. In 2003, the USACE, Tulsa District also surveyed 368 miles of the Red River above Lake Texoma from the Texas State Highway 207 bridge south of Claude, Texas, downstream along the Red River to the Interstate Highway 35 bridge at the upper limits of Lake Texoma. A total of 597 adult least terns were counted. Five hundred twenty one adult terns were associated with 48 colonies, and 76 terns were documented but could not be associated with a specific colony. A total of 220 nests were associated with the 48 colonies. Six fledglings were counted and no chicks found. Heavy thunderstorm caused flooding along most of the survey area shortly before this survey was conducted. This most likely contributed to the lack of young birds on this survey. A copy of this survey is included in Appendix 5. The USFWS Recovery Plan Goal for the Red River system is 300 birds. Presently, tern numbers for the Red River system are exceeding the Recovery Plan Goal for this species.

d. **Other Areas In Region**. The Lower Mississippi River (Gape Girardeau, Missouri, to Vicksburg, Mississippi) today hosts the largest population of nesting Interior least terns. This population has exceeded 5,000 individuals for 7 out of the last 7 years. It has exceeded the recovery goal established for the Lower Mississippi River of 2,200-2,500 birds, every year since 1990 (Rumancik, 1985, 2000). Some believe that the best explanation for the local increases in the Interior least tern population is immigration surges from coastal portions of the population, which is large and stable or increasing. However, this seems unlikely since numbers are stable or increasing each year.

N. ***Geocarpon minimum.***

1. **Description of Species.** Geocarpon is a small, succulent annual that ranges from 1-4 cm in height. The flowers have no petals and are inconspicuous in the axils of the leaves, which are oppositely arranged on the stems. Young plants are a dull gray color and turn reddish-purple at maturity. The plant has a short life cycle of approximately 3 weeks beginning in early spring.

2. **Distribution of Species**. Geocarpon is only known from 4 sites in Arkansas, 13 sites in southwestern Missouri, and recently from 2 new sites in Louisiana. In Arkansas, it is extant in four counties including Bradley, Cleveland, Drew, and Franklin. Only Franklin County

is within any of the proposed action areas. In Arkansas, a large population exists at Warren Prairie Natural Area in Bradley and Drew counties, two small populations exist at Kingsley Prairie in Cleveland County, and one small population exists on private lands in Franklin County. Surveys for this species were conducted at Fort Chaffee in Franklin and Sebastian counties, Arkansas, but this species was not found (Personal Communication, Jerry Sturdy, 2003).

3. **Habitat.** In Arkansas, this species is found on sites characterized as "saline soil prairies" where it grows on bare mineral soils high in sodium and magnesium. These bare areas, sometimes called "slicks" or "slick spots" are high in salinity and low in species diversity. They are sometimes colonized by prominent blue-green alga colonies.

4. **Cause of Decline.** This species is threatened by its limited distribution and by habitat destruction or modifications of saline soil prairies to pastureland, off-road vehicle use, forestry practices, and natural succession.

5. **Status of Species.** The USFWS determined this species to be threatened over the entire range in accordance with the Endangered Species Act of 1973, as amended on June 16, 1987 (Federal Register, Volume 52, No.115). No critical habitat was listed for this species. Geocarpon is unlikely to be found along the MCKARNS due to its limited distribution and specific habitat preferences (i.e., sandy clay prairies with bare mineral soils). It is unlikely that this species occurs on lands associated with any of the designated action areas.

O. Harperella.

1. **Description of Species.** Harperella (*Ptilimnium nodosom*) is an annual herb with slender, erect stems, and grows to height of 6 to 36 inches. It has hollow, quill like leaves and bears small white flowers. The flowers occur in heads or umbels and have five regular parts and are bisexual and unisexual.

2. **Distribution of Species.** It is currently known from 13 existing populations in 7 states including Alabama, Arkansas, Georgia, Maryland, North Carolina, South Carolina, and West Virginia. In Arkansas, the USFWS reports that Harperella occurs in Scott and Yell counties, while the Arkansas Natural Heritage Commission lists the species as occurring in Perry and Yell counties, which are both within the proposed action area. However, there are no records of this species on Federal lands. In Yell County, this species is listed as occurring on Irons Fork and is private ownership. This population contains several hundred plants distributed over 5-7 miles of river.

3. **Habitat.** This species occurs in two types of habitats: rocky or gravel shoals and margins of clear, swift-flowing streams, and along the edges of intermittent pineland ponds in the coastal plain. It is always found on saturated substrates and readily tolerates periodic, moderate flooding. Available evidence indicates this species tolerates and may require a very specific and unusual water regime that includes moderately intensive spring flooding, which is thought to eliminate competing vegetation. Due to its very specific habitat requirements it is easily eliminated from its habitat by minor alterations or disturbances.

4. **Cause of Decline.** At the time of listing, it was estimated that over 50% of known populations of *Ptilimnium nodosum* had been lost. The primary causes for decline of this species are attributed to loss of habitat due to human activities such as increased siltation, eutrophication, and impoundments. Other factors that may have an impact on this species include disease, predation from livestock grazing, and lack of protection.

5. **Status of Species.** Harperella was listed as endangered in the entire range by the USFWS in accordance with Threatened and Endangered Species Act of 1973, as amended on September 28, 1988 (Federal Register Volume 53, No. 188). No critical habitat was listed for this species. Due to its limited distribution and specific habitat requirements it is unlikely this species occurs on lands associated with any of the designated action areas.

P. Western Prairie Fringed Orchid.

1. **Description of Species.** The Western Prairie Fringed Orchid (*Platanthera praeclara)* is a perennial herb of the orchid family that can grow up to 1.2 m tall. It has large white flowers in an inflorescence that may reach as high as 47 inches with up to 40 flowers. The plant has numerous coarse, fleshy roots arising from a fleshy tuber. It regenerates from tuber rootstock that lie dormant in the winter. Dormant season burning and high moisture levels appear to promote flowering.

2. **Distribution of Species.** The historical range of this species is Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Manitoba. Extant populations now occur in 41 counties in 6 states including Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and Manitoba, Canada. This species is not reported from Arkansas, but has only been reported to occur in Craig and Rogers counties, Oklahoma.

It was originally widespread in eastern Nebraska, but is known presently from only four counties. One large scattered population occurs in North Dakota. In Kansas, it was historically found in 14 counties, but is now found in only 8. It has been extirpated from South Dakota. In Oklahoma, two populations, both located on privately owned hay meadows, were reported as late as 1975, but have not been observed since. The recovery plan for this species reports it is absent from Oklahoma and South Dakota. The only portion of proposed action areas that may have contained this species are project lands surrounding Oologah Lake and lands along the Verdigris River portion of the MCKARNS.

3. **Habitat.** This species is found in the tall grass prairie areas west of the Mississippi River. It is most commonly associated with unplowed prairies and wet meadows. It has also been documented to occur in disturbed areas such as borrow pits and road ditches.

4. **Cause of Decline.** The species is thought to have declined due to the massive conversion of tall grass prairie to cropland, overgrazing, and haying practices. It is also believed that depletion or contamination of the water table may also be a factor in the decline of this species.

5. **Status of Species.** The USFWS determined *Planthera praeclara* to be a threatened species in accordance with the Endangered Species Act of 1973, as amended on September 28, 1989 (Federal Register Volume 54, No. 187). No critical habitat was designated for this species. This species is not extant in Arkansas and has not been seen in Oklahoma since 1975. It is doubtful this species is present in the proposed action areas.

SECTION V. OPERATIONAL ACTIVITIES POTENTIALLY AFFECTING FEDERALLY LISTED SPECIES WITHIN THE ACTION AREA

A. Action Area I, Arkansas River (Kaw Lake to Muskogee, Oklahoma)

1. <u>Existing Operations/Impacts</u>. Action Area I is not within the documented range of the American alligator, scaleshell mussel, pink mucket pearly mussel, pallid sturgeon, *Geocarpon*, Western prairie fringed orchid, or Harperella. Continued operation of the Keystone and Kaw Lake projects would have no affect on these species.

In September 2003, USACE personnel at the projects within the proposed action area were surveyed concerning the presence or absence of bats noted during periodic inspections of dams and associated structures. A positive response noting the presence of bats was received from Keystone, Eufaula, and Tenkiller lakes, but no bats have been found at Kaw Dam or any of the other dams or locks and dams associated with the proposed action areas for the Arkansas River. No Gray, Indiana, or Ozark big-eared bats have been noted within Action Area I. Continued operation of the Keystone and Kaw Lake projects would have no affect on these species. Bats were found to be present at Keystone Lake in expansion joints under the roadway across the top of the dam in August 2003, but were determined to be big brown bats (*Eptesicus fuscus*). Additional studies are being conducted on this bat colony by Oklahoma State University.

Keystone Lake lies within parts of Osage, Creek, Tulsa, and Pawnee counties, Oklahoma, and Kaw Lake lies within Kay and Osage counties. The American burying beetle has been reported only from Tulsa County. USACE personnel conducted one survey for the American burying beetle at Keystone Lake in Pawnee County, but did not find this species. However, this species is highly mobile and could potentially be found at any given time in appropriate habitats at either project. The biggest threats to this species are probably the use of pesticides and the loss of habitat. The use of pesticides at USACE lakes has been severely curtailed and as long as activities involving loss of habitat are not allowed, existing operations of the reservoirs should not impact this species. However, any major ground disturbing activities proposed by the USACE at operating projects in counties where the beetle has been collected may affect this species, if it occurs in the area.

The whooping crane would be considered a rare migrant through this area, and is more commonly seen at the Great Salt Plains NWR. There should be no affect on this species with continued operation of Kaw and Keystone lakes.

Numerous bald eagles utilize Kaw and Keystone lakes and the Arkansas River below both lakes. Eagles are commonly seen below both dams fishing during the winter when hydropower releases keep the river free of ice. There is also a communal roost on the Arkansas River arm of Lake Keystone that has been used for over 20 years by eagles during the winter months. It is protected by the USACE and placed off limits to any recreational activities from November to March of each year.

The midwinter bald eagle counts for Kaw Lake have varied from 11 in 1987 to as high as 190 in 1986. The midwinter count for the Arkansas River that includes Keystone Lake has varied from 32 in 1993 to a high of 138 in 1994. Nesting has also been verified on the Arkansas River below Kaw Lake and the reach of the Arkansas River from Keystone Lake to Muskogee, Oklahoma. From the numbers of eagles using these areas and evidence of nesting on the Arkansas River, it would seem that current operations of these projects have a positive affect on this species. No critical habitat has been designated for this species; therefore, none will be affected.

The piping plover would be considered a migrant through the proposed action area and is known to utilize mudflats near the Winganon Bridge at Oologah Lake during migration periods. This species could use the Arkansas River above and below Keystone Lake and mudflats within Kaw and Keystone lakes, although it has not been documented there. Since it is present within the action area for such a short period of time during migration, continued operation of the Keystone and Kaw Lake projects should have no affect on this species.

The Arkansas River shiner was formerly found throughout Action Area I. However, following loss of habitat from construction and operation of Kaw and Keystone lakes and the MCKARNS on the Arkansas River, the shiner has been extirpated from this portion of its range. Continued operation of Kaw and Keystone lakes would have no affect on this species, since it no longer occurs in the Arkansas River.

Historical flows on the Arkansas River were significantly modified with the construction of Kaw and Keystone lakes. No longer does the river exhibit the large annual flood events lasting for several days followed by longer periods of median flows. Releases during storm events are now made at lesser non-damaging rates over a protracted period of time. Modified releases during the least tern-nesting season have not been beneficial to least tern reproduction. Also, operation of these lakes for hydropower has created wide fluctuation in daily flows and created many periods of little or no flow.

Long term affects on the nesting habitat for this species have also occurred as a result of constructing Kaw and Keystone lakes, but have not been quantified. Much of the sediment load transported by these rivers has become trapped behind the dams. This reduction in stream sediment transport combined with a reduction in large flow events and duration has impacted the quantity and quality of suitable nesting islands for this species. While it has been difficult to measure and quantify this loss, it nonetheless has occurred and will continue to occur with operation of the reservoirs.

Under existing operations, Kaw and Keystone lakes would continue to be operated for their authorized project purposes. Potential affects on least terns would be similar to those documented to have occurred in the past, which include flooding of nests as a result of flood control operations, land-bridging of nesting islands as a result of hydropower operations, and long term habitat loss. Survey data and information from previous years of operation confirm that these operations have resulted in “take” of least terns. However, with one exception (1998) on the Arkansas River, the levels of take associated with the Arkansas have been within the limits established for take under the existing 1998 BO.

With implementation of the measures and procedures outlined in the 2002 Management Guidelines and Strategies for Interior least terns, some "take" will continue to occur, but the continued existence of the species should not be jeopardized. Continued operation of these reservoirs with the existing management guidelines and implementation of the long-range strategies identified in the plan should be consistent with recovery of the species. No critical habitat has been designated for this species; therefore, none would be affected.

B. Action Area II, Arkansas River Navigation Study (Verdigris and Arkansas Rivers, Oklahoma)

1. <u>Phase I, Total System Operations</u>. The Phase I study developed and evaluated alternatives for implementing solutions to problems resulting from sustained high flows that are adverse to navigation. The results of the study identified a plan (Alternative 4, Operation Only Plan) that is very similar to existing operations, but would provide some benefits to navigation.

As shown in Table 6, this alternative provides approximately 14 fewer days per year at or above 61,000 cfs. At Van Buren, Arkansas, flows of 20,000 cfs would be increased by 0.6 days per year. Flows of 40,000 cfs would increase approximately 2.5 days per year. Flows of 75,000 cfs would decrease 1.8 days per year. Flows of 90,000 cfs would increase 2.1 days per year, and flows of 100,000 would increase 1.7 days per year. The recommended plan would provide a total reduction of 5 days of flow above 61,000 cfs, and would result in an average annual increase of 2 days per year in flow above 100,000 cfs. There would be no expected change in flow above 175,000 cfs along the MCKARNS compared with existing operations.

The annual changes in the number of days reservoirs are expected to be above and below the conservation pool compared to existing conditions are shown in Tables 6 and 8. The number of days affected reservoirs are expected to be above the existing conservation pool is very similar to existing conditions. Generally, reservoir levels would be between 0 and 8 feet above the conservation pool slightly more frequently than under existing conditions, and reservoir levels would be greater than 8 feet above the conservation pool slightly less frequently than under existing conditions. The magnitude of the projected changes in reservoir pool levels is even less than changes presently occurring at some lakes as a result of special operations implemented for nesting interior least terns. For most lakes, there is zero or minimal change (1-2 days) in the number of days above or below the conservation pool. The worse case scenario would be at Oologah and Keystone lakes, which would have 3 more days of pool elevation above 4 feet, and Tenkiller Lake, which would have 4 additional days of pool elevation above 2 feet. All potential environmental consequences of the proposed action would occur primarily as a result of changes in the frequency and duration of reservoir elevation and river stage water levels. None of the alternatives would result in higher reservoir water elevations or river stages than have been previously recorded in the 61 years of rainfall data

Table 11 shows the land cover classifications affected by a change in target flow under each alternative. This table was produced from land cover data provided by the USGS and map coverage of 150,000 cfs (baseline), 175,000 cfs, and 200,000 cfs flows at Van Buren provided by the USACE, Little Rock and Tulsa districts.

TABLE 11. LAND USE/LAND COVER POTENTIALLY IMPACTED BY THE MAXIMUM TARGET FLOW AT VAN BUREN, ARKANSAS, UNDER EACH ALTERNATIVE (ACRES AFFECTED)

Land Use Category	No Action Alternative (Alternative 1)	Operations Only Alternative (Alternative 4)
Barren land	610.2	610.2
Wetlands	1030.5	1030.5
Water	12103.8	12103.8
Forest	4541.0	4541.0
Rangeland	52.7	52.7
Agriculture	9160.2	9160.2
Urban	360.2	360.2

Source: USGS 1994 and USACE 2002.

With the recommended plan, there would be no change in land use/land cover as a result of modifying existing operations. No direct or indirect impacts to terrestrial or aquatic resources are expected with implementation of the recommended plan. River and associated reservoir levels would fluctuate similarly to current flow and reservoir draw down rates.

Implementation of the recommended plan would reduce the number of days per year with flows above 61,000 cfs by 14. A decrease in flow days above 61,000 cfs would reduce the duration of floodplain inundation, which potentially improves farming operations along the MCKARNS. While there would be no increases in agricultural/structural or recreational damages within the system, less frequent flooding of farm fields may stimulate agricultural production. Although impacts would vary over time and by location, these changes may encourage the cropping of additional land, thus potentially displacing native vegetation within the floodplain.

On the other hand, if increases in reservoir storage were short-term, shoreline vegetation would provide additional habitat for larval fish. According to hydrologic modeling data, increases in pool elevation at all lakes are spread throughout the year, with no more than 2 additional days over 8 feet above conservation pool occurring in any 2-month period. Other minor impacts of this water level fluctuation may include altering the littoral or shoreline zone of the reservoirs that provide important aquatic habitat. The USACE's modifications of flow rates would continue to remain compatible with the authorized operational plan of each reservoir.

Action Area II is on the periphery of the range of American alligator, but it would be considered a possible visitor to the lower portion of the MCKARNS. This species was originally classified as endangered throughout its range in 1967 due to concerns over harvesting. Since its

protection, it has recovered to the point where it is neither in danger of extinction nor likely to become so in the foreseeable future. Implementation of the "Operations Only Plan" would have no affect on this species.

In September 2003, USACE personnel at the projects within the proposed action areas were surveyed concerning the presence or absence of bats noted during periodic inspections of dams and associated structures. A single specimen of pipistrelle sp. was found at the Lake Dardanelle Powerhouse. A positive response noting the presence of bats was received from Keystone, Eufaula, and Tenkiller lakes, but no bats have been found at Kaw Dam or any of the other dams or locks and dams associated with the proposed action areas for the Arkansas River.

Bats were found to be present at Keystone Lake in expansion joints under the roadway across the top of the dam in August 2003, but were determined to be big brown bats (*Eptesicus fuscus*). Additional studies are being conducted on this bat colony. Previous investigations by USACE personnel in 1998 found large colonies of little brown bats *(Myotis lucifugus*) under the spillway bridges at both Eufaula and Tenkiller lakes. No Gray, Indiana, or Ozark big-eared bats have been documented to occur on Federal properties associated with Action Area II. Implementation of the proposed "Operations Only Plan" should have no affect on these species.

As discussed in Section IV, the American burying beetle has been recorded to occur within counties adjacent to the MCKARNS in Oklahoma and western Arkansas. USACE personnel conducted limited surveys for the American burying beetle at Keystone Lake, Wister, Robert S. Kerr, and at other locations in Tulsa County but did not find this species. Large populations of this species are found immediately to the MCKARNS at Camp Gruber located in Muskogee and Cherokee counties in Oklahoma and at Fort Chaffee in Sebastian and Franklin counties in Arkansas. In 1992, the American burying beetle was collected on Federal lands at the Sequoyah National Wildlife Refuge, along the MCKARNS.

It has usually been collected from upland sites in association open grasslands or forests. Most of the habitat along the MCKARNS was former floodplain of the Arkansas and Verdigris rivers and is probably not optimal habitat for this species. However, this species is highly mobile and could potentially be found at any given time in appropriate habitats along the MCKARNS, although it has not been documented to occur on these lands.

The biggest threats to this species are probably the use of pesticides and loss of habitat. The use of pesticides at USACE lakes has been severely curtailed and as long as activities involving loss of habitat are not allowed, existing operations of the reservoirs should not impact this species. However, any major ground disturbing activities proposed by the USACE at operational projects in counties where the beetle has been collected may have an affect on this species, if it occurs in the area.

The whooping crane would be considered a rare migrant through Action Area II and is more commonly seen at the Great Salt Plains NWR. The minor changes associated with implementation of the "Operations Only Plan" should have no affect on this species

As shown in Section IV, the bald eagle is found throughout the limits of Action Area II and utilizes the MCKARNS and 11 supporting reservoirs as well. Its numbers have increased under existing operation of the MCKARNS and the 11 supporting reservoirs. The minor changes associated with implementation of the "Operations Only Plan" would have negligible, if any, impacts on this species. Consequently, implementation of Alternative IV should have no affect on this species.

In Oklahoma, the scaleshell mussel is associated primarily with the Red River Basin in southeastern Oklahoma. It has been reported to occur in the Kiamichi, Mountain Fork, and Lower Little Rivers, and from the Poteau River, a tributary to the Arkansas River (USFWS, 2003b). The final rule listing this species (USFWS, 2001) reported it as occurring in the Poteau River based upon a single specimen, but states that existence of the scaleshell in the Poteau River is doubtful.

Within the State of Arkansas, the scaleshell mussel is reported to occur in seven counties including Crawford, Fulton, Jackson, Lawrence, Perry, Sevier, and Francis (USFWS, 2003b). The USFWS final rule listing this species reports this species as having been collected from Frog Bayou and the South Fourche LaFave and Mulberry rivers in Arkansas. Perry and Crawford counties are within the proposed action areas. The record (s) for Perry County are associated with the Fourche LaFave River, which is a tributary to the MCKARNS at navigation mile 146.5, and Frog Bayou, which is a tributary to the MCKARNS at navigation mile 277. Potential habitat for this species in Frog Bayou is restricted to the area between the town of Rudy and the MCKARNS (USFWS, 2001). Live mussels have not been found at the confluence of the Arkansas River, likely due to dredging activities (Gordon, 1980).

The only scaleshell mussel record from the South Fourche LaFave River is based on a single live specimen taken in 1991 (USFWS, 2001). The occurrence of the scaleshell mussel in the Mulberry River is based upon a single specimen (USFWS, 2001), and the USFWS believes its existence in the Mulberry River is unlikely. While this species occurs in the general area associated with Action Area II, it does not appear to be found within the MCKARNS. Consequently, implementation of the "Operations Only Plan" would have no affect on this species.

The pink mucket pearly mussel occurs throughout the Mississippi, Tennessee, Ohio, and Cumberland River systems. This species does not occur in Oklahoma, but is reported to occur in Arkansas County from the lower White River and Lower White-Bayou Des Arc (NatureServe Explorer 2003), which are near Action Area II. It is possible this species may have historically occurred within the lower reaches of the White River. However, the present range and status of this species within Action Area II show it is only recorded from the White river well above the confluence of the White River and the MCKARNS (Harris, 1997). Implementation of the "Operations Only Plan" would have negligible impacts on flows in the lower reaches of Action Area II. Consequently, implementation of this alternative should have no affect on this species.

The piping plover would be considered a migrant throughout the proposed action area and is known to utilize mudflats near the Winganon Bridge at Oologah Lake during migration periods. With implementation of the "Operations Only Plan," the pool level of Oologah Lake

would be between 4-8 feet above conservation pool for approximately 2 more days above the existing plan during the piping plover migration period (February-April and July-September) of each year. The proposed pool level changes associated with implementation of the Operations Only Plan within Action Area II should be negligible and have no affect on this species.

The Arkansas River shiner was formerly found in the western reaches of Action Area II. However, following loss of habitat from construction and operation of Kaw and Keystone lakes and the MCKARNS on the Arkansas River, the shiner has been extirpated from its former range in the Arkansas River. Implementation of the "Operations Only Plan "would have no affect on this species, since it no longer occurs in the designated action areas.

The pallid sturgeon inhabits large turbid river systems and is endemic to the middle and lower Mississippi River and Missouri River and larger tributaries. The lower White River and possibly the lower Arkansas River would be included in the range of this species. It has been recorded from the Mississippi River and the St. Francis River in Arkansas. However, there are no documented collection records of this species from either the White or Arkansas rivers. It has, however, been collected in the Mississippi River between river miles 585-615, which is near the confluences of the Arkansas and White rivers. While this species has not been recorded from within Action Area II, its possible occurrence, at least at times, cannot be discounted. Implementation of the "Operations Only Plan" should have no affect on this species, if it occurs in the action area.

The Interior least tern occurs throughout Action Area II. In Oklahoma, it primarily uses the Arkansas River from below Kaw Lake to Muskogee and the Canadian River from below Eufaula Lake to the Canadian Rivers confluence with the MCKARNS. Use of the remainder of the Oklahoma portion of the MCKARNS by the Interior least tern is very low. Terns for nesting utilize the portion of the MCKARNS within Arkansas, and evidence suggests that at times this population may have been flooded from current operations of the MCKARNS or reservoirs associated with the MCKARNS.

The USACE's modifications of flow rates are compatible with the authorized operational plan of each reservoir along the MCKARNS. The USACE would continue to cooperate with State and Federal fish and wildlife agencies to develop plans for some lakes and to provide regular seasonal pool fluctuations. Appropriate seasonal pool variations help to improve fish spawn by maintaining or increasing water levels during spring months, improve water recreation by maintaining levels sufficient for recreation during summer months, and improve waterfowl food and hunting by fluctuating water levels to maximize waterfowl habitat and hunting opportunities during fall months.

Implementation of the Operations Only Plan would result in very minor modifications to existing operation of the MCKARNS navigation system and the 11 upstream lakes providing flow to the MCKARNS. Consequently, implementation of this plan would have no affect on the Interior least tern.

Geocarpon is only known from four sites in Arkansas and has been recorded from only one location (Franklin County) within Action Area II. This population is located on private lands. *Geocarpon* is unlikely to be found along the MCKARNS due to its limited distribution and specific habitat preferences. Implementation of the "Operations Only Plan" should have no affect on this species.

The Western prairie fringed orchid historically occurred in association with tall grass prairies west of the Mississippi River from Texas to Canada. This species is not reported from Arkansas, but has only been reported to occur in Craig and Rogers counties. In Oklahoma, two populations, both located on privately owned hay meadows, were reported as late as 1975, but have not been observed since. The recovery plan for this species reports it is absent from Oklahoma and South Dakota. The only portion of proposed action areas that may have contained this species are project lands surrounding Oologah Lake and possibly lands along the Verdigris River portion of the MCKARNS. This species would not be expected to occur on project lands in Action Area II. Consequently, implementation of the "Operations Only Plan" would have no affect on this species.

Harperella is currently known from 13 existing populations in 7 states including Alabama, Arkansas, Georgia, Maryland, North Carolina, South Carolina, and West Virginia. In Arkansas, the USFWS reports that Harperella occurs in Scott and Yell counties, while the Arkansas Natural Heritage Commission lists the species as occurring in Perry and Yell counties, which are both within the proposed action area. However, there are no records of this species on Federal lands. In Yell County, this species is listed as occurring on Irons Fork and is in private ownership. This population contains several hundred plants distributed over 5-7 miles of river. Due to its limited distribution and specific habitat requirements, it is unlikely this species occurs on lands associated with the MCKARNS in Action Area II. Implementation of the "Operations Only Plan" should have no affect on this species.

2. <u>Phase II, Proposed Channel Modifications</u>. Phase II of the MCKARNS feasibility will evaluate deepening the navigation channel to 12 feet over the entire system from the Mississippi River to the Port of Catoosa, Oklahoma, and widening the channel from 150 feet to 300 feet on the Verdigris River portion of the system (to a depth of 12 feet). Phase II is a feasibility study. Detailed information will be developed, but is not available at this time for assessment purposes. The following assumptions were used to assess the affects of the proposed study on Federally listed species:

- All deepening would be through dredging only.
- There would be no modification of existing locks and dams.
- River maintenance structures, such as dikes and revetments, would be required.
- Additional dredge disposal areas would be required.
- Advance maintenance dredging would be required in problem areas.

Action Area II is on the periphery of the range of American alligator, but it would be considered a possible visitor to the lower portion of the MCKARNS. This species was originally classified as endangered throughout its range in 1967 due to concerns over harvesting. Since its protection, it has recovered to the point where it is neither in danger of extinction nor likely to

become so in the foreseeable future. Implementation of Phase II of the feasibility study, Proposed Channel Modifications should have no affect on this species.

In September 2003, USACE personnel at the projects within the proposed action area were surveyed concerning the presence or absence of bats noted during periodic inspections of dams and associated structures. A single specimen of pipistrelle sp. was found at the Lake Dardanelle Powerhouse. A positive response noting the presence of bats was received from Keystone, Eufaula, and Tenkiller lakes, but no bats have been found at Kaw Dam or any of the other dams or locks and dams associated with the proposed action areas for the Arkansas River**.**

Bats were found to be present at Keystone Lake in expansion joints under the roadway across the top of the dam in August 2003, but were determined to be big brown bats (*Eptesicus fuscus*). Additional studies are being conducted on this bat colony. Previous investigations by USACE personnel in 1998 found large colonies of little brown bats *(Myotis lucifugus*) under the spillway bridges at both Eufaula and Tenkiller lakes. No Gray, Indiana, or Ozark big-eared bats have been documented to occur on Federal properties associated with Action Area II. Implementation of Phase II of the feasibility study, Proposed Channel Modifications, should have no affect on these species.

As discussed in Section IV, the American burying beetle has been recorded to occur within counties adjacent to the MCKARNS in Oklahoma and western Arkansas. USACE personnel conducted one survey for the American burying beetle at Keystone Lake, Wister Lake, Robert S. Kerr Lock and Dam, and at other locations in Tulsa County but did not find this species. Large populations of this species have been found immediately adjacent to the MCKARNS at Camp Gruber located in Muskogee and Cherokee counties in Oklahoma and at Fort Chaffee in Sebastian and Franklin counties in Arkansas. This species is also known to occur on the Sequoyah National Wildlife Refuge located on the MCKARNS.

These species are usually collected from upland sites in association with open grasslands or forests. Most of the habitat along the MCKARNS was in former floodplains of the Arkansas and Verdigris rivers and is probably not optimal habitat for this species. However, this species is highly mobile and could potentially be found at any given time in appropriate habitats along the MCKARNS.

The biggest threats to this species are probably the use of pesticides and loss of habitat. The use of pesticides at USACE lakes has been severely curtailed and as long as activities involving loss of habitat are not allowed, existing operations of the reservoirs should not impact this species. Any major ground disturbing activities proposed by the USACE at operational projects in counties where the beetle has been collected may affect this species. No critical habitat has been designated for this species; therefore, none will be affected. Implementation of Phase II of the feasibility study, Proposed Channel Modifications, may affect this species if upland dredge disposal sites are used to dispose of dredge materials and the species occurs there.

The whooping crane would be considered a rare migrant through the western portion of Action Area II and is found more in association with the Great Salt Plains NWR. Implementation of Phase II of the feasibility study, Proposed Channel Modifications, should have no affect on this species.

The bald eagle utilizes Federally owned lands along the MCKARNS and the 11 reservoirs associated with operation of the MCKARNS. Activities associated with deepening the MCKARNS up to the Verdigris River (navigation mile 445.2) should have no affect on the habitat for this species. However, placement of dredge disposal material into disposal areas has the potential to adversely impact habitat utilized by eagles for roosting, nesting, or perching. This impact cannot be quantified until the locations of the proposed disposal areas have been delineated.

Deepening and widening the Verdigris River portion of the MCKARNS could have the potential to adversely impact the riparian corridor along the Verdigris River and adversely impact eagle habitat. In addition, any deepening activities by dredging have the potential to introduce contaminants tied up in the sediments into the aquatic environment. This could make contaminants available for assimilation into the food chain and the fish community, which is a major food source for eagles using the MCKARNS. Evidence suggests that some areas of the MCKARNS contain elevated levels of contaminants. Additional sampling of sediments within the proposed dredge areas would be required to better define the potential for risks to this species. Implementation of Phase II of the feasibility study, Proposed Channel Modifications, may have an affect on this species.

In Oklahoma, the scaleshell mussel is associated primarily with the Red River Basin in southeastern Oklahoma. It has been reported to occur in the Kiamichi, Mountain Fork, and Lower Little Rivers, and from the Poteau River, a tributary to the Arkansas River (USFWS, 2003b). The final rule listing this species (USFWS, 2001) reported it as occurring in the Poteau River based upon a single specimen, but states that existence of the scaleshell in the Poteau River is doubtful.

Within the State of Arkansas, this species is reported to occur in seven counties including Crawford, Fulton, Jackson, Lawrence, Perry, Sevier, and Francis (USFWS, 2003b). The USFWS final rule listing this species reports this species as having been collected from Frog Bayou and the South Fourche LaFave and Mulberry rivers in Arkansas. Perry and Crawford counties are within the proposed action areas. The record(s) for Perry County are associated with the Fourche LaFave River, which is a tributary to the MCKARNS at navigation mile 146.5, and Frog Bayou, which is a tributary to the MCKARNS at navigation mile 277. Potential habitat for this species in Frog Bayou is restricted to the area between the town of Rudy and the MCKARNS (USFWS, 2001). Live mussels have not been found at the confluence of the Arkansas River, likely due to dredging activities (Gordon, 1980).

The only scaleshell mussel record from the South Fourche LaFave River is based on a single live specimen taken in 1991 (USFWS, 2001). The occurrence of the scaleshell mussel in the Mulberry River is based upon a single specimen (USFWS, 2001), and the USFWS believes its existence in the Mulberry River is unlikely. While this species occurs in general areas

associated with Action Area II, it does not appear to be found within the MCKARNS. Implementation of Phase II of the feasibility study, Proposed Channel Modifications, should have no affect on this species.

The pink mucket pearly mussel occurs throughout the Mississippi, Tennessee, Ohio, and Cumberland River systems. This species does not occur in Oklahoma, but is reported to occur in Arkansas from the White River (Nature Serve Explorer 2003), which is within Action Area II. It is possible this species may have historically occurred within the lower reaches of the White River associated with the MCKARNS, but records do not support this. If it did, it is unlikely this species has survived the modifications associated with construction and operation of the MCKARNS. Harris (1997) reported this species from the middle and upper reaches of the White River well above its confluence with the MCKARNS. Harris (personal communication, 2003) reported this species to have been collected near Clarendon, Arkansas, on the White River, which is well above the influence of the MCKARNS. No records exist for this species on the White River below Clarendon at river mile 99. It is unlikely this species occurs within the MCKARNS. Consequently, implementation of Phase II of the feasibility study, Proposed Channel Modifications, should not affect this species since it is unlikely to occur there.

The piping plover would be considered a migrant within the western portion of the proposed action area and is known to utilize mudflats near the Winganon Bridge at Oologah Lake during migration periods. If it were to utilize any of the MCKARNS, it would be only briefly during its migration periods in the fall and spring. Implementation of Phase II of the feasibility study, Proposed Channel Modifications, should have no affect on this species.

The Arkansas River shiner was formerly found in the western reaches of Action Area II. However, following loss of habitat from construction and operation of Kaw and Keystone lakes and the MCKARNS on the Arkansas River, the shiner has been extirpated from its former range in the Arkansas River. Implementation of Phase II of the feasibility study, Proposed Channel Modifications, should have no affect on this species since it is no longer present in the area.

The pallid sturgeon inhabits large turbid river systems and is endemic to the middle and lower Mississippi River and Missouri River and larger tributaries. The lower White River and possibly the lower Arkansas River would be included in the range of this species. It has been recorded from the Mississippi River and the St. Francis River in Arkansas. However, there are no documented collection records of this species from either the White or Arkansas rivers. It has, however, been collected in the Mississippi River between river miles 585-615, which is near the confluences of the Arkansas and White rivers.

The loss of aquatic habitat and riverine dynamics due to navigation is well documented and has affected the pallid sturgeon on the Missouri River and tributaries. Types of activities associated with the loss of habitat include construction of impoundments, channelization, channel degradation, reduced sediment transport and turbidity, and lake operation. Similar operations presently occur on the MCKARNS. The activities on the Missouri River have impacted the pallid sturgeon by reducing larval and juvenile rearing habitat, reducing availability of seasonal refugia, reducing the forage base of pallid sturgeon by reducing nutrient cycling and

habitat diversity, reducing pallid sturgeon staging and spawning cues, and increasing hybridization with the shovelnose sturgeon.

While this species has not been recorded from within Action Area II, its possible occurrence, at least at times, cannot be discounted. Implementation of Phase II of the feasibility study, Proposed Channel Modifications may have an affect on this species, if it occurs in the lower White or Arkansas Rivers

The Interior least tern occurs throughout Action Area II. In Oklahoma, it primarily uses the Arkansas River from below Kaw Lake to Muskogee and the Canadian River from below Eufaula Lake to the Canadian Rivers confluence with the MCKARNS. Use of the remainder of the Oklahoma portion of the MCKARNS by the Interior least tern is very low. Terns utilize the portion of the MCKARNS within Arkansas for nesting, and evidence suggests that at times this population may have been flooded from operations of the MCKARNS or reservoirs associated with the MCKARNS. Deepening the MCKARNS to an overall depth of 12 feet would have little impact on this species since most of the system is already at this depth. Widening the Verdigris River to a width of 300 feet for navigation would probably not impact this species since terns do not nest on the Verdigris River below Oologah Lake.

However, deepening of the MCKARNS by dredging has the potential to introduce contaminants tied up in the sediments into the aquatic environment. This could make contaminants available for assimilation into the food chain and the fish community, which is a major food source for nesting least terns using the MCKARNS at the mouth of the Canadian River and in Arkansas. Evidence suggests that some areas of the MCKARNS contain elevated levels of contaminants. Additional sampling of sediments within the areas proposed to be dredged would be required to better define the potential for risks to this species.

The disposal of dredge material could be used for construction of islands and with proper design and annual maintenance could create additional nesting habitat for this species. Implementation of Phase II of the feasibility study, Proposed Channel Modifications, may have an affect on this species.

The piping plover would be considered a migrant within the western portion of the proposed action area and is know to utilize mudflats near the Winganon Bridge at Oologah Lake during migration periods. If it were to utilize any of the MCKARNS, it would be only briefly during its migration periods in the fall and spring. Implementation of the Dredge Material Disposal Management Plan should have no affect on this species.

Geocarpon is only known from four sites in Arkansas but has been recorded from only one location (Franklin County) within Action Area II. This population is located on private lands. *Geocarpon* is unlikely to be found along the MCKARNS due to its limited distribution and specific habitat preferences**.** Implementation of Phase II of the feasibility study, Proposed Channel Modifications, should have no affect on this species.

The Western prairie fringed orchid historically occurred in association with tall grass prairies west of the Mississippi River from Texas to Canada. This species is not reported from Arkansas, but has only been reported to occur in Craig and Rogers counties. In Oklahoma, two populations, both located on privately owned hay meadows, were reported as late as 1975, but have not been observed since. The recovery plan for this species reports it is absent from Oklahoma and South Dakota. The only portion of proposed action areas that may have contained this species are project lands surrounding Oologah Lake and lands along the Verdigris River portion of the MCKARNS. This species would not be expected to occur on project lands in Action Area II. Implementation of Phase II of the feasibility study, Proposed Channel Modifications, should have no affect on this species.

Harperella is currently known from 13 existing populations in 7 states including Alabama, Arkansas, Georgia, Maryland, North Carolina, South Carolina, and West Virginia. In Arkansas, the USFWS reports that Harperella occurs in Scott and Yell counties, while the Arkansas Natural Heritage Commission lists the species as occurring in Perry and Yell counties, which are both within the proposed action area. However, there are no records of this species on Federal lands. In Yell County, this species is listed as occurring on Irons Fork and is in private ownership. This population contains several hundred plants distributed over 5-7 miles of river. Due to its limited distribution and specific habitat requirements, it is unlikely this species occurs on lands associated with the MCKARNS in Action Area II. Implementation of Phase II of the feasibility study, Proposed Channel Modifications, should have no affect on this species.

C. Action Area III, MCKARNS Dredge Material Disposal Management Plan (Verdigris and Arkansas River, Oklahoma

Flows moving down the Arkansas River are regulated in accordance with the Water Control Master Manual for the Arkansas River Basin, Tulsa and Little Rock Districts, approved July 11, 1980. The primary objective of the system water control plan is to provide a system operation that achieves a reasonable balance of purposes for which the projects are operated. Major emphasis of the plan is for flood operations and navigation requirements following a flood event. The system water control plan provides for a slow decrease or taper in the Arkansas River flow so that the sand shoals developed in the navigation channel during high flows can be located and removed before low flow conditions are reached again. Tapered flow also provides sufficient depth for normal navigation traffic to continue over the shoals while they are being located and removed. In order to accomplish the navigation objective, infringement on the flood control storage is required. The degree of infringement varies depending on basin hydrologic conditions and the distribution of flood control storage among projects.

The Southwestern Division, Tulsa and Little Rock districts developed a system regulation plan in a joint effort. The plan consists of flow regulation guides that take into consideration all beneficial uses of the projects. Individual project operational guide curves, system balancing of flood control storage, equivalent percent of basin storage utilized, and a seasonal guide curve for the Van Buren gage were developed for use in the system flow regulation.

Circumstances or events may arise under which the District Engineer will determine a deviation from the system regulation criteria is warranted. Typical deviations from the system

criteria may involve increasing or decreasing flood regulating flows and/or durations of navigation tapers, revisions to lake balancing criteria, or increasing lake releases for low flow navigation needs. Deviations from the system regulation plan may affect operations in both districts and require extensive coordination and approvals.

The operation and maintenance activities associated with the MCKARNS consist of operation of the locks for barge and boat traffic; maintenance of project structures, dikes, revetments, equipment, buildings; maintenance of minimum channel depth and width; maintenance of hydroelectric power generation, erosion control on channel banks and project lands; tree and grass planting for enhancement of aesthetic quality; cooperative wildlife management; administration and management of agriculture and grazing leases; inspection of general leases and outgrants; pollution control; recreation management which includes disposal of solid waste and sewage; control of undesirable vegetation; maintenance of recreation areas; and insect control.

The general instructions and policies with respect to operating and maintaining each of the individual projects of the MCKARNS are contained in the Operation and Maintenance Manuals developed specifically for each project.

During construction of the MCKARNS, dredge material from the Verdigris and Arkansas rivers were placed on the bank adjacent to the river. Many of these areas were also determined to be used for dredge materials disposal sites for maintaining and operating the project after construction. Maps showing these areas are shown in Appendix 3.

As a result of construction and operation of the MCKARNS and system operation of other USACE projects, the lower Verdigris and Arkansas rivers and associated terrestrial and aquatic habitat have been substantially modified from pre-project conditions.

Action Area III is not within the documented range of the American alligator, scaleshell mussel, pink mucket pearly mussel, pallid sturgeon, Geocarpon, or Harperella. Continued operation of the Oklahoma portion of MCKARNS would have no affect on these species.

In September 2003, USACE personnel surveyed project personnel within the proposed action area concerning the presence or absence of bats noted during periodic inspections of dams and associated structures. A positive response noting the presence of bats was received from Keystone, Eufaula, and Tenkiller lakes, but no bats have been found at Kaw Dam or any of the dams or locks and dams associated with operation of the MCKARNS or the Verdigris and Arkansas rivers. No Gray, Indiana, or Ozark big-eared bats have been noted within Action Area III. Continued operation of the Keystone and Kaw Lake projects would have no affect on these species. Bats were found to be present at Keystone Lake in expansion joints under the roadway across the top of the dam in August 2003, but were determined to be big brown bats (*Eptesicus fuscus*). Additional studies are being conducted on this bat colony by Oklahoma State University.

The American burying beetle has been recorded from several counties within the boundaries of the MCKARNS. One of the largest populations in Oklahoma is found on Camp

Gruber, which is located immediately adjacent to the MCKARNS in Muskogee County. USACE surveys for this species have been limited. There is one known occurrence of this species from USACE properties in the action area. The beetle was collected in 1992 from Federal lands at the Sequoyah National Wildlife Refuge. USACE personnel surveyed for this species on Fry Creeks along the Arkansas River in 1998, and from the Sallisaw Creek Recreation Area at Robert S. Kerr but did not find this species. Survey records from sampling conducted at Camp Gruber (Schnell, 1992) indicate this species is not usually found in bottomland habitats. Also, none were reported on Camp Gruber lands near the MCKARNS, although they are immediately adjacent to it. This species is more commonly found in uplands.

The MCKARNS and associated operational activities are located primarily in or along the floodplains of the Arkansas and Verdigris rivers. The habitats associated with this area are primarily bottomland hardwoods, agricultural areas, and wetlands. Very little, if any, of the preferred habitat for this species is found on USACE property associated with the MCKARNS. However, given the mobility of this species, it is highly probable that it does at times occur on periphery areas of the MCKARNS if suitable habitat and carrion are present. Activities associated with implementation of the Dredge Material Disposal Management Plan may affect this species.

Bald eagles are found throughout that portion of the MCKARNS operated by the U.S. Army Corps of Engineers, Tulsa District. Evidence suggests eagles use the area during the winter and also for nesting. Both adult and immature bald eagles have been sighted along the lower reaches of the Arkansas River near its confluence with the Verdigris River by USACE and USFWS personnel, while conducting Interior least tern surveys. Midwinter bald eagle counts show eagles are also present at Webbers Falls and Robert S. Kerr Lakes. Bald eagles are also known to nest in the Robert S. Kerr pool and along the Canadian River below Eufaula Lake.

Maintenance dredging and disposal activities associated with operation of the MCKARNS have been ongoing since project completion in 1969. As shown in Table 5, seven of the 23 sites have already been constructed as part of the ongoing maintenance program. Since construction of the MCKARNS, numerous areas on project lands have developed mature stands of bottomland hardwoods that could be utilized by bald eagles. At some disposal areas, mature trees have been removed during construction, which may have impacted eagle roosting and perching habitat. However, these activities may also have created shallow water habitat or wetlands, which could benefit this species. Overtime, these areas reestablish themselves and mature into habitat that can potentially be used by eagles. While construction and operation of the dredge disposal areas has probably impacted bald eagle habitat, there is no indication that eagle use of the MCKARNS has been impacted as a result of these ongoing activities since the project was constructed.

To date, most of the dredge material on the Oklahoma portion of he MCKARNS has been placed in confined disposal areas. The proposed Dredge Material Disposal Management Plan proposes the use of open-water disposal at one location on Robert S. Kerr Lake. This site (Site 15B) is located in Pool 15 between miles 348 and 349.5 in the Sandtown Bottom area. The recovery of the bald eagle is strongly linked to the ban of DDT and other organochlorine compounds. Consequently, there would be concerns associated with any dredge and disposal

operations that would disturb contaminated sediments and/or release contaminants into the water column. This concern would certainly be warranted with any proposed open water disposal.

Limited sampling of sediments has occurred at Site 15 B. However, the U.S. Army Corps of Engineers, Tulsa District has sampled sediments from Pool 16 (USACE, 1995) and found levels of arsenic, cyanide, and mercury to be above the classification guidelines. If open water disposal is found to be feasible and approved, additional sediment sampling would be required to determine if pollutants occur in the sediments at this location and the potential for risk to this species.

Implementation of the Dredge Material Disposal Management Plan may adversely affect the bald eagle and its habitat by the potential removal of habitat and the potential for release of contaminants into the water column from dredging. Implementation of the plan could also create additional shallow water habitat, which could be beneficial to the species.

The piping plover would be considered a migrant within the western portion of the proposed action area and is known to utilize mudflats near the Winganon Bridge at Oologah Lake during migration periods. If it were to utilize any of the MCKARNS, it would be only briefly during its migration periods in the fall and spring. Implementation of the Dredge Material Disposal Management Plan should have no affect on this species.

The Arkansas River shiner was formerly found within all of Action Area III. However, following loss of habitat from construction and operation Kaw, Oologah, and Keystone lakes and the MCKARNS on the Arkansas River, the shiner has been extirpated from its former range in the Arkansas River. Implementation of the Dredge Material Disposal Management Plan should have no affect on this species since it is no longer present in this area.

The range of the Interior least tern includes the areas associated with the proposed Dredge Material Disposal Management Plan. This species is present primarily as a migrant through the area during spring and fall migrations. There is at least one record of this species nesting at the confluence of the Canadian River on an island within the Sequoyah National Wildlife Refuge, but this island has become heavily vegetated and is no longer used by terns for nesting. It does nest in proximity to the MCKARNS near its confluence with the Arkansas and Canadian rivers and possibly forages in the MCKARNS at these locations. It is doubtful least terns utilize the Verdigris River portion of the MCKARNS due to lack of suitable sandbar and island habitats.

Implementation of the proposed Dredge Material Disposal Management Plan should not adversely impact existing least tern habitat or nesting habitat. However, implementation of the plan could create new nesting habitat for this species, especially if islands were created (and regularly maintained) from dredged material. Similar concerns exist for least terns with respect to the occurrence of pollutants in the sediments, as previously discussed for bald eagles. Additional testing of sediments would be required to assess the risk, if any, to this species prior to island creation. No critical habitat has been designated for this species; therefore, none will be affected. Implementation of the proposed Dredge Material Disposal Management Plan may have both a positive and negative affect this species.

The Western prairie fringed orchid historically occurred in association with tall grass prairies west of the Mississippi River from Texas to Canada. This species has only been reported to occur in Craig and Rogers counties. The two populations in Oklahoma are both located on privately owned hay meadows. These populations have not been observed since 1975 and are presumed extinct. The recovery plan for this species reports it is absent from Oklahoma and South Dakota. The only portion of proposed action areas that may have contained this species are project lands surrounding Oologah Lake and lands along the Verdigris River portion of the MCKARNS. This species would not be expected to occur on project lands in Action Area III. Implementation of the Dredge Material Disposal Management Plan would not be expected to affect this species since it no longer occurs in the area.

D. Action Area IV, Canadian River, Oklahoma

Action Area IV is not within the documented range of the American alligator, scaleshell mussel, pink mucket pearly mussel, pallid sturgeon, Geocarpon, Western prairie fringed orchid, or Harperella. Continued operation of the Oklahoma portion of MCKARNS would have no affect on these species.

In September 2003, USACE personnel surveyed project personnel within the proposed action area concerning the presence or absence of bats noted during periodic inspections of dams and associated structures. A positive response noting the presence of bats was received from Eufaula Lake. Apparently a large colony of little brown bats are located under the spillway bridge at Eufaula. This population was investigated by Operations personnel in 1998 and did not contain any Federally listed species of bats. No Gray, Indiana, or Ozark big-eared bats have been noted within Action Area III. Continued operation of the Eufaula Lake projects should have no affect on these species.

The American burying beetle has been recorded from several counties within the boundaries of the MCKARNS. One of the largest populations in Oklahoma is found on Camp Gruber, which is located immediately adjacent to the MCKARNS in Muskogee County. USACE surveys for this species have been limited; however, there are no known occurrences of this species from USACE properties in the action area. USACE personnel surveyed for this species on Fry Creeks along the Arkansas River in 1998, and from the Sallisaw Creek Recreation Area at Robert S. Kerr but did not find this species. Survey records from sampling conducted at Camp Gruber (Schnell, 1992) indicate this species is not usually found in bottomland habitats. Also, none were reported on Camp Gruber lands near the MCKARNS, although they are immediately adjacent to it. This species is more commonly found in uplands.

Lake Eufaula lies within Pittsburg and McIntosh counties, Oklahoma. The American burying beetle has been not been reported from McIntosh County, but has been recorded from Pittsburg County and several adjacent counties. USACE personnel conducted one survey for the American burying beetle on Longtown Creek (Pittsburg County) at Eufaula Lake in 2001, but did not find this species. This species has been collected on uplands adjacent to the Canadian River downstream of the dam in Haskell County. It is also reported to occur on Federal property at the Sequoyah National Wildlife Refuge at the confluence of the Canadian River and the

MCKARNS. Since this species is highly mobile and could potentially be found at any given time in suitable habitat on Eufaula, the probabilities are high that it occurs on project lands. The greatest threats to this species are probably the use of pesticides and loss of habitat. The use of pesticides at USACE projects has been severely curtailed and as long as activities involving loss of habitat are not allowed, existing operations of the reservoirs should not affect this species. Continued operation of Eufaula Lake for its authorized purposes should not affect this species if it occurs along the Canadian River downstream of Eufaula Dam. However, any future major ground disturbing activities or land use changes proposed by the USACE through its operation and management program at Eufaula Lake may affect this species.

Numerous bald eagles winter around Eufaula Lake and on the Sequoyah National Wildlife Refuge near the confluence of the Canadian with the MCKARNS. Eagles are commonly seen below both the dam fishing during the winter when hydropower releases keep the river free of ice. There have also been some nesting attempts along the Canadian River immediately below the dam and at the Belle Star Public Use Area on the lake. Both sites are protected by the USACE and placed off limits to any recreational activities during the nesting season, and the area below the dam is protected from November-March of each year.

The midwinter bald eagle counts for Eufaula Lake have varied from 2 in 1995 to as high as 32 in 1991. The bald eagle recovery is strongly linked to the ban of DDT and other organochlorine compounds. Since the ban of DDT and protection from shooting and poisoning, the eagle has recovered. Today, most bald eagle fatalities are associated with power line collisions. From the numbers of eagles using the Eufaula Lake area and nesting activities around the lake, the USACE believes current operations of the project have a positive affect on this species. No critical habitat has been designated for this species; therefore, none will be affected.

The piping plover would be considered a migrant within the western portion of the proposed action area and is known to utilize mudflats near the Winganon Bridge at Oologah Lake during migration periods. Eufaula Lake is within the migratory corridor for this species. If it were to utilize any of the Eufaula Lake project lands, it would be only briefly during its migration periods in the fall and spring. Continued operation of Eufaula Lake for its authorized project purpose should have no affect on this species.

The Arkansas River shiner was formerly abundant throughout the Canadian River system. However, following loss of habitat from construction and operation of Eufaula Lake and the MCKARNS on the Arkansas River, the shiner has been extirpated from that portion of its range on the Canadian River below Eufaula Lake. The USFWS (Federal Register Vol. 66, No. 65, April 4, 2001) reports that it still exists in a 30-mile section of the South Canadian River from the Indian Nation Turnpike Bridge downstream to the upper limits of Eufaula Lake. They report, …"the distributional limit of these populations frequently fluctuates. Management of water surface elevations in Eufaula Reservoir for flood control and the resultant backwater effects routinely alter stream morphology at the downstream extent of the population. Under elevated surface water conditions, the lower reaches of this segment are degraded or may be entirely unsuitable for the Arkansas River shiner". Continued operation of Eufaula Lake for its authorized project purposes should have no affect on this species over that which has already occurred.

Historical flows on the Canadian River have been significantly modified with construction and operation of Eufaula Lake. No longer does the river exhibit the large annual flood events lasting for several days followed by longer periods of median flows. Releases during storm events are now made at a non-damaging rate over a protracted period of time. The lack of large recurring floods does not maintain abundant tern nesting habitat.

Historically, flood events measured at the Whitefield gage below Eufaula Lake with flows of at least 50,000 cfs occurred 42 times between 1939 and 1960, flows of at least 75,000 cfs occurred 24 times, and flows of 100,000 cfs occurred 16 times for the same period of record. Since closure of Eufaula Dam in 1962, flood events of at least 50,000 cfs have occurred only 5 times, flows of at least 75,000 cfs have occurred only 1 time, and flows of at least 100,000 cfs have occurred only 1 time.

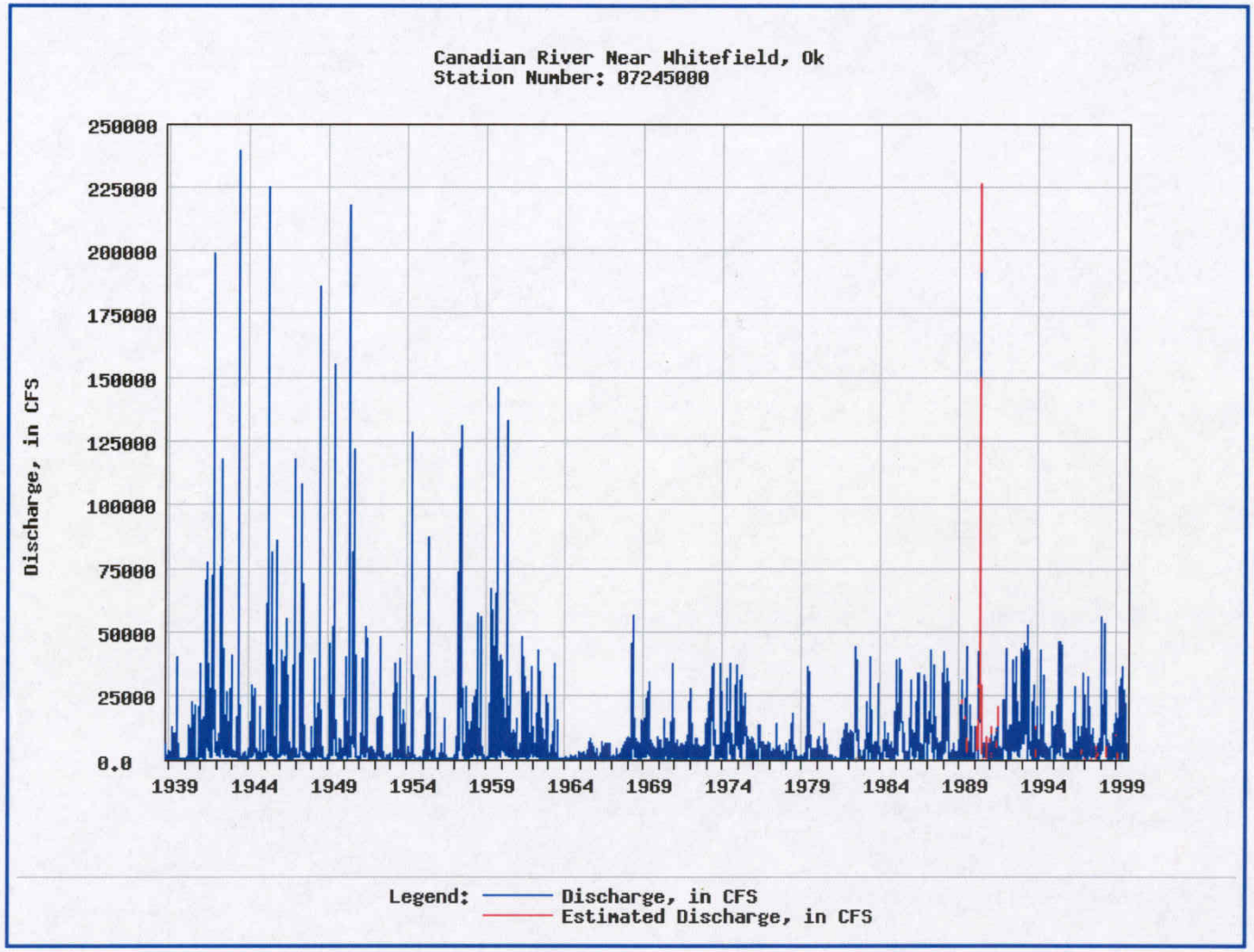
Also, operation of the lake for hydropower has created wide fluctuation in daily flows of the river downstream of the dam, and created many periods of little or no flow during the least tern nesting season. The daily fluctuations at the Whitefield gage attributable only to hydropower releases on a daily cycle basis can vary between over 12,000 cfs running three generating units to less than 2,000 cfs. During periods when less than three units are operating or when the units are shut down for more than a 24-hour period, low flows would be much less than 2,000 cfs unless flood or low flow releases are made.

Off-road vehicle use is a major activity pursued on the sandbars in the area. Four-wheeler activity is evident year-round with groups of vehicles being operated on many of the sandbars on weekends. Four-wheeler activity increases to almost a daily occurrence during the summer when school is out. Fishermen also use four-wheelers to access the river and fish the deeper holes in the river for striped bass during the summer. These high-use activities coincide with much of the tern-nesting season. A major parking and access area is at the Highway 2 bridge at Whitefield. From this access point during low or no flows, recreational four-wheelers utilize the sandbars along the river channel for several miles.

Long term affects on the nesting habitat for this species have also occurred as a result of Eufaula Lake, but have not been quantified. Much of the sediment transported by the Canadian River has become trapped behind the dam. This reduction in stream sediment transport combined with a reduction in large flow events has impacted the quantity and quality of suitable nesting islands for this species. While it has been difficult to measure this loss, it nonetheless has occurred and will continue to occur. Evidence of this is can be seen from immediately below the dam to just above the Whitefield Bridge where the river has degraded to rock with few if any islands remaining in this reach that are suitable for nesting sites. Presently, the only available nesting habitat on the Canadian River is from the Whitefield Bridge downstream to the upper limits of the MCKARNS navigation pool.

From Figure 14, it can be seen that least terns are present along the lower Canadian River and attempt to nest. However, survey data indicate reproductive success has been severely limited. In 1999, no reproduction was noted, though 106 adults were found on the first survey. It appeared that all nests had been flooded. In 2000, some reproduction occurred, but was

Historical Streamflow Daily Values Graph for Canadian River Near Whitefield, Ok (07245000)



impacted by predation caused by periods of low flow due to hydropower operations. The 2001 surveys found 65 adults and 7 flying young. Reproduction during 2001 was minimally successful. In 2002, there were 52 adult birds and 31 nests. Six chicks were counted, but only 4 fledglings were produced. Evidence suggests that production was thought to be severely impacted by a severe summer thunderstorm producing large hail, heavy rain, and winds in the small nesting area in late July.

Under existing operations, Eufaula Lake would continue to be operated for its authorized project purposes. Potential affects on lest terns would be similar to those documented to have occurred in the past, which include flooding of nests as a result of flood releases and land bridging as a result of hydropower operations. With implementation of the measures and procedures outlined in the 2002 Management Guidelines and Strategies for Interior least terns, some "take" will probably continue to occur. To date, implementation of these measures has not achieved the desired levels of results as they have for the Arkansas River below Kaw and Keystone lakes. It is doubtful that this species will ever be too successful in the Canadian River below Eufaula for the following reasons

- Limited availability of suitable nesting islands
- Limited length of river suitable for nesting
- Uncontrolled recreational use of the river from adjacent private property
- Occurrence of severe summer thunderstorms

With continued implementation of the measures and procedures outlined in the 2002 Management Guidelines and Strategies for Interior least terns, "take" will continue to occur, but it is highly unlikely that recovery of this species to the recommended recovery plan goal of 300 adults can be achieved on the Canadian River below Lake Eufaula. USACE will continue operation of Eufaula Lake under the agreed upon Management Guidelines and Strategies for least terns. Implementation of the long-range strategies identified in the plan would be consistent with recovery of the species, but their effectiveness is questionable. It might be more prudent to consider implementing these measures in other areas where the chance for success is more practical and certain.

E. Action Area V, Red River Below Denison Dam to Index, Arkansas; Texas; and Oklahoma

Action Area V is not within the expected range of Gray bat, Indiana bat, Ozark big-eared bat, pink mucket pearly mussel, Arkansas River shiner, pallid shiner, *Geocarpon,* Western prairie fringed orchid, or Harperella. Consequently, continued operation of Lake Texoma and the Red River system of lakes for their authorized project purposes would have no affect on these species.

Action Area V is on the periphery of the range of American alligator, but it would be considered a possible visitor to the lower portion of the Red River. This species was originally classified as endangered throughout its range in 1967 due to concerns over harvesting. Since its protection, it has recovered to the point where it is neither in danger of extinction nor likely to

become so in the foreseeable future. Continued operation of the Red River system should have no affect on this species.

The American burying beetle is known to occur in Bryan, Choctaw, and McCurtain counties along the Red River. USACE personnel have conducted limited surveys for the American burying beetle on the Washita Arm of Lake Texoma and at Hugo Lake, but did not collect this species. One specimen has been observed and was filmed on a gopher carcass near Hugo Lake (personal communication David Stewart). Since this species is highly mobile and could potentially be found at any given time in suitable habitat on Lake Texoma and other USACE lakes on tributary streams downstream of Lake Texoma, the probabilities are high that it occurs on project lands. The greatest threats to this species are probably the use of pesticides and loss of habitat. The use of pesticides at USACE projects has been severely curtailed. However, any major ground disturbing activities or land use changes at Lake Texoma or other dams located on tributaries downstream has the potential to affect this species if it occurs on project lands.

The Whooping Crane would be considered a rare migrant through Action Area V. While it is possible that it could use Lake Texoma and the Red River below Denison Dam during both spring and fall migration periods, records indicate it primarily uses the Red River above Lake Texoma. Historical populations occurring in Arkansas have apparently been extirpated. Continued operation of Lake Texoma and the Red River system for their authorized project purposes should have no affect on this species.

As documented in Section IV, bald eagles utilize both Lake Texoma and the Red River below Lake Texoma. Survey teams conducting Interior least tern surveys on the Red River below Lake Texoma report sighting bald eagles during the summer, which indicates this species probably nests as well as winters along this stretch of the river. Currently, there is a study underway on Lake Texoma to investigate reallocation of 300,000 acre feet of hydropower storage in Lake Texoma to water supply. If study findings are positive and implemented, this could have a minor change on the amount of water being released downstream into the Red River. However, data on these potential changes are not available at the present time so projected impacts on this species cannot be evaluated.

In Oklahoma, the scaleshell mussel has been reported from the Red River Basin in southeastern Oklahoma. It has been reported to occur in the Kiamichi, Mountain Fork, and Lower Little Rivers, and from the Poteau River, a tributary to the Arkansas River (USFWS, 2003b). It is globally ranked as S1 Critically Imperiled for Oklahoma.

Within the State of Arkansas, this species is reported to occur in seven counties including Crawford, Fulton, Jackson, Lawrence, Perry, Sevier, and Francis (USFWS, 2003b). It may occur in the Little River system, which is also a tributary of the Red River in Arkansas. In Oklahoma, recent surveys of the Red River Basin failed to find this species (Federal Register, 2001). It appears the most likely occurrence of this species would be the Kiamichi River above Hugo Lake.

While this species occurs in the general area associated with Action Area V, it does not appear to be found within the Proposed Action Areas associated with the Red River. Continued system operations of the Red River for its authorized project purposes should not impact this species since it is unlikely to be found in the lower Red River.

Lake Texoma and the Red River below the lake are within the migration corridor of the piping plover. It is possible for this species to use mudflats associated with the Red River system of lakes and sandbars along the Red River during fall and summer migration periods (February-April and July-September) of each year. However, there are no records of frequently used areas noted for this species in Action Area V. Due to the limited amount of time this species would be in Action Area V, continued system operations in the Red River for its authorized project purposes should not affect this species.

The Interior least tern was once common in the Red River Basin between 1910 and 1960 and has been reported from most of the counties along the Texas-Oklahoma border. They were also known to occur on the Prairie Dog Town Fork of the Red River in the Texas panhandle. Previous to recent surveys populations of this species in the Red River above and below Lake Texoma found only a few scattered colonies

The USACE, Tulsa District and the USFWS conducted an aerial survey in July 1991 on segments of the Red River above and below Denison Dam. They counted two colonies with ten or more terns and two with four to nine terns and reported eight "potential or probable colonies" in the BLM portion of the river upstream of Lake Texoma. Below the dam, they reported six to seven colonies of ten or more birds and 12-14 sites with four to nine birds. Adults seen totaled 139-152 upstream and 323-339 downstream. The main concentration of downstream individuals and colonies was between U.S. Highway 78 and U.S. Highway 71 below Denison Dam.

The USFWS and BLM personnel surveyed the Red River upstream of Lake Texoma from the North Fork of the Red River to 79 miles downstream in July 1994. They reported over 200 adults with little evidence of nesting or chicks. The lack of nests and chicks along with the low number of immature birds seen (three) led USFWS personnel to conclude that flood flows apparently severely reduced nesting success during the 1994 season.

The USACE, Tulsa District has been conducting intensive tern nesting surveys on the lower 240-mile stretch of the Red River below Lake Texoma since 1999. A summary of these surveys is shown in Figure 17. Bird numbers for the lower Red River are consistently higher than those reported earlier by the USFWS, with the numbers of adult birds being over 600 for the years surveyed. However, reproduction in this reach has not been as great as anticipated despite efforts to manage flows in this reach for the benefit of nesting terns. An FBR of 0.5 has been achieved in only 2001, yet tern numbers appear fairly stable to increasing. The large influx of individuals in 2001 cannot be explained, but could reflect an influx of terns moving to the Red River from some other geographic region. Based on the numbers of adult birds returning since 1991, it would appear this population is growing.

Historical flows on the Arkansas River were significantly modified with the construction Denison Dam and Lake Texoma. No longer does the river exhibit the large annual flood events

lasting for several days followed by longer periods of median flows. Releases during storm events are now made at lesser non-damaging rates over a protracted period of time. Also, operation of the lake for hydropower has created wide fluctuation in daily flows and created many periods of little or no flow.

Long term affects on the nesting habitat for this species have also occurred as a result of constructing Lake Texoma, Waurika, Hugo, Pat Mayse, and possibly the chain of lakes on the Little River in Arkansas, but have not been quantified. Much of the sediment load transported by these rivers has become trapped behind the dams. This reduction in stream sediment transport combined with a reduction in large flow events and flood duration have impacted the quality of suitable nesting islands for this species. While it has been difficult to measure this loss, it nonetheless has occurred and will continue to occur with operation of the reservoirs.

Under existing operations, Lake Texoma and the other Red River tributary lakes would continue to be operated for their authorized project purposes. Potential affects on least terns would be similar to those documented to have occurred in the past, which include flooding required by high flood release operations, land-bridging of nesting islands as a result of hydropower operations, and long term habitat loss.

With implementation of the measures and procedures outlined in the 2002 Management Guidelines and Strategies for Interior Least Terns, some "take" will continue to occur, but continued existence of the species should not be jeopardized. Continued operation of these reservoirs with the existing management guidelines and implementation of the long-range strategies identified in the plan should be consistent with recovery of the species. No critical habitat has been designated for this species; therefore, none will be affected.

The operation of Lake Texoma and the other Red River tributary lakes has impacted the population of Interior least terns nesting below Denison Dam, both positively and negatively. Operation of Lake Texoma and the associated impoundments has the potential for causing an adverse affect on this species and its habitat if release guidelines are not followed. However, based on HQUSACE surveys in the Red River Basin since 1999, it appears this population of least terns is increasing despite the amount of take occurring.

SECTION VI. SUMMARY OF DIRECT AND INDIRECT EFFECTS OF THE PROPOSED ACTION(S)

The proposed action(s) were evaluated and the anticipated effects of the proposed actions determined in accordance with the ESA. The potential direct, indirect, and cumulative impacts identified with respect to the listed species and proposed actions are summarized as follows and are shown in Table 12.

A. Interior Least Tern.

- Damage or destruction to nests, eggs, or chicks resulting from operation of reservoirs for flood control during breeding period.
- Damage or destruction to nests, eggs, or chicks resulting from recreational uses of sandbars and islands during the breeding period under low-flow conditions.
- Modification of nesting islands due to vegetation encroachment from lack of scouring flows.
- Gradual diminution of suitable nesting islands and sand bars due to the capture of sediment by main stem dams and sand and gravel operations.
- Exposure of nesting sites to terrestrial predators and increased recreation due land-bridging.
- Loss of nesting habitat behind navigational dikes and revetments due to vegetation encroachment.
- Potential for increase of turbidity during dredging operations, which could limit ability of Interior least terns to capture prey species.
- Potential for increased levels of pollutants and uptake of contaminants at proposed open water dredge disposal sites
- Potential for increasing nesting island habitat from placement of dredge materials.

B. Bald Eagle.

- Potential loss of habitat (mature cottonwood trees) used for perching and roosting associated with creation of dredge material disposal sites.
- Potential for temporary increases in turbidity during dredging operations, which could limit ability of bald eagles to capture prey species.
- Potential long-term increase in shallow water habitat, which could increase prey base and facilitate capture of prey species.

- Potential for increased levels of pollutants and uptake of contaminants at proposed open water dredge disposal sites.

C. American Burying Beetle.

- Potential for slight increase in flooding frequency of flood pool lands in 11 upstream reservoirs contributing flow to the Arkansas River.

- Potential for loss of habitat on USACE projects within the range of this species due to land use changes and out-granting real estate practices.

- Potential for loss of habitat if dredge material is placed on upland sites.

D. Pallid Sturgeon.

- Potential for loss of habitat, juvenile rearing habitat, forage base, and spawning cues from channelization, dredging, and operational activities associated with the MCKARNS, if this species occurs in the lower White and Arkansas rivers.

TABLE 12. SUMMARY OF POTENTIAL IMPACTS ON FEDERALLY LISTED SPECIES OCCURRING IN THE PROPOSED ACTION AREAS

Species Listings	Status	Range		Impacts
		OK	AR	
Alligator, American (*Alligator mississippiensis*)	T (S/A)	X	X	No affect.
Bat, Gray (*Myotis grisescens*)	E	X	X	No affect. Not likely to occur on project lands.
Bat, Indiana (*Myotis sodalis*)	E	X	X	No affect. No likely to occur on project lands.
Bat, Ozark big-eared (*Corynorhinus townsendii ingénues*)	E	X	X	No affect. Not likely to occur on project lands.
Beetle, American burying (*Nicrophorus americanus*)	E	X	X	Potential for may affect if this species occurs on project lands.
Crane, whooping (*Grus americana*)	E	E	X	No affect, species not present over most of action areas.
Eagle, bald (*Haliaeetus leucocephalus*)	T	X	X	May affect due to loss of bottomland hardwoods resulting from widening of the Verdigris River. Positive affect from created wetlands.
Mucket, pink (*Lampsilis abrupta*)	E	-	X	No affect. Species occurs only in the White River well above the influence of the MCKARNS.
Mussel, scaleshell (*Leptodea leptodon*)	E	X	X	No affect. Species not likely to occur on project lands.
Plover, piping (*Charadrius melodius*)	T	X	-	No affect. Species only occurs in action areas during migration.
Shiner, Arkansas River (*Notropis girardi*)	T	X	X	No affect. Species extirpated from project area.
Sturgeon, pallid (*Scaphirhynchus albus*)	E	-	X	May affect due to construction and operation of the MCKARNS if species is found to occur in the lower White or Arkansas rivers.

TABLE 12. (Continued)

Species Listings	Status	Range		Impacts
		OK	AR	
Tern, least (*Sterna antillarum*)	E	X	X	May affect due to operation of projects for authorized project purposes (both positive and negative affects).
Geocarpon minimum *(no common name)*	T		X	No affect. Species not likely to occur in project area.
Orchid, western prairie fringed (*Platanthera praeclara*)	T	X	-	No affect. Species not likely to occur in project area.
Harperella (*Ptilimnium nodosum*)	E	-	X	No affect. Species not likely to occur in project area.

SECTION VII. OTHER NON-USACE ACTIVITIES OCCURRING IN THE PROPOSAL ACTION AREAS THAT MAY POTENTIALLY IMPACT FEDERALLY LISTED SPECIES

The procedures for conducting consultation and conference activities under Section 7 of the ESA require the Federal agency preparing the BA to describe any known, unrelated, future non-Federal activities ("cumulative effects") reasonably certain to occur within the action area that are likely to affect the species. With respect to this BA, the USACE has identified two such actions that have the potential to affect one of the Federally listed species, the Interior least tern.

The first action is a proposed surface water delivery system as an irrigation source for a large area of southwest Little River County, Arkansas. It is being proposed by the USDA Natural Resources Conservation Service and is entitled the "Walnut Bayou Irrigation Project." The proposed plan consists of installation of a surface water delivery system to pump water from the Red River into a series of canals, streams, and pipelines, which will deliver irrigation water to farms. The proposed plan would pump up to 385 cfs from the Red River during May through September, which coincides with the least tern nesting season. Potential impacts to this species include a reduction in stage of low flows on the Red River. This has the potential to increase the occurrence of land bridging of least tern nesting islands, which increases the risk of predation and human disturbance to nesting least terns. If implemented, this action could have additional impacts on nesting least terns over those occurring as a result of operational activities associated with existing USACE projects above Index, Arkansas.

The NRCS is presently consulting with the USFWS with respect to this proposed action. If a Section 404 permit is required for this activity, the Regulatory Branch of the Little Rock District, USACE will become involved with this action through the Section 404 permit process.

As previously noted in the BA, long-term effects on nesting habitat for this species have occurred as a result of construction of main stem impoundments. Much of the sediment load transported by these rivers has become trapped behind dams. This reduction in stream sediment transport combined with a reduction in large flow events and duration has impacted both the quantity and quality of suitable nesting islands for this species. While it is difficult to measure and quantify this loss, it nonetheless has occurred and is noticeable in large stretches of the rivers immediately below Lakes Texoma, Keystone, Kaw, and Eufaula.

The second "cumulative effect" identified by the USACE concerns the long-term loss of nesting habitat in the Arkansas and Red rivers resulting from removal of sand and gravel for commercial purposes. This is especially true for the stretch of the Arkansas River from below Keystone Lake to Muskogee, Oklahoma, where numerous operators remove large amount of material daily. Over time, removal of this material for commercial purposes may contribute to shortages f sand available to the fluvial processes for creation and maintenance of island habitat for this species. Most of the commercial sand operations are suction dredge operations and are deemed non-regulated activities under Section 404 of the Clean Water Act. Consequently, these activities and any impacts on threatened or endangered species are largely uncontrolled.

SECTION VIII. DETERMINATION

Based upon the best available information, the USACE has evaluated the impacts of its continued operation of its existing projects, proposed projects, studies, and cumulative impacts for the noted 16 Federally listed species and concludes there would be no affect on the following Federally listed species; American alligator, Gray bat, Indiana bat, Ozark big-eared bat, Whooping crane, Scaleshell mussel, Piping plover, Arkansas River shiner, *Geocarpon*, Western prairie fringed orchid, and Harperella. This is due to the fact that the range of many of these species is not associated with the projects, the species is no longer found in the area, suitable habitat is not present on project lands, or the impacts were considered to be inconsequential.

The evaluation also concludes that continued operation of its existing projects, proposed projects, studies, and cumulative impacts may have an affect on the following Federally listed species and or their habitats: Interior least tern, Pallid sturgeon, Bald eagle, and American burying beetle.

Documented evidence has shown that operation of USACE reservoirs for their authorized project purposes has had and will continue to have an impact, both positive and negative, on the Interior least tern and its habitat. Operation of these reservoirs for flood control and hydropower have the potential to reduce nest flooding during flood events and conversely have flooded nesting terns and created occurrences of land bridging, which have resulted in documented take of this species. Though unquantifiable, there has been a gradual diminution of suitable nesting islands and sand bars immediately downstream of large reserviors due to the capture of sediment by these impoundments. Sand and gravel operations are also partially responsible for the removal of sand from the rivers.

Implementation of the Dredge Material Disposal Management Plan and Phase II of the Arkansas River Navigation Study could have both a positive and negative impact on least terns. With disturbance of sediments by dredging, there is a potential for increased levels of pollutants and uptake of contaminants at proposed dredge disposal sites. However, with this proposal, an opportunity exists to create additional nesting habitat for this species.

Several issues have arisen under operation of the existing BO, which the USACE, Tulsa District believes should be readdressed under the new BO. One deals with the calculation of "take" based upon an established FBR. From surveys since 1990, we believe that calculation of an FBR does not represent the most acceptable method of attributing "take" to the USACE. There are too many variables associated with calculating fledging ratios to make it a reliable tool for estimating "take". These variables include mobility and hiding ability of chicks, calculation of fledge rates between colonies, movement of fledglings away from colony sites, and sources of mortality attributable to non-USACE related activities such as aerial predation and weather.

The USACE believes that a more acceptable measure of "take" would be to base it upon factors the USACE can control or manage. Consequently, the USACE requests the BO consider this request and propose that in lieu of FBR's, the USACE be required to measure "take" by providing the birds with an appropriate number of nesting days free of flooding and with an acceptable level of low flows.

While no records exist for the occurrence of the pallid sturgeon in either the Arkansas River or the White River, it is reasonable to assume that at times it could be found in the lower White river. Therefore, it is reasonable to assume that implementation of the Arkansas River Navigation Study, Phase II, Channel Modification, could have an affect on this species if it is found to occur in this area. Additional surveys for this species would be required to confirm its occurrence prior to implementation of this project.

The bald eagle occurs throughout all the proposed action areas. Most of the proposed actions would have no affect on this species. However, implementation of the Dredge Material Disposal Management Plan and Phase II of the Arkansas River Navigation Study, Deepening and Widening, would have the potential to negatively affect this species directly by removal and loss of habitat and indirectly by disturbing sediments that may contain contaminants.

The known range of the American burying beetle is found throughout much of the MCKARNS and the 11 supporting reservoirs. Limited sampling has failed to find this species on USACE managed properties, but given the mobility of this species it probably is there if suitable habitat exists. Since complete surveys have not been conducted at any of the operating projects within the proposed action areas, it is reasonable to assume that it may be present. Consequently, continued operation of existing reservoirs, the MCKARNS, and supporting projects may have an affect on this species. Indirectly, operation of the 11 supporting reservoirs may have an indirect adverse impact on this species through implementation of land use changes and the real estate outgrant programs associated with operational activities.

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APPENDIX 1

CORRESPONDENCE

APPENDIX 3

USACE

DRAFT
DREDGE MATERIAL DISPOSAL MANAGEMENT PLAN
AND SITE DRAWINGS

APPENDIX 4

HYDROGRAPHS FOR RED RIVER BELOW LAKE TEXOMA

APPENDIX 5

USACE LEAST TERN SURVEY
FOR RED RIVER ABOVE LAKE TEXOMA