DRAFT ENVIRONMENTAL ASSESSMENT

for

DESIGNATION OF CRITICAL HABITAT

for Neosho mucket and Rabbitsfoot Mussels

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Prepared by the

Department of Interior
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DRAFT ENVIRONMENTAL ASSESSMENT FOR THE DESIGNATION OF CRITICAL HABITAT FOR THE NEOSHO MUCKET AND RABBITSFOOT MUSSELS

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Summary

The purpose of this draft Environmental Assessment (EA) is to identify and disclose the environmental consequences resulting from the proposed action of designating critical habitat for the Neosho mucket (*Lampsilis rafinesqueana*) and rabbitsfoot (Q*uadrula cylindrica cylindrica*) mussels proposed for listing as endangered and threatened, respectively, on October 16, 2012 (76 FR 46218), under the Endangered Species Act of 1973 (ESA), as amended. The need for the proposed action is to comply with the National Environmental Policy Act (NEPA).

The Neosho mucket was identified as a candidate for protection in the May 22, 1984, *Federal Register* (49 FR 21664) and was assigned a status Category 2 designation until 1996 (61 FR 7596) when that designation was discontinued and only species for which the Service had sufficient information on biological vulnerability and threats to support issuance of a proposed rule were regarded as candidate species. The Neosho mucket was added to the candidate list in the October 30, 2001, *Federal Register* (66 FR 54808) with a listing priority number (LPN) of 5. In 2010, its listing priority number was changed from 5 to 2, reflecting a species with threats that are both imminent and high in magnitude.

The rabbitsfoot was first identified as a candidate for protection in the November 15, 1994, *Federal Register* (59 FR 58982) and was assigned a status Category 2 designation until 1996 (61 FR 7596) when that designation was discontinued due to reasons described above for Neosho mucket. The rabbitsfoot was added to the candidate list in the November 9, 2009, *Federal Register* (74 FR 57804) with a LPN of 9. A LPN of 9 indicates threats are of a moderate magnitude but imminent overall. In our Notice of Review dated November 10, 2010 (75 FR 69222), it was again identified as a candidate species with an LPN of 9.

The ESA requires that, to the maximum extent prudent and determinable, the Secretary shall designate critical habitat at the time the species is determined to be endangered or threatened. The ESA states (16 U.S.C. 1533 §(b)(1)(A)), "the Secretary shall make determinations required by subsection (a)(1) of this section [species listing status] solely on the basis of the best scientific and commercial data available…" However, a court opinion of the Tenth Circuit ruled that "the Secretary must comply with NEPA when designating critical habitat under ESA (*Catron County Board of Commissioners v. U.S. Fish & Wildlife Service*, 75 F. 3d 1429, 10th Circuit, 1996). Portions of the Neosho mucket and rabbitsfoot mussels ranges include States within the Tenth Circuit (Oklahoma and Kansas). Therefore, this EA analyzes the impacts of the proposed designation of critical habitat, which is contained in the proposal for listing the Neosho mucket as an endangered species and rabbitsfoot as a threatened species (77 FR 63440), but does not analyze impacts of the listing action.

The Neosho mucket is a medium size freshwater mussel, reaching 9.5 centimeters (cm) (4 inches (in)) in length. The Neosho mucket is associated with streams having shallow riffles and runs comprised of gravel substrate and moderate to swift currents. Neosho mucket historically occurred in at least 16 streams within the Illinois, Neosho, and Verdigris River basins covering four states (Arkansas, Kansas, Oklahoma, and Missouri). It is endemic to the Arkansas River system. Of the 9 extant streams, there is only one viable population.

Rabbitsfoot is a medium to large freshwater mussel, elongate and rectangular, reaching 12 cm (6 in) in length. It is primarily an inhabitant of small to medium sized streams and some larger rivers. Rabbitsfoot historically occurred in 140 streams within the lower Great Lakes Subbasin and Mississippi River Basin. The historical range included Alabama, Arkansas, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, Tennessee, and West Virginia. In the 51 extant streams, populations are highly fragmented and restricted to short reaches.

Although little is known of the specific habitat requirements for the Neosho mucket and rabbitsfoot mussels, it can be determined that they require flowing water, geomorphically stable river channels and banks with suitable substrate, adequate food, the presence and abundance of fish hosts, adequate water and sediment quality, and few or no competitive or predaceous invasive (nonnative) species

The habitats of freshwater mussels are vulnerable to water quality degradation and habitat modification from a number of activities associated with modern civilization. The decline of the Neosho mucket and rabbitsfoot is primarily the result of habitat loss and degradation. Chief among the causes of decline in distribution and abundance of the Neosho mucket and rabbitsfoot, and in no particular order of ranking, are impoundment, channelization, sedimentation, chemical contaminants, mining, and oil and natural gas development. Neosho mucket and rabbitsfoot are both found within medium to large river drainages exposed to a variety of landscape uses.
Two alternatives were considered in this EA: the No Action Alternative, under which no critical habitat would be designated and the Proposed Action Alternative, under which eight units occupied by Neosho mucket are proposed for designation and 35 units occupied by rabbitsfoot are proposed for designation.

We are proposing to designate approximately 779 river kilometers (rkm) (484 river miles (rmi)) as critical habitat for the Neosho mucket in:

- Benton and Washington counties, Arkansas;
- Allen, Chase, Cherokee, Coffey, Elk, Greenwood, Labette, Montgomery, Neosho, Wilson, and Woodson counties, Kansas;
- Jasper, Lawrence, McDonald, and Newton counties, Missouri; and
- Adair, Cherokee, and Delaware counties, Oklahoma.

We also are proposing to designate approximately 2,664 rkm (1,655 rmi) as critical habitat for the rabbitsfoot in:

- Colbert, Jackson, Madison, and Marshall counties, Alabama;
- Arkansas, Ashley, Bradley, Clark, Cleburne, Cleveland, Dallas, Drew, Fulton, Grant, Hot Spring, Independence, Izard, Jackson, Lawrence, Little River, Marion, Monroe, Montgomery, Newton, Ouachita, Randolph, Saline, Sevier, Sharp, Van Buren, White, and Woodruff counties, Arkansas;
- Massac, Pulaski, and vermilion counties, Illinois;
- Carroll, Pulaski, Tippecanoe, and White counties, Indiana;
- Allen and Cherokee counties, Kansas;
- Ballard, Edmonson, Green, Hart, Livingston, Logan, Marshall, and McCracken counties, Kentucky;
- Hinds, Sunflower, Toshimingo, and Warren counties, Mississippi;
- Jasper, Madison, and Wayne counties, Missouri;
- Coshocton, Madison, Union, and Williams counties, Ohio;
- McCurtain and Rogers counties, Oklahoma;
- Crawford, Erie, Mercer, and Venango counties, Pennsylvania; and
- Hardin, Hickman, Humphreys, Marshall, Maury, Montgomery, Perry, and Robertson counties, Tennessee.

Areas proposed as critical habitat for the Neosho mucket and rabbitsfoot include only stream channels within the ordinary high water line, and we made every effort to avoid including any developed areas, structures, or areas inundated by lakes and reservoirs because such structures usually lack physical or biological features for these species. The ordinary high water line defines the stream channel and is the point on the stream bank where water is continuous and leaves some evidence, such as erosion or aquatic vegetation. Any such areas inadvertently left inside critical habitat boundaries shown on the maps of this proposed rule have been excluded by text in the proposed rule and are not proposed for designation as critical habitat. Therefore, if the critical habitat is finalized as proposed, a Federal action involving these areas would not trigger section 7 consultation with respect to critical habitat and the requirement of no adverse modification unless the specific action would affect the physical or biological features in the adjacent critical habitat.

The environmental issues identified by the Service during resource analysis include: conservation of the Neosho mucket and rabbitsfoot, water resource management, energy development and production, socioeconomic conditions and environmental justice. The

proposed critical habitat designation occurs only in navigable waters in which the river bottom is generally owned by the State. However, the adjacent upland properties are owned by private, Federal, or State entities and in Oklahoma some are under Tribal jurisdiction. The designation of critical habitat in areas with extant populations of Neosho mucket and rabbitsfoot may impose nominal additional regulatory restrictions to those currently in place and, therefore, may have minor incremental impacts on State and local governments and their activities. The designation may have some benefit to these governments because the areas that contain the physical or biological features essential to the conservation of these species are more clearly defined, and the elements of the features of the habitat necessary to the conservation of these species are specifically identified. This information does not alter where and what federally sponsored activities may occur. However, it may assist local governments in long-range planning (rather than having them wait for case-by-case section 7 consultations to occur).

If any Federal actions triggered section 7 consultation, the incremental effects of the designated critical habitat for the Neosho mucket and rabbitsfoot would likely include applying similar conservation measures as those that would be created for the jeopardy part of section 7 consultation. Thus, the incremental effects of critical habitat designation should be minimal, if any, as project modifications would be the same under the jeopardy and adverse modification standards. Therefore, there is a low likelihood that the proposed designation of critical habitat for the Neosho mucket and rabbitsfoot will result in any incremental effects.

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CHAPTER 1
PURPOSE OF AND NEED FOR ACTION

1.1 Introduction

The United States Department of the Interior (USDI), Fish and Wildlife Service (Service) has prepared this draft Environmental Assessment (EA) to analyze the potential effects on physical and biological resources and social and economic conditions that may result from the designation of critical habitat for the Neosho mucket (*Lampsilis rafinesqueana*) and rabbitsfoot (*Quadrula cylindrica cylindrica*) mussels, proposed for listing as endangered and threatened species, respectively, under the Endangered Species Act of 1973 (ESA), as amended. The proposed rule to list the species and designate critical habitat was published in the *Federal Register* on October 16, 2012 (77 FR 63440). This EA is used by the Service to decide whether critical habitat will be designated as proposed, if the proposed action requires refinement, or if further analyses are needed through preparation of an Environmental Impact Statement. If the proposed action is selected as described or with minimal changes and no further environmental analyses are needed, a Finding of No Significant Impact (FONSI) would be prepared. This EA has been prepared pursuant to the requirements of the National Environmental Policy Act of 1969 (NEPA) as implemented by the Council on Environmental Quality (CEQ) regulations 40 Code of Federal Regulations (CFR) Part 1500 *et seq.* and USDI NEPA procedures.

The Neosho mucket was first identified as a candidate for protection under the ESA in the May 22, 1984 *Federal Register* (49 FR 21664). As a candidate, it was assigned a status Category 2 designation, which was given to those species with some evidence of vulnerability but for which additional biological information was needed to support a proposed rule to list as endangered or threatened. In our Notices of Review dated January 6, 1989 (54 FR 554), November 21, 1991 (56 FR 58804), and November 15, 1994 (59 FR 58982), we retained a status Category 2 designation for this species. We discontinued assigning categories to candidate species in our Notice of Review dated February 28, 1996 (61 FR 7596), and only species for which the Service had sufficient information on biological vulnerability and threats to support issuance of a proposed rule were regarded as candidate species.

On October 30, 2001, we listed the Neosho mucket in the *Federal Register* (66 FR 54808) as a candidate species with a listing priority number (LPN) of 5. Candidate species are assigned LPNs based on immediacy and magnitude of threats, as well as taxonomic status. The lower the LPN, the higher priority that species is for us to determine appropriate action using our available resources. In our Notices of Review dated June 13, 2002 (67 FR 40657) and May 4, 2004 (69 FR 24876) we maintained a LPN of 5. We published a petition finding for the Neosho mucket on May 11, 2005 (70 FR 24870) in response to a petition received on May 11, 2004 stating in the finding that the Neosho mucket would retain a LPN of 5. In our Notices of Review dated September 12, 2006 (71 FR 53756), December 6, 2007 (72 FR 69034), and December 8, 2008 (73 FR 75176), we maintained a LPN of 5, reflecting the non-imminent threats of high magnitude. The LPN was elevated to 2 in our Notice of Review dated November 10, 2010 (75 FR 69222) to reflect the change from non-imminent to imminent threats of high magnitude.

The rabbitsfoot was first identified as a candidate for protection under the ESA in the November 15, 1994 *Federal Register* (59 FR 58982). As a candidate, it was assigned a status Category 2 designation. The category 2 list was eliminated in 1996 (61 FR 7596). On November 9, 2009, we added the rabbitsfoot to our candidate list in the *Federal Register* (74 FR 57804) with a LPN of 9. A LPN of 9 indicates threats of a moderate magnitude but are imminent overall. In our Notice of Review dated November 10, 2010 (75 FR 69222), it was again identified as a candidate species with a LPN of 9.

1.2 Purpose and Need of the Action

Preservation of the habitat of an endangered species is a crucial element for the conservation of that species. A primary purpose of the ESA is to "provide a means whereby the ecosystems upon which endangered species and threatened species may be conserved" (section 2[b]). The purpose of critical habitat designation as specified in the ESA is to provide protection of habitat that is essential to the conservation of listed species. The purpose of this action is to consider the designation of critical habitat for the Neosho mucket and rabbitsfoot being proposed for listing under the ESA as endangered and threatened, respectively.

The ESA defines critical habitat as follows ((16 U.S.C. §1532(5)(A)):

> The term “critical habitat” for a threatened or endangered species means—
> (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the ESA on which are found those physical or biological features
> (I) essential to the conservation of the species and
> (II) which may require special management considerations or protection; and
> (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the ESA, upon a determination by the Secretary that such areas are essential for the conservation of the species.

The designation also describes the elements of physical and biological features that provide for the species’ life-history processes and are essential to the conservation of the species. These are known as the primary constituent elements (PCEs).

This action complies with the ESA Section 4(a)(3)(A), which requires the Secretary of the Interior to designate critical habitat if such a designation is prudent and determinable. Habitat protection and management is needed for the conservation of the Neosho mucket and rabbitsfoot, as both species populations are highly fragmented and restricted to short stream reaches in their ranges with the threats occurring throughout their ranges. The Service found the designation prudent because there could be some benefit to both species from communicating the need for habitat protection and management and through section 7 consultations if a Federal action were proposed that may affect critical habitat. The Service also found the designation of critical habitat determinable because the basic information about the location of both species and their habitat use are known.

1.3 Proposed Action

The Proposed Action (Alternative B) consists of eight units to be designated as critical habitat for the Neosho mucket in Arkansas, Kansas, Missouri and Oklahoma and 35 units for the rabbitsfoot in Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, and Tennessee. These critical habitat areas constitute the Service's current best assessment of areas that meet the definition of critical habitat for the species. The proposed units are described in Section 2.3 of this document and incorporated herein by reference to the proposed listing and critical habitat rule (77 FR 63440). In total, approximately 779 river kilometers (rkm) (484 river miles (rmi)) in the Elk, Fall, Illinois, Neosho, Shoal, Spring, North Fork Spring, Cottonwood, and Verdigris Rivers are being proposed for designation as critical habitat for the Neosho mucket in Arkansas, Kansas, Missouri, and Oklahoma. In total, approximately 2,664 rkm (1,655 rmi) in the Neosho, Spring (Arkansas River system), Verdigris, Black, Buffalo, Little, Ouachita, Saline, Middle Fork Little Red, Spring (White River system), South Fork Spring, Strawberry, White, St. Francis, Big Sunflower, Big Black, Paint Rock, Duck, Tennessee, Red, Ohio, Allegheny, Green, Tippecanoe, Walhonding, Middle Branch North Fork Vermilion, and North Fork Vermilion Rivers and Bear, French, Muddy, Little Darby and Fish Creeks in Alabama, Arkansas, Kansas, Kentucky, Illinois, Indiana, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, and Tennessee are being proposed for designation as critical habitat for the rabbitsfoot. The proposed units are described briefly in section 2.3 in this document and incorporated herein by reference to the proposed listing and critical habitat rule (77 FR 63440).

1.4 Background

1.4.1 Critical Habitat

In section 3(5)(A) of the ESA, critical habitat is defined as (i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the provisions of section 4 of the ESA, on which are found those physical or biological features (1) essential to the conservation of the species and (2) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the ESA, upon the determination by the Secretary of the Interior that such areas are essential for the conservation of the species. Section 3(5)(C) also states that critical habitat "shall not include the entire geographic area which can be occupied by the threatened or endangered species," except when the Secretary of the Interior determines that the areas are essential for the conservation of the species. For these areas, critical habitat designations identify, to the extent known using the best scientific data available, those physical or biological features that are essential to the conservation of the species (such as space, food, cover, and protected habitat). In identifying those physical and biological features within an area, we focus on the principal biological or physical constituent elements (PCEs such as roost sites, nesting grounds, seasonal wetlands, water quality, tide, soil type) that are essential to the conservation of the species. PCEs are the elements of physical or biological features that provide for a species' life-history processes, are essential to the conservation of the species.

In accordance with section 3(5)(A)(i) and 4(b)(1)(A) of the ESA and regulations at 50 CFR 424.12, in determining which areas within the geographic area occupied by the species at the

time of listing to designate as critical habitat, we consider the physical or biological features that are essential to the conservation of the species and which may require special management considerations or protection. These include, but are not limited to:

(1) Space for individual and population growth and for normal behavior;
(2) Food, water, air, light, minerals, or other nutritional or physiological requirements;
(3) Cover or shelter;
(4) Sites for breeding, reproduction, or rearing (or development) of offspring; and
(5) Habitats that are protected from disturbance or are representative of the historical, geographic, and ecological distributions of a species.

When we are determining which areas should be designated as critical habitat, our primary source of information is generally the information developed during the listing process for the species.

Based on the above needs and our current knowledge of the physical and biological features and habitat characteristics required to sustain the species' life-history processes, we determined that the PCEs specific to the Neosho mucket and rabbitsfoot are flowing waters, geomorphically stable river channels and banks with suitable substrate , an appropriate hydrologic flow regime, adequate water and sediment quality, adequate food, the presence and abundance of fish hosts necessary for recruitment, and few or no competitive or predaceous invasive (nonnative) species.

When designating critical habitat, we assess whether the specific areas within the geographic area occupied by the species at the time of listing contain features which are essential to the conservation of the species and which may require special management considerations or protection. Habitat is dynamic, and species may move from one area to another over time. We recognize that critical habitat designated at a particular point in time may not include all of the habitat areas that we may later determine are necessary for the recovery of the species. For these reasons, a critical habitat designation does not signal that habitat outside the designated area is unimportant or may not be needed for recovery of the species.

As required by section 4(b)(2) of the ESA, we use the best scientific data available to designate critical habitat. We review available information and information developed during the listing process pertaining to the habitat requirements of the species. In accordance with the ESA and its implementing regulation at 50 CFR 424.12(e), we consider whether designating additional areas—outside those currently occupied as well as those occupied at the time of listing—are necessary to ensure the conservation of the species. We are not currently proposing to designate any areas outside the geographic area occupied by either species because occupied areas are sufficient for the conservation of both species.

When determining proposed critical habitat boundaries, we made every effort to avoid including developed areas such as lands or waters that include structures such as buildings (powerhouses), dams, groins, because such structures usually lack physical or biological features for the species. Areas proposed as critical habitat for the Neosho mucket and rabbitsfoot include only stream channels within the ordinary high water line, and do not contain any developed areas, structures, or areas inundated by lakes and reservoirs. The ordinary high water line defines the stream

channel and is the point on the stream bank where water is continuous and leaves some evidence, such as erosion or aquatic vegetation.

We proposed designation of critical habitat areas that we have determined are occupied at the time of listing and contain sufficient elements of physical or biological features to support life-history processes essential for the conservation of the Neosho mucket and the rabbitsfoot. We have defined occupied habitat for the Neosho mucket as those stream reaches known to be currently extant. For the rabbitsfoot, we have defined occupied habitat as those stream reaches that are sizeable and small populations as defined by Butler (2005), and the marginal populations of Fish Creek, Red River and Allegheny River that are the last extant populations in their respective basins (Great Lakes and Cumberland) and a metapopulation.

The Neosho mucket and rabbitsfoot persist in scattered portions of 40 different rivers and creeks proposed as critical habitat. Distribution and status information pertaining to the Neosho mucket and rabbitsfoot were discussed in the *ENDANGERED STATUS FOR NEOSHO MUCKET AND THREATENED STATUS FOR RABBITSFOOT* section of the proposed listing (77 FR 63440). River habitats are highly dependent upon upstream and downstream channel habitat conditions for their maintenance. Therefore, where one occurrence record was known from a river reach, we considered the entire reach between the uppermost and lowermost locations as occupied habitat, as discussed below, except lakes and reservoirs. We find that unoccupied stream reaches are not essential for the conservation of either species for one or more of the following reasons: (1) Unoccupied habitats are isolated from occupied habitats due to reservoir construction and dam operations (dam water releases have altered natural stream hydrology, geomorphology, water temperature, and native mollusk and fish communities); (2) Unoccupied areas exhibit limited habitat availability, degraded habitat, or low potential value for management; (3) Collection records for these species indicate that these species have been extirpated from unoccupied areas for several decades or more; or (4) There are no historical records of occurrence within the stream reach for Neosho mucket, rabbitsfoot, or both. Our analysis concludes that inclusion of unoccupied habitats is not essential to conserve these species.
A total of 43 units were proposed for designation based on sufficient elements of physical or biological features being present to support Neosho mucket (8 units) and rabbitsfoot (35 units) life-history processes. Some units contained all of the identified elements of physical or biological features and supported multiple life-history processes. Some units contained only some elements of the physical or biological features necessary to support the Neosho mucket and rabbitsfoot particular use of that habitat.

In summary, areas we are proposing as critical habitat that are occupied at the time of listing contain the features essential to the conservation of the Neosho mucket and rabbitsfoot, and that these features may require special management considerations or protections. Special management considerations or protections may be required to eliminate, or to reduce to negligible levels, the threats affecting each unit and to preserve and maintain the essential physical and biological features that the proposed critical habitat units provide to the Neosho mucket and rabbitsfoot. Additional discussions of threats facing individual sites are provided in the individual unit descriptions.

In total, approximately 779 river kilometers (rkm) (484 river miles (rmi)) in the Elk, Fall, Illinois, Neosho, Shoal, Spring, North Fork Spring, and Verdigris Rivers are being proposed for designation as critical habitat for the Neosho mucket in Arkansas, Kansas, Missouri, and Oklahoma. The proposed critical habitat for the Neosho mucket is located in Benton and Washington Counties, Arkansas; Jasper, Lawrence, Newton, and McDonald Counties, Missouri; Allen, Chase, Cherokee, Coffey, Elk, Greenwood, Labette, Montgomery, Neosho, Wilson, and Woodson Counties, Kansas; and Adair, Delaware, and Cherokee Counties, Oklahoma. In total, for the rabbitsfoot, approximately 2,664 rkm (1,655 rmi) in the Neosho, Spring (Arkansas River system), Verdigris, Black, Buffalo, Little, Ouachita, Saline, Middle Fork Little Red, Spring (White River system), South Fork Spring, Strawberry, White, St. Francis, Big Sunflower, Big Black, Paint Rock, Duck, Tennessee, Red, Ohio, Allegheny, Green, Tippecanoe, Walhonding, Middle Branch North Fork Vermilion, and North Fork Vermilion Rivers and Bear, French, Muddy, Little Darby and Fish Creeks in Alabama, Arkansas, Kansas, Kentucky, Illinois, Indiana, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, and Tennessee are being proposed for designation as critical habitat for the rabbitsfoot. The proposed critical habitat for the rabbitsfoot is located in Colbert, Jackson, Madison, and Marshall Counties, Alabama; Ashley, Arkansas, Bradley, Clark, Cleburne, Cleveland, Dallas, Drew, Fulton, Grant, Hot Spring, Independence, Izard, Jackson, Lawrence, Little River, Marion, Monroe, Montgomery, Newton, Ouachita, Randolph, Saline, Searcy, Sevier, Sharp, Van Buren, White, and Woodruff Counties, Arkansas; Allen and Cherokee Counties, Kansas; Carroll, Pulaski, Tippecanoe, and White Counties, Indiana; Massac, Pulaski, and Vermilion Counties, Illinois; Ballard, Edmonson, Green, Hart, Livingston, Logan, Marshall, and McCracken Counties, Kentucky; Hinds, Sunflower, Toshimingo, and Warren Counties, Mississippi; Jasper, Madison, and Wayne Counties, Missouri; Coshocton, Madison, Union, and Williams Counties, Ohio; McCurtain and Rogers Counties, Oklahoma; Crawford, Erie, Mercer, and Venango Counties, Pennsylvania; and Hardin, Hickman, Humphreys, Marshall, Maury, Montgomery, Perry and Robertson Counties, Tennessee.

Three critical habitat units proposed for the Neosho mucket and rabbitsfoot are currently designated under the ESA for the oyster mussel (*Epioblasma capsaeformis*) (Duck River Dartersnapper), and Cumberlandian combshell (*Epioblasma brevidens*) encompassing the Duck River, Tennessee (74 rkm,46 rmi) and Bear Creek, Alabama and Mississippi (40 rkm, 25 rmi) (50 CFR part 17.95(f)), and for the yellowcheek darter (*Etheostoma moorei*) in the Middle Fork Little Red River, Arkansas (23.2 rkm, 14.5 rmi; 50 CFR part 17.95(e)). The existing critical habitat for the oyster mussel (Duck River Dartersnapper), Cumberlandian combshell, and yellowcheek darter completely overlaps Units RF7 (Middle Fork Little Red River), RF16 (Bear Creek) and RF19 (Duck River), but the exact unit descriptions for (length) differ due to mapping refinement since the earlier designation. In addition, five critical habitat units proposed for the Neosho mucket and rabbitsfoot are currently designated by the State of Kansas as critical habitat for both species in the Fall, Spring, Neosho, Cottonwood River, and Verdigris Rivers and Neosho mucket in Shoal Creek (K.S.A. 32–959; Table 1) and are afforded similar state-level protections as those provided under the ESA. No other critical habitat units proposed for these species have been designated or proposed as critical habitat for other species under the ESA.

Table 1. Critical habitat proposed for the Neosho mucket and rabbitsfoot which are currently designated as critical habitat for other federally and State listed species.

Proposed critical habitat unit Neosho mucket – NM Unit # **Rabbitsfoot – RF Unit#**	**Species Present in Unit**	**Federal Reference**	**State Reference**	**Length of overlap (rkm/rmi)**
Shoal Creek (NM3)	Neosho mucket, fluted shell, Ouachita kidneyshell, Western fanshell, redspot chub		Kansas Statutes Annontated 32–959	9.7/6.0
Spring River (NM4 and RF1)	Neosho mucket, rabbitsfoot, elktoe, ellipse shell, Neosho madtom, fluted shell, Ouachita kidneyshell, Western fanshell, redspot chub		Kansas Statutes Annotated 32–959	11.6/7.2
Fall River (NM6)	Neosho mucket, Western fanshell		Kansas Statutes Annotated 32–959	90.4/56.2
Verdigris River (NM6 and RF2)	Neosho mucket, rabbitsfoot, Ouachita kidneyshell, western		Kansas Statutes Annotated 32–959	80.6/50.1

Proposed critical habitat unit Neosho mucket – NM Unit # Rabbitsfoot – RF Unit#	Species Present in Unit	Federal Reference	State Reference	Length of overlap (rkm/rmi)
	fanshell, butterfly…..			
Neosho River (NM7 and RF3)	Neosho mucket, rabbitsfoot, butterfly, Neosho madtom, Ouachita kidneyshell, western fanshell		Kansas Statutes Annotated 32–959	245.9/152.8
Cottonwood River (NM8)	Neosho mucket, rabbitsfoot, butterfly, Ouachita kidneyshell, western fanshell		Kansas Statutes Annotated 32–959	2.6/1.6
Middle Fork Little Red River (RF7)	Yellowcheek darter	77 FR 63603, October 16, 2012		23.3/14.5
Bear Creek (RF16)	Oyster mussel (Duck River Dartersnapper), Cumberland combshell	50 CFR 17.95(f)		49.7/30.9

Proposed critical habitat unit Neosho mucket – NM Unit # Rabbitsfoot – RF Unit#	Species Present in Unit	Federal Reference	State Reference	Length of overlap (rkm/rmi)
Duck River (RF19)	Oyster mussel (Duck River Dartersnapper), Cumberland Combshell	50 CFR 17.95(f)		74.0/46.0
Total	……	……	……	*587.9/365.3*

1.4.1.1 Provisions of the ESA

Section 4(a)(3) of the ESA states that critical habitat shall be designated to the maximum extent prudent and determinable and that such designation may be revised periodically as appropriate. Section 4(b)(2) of the ESA requires that critical habitat designation be based on the best scientific information available and that economic, national security, and other relevant impacts must be considered. Areas may be excluded from critical habitat designation if it is determined that the benefits of exclusion outweigh the benefits of inclusion unless, based on the best available scientific and commercial data available, the failure to include the areas in critical habitat would result in the extinction of the species.

1.4.1.2 Section 4(b)(2) Exclusion Process

Section 4(b)(2) of the ESA allows the Secretary of the Interior to exclude any area from the critical habitat designation after considering the economic, national security, or other relevant impacts of designating the area or if the Secretary determines that the benefit of excluding the area exceeds the benefit of designating it as critical habitat, unless the exclusion would result in the extinction of the species. After reviewing public comments on the critical habitat proposal, this draft EA, and the draft economic analysis, the Secretary will decide whether to designate critical habitat for the Neosho mucket and rabbitsfoot and, if so, according to which of the alternatives described in Chapter 2. This is as provided for in ESA section 4(b)(2) and in implementing regulations at 50 CFR Part 424.19.

1.4.1.3 Section 7 Consultation Process

Section 7(a)(2) of the ESA requires Federal agencies to consult with the Service to “ensure 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 which is determined to be critical." Each agency is required to use the best scientific and commercial data available. This consultation process is typically referred to as s*ection 7 consultation*. Section 7 of the ESA does not apply to state, local, or private land unless there is a Federal nexus (i.e., Federal funding, authorization, or permitting). Designation of critical habitat can help focus conservation efforts by identifying areas that are essential for the conservation of the species. Designation of critical habitat also serves to alert the public and land management agencies to the importance of an area for conservation of a listed species. As described above, critical habitat receives protection from destruction or adverse modification through required consultation under section 7 of the ESA. Aside from outcomes of consultation with the Service under section 7, the ESA does not automatically impose any restrictions on lands designated as critical habitat.

We describe the relevant aspects of the consultation process below and discuss in later sections the types of activities that were evaluated as possibly requiring section 7 consultation.

The section 7 consultation process begins with a determination of the effects on a listed species and designated critical habitat by a Federal action agency (Figure 1). If the Federal action agency determines that there would be no effect on listed species or designated critical habitat, then the section 7 consultation process concludes at that point. If the Federal action agency determines that listed species or designated critical habitat may be affected, then consultation with the Service is initiated. Once it is determined that the proposed Federal action may affect a listed species or critical habitat, the Federal action agency and the Service may enter into informal section 7 consultation. Informal consultation is an optional process for identifying affected species and critical habitat, determining potential effects, and exploring ways to modify the action to remove or reduce adverse effects on listed species or critical habitat (50 CFR Part 402.13). During this process the Service may make suggestions concerning project modifications, which then can be adopted by the action agency.

The informal section 7 consultation process concludes in one of two ways: (1) the Service concurs in writing that the proposed action is not likely to adversely affect listed species or critical habitat, or (2) the Service determines that adverse effects are likely to occur. Formal consultation is initiated when it is determined that the proposed Federal action is likely to adversely affect listed species or critical habitat (50 CFR Part 402.14). Formal consultation concludes with a biological opinion issued by the Service on whether the proposed Federal action is likely to jeopardize the continued existence of a listed species or to destroy or adversely modify critical habitat (50 CFR Part 402.14[h]) (Figure 1 simplifies the end of the process by stating "End Consultation"; more precisely, consultations are formally concluded with the issuance of the Biological Opinion).

Independent analyses are made under both the jeopardy and the adverse modification standards. While the jeopardy analysis evaluates potential impacts on the species as described above, the adverse modifications analysis specifically evaluates potential impacts on designated critical habitat. In making a determination on whether an action will result in jeopardy, the Service begins by looking at the current status of the species, or "baseline." Added to the baseline are the various effects – direct, indirect, interrelated, and interdependent – of the proposed Federal

action. The Service also examines the cumulative effects of other non-Federal actions that may occur in the action area, including state, tribal, local, or private activities that are reasonably certain to occur in the project area. The Service's analysis is then measured against the definition of jeopardy. Under the ESA, jeopardy occurs when an action is reasonably expected, directly or indirectly, to diminish a species' numbers, reproduction, or distribution so that the likelihood of survival and recovery in the wild is appreciably reduced.

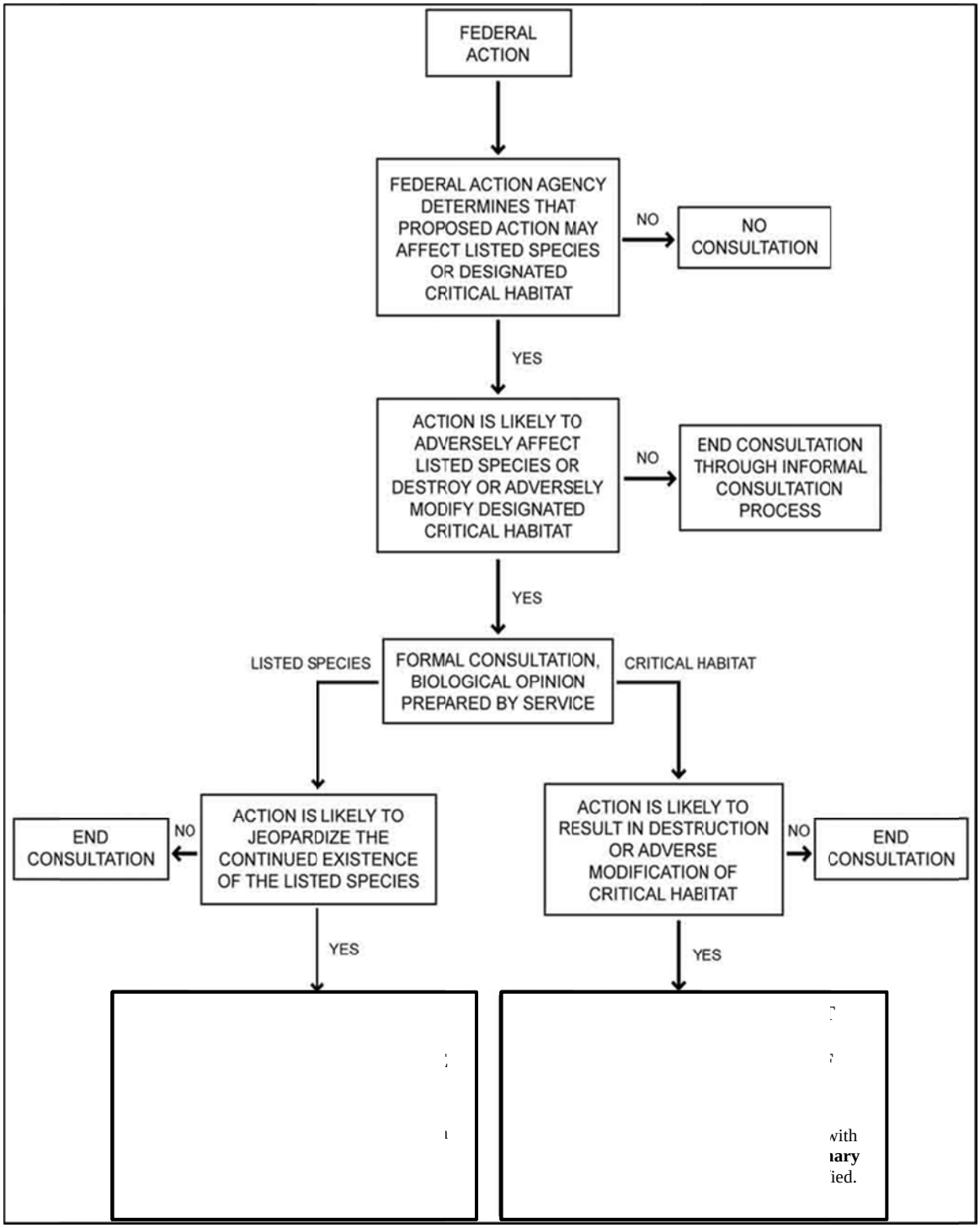


Figure 2. Simplified Diagram of the ESA Section 7 Process

Decisions by the 5th and 9th Circuit Courts of Appeals have invalidated our regulatory definition of "destruction or adverse modification" (50 CFR 402.02) (see *Gifford Pinchot Task Force* v. *U.S. Fish and Wildlife Service*, 378 F. 3d 1059 (9th Cir. 2004) and *Sierra Club* v. *U.S. Fish and Wildlife Service et al*., 245 F.3d 434, 442 (5th Cir. 2001)), and we do not rely on this regulatory definition when analyzing whether an action is likely to destroy or adversely modify critical habitat. Under the provisions of the ESA, we determine destruction or adverse modification on the basis of whether, with implementation of the proposed Federal action, the affected critical habitat would continue to serve its intended conservation role for the species.

Critical habitat is defined in section 3(5)(A) of the ESA as those areas that are essential for conservation of the species, and the definition of conservation includes species recovery. An activity adversely affecting critical habitat must be of a severity or intensity that the PCEs are compromised to the extent that the critical habitat can no longer meet its intended conservation function before a destruction or adverse modification determination is reached.

A "non-jeopardy" or "no adverse modification" biological opinion concludes consultation, and the proposed action may proceed under the ESA. The Service may prepare an incidental take statement with reasonable and prudent measures to minimize take and associated, mandatory terms and conditions that describe the methods for accomplishing the reasonable and prudent measures. Discretionary conservation recommendations may be included in a biological opinion based on the effects on the species. Conservation recommendations, whether they relate to the jeopardy or adverse modification standard, are discretionary actions recommended by the Service. These recommendations may address minimizing adverse effects on listed species or critical habitat, identifying studies or monitoring, or suggesting how action agencies can assist species under their own authorities and section 7(a)(1) of the ESA.

There are no ESA section 9 prohibitions for critical habitat. Therefore, a biological opinion that concludes no destruction or adverse modification of critical habitat may contain conservation recommendations but would not include an incidental take statement, reasonable and prudent measures, or mandatory terms and conditions. In a biological opinion that results in a jeopardy or adverse modification conclusion, the Service develops mandatory reasonable and prudent alternatives to the proposed action. Reasonable and prudent alternatives are actions that the Federal agency can take to avoid jeopardizing the continued existence of the species or adversely modifying the critical habitat. Reasonable and prudent alternatives may vary from minimal project changes to extensive redesign or relocation of the project, depending on the situations involved. Reasonable and prudent alternatives must be consistent with the intended purpose of the proposed action, and they also must be consistent with the scope of the Federal agency's legal authority. Furthermore, the reasonable and prudent alternatives must be economically and technically feasible.

1.4.1.3 Proposed Primary Constituent Elements for Neosho mucket and rabbitsfoot

For inclusion in a critical habitat designation, the habitat within the geographical area occupied by the species at the time it was listed must contain physical and biological features essential to the conservation of the species and be included only if those features may require special management considerations or protection. Critical habitat designations identify, to the extent known using the best scientific and commercial data available, those physical and biological features that are essential to the conservation of the species (such as space, food, cover, and protected habitat), focusing on the PCEs within an area that are essential to the conservation of the species (such as roost sites, nesting grounds, seasonal wetlands, water quality, tide, soil type). We consider PCEs as those specific elements of the physical or biological features that provide for a species' life-history processes and are essential to the conservation of the species.

The following briefly summarizes key information about the Neosho mucket and rabbitsfoot and the PCEs that are essential to the conservation of these species. Based on the above needs and our current knowledge of the physical and biological features and habitat characteristics required to sustain the species' life-history processes, the Service has determined that the PCEs specific to the Neosho mucket and rabbitsfoot are:

(1) Geomorphically stable river channels and banks (channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as, stable riffles, sometimes with runs, and mid–channel island habitats that provide flow refuges consisting of gravel and sand substrates with low to moderate amounts of fine sediment and attached filamentous algae).

(2) A hydrologic flow regime (the magnitude, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species are found and to maintain connectivity of rivers with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the mussels and fish hosts habitat, food availability, spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats.

(3) Water and sediment quality (including, but not limited to, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.

(4) The presence and abundance (currently unknown) of fish hosts necessary for recruitment of the Neosho mucket and rabbitsfoot. The occurrence of natural fish assemblages, reflected by fish species richness, relative abundance, and community composition, for each inhabited river or creek will serve as an indication of appropriate presence and abundance of fish hosts until appropriate host fish can be identified.

(5) Few or no competitive or predaceous invasive (nonnative) species in quantities low enough to have minimal effect on survival of freshwater mussels.

The decline of the Neosho mucket and rabbitsfoot is primarily the result of habitat loss and degradation. Chief among the causes of decline, but in no particular ranking order, are

impoundments, sedimentation, channelization, chemical contaminants, oil and natural gas development, and mining. These stressors have had profound adverse effects on Neosho mucket and rabbitsfoot populations, their habitats, and fish hosts. Although there are ongoing attempts to alleviate some of these threats at some locations, there appear to be no populations without current significant threats.

1.4.2 Background Information on the Neosho mucket and rabbitsfoot

For a more detailed description of the Neosho mucket and rabbitsfoot life history, habitat, and distribution, consult the proposed listing and critical habitat rule (76 FR 46218).

1.5 Permits Required for Implementation

No permits are required for critical habitat designation. Designation of critical habitat occurs through a rulemaking process under the Administrative Procedures Act (5 U.S.C. §551–59, 701–06, 1305, 3105, 3344, 5372, 7521) and the ESA.

1.6 Related Laws, Authorizations, and Plans

Related provisions of the ESA require Federal agencies to consult with the Service when there are potential effects to endangered or threatened species, independent of critical habitat. The ESA also prohibits any person from "taking" the species without a permit from the Service. Other Federal laws address various conservation aspects of fish and wildlife and their habitat, which apply to the Neosho mucket and rabbitsfoot. In addition, both species are listed as State of Kansas endangered species with critical habitat in the Fall, Spring, Neosho, Cottonwood, and Verdigris Rivers and Shoal Creek (K.S.A. 32-959; Table 1). This listing affords them similar state-level protections as those provided under the ESA. Rabbitsfoot also is listed as a state endangered species in Pennsylvania (39 Pennsylvania Bulletin 3442).

1.7 Issues and Concerns from Public Comments

Issues are defined as concerns about the potential effects of the proposed action. Issues associated with designation of critical habitat were identified in written comments received during the public comment period for the proposed listing and designation of critical habitat for both species that closed December 17, 2012 (77 FR 63439). The Service received 18 comments from the proposed listing and critical habitat designation. Of the 18 comments, eight were not directly related to potential effects of the proposed critical habitat listing and, therefore, are not considered to be issues. Remaining comments from the public related to potential (real or perceived) effects of the proposed action are summarized below:

- Critical habitat designation may lead to increased public costs for highway departments and other public entities as well as an increase in formal consultations on transportation projects.
- Critical habitat designation may have an effect on the Corps of Engineers from an operation and regulatory perspective and on navigation and maintenance activities.

- Critical habitat designation may or may not contribute to the conservation of the two mussel species.
- Critical habitat designation may lead to an increase in consultations, related to the hauling of hazardous materials through designated critical habitat.
- Critical habitat designation for the Shanango River should be expanded to include the entire Shenango River from Pymatuning Dam down to Shenango River Lake.

1.8 Topics Analyzed in Detail in this Environmental Assessment

Federal regulations (40 CFR §1500 et seq.) require that certain topics be addressed as part of a NEPA analysis. The Service analyzed the potential impacts of critical habitat designation on the following resources:

- Conservation of the Neosho mucket and Rabbitsfoot
- Water Resources (including water management projects and surface and groundwater diversion)
- Energy Development and Production (including natural gas, oil, coal and other minerals)
- Socioeconomic and Environmental Justice

1.8.1 Topics Considered But Dismissed from Detailed Analysis

Federal regulations (40 CFR §1500 et seq.) require that certain topics be addressed as part of a NEPA analysis. The Service reviewed the mandatory topics listed below and determined that the proposed action has no potential to affect them. These topics have been dismissed from detailed analysis in this document because designation of critical habitat for the Neosho mucket and rabbitsfoot is likely to have no or, at most, negligible effect on them.

- *Energy requirements and conservation potential (1502.16)*. Additional section 7 consultations resulting from critical habitat designation of the Neosho mucket and rabbitsfoot would not require any increase in energy consumption in the form of fuel for vehicles or from other conservation actions.

- *Urban quality and design of the built environment (1502.16)*. The proposed critical habitat segments are not located in urban or other built environments and would not affect the quality of such environments.

- *Prime and unique agricultural lands (1508.27)*. Prime agricultural land is defined (7 U.S.C. 4202(a)) as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses. Unique agricultural land is defined as land other than prime farmland that is used for the production of specific high-value food and fiber crops (e.g., citrus, tree nuts, olive, cranberries, fruits, and vegetables). Further, regulations for the Farmland Protection Policy Act (7 CFR 658.2) exclude Federal permitting and licensing activities ("program activities") on private lands, so consultations triggered by critical

habitat designation would have no impact on this prime agricultural land. For these reasons, this topic is dismissed from further consideration.

- Important scientific, archeological, and other cultural resources, including historic properties listed in or eligible for the National Register of Historic Places (NRHP) (1508.27). The proposed designation would not result in any ground-disturbing activities that have the potential to affect archeological or other cultural resources. There are no NRHP-listed historical sites within, or within close range of, critical habitat units.

- *Public health and safety (1508.27).* These topics are not analyzed in detail in this EA because the potential for effects from designation of critical habitat are negligible, due to the distance of the proposed units from activities that could impact public health and safety, such as fire management or construction of access roads from residential development.

- *Wetlands.* No wetlands would be lost or altered as a result of designating critical habitat for the Neosho mucket and rabbitsfoot.

- *Other socioeconomic impacts*—All the areas proposed for critical habitat are waters owned by the States. There are current uses of these areas that involve a Federal nexus (navigation, water supply, transportation, etc.). Consequently, there may be direct economic impacts of designating these units, since designation of critical habitat may impose restrictions where an action is funded, permitted, or conducted by the Federal government. Where areas adjacent to the critical habitat may be owned by a federal, State, local, or private entity, the potential may exist for indirect impacts of critical habitat designation in the form of a stigma effect (IEc, 2013, 2-14).

  A stigma effect occurs when the public perceives that critical habitat designation may result in limitations on private property uses above and beyond those associated with section 7 consultations. Public attitudes about the limits or restrictions that critical habitat may impose can cause real economic effects to property owners, regardless of whether such limits are actually imposed. All else equal, a property that is designated as critical habitat may have a lower market value than an identical property that is not within the boundaries of critical habitat due to perceived limitations or restrictions on future uses.

  Data limitations prevent the quantification of such a stigma effect. Specifically, the Service does not have information regarding the magnitude of the potential effect (e.g., the percentage reduction in unit value) or the extent of the effect (e.g., the effect might be limited to the acres proposed for critical habitat or could extend to include the entire parcel encompassing each unit).

- *Impacts to Small Entities*-- When a Federal agency proposes a regulation, the Regulatory Flexibility Act (RFA) requires the agency to prepare and make available for public comment an analysis that describes the effect of the rule on small entities (i.e., small businesses, small organizations, and small government jurisdictions as defined by the RFA). No initial regulatory flexibility analysis is required if the head of an agency certifies that the rule will not have a significant economic impact on a substantial number

of small entities. SBREFA amended the RFA to require Federal agencies to provide a statement of the factual basis for certifying a rule.

According to the Small Business Administration, small entities include small organizations such as independent nonprofit organizations; small governmental jurisdictions, including school boards and city and town governments that serve fewer than 50,000 residents; and small businesses (13 CFR 121.201). Small businesses include such businesses as manufacturing and mining concerns with fewer than 500 employees, wholesale trade entities with fewer than 100 employees, retail and service businesses with less than $5 million in annual sales, general and heavy construction businesses with less than $27.5 million in annual business, special trade contractors doing less than $11.5 million in annual business, and forestry and logging operations with fewer than 500 employees and annual business less than $7 million. To determine if potential economic impacts on these small entities are significant, we will consider the types of activities that might trigger regulatory impacts under this designation as well as types of project modifications that may result. In general, the term "significant economic impact" is meant to apply to a typical small business firm's business operations.

- Importantly, the incremental impacts of a rule must be *both* significant and substantial to prevent certification of the rule under the RFA and to require the preparation of an initial regulatory flexibility analysis. If a substantial number of small entities are affected by the proposed critical habitat designation, but the per-entity economic impact is not significant, the Service may certify. Likewise, if the per-entity economic impact is likely to be significant, but the number of affected entities is not substantial, the Service may also certify.

- The Service's current understanding of recent case law is that Federal agencies are only required to evaluate the potential impacts of rulemaking on those entities directly regulated by the rulemaking; therefore, they are not required to evaluate the potential impacts to those entities not directly regulated. The designation of critical habitat for an endangered or threatened species only has a regulatory effect where a Federal action agency is involved in a particular action that may affect the designated critical habitat. Under these circumstances, only the Federal action agency is directly regulated by this designation, and, therefore, the Service may limit its evaluation of the potential impacts to those identified for Federal action agencies. Under this interpretation, there is no requirement under the RFA to evaluate the potential impacts to entities not directly regulated, such as small businesses. However, Executive Orders 12866 and 13563 direct Federal agencies to assess costs and benefits of available regulatory alternatives in quantitative (to the extent feasible) and qualitative terms. Consequently, it is the current practice of the Service to assess to the extent practicable these potential impacts if sufficient data are available, whether or not this analysis is believed by the Service to be strictly required by the RFA. In other words, while the effects analysis required under the RFA is limited to entities directly regulated by the rulemaking, the effects analysis under the ESA, consistent with the Executive Order regulatory analysis requirements, can take into consideration impacts to both directly and indirectly impacted entities, where practicable and reasonable.

- We acknowledge, however, that in some cases, third-party proponents of the action subject to permitting or funding may participate in a section 7 consultation, and thus may be indirectly affected. We believe it is good policy to assess these impacts if we have sufficient data before us to complete the necessary analysis, whether or not this analysis is strictly required by the RFA. While this regulation does not directly regulate these entities, in our draft economic analysis we will conduct a brief evaluation of the potential number of third parties participating in consultations on an annual basis in order to ensure a more complete examination of the incremental effects of this proposed rule in the context of the RFA.

- In conclusion, we believe that, based on our interpretation of directly regulated entities under the RFA and relevant case law, this designation of critical habitat will only directly regulate Federal agencies which are not by definition small business entities. And as such, certify that, if promulgated, this designation of critical habitat would not have a significant economic impact on a substantial number of small business entities. Therefore, an initial regulatory flexibility analysis is not required. However, though not necessarily required by the RFA, in our draft economic analysis for this proposal we will consider and evaluate the potential effects to third parties that may be involved with consultations with Federal action agencies related to this action.

1.9 Decision to be Made

Critical habitat is designated in a Federal rule-making process that includes publication of notices for the draft and final rule in the *Federal Register*. The draft rule notice solicits public comment. The decisions to be made by the Secretary are whether to list the Neosho mucket as endangered and the rabbitsfoot as threatened and whether to designate critical habitat for the Neosho mucket and rabbitsfoot.

CHAPTER 2
ALTERNATIVES, INCLUDING THE NO ACTION ALTERNATIVE

This section describes the alternatives for critical habitat designation for the Neosho mucket and rabbitsfoot. For the purposes of this EA, alternatives provide a clear basis for choice by the decision-maker and the public for critical habitat designation, as described in Chapter One, which can be summarized as determining which areas meet the definition of critical habitat for the Neosho mucket and rabbitsfoot. In addition, the analysis of alternatives can provide information in an evaluation if any of the proposed critical habitat units should be excluded from the final designation.

2.1 Development of Alternatives

In developing the action alternatives, the Service based decisions on the best scientific data available in determining areas within the geographical area occupied at the time of listing that contain the features essential to the conservation of the Neosho mucket and rabbitsfoot, and areas outside of the geographical area occupied at the time of listing that are essential for the conservation of the species.

Critical habitat units are proposed for designation based on sufficient PCEs being present to support the Neosho mucket's and rabbitsfoot's life history processes. All proposed units satisfy these criteria, as they are streams, creeks and rivers with the characteristics of geomorphically stable river channels and banks, hydrologic flow regimes, water and sediment quality, presence and abundance of fish hosts, either no competitive or predaceous invasive (nonnative) species, or such species in quantities low enough to have minimal effect on survival of freshwater mussels that constitute the PCEs. Habitat conditions described above provide space, cover, shelter, and sites for breeding, reproduction, and growth of offspring for the Neosho mucket and rabbitsfoot.

Based on the above criteria, the Service developed two alternatives for impact analysis:

- No Action Alternative, No critical habitat designation
- Proposed Alternative, Critical habitat designation

2.2 No Action Alternative

The No Action Alternative would be no designation of critical habitat for the Neosho mucket and rabbitsfoot. An analysis of a No Action Alternative is required by NEPA and provides a baseline for analyzing effects of the action alternatives. Analysis of this alternative describes the existing environment and consequences that are anticipated as a result of the proposed listing status of the species, without the designation of critical habitat (76 FR 46218). Therefore, this alternative would have no substantial effects beyond those incurred from the concurrent listing of the Neosho mucket as endangered and rabbitsfoot as threatened.

2.3 Proposed Alternative – Critical Habitat Designation

The proposed action alternative consists of designating eight units for Neosho mucket and 35 units for rabbitsfoot as critical habitat. We are proposing eight units, totaling approximately 779 rkm (484 rmi), in four states (Arkansas, Kansas, Missouri, and Oklahoma) as critical habitat for the Neosho mucket (Table 2). We are proposing 35 units, totaling approximately 2,664 rkm (1,655 rmi), in 12 states (Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Missouri, Mississippi, Oklahoma, Ohio, Pennsylvania, Tennessee) as critical habitat for the rabbitsfoot (Table 2). Four of the 43 units (Units NM4, NM7, RF1, and RF3), totaling approximately 82.6 rkm (51.6 rmi), are occupied by both Neosho mucket and rabbitsfoot (Table 2).

Table 2. Neosho mucket and rabbitsfoot proposed critical habitat units and length.

Species	Approximate river distances (all currently occupied by the species)	
	River km	River miles
Neosho mucket	779.1	484.1
Rabbitsfoot	2,663.9	1,655.2
Total	3,443.0	2,139.3
Neosho mucket:		
Unit NM1, Illinois River AR, OK	146.1	90.8
Unit NM2, Elk River, MO, KS	20.3	12.6
Unit NM3, Shoal Creek, KS, MO	75.8	47.1
Unit NM4, Spring River, KS, MO	102.3	63.6
Unit NM5, North Fork Spring River, MO	16.4	10.2
Unit NM6, Fall and Verdigris Rivers, KS	171.1	106.3
Unit NM7, Neosho River, KS	244.5	151.9
Unit NM8, Cottonwood River, KS	2.6	1.6

Total	779.1	484.1
Rabbitsfoot:		
Unit RF1, Spring River, KS, MO	56.5	35.1
Unit RF2, Verdigris River, OK	45.5	28.3
Unit RF3, Neosho River, KS	26.6	16.5
Unit RF4a, Ouachita River, AR	21.9	13.6
Unit RF4b, Ouachita River, AR	157.9	98.1
Unit RF5, Saline River, AR.	289.2	179.7
Unit RF6, Little River, AR, OK	139.7	86.8
Unit RF7, Middle Fork Little Red River, AR	24.8	15.4
Unit RF8a, White River, AR	188.3	117.0
Unit RF8b, White River, AR	68.9	42.8
Unit RF9, Black River, AR	92.2	57.3
Unit RF10, Spring River, AR	62.8	39.0
Unit RF11, South Fork Spring River, AR	16.4	10.2
Unit RF12, Strawberry River, AR	123.8	76.9
Unit RF13, Buffalo River, AR	113.6	70.6
Unit RF14, St. Francis River, MO	64.3	40.0
Unit RF15, Big Sunflower River, MS	51.5	32.0
Unit RF16, Bear Creek, AL, MS	49.7	30.9
Unit RF17, Big Black River, MS	43.3	26.9
Unit RF18, Paint Rock River, AL	81.0	50.3

Unit RF19, Duck River, TN	235.3	146.2
Unit RF20a, Tennessee River, TN	26.7	16.6
Unit RF20b, Tennessee River, KY	35.6	22.1
Unit RF21, Ohio River, IL, KY	45.9	28.5
Unit RF22, Green River, KY	175.6	109.1
Unit RF23, French Creek, PA	120.4	74.8
Unit RF24, Allegheny River, PA	57.3	35.6
Unit RF25, Muddy Creek, PA	20.1	12.5
Unit RF26, Tippecanoe River, IN	75.6	47.0
Unit RF27, Walhonding River, OH	17.5	10.9
Unit RF28, Little Darby Creek, OH	33.3	20.7
Unit RF29, North Fork Vermilion River and Middle Branch North Fork Vermilion River, IL	28.5	17.7
Unit RF30, Fish Creek, OH	7.7	4.8
Unit RF31, Red River, KY, TN	50.2	31.2
Unit RF32, Shenango River, PA	16.3	10.1
Total	2,663.9	1,655.2

Three critical habitat units proposed for the Neosho mucket and rabbitsfoot are currently designated under the ESA for the oyster mussel (*Epioblasma capsaeformis;* Duck River dartersnapper (*Epioblasma ahlstedti*)) and Cumberlandian combshell (*Epioblasma brevidens*) encompassing the Duck River, Tennessee (74 rkm,46 rmi) and Bear Creek, Alabama and Mississippi (40 rkm, 25 rmi) (50 CFR part 17.95(f)) or proposed as critical habitat under the ESA for the yellowcheek darter (*Etheostoma moorei*) in the Middle Fork Little Red River, Arkansas (23.2 rkm, 14.5 rmi; 50 CFR part 17.95(e); Table 1). The existing critical habitat for the oyster mussel (Duck River dartersnapper), Cumberlandian combshell, and yellowcheek darter completely overlaps Units RF7 (Middle Fork Little Red River), RF16 (Bear Creek) and RF19 (Duck River), but the exact unit descriptions for (length) differ due to mapping refinement

since the earlier designation. In addition, five critical habitat units proposed for the Neosho mucket and/ or rabbitsfoot are currently designated by the State of Kansas as critical habitat for both species in the Fall, Spring, Neosho, Cottonwood River, and Verdigris Rivers and Neosho mucket in Shoal Creek (K.S.A. 32–959; Table 1) and are afforded similar state-level protections as those provided under the ESA. No other critical habitat units proposed for these species have been designated or proposed as critical habitat for other species under the ESA.

Table 3 summarizes primary adjacent riparian landowners in each of the proposed Neosho mucket and rabbitsfoot critical habitat units by private, State, Tribal, or Federal ownership. One Neosho mucket and two rabbitsfoot proposed critical habitat units, respectively, are located within Tribal jurisdictional areas, Unit NM1 (Illinois River, Oklahoma; 103 rkm (64.0 rmi)), Unit RF3 (Verdigris River; 45.5 rkm (28.3 rmi)), and Unit RF6 (Little River, Oklahoma; 41.4 rkm (25.7 rmi)). Public lands adjacent to Neosho mucket and rabbitsfoot critical habitat units consist of approximately 505.3 rkm (315.0 rmi) of riparian lands, including the Ozark National Forest (20.3 rkm (12.7 rmi)), Corps' Lake Tenkiller Project (9.0 rkm (5.6 rmi)) and Sparrowhawk Wildlife Management Area (WMA) (2.2 rkm (1.4 rmi)) in Unit NM1; Spring River Wildlife Area (1.4 rkm (0.9 rmi)) in Units NM4 and RF1; Corps' Oologah Lake Project (0.6 rkm (0.4 rmi)) and Corps' McClellan–Kerr Arkansas River Navigation System Project (3.4 rkm (2.1 rmi)) in Unit RF2; Neosho Wildlife Area (6.1 rkm/3.8 rmi) in Unit NM7; Ouachita National Forest (21.8 rkm (13.6 rmi)) in Unit RF4a; Jenkins' Ferry State Park (22.2 rkm (13.9 rmi)) in Unit RF5; Little River NWR (37.6 rkm (23.5 rmi)), Ouachita National Forest (16.0 rkm (10.0 rmi)), and Cossatot NWR (11.5 rkm (7.2 rmi)) in Unit RF6; Jacksonport State Park (2.9 rkm (1.8 rmi)) and Henry Gray–Hurricane Lake WMA (7.8 rkm (4.9 rmi)) in Unit RF8a; White River NWR (57.6 rkm ((36.0 rmi)) in Unit RF8b; Shirey Bay Rainey Brake WMA (10.1 rkm (6.3 rmi)) in Unit RF9; Harold Alexander WMA (1.1 rkm (0.7 rmi)) in Unit RF10; Buffalo National River (113.0 rkm (70.6 rmi) in Unit RF13; Sam A. Baker State Park (1.0 rkm (0.6 rmi)) and Corps' Wappapello Lake Project (25.1 rkm (15.7 rmi)) in Unit RF14; Tishomingo State Park (6.1 rkm (3.8 rmi)), NPS Natchez Trace Parkway (4.5 rkm (2.8 rmi)), and TVA Pickwick Lake Project (7.4 rkm (4.6 rmi)) in Unit RF16; Fern Cave NWR (0.5 rkm (0.3 rmi)) in Unit RF18; Yanahli WMA (38.9 rkm (24.3 rmi)) and Santa Fe County Park (1.4 rkm (0.9 rmi)) in Unit RF19; Shiloh National Military Park (2.6 rkm (1.6 rmi)) in Unit RF20a; Kentucky Dam Village State Resort Park (0.6 rkm (0.4 rmi)) and unnamed TVA land downstream of Kentucky Lake Dam (2.4 rkm (1.5 rmi)) in Unit RF20b; Massac Forest Nature Preserve (2.2 rkm (1.4 rmi)), West Kentucky WMA (5.6 rkm (3.5rmi)), Ballard WMA (2.6 rkm (1.6 rmi)) and Chestnut Hills Nature Preserve (2.4 rkm (1.5 rmi)) in Unit RF21; Mammoth Cave National Park (17.0 rkm (10.6 rmi)) in Unit RF22; Pennsylvania State Game Land 277 (2.9 rkm (1.8 rmi)) and Pennsylvania State Game Land 85 (0.6 rkm (0.4 rmi)) in Unit RF23; Clear Creek State Forest (9.9 rkm (6.2 rmi) in Unit RF24; Erie NWR (16.2 rkm (10.1 rmi)) in Unit RF25; Prophetstown State Park (2.1 rkm (1.3 rmi)) in Unit RF26; Muskingum Watershed Conservancy Land (5.0 rkm (3.1 rmi)) in Unit RF27; Little Darby State Scenic Waterway/River Lands (8.7 rkm (5.4 rmi)) in Unit RF28; Fish Creek Wildlife Area (1.6 rkm (1.0 rmi)) in Unit RF30; and Corps' Shenango River Lake Project (8.8 rkm (5.5 rmi)) in Unit RF32.

States were granted ownership of lands beneath navigable waters up to the ordinary high–water line upon achieving statehood (*Pollard v. Hagan*, 44 U.S. (3 How.) 212 (1845)). Prior to statehood, the American colonies may have made grants to private parties that included lands

below the ordinary high–water mark of some navigable waters that are included in this proposal. However, we believe, that most, if not all, lands beneath the navigable waters included in this proposed rule are owned by the States, except Kentucky. Riparian lands along the waters are either in private ownership, or owned by municipalities, States, or Federal entities (Table 3).

Table 3. Proposed critical habitat units for Neosho mucket and rabbitsfoot and ownership of riparian lands

Critical Habitat Units	Federal rkm; rmi	State & local government rkm; rmi	Private rkm; rmi	Tribal* (subset of private) rkm; rmi
Neosho Mucket				
Unit NM1: Illinois River	29.4; 18.3	2.3; 1.4	114.4; 71.1	103.0; 64.0
Unit NM2: Elk River	0	0	20.3; 12.6	0
Unit NM3: Shoal Creek	0	0	75.8; 47.1	0
Unit NM4: Spring River	0	1.4; 0.9	100.9; 62.7	0
Unit NM5: North Fork Spring River	0	0	16.4; 10.2	0
Unit NM6: Fall River	0	0	90.4; 56.2	0
Unit NM6: Verdigris River	0	0	80.6; 50.1	0
Unit NM7: Neosho River	0	6.1; 3.8	238.3; 148.1	0
Unit NM8: Cottonwood River	0	0	2.6; 1.6	0
Total	29.4; 18.3	9.8; 6.1	739.8; 459.7	103.0; 64.0
Rabbitsfoot				
Unit RF1: Spring River	0	1.4; 0.9	55.0; 34.2	0
Unit RF2: Verdigris River	4.0; 2.5	0	41.5; 25.8	41.5; 25.8
Unit RF3: Neosho River	0	0	26.6; 16.5	0
Unit RF4a: Ouachita River	3.9; 2.4	0	18.0; 11.2	0
Unit RF4b: Ouachita River	0	0	157.9; 98.1	0
Unit RF5: Saline River	0	22.3; 13.9	266.8; 165.8	0
Unit RF6: Little River	63.9; 39.7	0	75.8; 47.1	41.4; 25.7
Unit RF7: Middle Fork Little Red River	0	0	24.8; 15.4	0
Unit RF8a: White	0	10.8; 6.7	177.5; 110.3	0

Critical Habitat Units	Federal rkm; rmi	State & local government rkm; rmi	Private rkm; rmi	Tribal* (subset of private) rkm; rmi
River				
Unit RF8b: White River	57.9; 36.0	0	10.9; 6.8	0
Unit RF9: Black River	0	10.1; 6.3	82.1; 51.0	0
Unit RF10: Spring River	0	1.1; 0.7	61.6; 38.3	0
Unit RF11: South Fork Spring River	0	0	16.4; 10.2	0
Unit RF12: Strawberry River	0	0	123.8; 76.9	0
Unit RF13: Buffalo River	113.6; 70.6	0	0	0
Unit RF14: St. Francis River	25.2; 15.7	1.0; 0.6	38.1; 23.7	0
Unit RF15: Big Sunflower River	0	0	51.5; 32.0	0
Unit RF16: Bear Creek	11.9; 7.4	6.1; 3.8	31.7; 19.7	0
Unit RF17: Big Black River	0	0	43.3; 26.9	0
Unit RF18: Paint Rock River	0.5; 0.3	0	80.5; 50.0	0
Unit RF19: Duck River	0	40.5; 25.2	194.7; 121.0	0
Unit RF20a: Tennessee River	2.6; 1.6	0	24.1; 15.0	0
Unit RF20b: Tennessee River	2.4; 1.5	0.6; 0.4	32.5; 20.2	0
Unit RF21: Ohio River	0	12.9; 8.0	33.0; 20.5	0
Unit RF22: Green River	17.0; 10.6	0	158.5; 98.5	0
Unit RF23: French Creek	0	3.5; 2.2	116.8; 72.6	0
Unit RF24: Allegheny River	0	10.0; 6.2	47.3; 29.4	0
Unit RF25: Muddy Creek	16.3; 10.1	0	3.9; 2.4	0
Unit RF26: Tippecanoe River	0	2.1; 1.3	73.5; 45.7	0
Unit RF27: Walhonding River	0	5.0; 3.1	12.6; 7.8	0
Unit RF28: Little Darby Creek	0	8.7; 5.4	24.6; 15.3	0
Unit RF29: North Fork				

Critical Habitat Units	Federal rkm; rmi	State & local government rkm; rmi	Private rkm; rmi	Tribal* (subset of private) rkm; rmi
Vermilion River and Middle Branch North Fork Vermilion River	0	0	28.5; 17.7	0
Unit RF30: Fish Creek	0	1.6; 1.0	6.1; 3.8	0
Unit RF31: Red River	0	0	50.2; 31.2	0
Unit RF32: Shenango River	8.8; 5.5	0	7.4; 4.6	0
Total	328.1; 203.9	137.9; 85.7	2,197.5; 1,365.6	86.9; 54.0
Total for both species	357.6; 222.2	147.7; 91.8	2,937.3; 1,825.3	189.9; 118.0

Note: Distances may not sum due to rounding

* Tribal Jurisdictional Area only, does not represent riparian land ownership by any tribe and is a subset of the private lands category.

We present brief descriptions of all units and reasons why they meet the definition of critical habitat for the Neosho mucket and rabbitsfoot. Proposed critical habitat units include the river channels within the ordinary high water line. As defined in 33 CFR 329.11, the ordinary high water mark on non-tidal rivers is the line on the shore established by the fluctuations of water and indicated by physical characteristics, such as a clear, natural line impressed on the bank; shelving; changes in the character of soil; destruction of terrestrial vegetation; the presence of litter and debris; or other appropriate means that consider the characteristics of the surrounding areas. For each stream reach proposed as a critical habitat unit, the upstream and downstream boundaries are described generally below.

2.3.1 Neosho Mucket

Neosho mucket status and distribution for each critical habitat unit was previously described in the *ENDANGERED STATUS FOR NEOSHO MUCKET AND THREATENED STATUS FOR RABBITSFOOT* section of the proposed listing and critical habitat rule (77 FR 63440). For a description of the PBFs for each Neosho mucket critical habitat unit consult the *CRITICAL HABITAT DESIGNATION FOR NEOSHO MUCKET AND RABBITSFOOT* section of the proposed listing and critical habitat rule (77 FR 63440). Maps illustrating each critical habitat unit are provided in Appendix 1.

Unit NM1: Illinois River—Benton and Washington Counties, Arkansas; and Adair, Cherokee, and Delaware Counties, Oklahoma.

Unit NM1 includes 146.1 rkm (90.8 rmi) of the Illinois River from the Muddy Fork Illinois River confluence with the Illinois River south of Savoy, Washington County, Arkansas, downstream to the Baron Creek confluence southeast of Tahlequah, Cherokee County, Oklahoma. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains PCEs 2, 3, 4, and 5.

Unit NM2: Elk River—McDonald County, Missouri; and Delaware County, Oklahoma.

Unit NM2 includes a total of 20.3 rkm (12.6 rmi) of the Elk River from Missouri Highway 59 at Noel, McDonald County, Missouri, to the confluence of Buffalo Creek immediately downstream of the Oklahoma and Missouri State line, Delaware County, Oklahoma. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit NM3: Shoal Creek—Cherokee County, Kansas; and Newton County, Missouri.

Unit NM3 includes approximately 75.8 rkm (47.1 rmi) of Shoal Creek from Missouri Highway W near Ritchey, Newton County, Missouri, to Empire Lake where inundation begins in Cherokee County, Kansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit NM4: Spring River—Jasper and Lawrence Counties, Missouri; and Cherokee County, Kansas.

Unit NM4 includes 102.3 rkm (63.6 rmi) of the Spring River from Missouri Highway 97 north of Stotts City, Lawrence County, Missouri, downstream to the confluence of Turkey Creek north of Empire, Cherokee County, Kansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit NM5: North Fork Spring River—Jasper County, Missouri.

Unit NM5 includes 16.4 rkm (10.2 rmi) of the North Fork Spring River from the confluence of Buck Branch southwest of Jasper, Missouri, downstream to its confluence with the Spring River near Purcell, Jasper County, Missouri. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit NM6: Fall River—Elk, Greenwood, and Wilson Counties, Kansas; Verdigris River—Montgomery and Wilson Counties, Kansas.

Unit NM6 includes a total of 171.1 rkm (106.3 rmi) including 90.4 rkm (56.2 rmi) of the Fall River from Fall River Lake dam northwest of Fall River, Greenwood County, Kansas, downstream to its confluence with the Verdigris River near Neodesha, Wilson County, Kansas. Unit NM6 also includes 80.6 rkm (50.1 rmi) of the Verdigris River from Kansas Highway 39 near Benedict, Wilson County, Kansas downstream to the Elk River confluence near Independence, Montgomery County, Kansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit NM7: Neosho River—Allen, Cherokee, Coffey, Labette, Neosho, and Woodson Counties, Kansas.

Unit NM7 includes 244.5 rkm (151.9 rmi) of the Neosho River from Kansas Highway 58 west of LeRoy, Coffey County, Kansas, downstream to the Kansas and Oklahoma State line, Cherokee County, Kansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit NM8: Cottonwood River—Chase County, Kansas.

Unit NM8 includes 2.6 rkm (1.6 rmi) of the Cottonwood River from the South Fork Cottonwood River confluence downstream to the Kansas Road 140 (also known as Heins Road), east of Cottonwood Falls, Chase County, Kansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

2.3.2 Rabbitsfoot

Rabbitsfoot status and distribution for each critical habitat unit was previously described in the *ENDANGERED STATUS FOR NEOSHO MUCKET AND THREATENED STATUS FOR RABBITSFOOT* section of the proposed listing and critical habitat rule (77 FR 63440). For a description of the PBFs for each rabbitsfoot critical habitat unit consult the *CRITICAL HABITAT DESIGNATION FOR NEOSHO MUCKET AND RABBITSFOOT* section of the proposed listing and critical habitat rule (77 FR 63440). Maps illustrating each critical habitat unit are provided in Appendix 1.

Unit RF1: Spring River—Jasper County, Missouri; and Cherokee County, Kansas.

Unit RF1 includes 56.5 rkm (35.1 rmi) of the Spring River from Missouri Highway 96 at Carthage, Jasper County, Missouri, downstream to the confluence of Turkey Creek north of Empire, Cherokee County, Kansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF2: Verdigris River—Rogers County, Oklahoma.

Unit RF2 includes 45.5 rkm (28.3 rmi) of the Verdigris River from Oologah Lake dam north of Claremore, Oklahoma, downstream to Interstate 44 (Will Rogers Turnpike) west of Catoosa, Rogers County, Oklahoma. This unit was occupied at the time of listing and contains all or some components of all four PBFs and in part, contains all five PCEs. It is possible that PCEs 1 and 2 are limiting factors for rabbitsfoot distribution and abundance from Oologah Lake dam downstream to the confluence of the Caney River; thus we are unable to determine at this time whether this reach contains PCEs 1 and 2.

Unit RF3: Neosho River—Allen County, Kansas.

Unit RF3 includes 26.6 rkm (16.5 rmi) of the Neosho River from the Deer Creek confluence northwest of Iola, Kansas, downstream to the confluence of Owl Creek southwest of Humboldt, Allen County, Kansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF4a: Ouachita River—Montgomery County, Arkansas.

Unit RF4a includes 21.9 rkm (13.6 rmi) of the Ouachita River from Arkansas Highway 379 south of Oden, Montgomery County, Arkansas, downstream to Arkansas Highway 298 east of Pencil Bluff, Montgomery County, Arkansas. Units RF4a and RF4b are separated by three reservoirs (Lakes Ouachita, Hamilton, and Catherine). This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF4b: Ouachita River—Clark, Hot Spring, and Ouachita Counties, Arkansas.

Unit RF4b includes 157.9 rkm (98.1 rmi) of the Ouachita River from Interstate 30 at Malvern, Hot Spring County, Arkansas, downstream to U.S. Highway 79 at Camden, Ouachita County, Arkansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF5: Saline River—Ashley, Bradley, Cleveland, Dallas, Drew, Grant, and Saline Counties, Arkansas.

Unit RF5 includes 289.2 rkm (179.7 rmi) of the Saline River from Interstate 30 near Benton, Saline County, Arkansas, to the Snake Creek confluence north of the northern boundary of Felsenthal NWR northwest of Crossett, Ashley, and Bradley Counties, Arkansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF6: Little River—McCurtain County, Oklahoma; and Little River and Sevier Counties, Arkansas.

Unit RF6 includes 139.7 rkm (86.8 rmi) of the Little River from the Glover River confluence northwest of Idabel, McCurtain County, Oklahoma, downstream to U.S. Highway 71 north of Wilton, Little River and Sevier Counties, Arkansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF7: Middle Fork Little River—Van Buren County, Arkansas.

Unit RF7 includes 24.8 rkm (15.4 rmi) of the Middle Fork Little Red River from the confluence of Little Tick Creek north of Shirley, Arkansas, downstream to Greers Ferry Reservoir where inundation begins, Van Buren County, Arkansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF8a: White River—Independence, Jackson, White, and Woodruff Counties, Arkansas.

Unit RF8a includes 188.3 rkm (117.0 rmi) of the White River from the Batesville Dam at Batesville, Independence County, Arkansas, downstream to the Little Red River confluence north of Georgetown, White, and Woodruff Counties, Arkansas. There are no records of rabbitsfoot from the 160 rkm (100 rmi) reach separating Unit RF8a from Unit RF8b (Butler 2005, p. 66). This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains PCEs 2, 3, 4, and 5. The U.S. Army Corps of Engineers maintains a navigation channel, which involves routine dredging and snag removal, from Newport, Arkansas to its confluence with the Mississippi River.

Unit RF8b: White River—Arkansas and Monroe Counties, Arkansas.

Unit RF8b includes 68.9 rkm (42.8 rmi) of the White River from U.S. Highway 79 at Clarendon, Monroe County, Arkansas, downstream to Arkansas Highway 1 near St. Charles, Arkansas County, Arkansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains PCEs 2, 3, 4, and 5. The U.S. Army Corps of Engineers maintains a navigation channel, which involves routine dredging and snag removal, from Newport, Arkansas, to its confluence with the Mississippi River.

Unit RF9: Black River—Lawrence and Randolph Counties, Arkansas.

Unit RF9 includes 92.2 rkm (57.3 rmi) of the Black River from U.S. Highway 67 at Pocahontas, Randolph County, Arkansas, downstream to the Strawberry River confluence southeast of Strawberry, Lawrence County, Arkansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF10: Spring River—Lawrence, Randolph, and Sharp Counties, Arkansas.

Unit RF10 includes 62.8 rkm (39.0 rmi) of the Spring River from U.S. Highway 412 and 62 at Hardy in Sharp County, Arkansas, downstream to its confluence with the Black River east of Black Rock, Lawrence, and Randolph Counties, Arkansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF11: South Fork Spring River—Fulton County, Arkansas.

Unit RF11 includes 16.4 rkm (10.2 rmi) of the South Fork Spring River from Fulton County Road 198 north of Heart, Arkansas, downstream to Arkansas Highway 289 at Saddle, Fulton County, Arkansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF12: Strawberry River—Izard, Lawrence, and Sharp Counties, Arkansas.

Unit RF12 includes 123.8 rkm (76.9 rmi) of the Strawberry River from Arkansas Highway 56 south of Horseshoe Bend, Izard County, Arkansas, downstream to its confluence with the Black River southeast of Strawberry, Lawrence County, Arkansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF13: Buffalo River—Newton and Searcy Counties, Arkansas.

Unit RF13 includes 113.6 rkm (70.6 rmi) of the Buffalo River from the Cove Creek confluence southeast of Erbie, Newton County, Arkansas, downstream to U.S. Highway 65 west of Gilbert, Searcy County, Arkansas, and Arkansas Highway 14 southeast of Mull, Arkansas, downstream to the Leatherwood Creek confluence in the Lower Buffalo Wilderness Area, Arkansas. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF14: St. Francis River—Madison and Wayne Counties, Missouri.

Unit RF14 includes 64.3 rkm (40.0 rmi) of the St. Francis River from the Twelvemile Creek confluence west of Saco, Madison County, Missouri, downstream to Lake Wappepello where inundation begins, Wayne County, Missouri. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF15: Big Sunflower River—Sunflower County, Mississippi.

Unit RF15 includes 51.5 rkm (32.0 rmi) of the Big Sunflower River from Mississippi Highway 442 west of Doddsville, Mississippi, downstream to the Quiver River confluence east of Indianola, Sunflower County, Mississippi. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF16: Bear Creek—Tishomingo County, Mississippi; and Colbert County, Alabama.

Unit RF16 includes 49.7 rkm (30.9 rmi) of Bear Creek from the Alabama and Mississippi State line east of Golden, Tishomingo County, Mississippi, downstream to Alabama County Road 4 southwest of Sutton Hill, Colbert County, Alabama (just upstream of Pickwick Lake). Unit RF16 in its entirety is currently designated as critical habitat for the oyster mussel (*Epioblasma capsaeformis*) (Duck River Dartersnapper) and Cumberlandian combshell (*Epioblasma brevidens*; 50 CFR 17.95(f)). This unit was occupied at the time of listing and contains all or some components of all four PBFs, except in the Bear Creek Floodway, which has been channelized for flood control and only contains components of PBF 2 and contains all five PCEs, except in the Bear Creek Floodway, which has been channelized for flood control and only contains PCEs 3, 4, and 5.

Unit RF17: Big Black River—Hinds and Warren Counties, Mississippi.

Unit RF17 includes 43.3 rkm (26.9 rmi) of Big Black River from Porter Creek confluence west of Lynchburg, Hinds County, Mississippi, downstream to Mississippi Highway 27 west of Newman, Warren County, Mississippi. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF18: Paint Rock River—Jackson, Madison, and Marshall Counties, Alabama.

Unit RF18 includes 81.0 rkm (50.3 rmi) of the Paint Rock River from the convergence of Estill Fork and Hurricane Creek north of Skyline, Jackson County, Alabama, downstream to U.S. Highway 431 south of New Hope, Madison and Marshall Counties, Alabama. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF19: Duck River—Hickman, Marshall, and Maury Counties, Tennessee.

Unit RF19 includes 235.3 rkm (146.2 rmi) of the Duck River from Lillard Mill (RKM 288; rmi 179) west of Tennessee Highway 272, Marshall County, Tennessee, downstream to Interstate 40 near Bucksnort, Hickman County, Tennessee. Seventy-four rkm (46 rmi) in Unit RF19 from rkm 214 (rmi 133) upstream to Lillards Mill at rkm 288 (rmi 179) is currently designated as critical habitat for the oyster mussel and Cumberlandian combshell (50 CFR 17.95(f)). This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF20a: Tennessee River—Hardin County, Tennessee.

Unit RF20a includes 26.7 rkm (16.6 rmi) of Tennessee River from Pickwick Lake Dam downstream to U.S. Highway 64 near Adamsville, Hardin County, Tennessee. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains PCEs 1, 3, 4, and 5.

Unit RF20b: *Tennessee River—Livingston, Marshall, and McCracken Counties, Kentucky.*

Unit RF20b includes 35.6 rkm (22.1 rmi) of Tennessee River from Kentucky Lake Dam downstream to its confluence with the Ohio River, McCracken and Livingston Counties, Kentucky. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains PCEs 1, 3, 4, and 5.

Unit RF21: Ohio River—Ballard, Livingston, and McCracken Counties, Kentucky; Massac and Pulaski Counties, Illinois.

Unit RF21 includes 45.9 rkm (28.5 rmi) of the Ohio River from the Tennessee River confluence downstream to Lock and Dam 53 near Olmstead, Illinois. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains PCEs 1, 3, 4, and 5.

Unit RF22: Green River—Green, Hart, and Taylor Counties, Kentucky.

Unit RF22 includes 175.6 rkm (109.1 rmi) of the Green River from Green River Lake Dam south of Campbellsville, Taylor County, Kentucky, downstream to Maple Springs Ranger Station Road in Mammoth Cave National Park, Kentucky. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains PCEs 1, 3, 4, and 5.

Unit RF23: French Creek—Crawford, Erie, Mercer, and Venango Counties, Pennsylvania.

Unit RF23 includes 120.4 rkm (74.8 rmi) of French Creek from Union City Reservoir Dam northeast of Union City, Erie County, Pennsylvania, downstream to its confluence with the Allegheny River near Franklin, Venango County, Pennsylvania. The Allegheny River rabbitsfoot population (Unit RF24) is likely a single metapopulation with the French Creek population (Butler 2005, p. 31). This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF24: Allegheny River—Venango County, Pennsylvania.

Unit RF24 includes 57.3 rkm (35.6 rmi) of the Allegheny River from the French Creek confluence near Franklin, Venango County, Pennsylvania, downstream to Interstate 80 near Emlenton, Venango County, Pennsylvania. The lower Allegheny River and French Creek (Unit RF23) populations likely represent a single metapopulation because no barriers exist between the streams (Butler 2005, p. 29). This unit was occupied at the time of listing and contains all four PBFs and contains PCEs 1, 3, 4, and 5. A series of nine lock and dams and Kinzua Dam constructed over the past century has resulted in altered hydrologic flow regimes in the Allegheny River (Butler 2005, p. 29).

Unit RF25: *Muddy Creek—Crawford County, Pennsylvania*.

Unit RF25 includes 20.1 rkm (12.5 rmi) of Muddy Creek from Pennsylvania Highway 77 near Little Cooley, Crawford County, Pennsylvania, downstream to its confluence with French Creek east of Cambridge Springs, Crawford County, Pennsylvania. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF26: Tippecanoe River—Carroll, Pulaski, Tippecanoe, and White Counties, Indiana.

Unit RF26 includes 75.6 rkm (47.0 rmi) of the Tippecanoe River from Indiana Highway 14 near Winamac, Pulaski County, Indiana, downstream to its confluence with the Wabash River northeast of Battle Ground, Tippecanoe County, Indiana, excluding Lakes Schafer and Freeman and the stream reach between the two lakes. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF27: Walhonding River—Coshocton County, Ohio.

Unit RF27 includes 17.5 rkm (10.9 rmi) of the Walhonding River from the convergence of the Kokosing and Mohican Rivers downstream to Ohio Highway 60 near Warsaw, Coshocton County, Ohio. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF28: Little Darby Creek—Madison and Union Counties, Ohio.

Unit RF28 includes 33.3 rkm (20.7 rmi) of Little Darby Creek from Ohio Highway 161 near Chuckery, Madison County, Ohio, downstream to U.S. Highway 40 near West Jefferson, Madison County, Ohio. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF29: North Fork Vermilion River and Middle Branch North Fork Vermilion River, respectively, Vermilion County, Illinois.

Unit RF29 includes 28.5 rkm (17.7 rmi) of the North Fork Vermilion River from the confluence of Middle Branch North Fork Vermilion River downstream to Illinois Highway 1 and U.S. Highway 136 upstream of Lake Vermilion, Vermilion County, Illinois. Unit RF29 also includes 7.2 rkm (4.5 rmi) of the Middle Branch North Fork Vermilion River from the Jordan Creek confluence northwest of Alvin, Illinois, downstream to its confluence with North Fork Vermilion River west of Alvin, Vermilion County, Illinois. The rabbitsfoot in the North Fork Vermilion River is considered a metapopulation with the Middle Branch North Fork Vermilion River population (Butler 2005, p. 47). This unit provides connectivity between North Fork Vermilion River and Middle Branch North Fork Vermilion River. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF30: Fish Creek—Williams County, Ohio.

Unit RF30 includes 7.7 rkm (4.8 rmi) of Fish Creek from the Indiana and Ohio State line northwest of Edgerton, Ohio, downstream to its confluence with the St. Joseph's River north of Edgerton, Williams County, Ohio. This unit sustains genetic diversity and historical distribution as the only remaining rabbitsfoot population in the Great Lakes subbasin. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF31: Red River—Logan County, Kentucky; and Robertson County, Tennessee.

Unit RF31 includes 50.2 rkm (31.2 rmi) of the Red River from the South Fork Red River confluence west of Adairville, Kentucky, downstream to the Sulphur Fork confluence southwest of Adams, Tennessee. This unit sustains genetic diversity and historical distribution as the largest of two remaining rabbitsfoot populations within the Cumberland River basin. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

Unit RF32: Shenango River—Mercer County, Pennsylvania.

Unit RF32 includes 16.3 rkm (10.1 rmi) of the Shenango River from Kidds Mill Road near Greenville, Pennsylvania, downstream to the point of inundation by Shenango River Lake near Big Bend, Mercer County, Pennsylvania. This unit was occupied at the time of listing and contains all or some components of all four PBFs and contains all five PCEs.

2.4 Comparison of Potential Impacts for Neosho mucket and Rabbitsfoot Proposed Critical Habitat Designation

Table 4 summarizes the potential effects of the alternative critical habitat designations. Potential effects on resources are summarized from the analyses presented in Chapter 3.

Table 4. Comparison of Potential Effects of Neosho mucket and Rabbitsfoot Proposed Critical Habitat Designation

Resource	No Action	Proposed Alternative
Conservation of the Neosho mucket and rabbitsfoot	• Section 7 consultation on potential effects of proposed federal actions on the Neosho mucket and rabbitsfoot under the jeopardy standard • No section 7 consultation on potential effects to critical habitat under the destruction or adverse modification standard; except in the units that overlap with existing critical habitat for the oyster mussel, Cumberlandian combshell mussel, and yellowcheek darter • Non-regulatory or educational benefits from critical habitat may not occur	• Section 7 consultation on potential effects to critical habitat under the destruction or adverse modification standard for federal action would ensure that habitat essential for conservation of both species retains its suitability • Non-regulatory and educational benefits to conservation of the Neosho mucket and rabbitsfoot would occur, including informing the public of areas important for conservation of the species, and focusing attention on and awareness of those areas
Water Resources	• Section 7 consultation on potential effects of proposed federal actions on the Neosho mucket and rabbitsfoot under the jeopardy standard • No section 7 consultation on potential effects to critical habitat under the destruction or adverse modification standard; except in the units that overlap with existing critical habitat for the oyster mussel, Cumberlandian combshell mussel, and yellowcheek	• Section 7 consultation on effects to the Neosho mucket and rabbitsfoot under both the jeopardy and adverse modification/destruction of critical habitat standards would be required for federal actions in all critical habitat units • Additional section 7 consultations regarding water resources would not be expected to occur as a result of critical habitat designation • Substantive changes to reasonable and prudent alternatives developed under the jeopardy standard for water projects with a federal nexus would not be expected to occur with addition

Resource	No Action	Proposed Alternative
	darter • Water projects with a Federal nexus that could alter the hydrology, water temperature, or water quality of the two mussels habitats, destabilize the stream bank would likely trigger formal section 7 consultation under the jeopardy standard	of critical habitat designation • Minor additional effort may be required as part of the section 7 consultation to describe the potential impacts from water projects that may result in adverse modification

Resource	No Action	Proposed Alternative
Energy Development and Production	•Section 7 consultation on potential effects of proposed federal actions on the Neosho mucket and rabbitsfoot under the jeopardy standard •No section 7 consultation on potential effects to critical habitat under the destruction or adverse modification standard; except in the units that overlap with existing critical habitat for the oyster mussel, Cumberlandian combshell mussel, and yellowcheek darter •Energy projects with a Federal nexus that could alter the hydrology, water temperature, or water quality of the two mussels habitats, or destabilize the stream bank would likely trigger formal section 7 consultation under the jeopardy standard	• Section 7 consultation on effects to the Neosho mucket and rabbitsfoot under both the jeopardy and adverse modification/destruction of critical habitat standards would be required for federal actions or projects with federal nexus in all critical habitat units • Additional section 7 consultations regarding energy development and production would not likely occur as a result of critical habitat designation • Substantive changes to reasonable and prudent alternatives developed under the jeopardy standard for energy projects with a federal nexus would not expected to occur with addition of critical habitat designation • Minor additional effort may be required as part of the section 7 consultation to describe the potential impacts from energy projects that may result in adverse modification
Socioeconomic Conditions and Environmental Justice	•Section 7 consultation on potential effects of proposed federal actions on the Neosho mucket and rabbitsfoot under the jeopardy standard •No section 7 consultation on potential effects to critical habitat under the destruction or adverse modification standard; except in the units that overlap with existing critical habitat for the oyster mussel, Cumberlandian combshell	• Section 7 consultation on effects to the Neosho mucket and rabbitsfoot under both the jeopardy and adverse modification/destruction of critical habitat standards would be required for federal actions in all critical habitat units • Designation of critical habitat would not impact community services • Designation of critical habitat is not expected to generate additional requests for project modification in any of the proposed critical habitat units beyond what would be required

Resource	No Action	Proposed Alternative
	mussel, and yellowcheek darter • Actions on private lands that have the potential to result in take of any listed species would be subject to section 9 of the EAS. Coverage for the incidental take could be covered under section 10 of the ESA, which requires development of a Habitat Conservation Plan as part of an application to the Service for an incidental take permit	to avoid jeopardy to the two mussels • Estimated total economic costs specifically due to critical habitat designation range from $290,000 to $390,000 annually

CHAPTER 3 AFFECTED ENVIRONMENT & ENVIRONMENTAL CONSEQUENCES

This chapter describes aspects of the environment that may potentially be affected by designating critical habitat for the Neosho mucket in Arkansas, Kansas, Missouri, and Oklahoma and for the rabbitsfoot in Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, and Tennessee. Potential effects of designating critical habitat under each alternative are described for each of a number of resource categories. These categories were selected based on projects that have triggered section 7 consultations in the past, issues identified during the public comment period on the proposed rule (*cf.* section 1.7), and conservation considerations for the two mussel species. Critical habitat designation may have effects on conservation of the two mussel species and various land uses or activities that have a Federal nexus (*e.g.*, land uses or activities that are proposed by a Federal agency, require Federal permitting, or are Federal funded). In the case of the two mussel species, critical habitat extends to the ordinary high water line (*cf.* section 1.4.1 Critical Habitat).

3.1 Assessment of Impacts

3.1.1 Nature of Impacts from Critical Habitat Designation

Impacts on the environment from designation of critical habitat stem from the section 7 consultation requirements of the ESA (*cf.* section 1.4.1.2). Under section 7(a)(2) of the ESA, Federal agencies are required to consult with the Service on actions that they fund, implement, or authorize, which may affect listed species or critical habitat (50 CFR § 402). The purpose of section 7 consultation, with respect to critical habitat, is to ensure that the actions of Federal agencies do not destroy or adversely modify critical habitat. Critical habitat is defined in section 3 of the Act as: (1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features: (a) Essential to the conservation of the species and (b) Which may require special management considerations or protection; and (2) Specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Critical habitat designation does not have any impact on the environment other than through the ESA section 7 consultation process conducted for Federal actions. Private actions that have no Federal involvement are not

Critical habitat designation does not have any impact on the environment other than through the section 7 consultation process. Critical habitat designation alone does not establish blanket rules or restrictions on land use, nor does it automatically prohibit or modify any activity. Each proposed Federal action that may potentially affect designated critical habitat is analyzed individually during the section 7 consultation process. Individuals, organizations, states, local governments, and other non-Federal entities are potentially affected by the designation of critical habitat only if their actions occur on Federal lands, require a Federal permit, license, or other authorization, or involve Federal funding.

Separate analyses are made under both the jeopardy and adverse modification standards. The jeopardy analysis evaluates potential impacts on the species, while the adverse modifications analysis specifically evaluates potential impacts on designated critical habitat. The United States Court of Appeals for the Ninth Circuit determined that there is an additional difference between the two standards. In *Gifford Pinchot Task Force v. United States Fish and Wildlife Service*, 378 F.3d 1059 (9th Cir. 2004), the court held that while the jeopardy standard concerns the survival of a species or its risk of extinction, the adverse modification standard concerns the value of critical habitat for the recovery, or eventual delisting, of a species. As pointed out in the decision, survival of a species and recovery (or conservation) of a species are distinct concepts in the ESA. Implementation of the two standards, therefore, involves separate and distinct analyses based on these concepts.

Because of the *Gifford Pinchot* decision, the Service no longer relies on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, the Service relies on the statutory provisions of the Act to complete the analysis with respect to critical habitat. The potential for destruction or adverse modification of critical habitat by a Federal action is assessed under the statutory provisions of the ESA by determining whether the effects of the implementation of the proposed Federal action would allow the affected critical habitat to remain functional (or retain those physical and biological features and primary constituent elements (PCEs) that relate to the ability of the area to periodically support the species) to serve its intended conservation role for the species (75 FR 66519, October 28, 2010). This analysis provides the basis for determining the significance of anticipated effects of the proposed Federal action on critical habitat. The threshold for destruction or adverse modification is evaluated in the context of whether the critical habitat would remain functional to serve the intended conservation role for the two mussel species.

Even though the jeopardy and adverse modification standards are different, in the case of the two mussel species, the results of the application of the two standards on project modifications are expected to have similar outcomes. The ability of these species to persist is very closely tied to the quality of their habitats. Jeopardy can only occur when there is harm to habitat which would prevent the species from adequately reproducing and reestablishing its population or recovery. The PCEs needed by both mussel species include: (1) geomorphically stable stream and river channels and banks that provide stable substrates of sand or mixtures of sand with clay or gravel with low to moderate amounts of fine sediment and attached filamentous algae; (2) a hydrologic flow regime necessary to maintain benthic habitats where the species are found, and to maintain connectivity of rivers with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the mussels and host fish habitat, food availability, spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats; (3) water and sediment quality, including temperature (not greater than 32 ºC (89.6 ºF)) (Pandolfo *et al*. 2010, p. 959), pH (between 6.0 and 8.5), oxygen content (not less than 5.0 milligrams per liter (mg/L), hardness, turbidity, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages; (4) the presence and abundance of (currently unknown) fish hosts necessary for the recruitment of the Neosho mucket and rabbitsfoot as indicated by the fish species richness, relative abundance, and community composition until such appropriate host fish can be identified; and (5) low quantities of competitive or predaceous invasive (nonnative) species to have minimal effect on survival of freshwater mussels.

In most cases, the results of consultation under the adverse modification and jeopardy standards are likely to be similar because the PCEs that define critical habitat are also essential for survival of the two mussel species, the two mussel species are severely limited in their respective geographic ranges, and the surviving populations are small (Service 2012a, p. 3). There is little chance of a determination of destruction or adverse modification which is not also determined to jeopardize these species.

Activities that may result in adverse effects to critical habitat of the two mussels could include those actions that: (1) would destabilize the stream channel (*e.g.*, dredging and mining); (2) alter the hydrology or water quality of their habitats (*e.g.*, discharge of fill material; release or dumping of toxic chemicals, silt, or biological pollutants; diversion, alteration, or withdrawal of surface or groundwater flow; construction and operation of impoundments, and installation of transportation crossings; (3) result in the introduction, spread, augmentation of competitive or predaceous invasive (nonnative) species in occupied stream segments, even if those segments are occasionally intermittent; and (4) appreciably affect the presence and abundance of fish hosts. Alterations of habitat that diminish the value of the habitat (*e.g.*, flow, water quality, suitability of substrate) and the amount of habitat for the species would be likely to also affect population size, reproduction, and recruitment of the invertebrates, and would therefore, appreciably reduce their likelihood of survival in the wild and constitute jeopardy. Consequently, the reasonable and prudent measures required as a result of section 7 consultations at the proposed critical habitat units may not be materially different when compared to listing of the species alone (Service 2012a, p. 3).

Examples of actions not likely to destroy or adversely modify critical habitat include, but are not limited to, oil and gas exploration in areas where surface or ground water is not connected to proposed critical habitat areas, and projects implemented in accordance with biological opinions issued by the Service.

Furthermore, the Service is not proposing to designate any unoccupied habitat for Neosho mucket or rabbitsfoot. No unoccupied habitat for expansion of the species is proposed by the Service because the agency has determined no suitable unoccupied habitat has the required PCEs to support either the Neosho mucket or rabbitsfoot. Therefore, all proposed critical habitat is occupied by the two species and any harm to the habitat is likely to also harm the members of the species.

Some activities may be considered to be of benefit to the two mussel species and, therefore, would not be expected to adversely modify critical habitat when carefully planned. Examples of such beneficial actions could include removal of structures such as dams that fragment habitat and inhibit movement of host fish, and removal of nonnative aquatic species.

3.1.2 Overlap with Other Species

As discussed in Section 1.4.1, three critical habitat units proposed for the two mussel species are currently designated critical habitat under the Act: for the oyster mussel (Duck River dartersnapper) and Cumberlandian combshell in the Duck River in Tennessee and Bear Creek in Alabama and Mississippi (50 CFR part 17.95(f)), and for the yellowcheek darter, the Middle Fork Little Red River in Arkansas (76 FR 63360, October 12, 2011, Table 5). The existing critical habitat for the oyster mussel (Duck River dartersnapper) and Cumberlandian combshell completely overlaps proposed rabbitsfoot Unit RF16 (Bear Creek), but the exact unit

descriptions (length) differ due to mapping refinement that has taken place since the earlier designation. In addition, five critical habitat units proposed for the Neosho mucket and rabbitsfoot are currently designated by the State of Kansas as critical habitat for both species in the Fall, Spring, Neosho, Cottonwood, and Verdigris rivers and the Neosho mucket in Shoal Creek (K.S.A. 32–959; Table 5) and are afforded similar state–level protections as those provided under the Act. No other critical habitat units proposed for these species have been designated or proposed as critical habitat for other species under the Act.

Primary constituent elements (PCEs) of critical habitat for the oyster mussel, Cumberlandian combshell, and yellowcheek darter also occur in proposed critical habitat for the Neosho mucket and rabbitsfoot. Consequently, many of the habitat elements relevant to conservation of the Neosho mucket and rabbitsfoot are currently considered in section 7 consultations for the three overlapping species' critical habitat (69 FR 53136, August 31, 2004, p. 53147; 77 FR 63644, October 16, 2012, p.63620). This reduces the probability of additional conservation requirements arising from section 7 consultations for the Neosho mucket and rabbitsfoot species since they are likely to be considered under consultations for the overlapping species.

3.1.3 Impact Assessment Method

The consequences of section 7 consultations on potential effects to the two mussel species and critical habitat may be highly variable, depending on the characteristics, context, location, duration, geographic extent, and timing of each proposed action subject to consultation. This complexity is heightened by the dynamics of the natural environment. Biological conditions that influence the magnitude of potential impacts may change over time and from place to place. The complexity of the potential effects of critical habitat designation was addressed by using past section 7 consultations that involved similar listed species and interviews with Service biologists on potential future consultation issues as a basis for the impact assessment. In addition, in order to capture the land and water use threats occurring outside of the proposed critical habitat that may affect the physical and biological features of critical habitat, a broader study area for the analysis has been defined based primarily on fourth level (8-digit) Hydrologic Unit Code (HUC) watersheds containing the stream and river channels that could potentially affect proposed critical habitat. The study area has been further refined with the addition of a few sixth level (12-digit) HUCs facilitating the inclusion of additional areas where activities may impact the two mussels, and are terminated at geographic features such as upstream dams or downstream roads. Figures 2 and 3 illustrate the locations of the study areas. Appendix 2 presents the study area locations by river basin, state, and stream, and provides the 12-digit HUC designations comprising them. Figures 4 and 5 depict the location of major river basins discussed in this document.

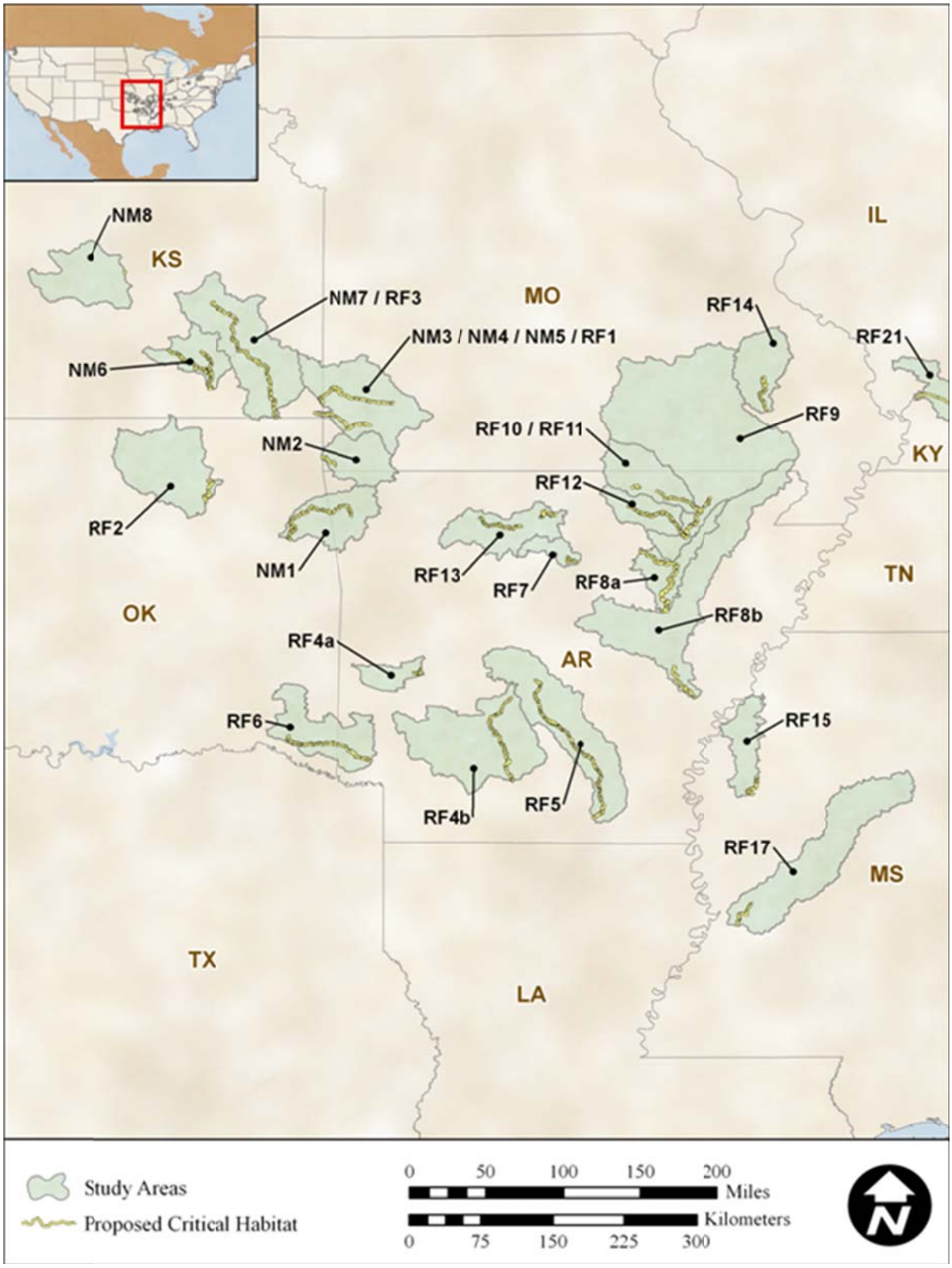


Figure 3. Study area in watersheds where activities may occur that have the most potential to impact proposed critical habitat units for the Neosho mucket throughout its range and rabbitsfoot in the western portions of its range.

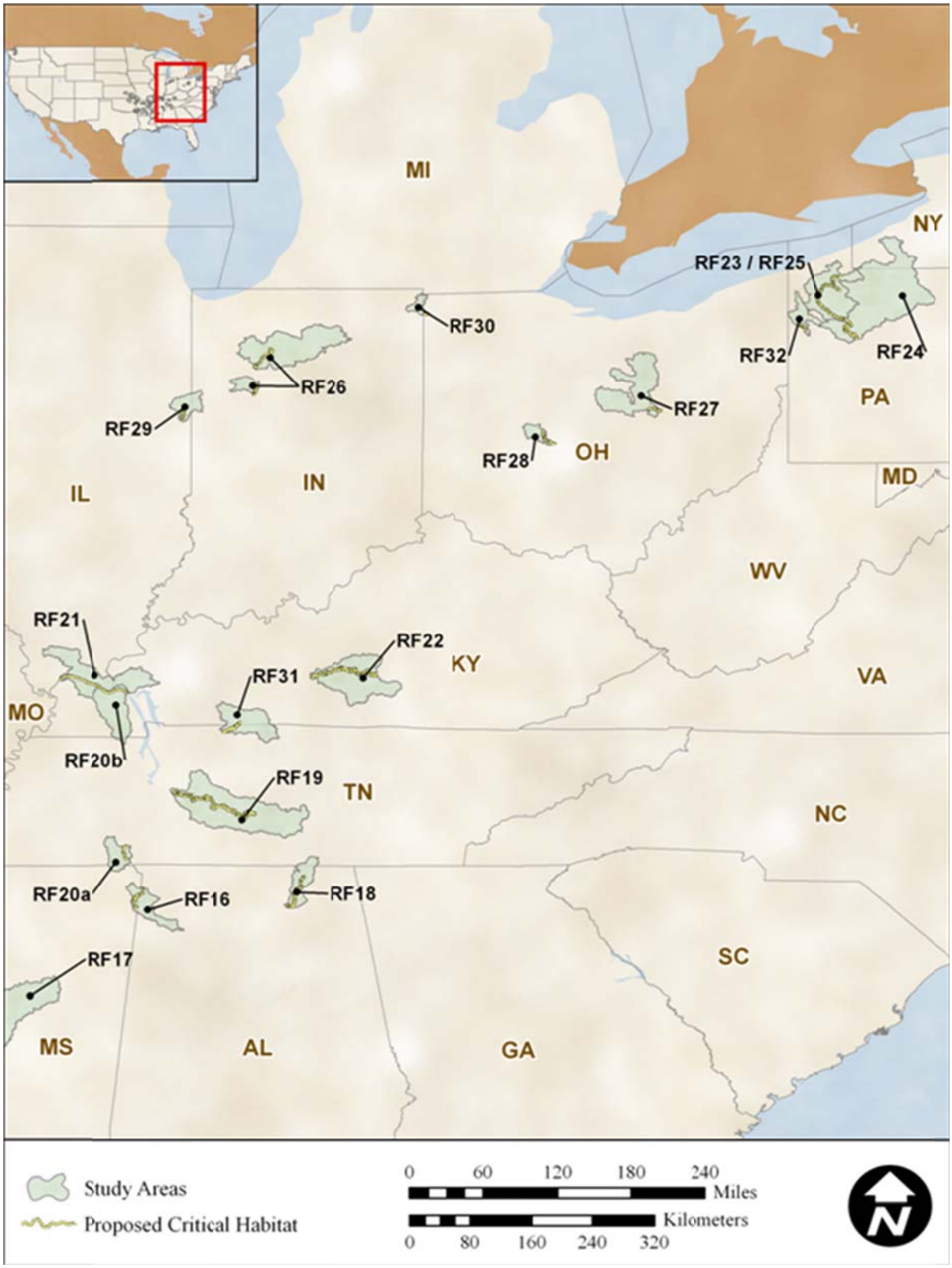
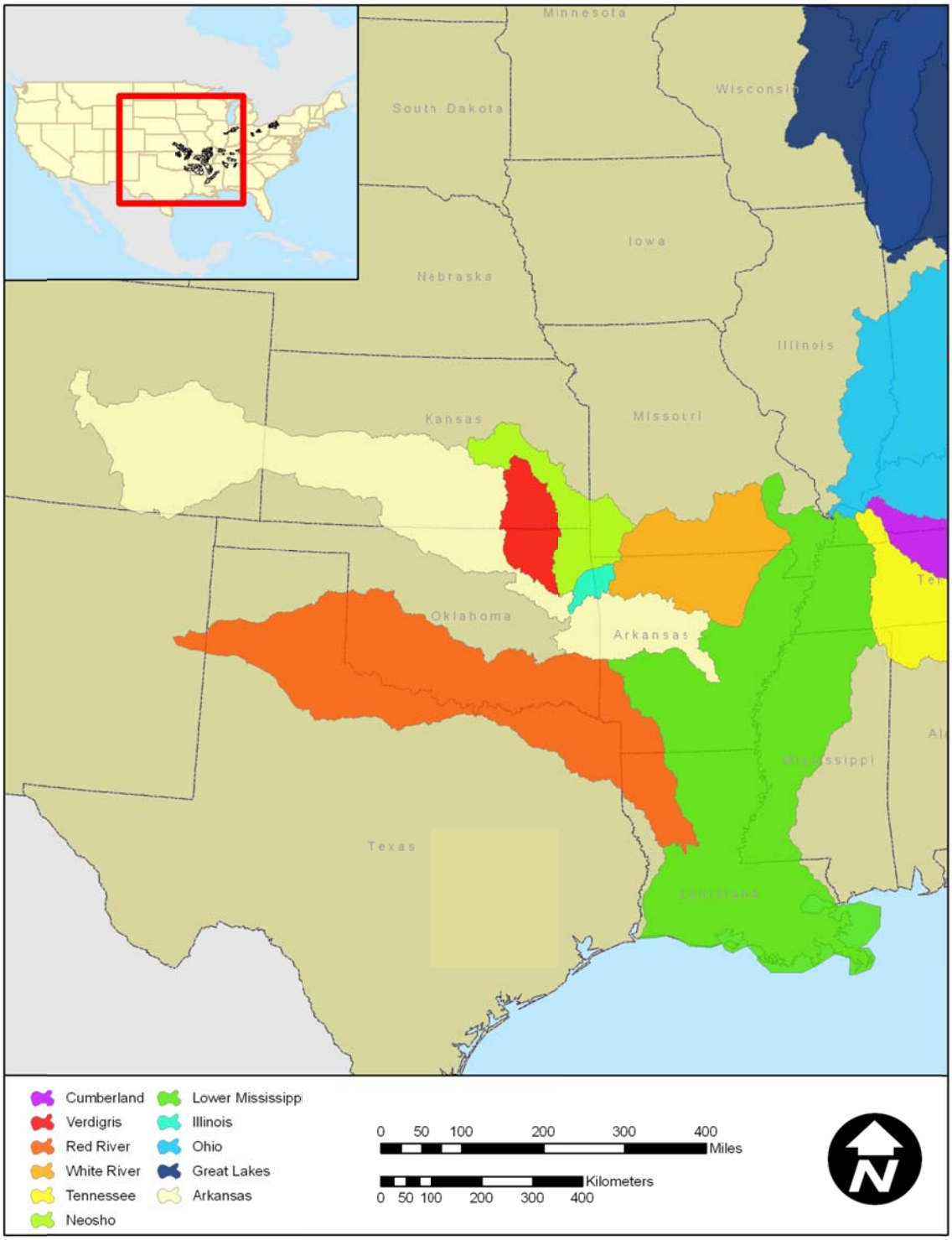
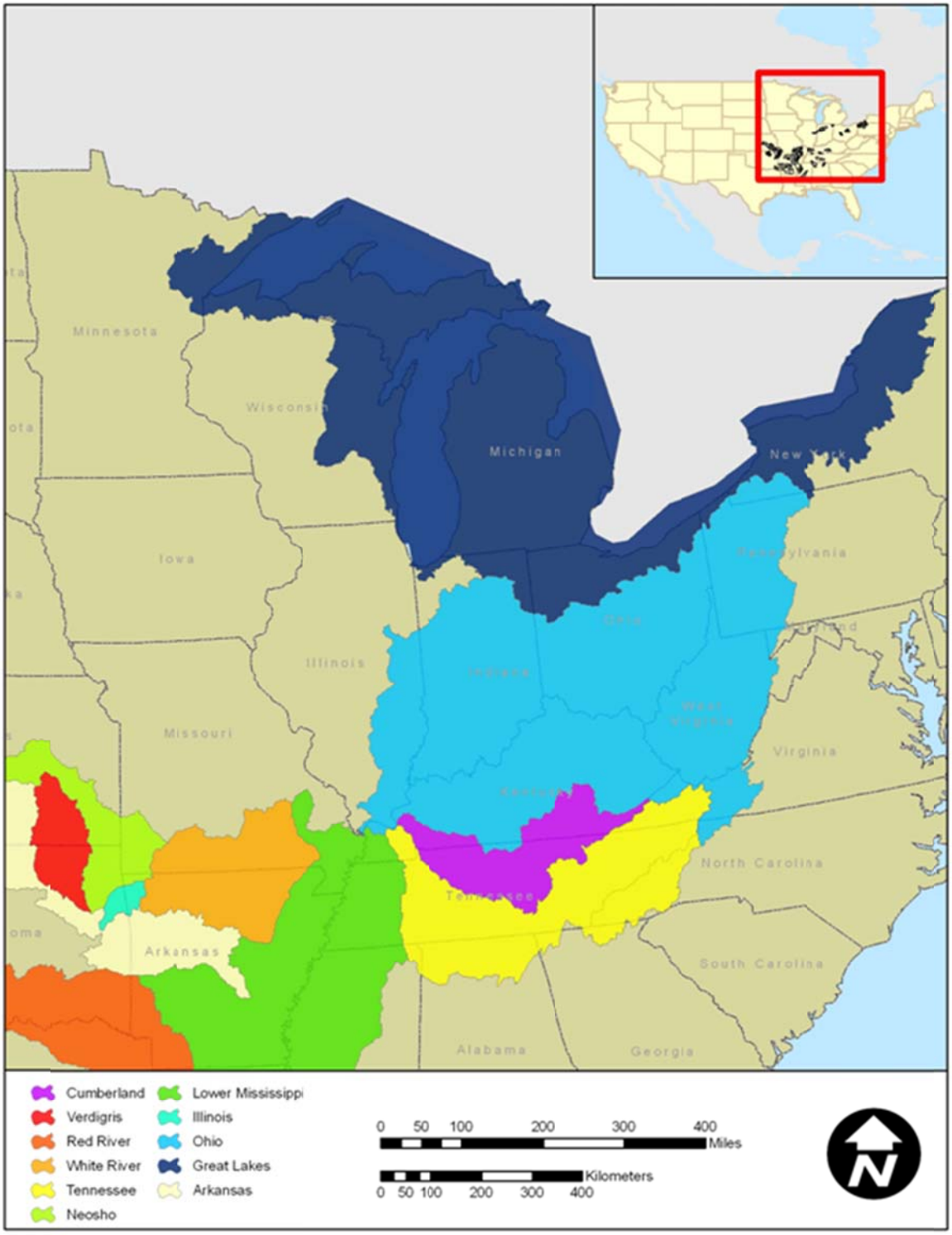


Figure 4. Study area in watersheds where activities occur that have the potential to impact proposed critical habitat units for the rabbitsfoot in the eastern portion of its range.



Source: NRCS 2012, ftp://ftp.ftw.nrcs.usda.gov/pub/wbd;
National Atlas of the United States 2005,
http://nationalatlas.gov/atlasftp.html?openChapters=chpwater#chpwater>

Figure 5. Major river basins containing proposed critical habitat units for the Neosho mucket and rabbitsfoot mussels in the western region.



Source: NRCS 2012, ftp://ftp.ftw.nrcs.usda.gov/pub/wbd;
National Atlas of the United States 2005,
http://nationalatlas.gov/atlasftp.html?openChapters=chpwater#chpwater>

Figure 6. Major river basins containing proposed critical habitat units for the Neosho mucket and rabbitsfoot mussels in the eastern region.

The No Action Alternative would be no designation of critical habitat for the Neosho mucket and rabbitsfoot. Analysis of this alternative describes the existing environment and consequences that are anticipated as a result of the proposed listing under the ESA of the Neosho mucket as endangered and rabbitsfoot as threatened (77 FR 63440, October 16, 2012), without designation of critical habitat. The Proposed Action is designation of critical habitat for the two mussel species concurrent with their listing.

A separate analysis of the incremental economic impacts of proposed critical habitat designation for the two mussel species ("economic analysis") was conducted (Industrial Economics, Inc. 2013) and its results are incorporated into this EA. The draft economic analysis reports both the baseline economic impacts resulting solely from the two mussel species being respectively listed as endangered and threatened, without any critical habitat, and the estimated incremental economic effects arising specifically from the proposed critical habitat designation. The time frame for the analysis in this EA is 20 years extending from 2013 to 2032. Recovery plans have not yet been developed for either of the mussel species. However, 10 to 50 years is a typical time frame for recovery, with many plans forecasting recovery in a 10-year time frame following completion of the plan (General Accounting Office 2006, p.4). Recovery of the two mussel species would presumably lead to their delisting, in which case critical habitat for the two mussel species would no longer be designated.

3.1.4 Summary of Section 7 Consultation Case Studies

No prior section 7 consultation involving Neosho mucket as a candidate species has been conducted and only two prior section 7 consultations concerning the rabbitsfoot as a candidate species have occurred. In 2010, a Final Intra-Service Biological and Conference Opinion (BO/CO) was issued based on a Memorandum of Agreement between the Service and Frontier Energy Services, LLC governing recovery-focused conservation for the speckled pocketbook mussel (*Lampsilis streckeri*), the yellowcheek darter, and the rabbitsfoot while allowing incidental take resulting from pipeline construction and maintenance activities in Arkansas (Service 2010a, p. 1). This agreement was subsequently amended in 2011 transferring terms and conditions to Crestwood Midstream Partners LP upon its acquisition of the prior company (Service 2011, p.1).

From Federal fiscal year 2007 to 2012, based upon the Service's Tracking and Integrated Logging System (TAILS) documenting section 7 consultations, there have been 843 consultations with the Service on actions in the Neosho mucket and rabbitsfoot study areas on other listed freshwater species (Service 2012b). These actions are summarized by activity category in Table 5 and major river basin in Table 6. These section 7 consultations constitute the pool of case studies that form the basis of the effects analysis.

Of these section 7 consultation cases, the majority involved transportation projects such as roads, bridges, and a few airport improvements, and construction of utilities such as electric transmission lines, water pipelines, and communication towers. Land development (including residential, commercial, and Federal, local, and Native American tribal governments), and oil and gas exploration, development, and pipelines are also major activities prompting section 7 consultation. Forty-four percent of the consultations occurred in the Ohio River Basin, an area encompassing many commercially navigable rivers and that is experiencing intensive residential and commercial land and energy development and the construction of the transportation and

utility infrastructure needed to support these activities. Fifteen percent of the consultations occurred in the White River Basin, the next most active watershed in Arkansas and Missouri, most involving transportation and utilities, water treatment, and land development activities.

Approximately 61 percent of the cases were informal consultations, followed in frequency by technical assistance (36 percent), species list requests (1.5 percent), and formal consultations (1.3 percent). The number of formal consultations totaled 11, of which seven involved transportation activities, one was for removal of a non-federal dam, one a sanitary sewer siphon, one BLM wild horse holding facility, and one intra-service consultation/biological opinion for a Safe Harbor Agreement (SHA)/Candidate Conservation Agreement with Assurances (CCAA) for the speckled pocketbook mussel and yellowcheek darter in the White River Basin.

The lead agency for the majority of cases were states (42.0 percent), followed in frequency by Federal agencies (24.8 percent, mostly the U.S. Army Corps of Engineers (Corps) and Federal Highway Administration (FHWA)); and municipalities (0.2 percent). The remaining 32.7 percent were initiated by various other entities, including but not limited to consultants and other non-federal agencies.

Table 5. Section 7 consultation history by activity category

Activity Categories	Number of Cases	Activities
Land Development	150	Residential, commercial, government, Tribal
Water Management Impoundments/Dams/Diversions/ Groundwater Development	82	Dam and reservoir operation and maintenance, diversion structures, flood control, wells, bank stabilization
Navigation	16	Locks and dam structures, dredging, channelization, docks
Transportation/Utilities	229	Bridge and road construction, communication towers, wind turbines, powerlines, pipelines
Forest Management	7	Timber, prescribed burns, recreation facilities
Agriculture	22	Crop production, grazing, CAFO[1]
Hydropower	5	Dams and associated facilities
Oil/Gas	131	Drilling, mining, pipelines, and exploration
Non-energy Mining	21	Instream sand and gravel mining, mineral extraction
Coal Mining	2	Coal mining and associated access and facility development
Resource Management Plans	15	Federal lands
Recreation	22	Recreation facilities
Federal Lands Management	14	Fire suppression, pesticide use, exotic/invasive species control, stream bank stabilization

Activity Categories	Number of Cases	Activities
Water Treatment	93	Wastewater, stormwater
Research	3	Research potentially impacting aquatic listed species or critical habitat
Other	31	Other and unidentified activities
TOTAL	843	

Source: Service 2012b
Note: [1] Concentrated Animal Feed Operation

Table 6. Section 7 consultation history by river basin, 2007-2012

River Basin	Number of Cases
Arkansas River	24
Cumberland River	0
Illinois River	121
Lower Mississippi	1
Neosho	40
Ohio River	375
Red River	98
Tennessee River	53
Verdigris River	1
White River	130
TOTAL	843

Source: Service 2012b

3.2 Conservation of the Neosho Mucket and Rabbitsfoot

3.2.1 Existing Conditions

Although the Neosho mucket nor rabbitsfoot are currently listed under the ESA, there has been one conference opinion for the under the jeopardy standard has been conducted. Also, there is designated critical habitat for the oyster mussel (Duck River dartersnapper), Cumberlandian combshell mussel, and yellowcheek darter (50 CFR 17.95(f)) that overlaps with rabbitsfoot proposed critical habitat units RF7, RF16, and RF19 (*cf.* section 1.4.1) As these species have physical or biological feature similar to those of Neosho mucket and rabbitsfoot, rabbitsfoot already receives a similar level of protection from threats due to critical habitat designated for the other three species. In addition, the State of Kansas has designated state critical habitat for the Neosho mucket and rabbitsfoot in areas that overlap proposed Federal critical habitat Units NM3, NM4, NM6, NM7, RF1, RF2, and RF3 and affords state-level protections similar to those under the ESA.

The Neosho mucket and rabbitsfoot are not currently covered under any SHAs and CCAAs; however, one permitted SHA and CCAA and two additional SHAs and CCAAs currently under review by the Service for aquatic species occur within the study area associated with proposed critical habitat units in Arkansas. The endangered speckled pocketbook (mussel) and yellowcheek darter are covered by a programmatic SHA and CCAA in the upper Little Red River watershed in Arkansas. This watershed includes proposed critical habitat for rabbitsfoot (Unit RF7). The Service is currently reviewing a proposed amendment to these agreements that would add rabbitsfoot to the SHA. No additional conservation measures would be required beyond those already recommended for speckled pocketbook and yellowcheek darter. Of the 205,761 hectares (ha) (508,446 acres (ac)) within the upper Little Red River watershed known to support the yellowcheek darter, approximately 35,208 ha (87,000 ac) are owned by private parties (Service 2007, p. 4). To date, multiple landowners have enrolled 4,935 ha (12,195 ac) in the program since its inception in mid-2007, and 10 more landowners with approximately 20,234 ha (50,000 ac) have pending draft agreements.

The Service is currently reviewing two other programmatic SHAs and CCAAs in Arkansas. Rabbitsfoot would be covered by one SHA in the upper Ouachita and Saline rivers. Private lands eligible for enrollment in this conservation program include areas within the proposed critical habitat for rabbitsfoot Units RF4a and RF5

Neosho mucket and rabbitsfoot would benefit indirectly from a programmatic SHA and CCAA covering the karst region (cave-dependent species that depend upon caves, their groundwater recharge areas, and riparian foraging areas) of northwest and north central Arkansas. Private lands eligible for enrollment in this conservation program include riparian and upland areas that are adjacent to the proposed critical habitat boundary (Unit NM1 and Units RF7, RF10, RF11, and RF12). If a karst-region conservation plan is implemented, special management activities could minimize threats to the two mussel species by reducing sedimentation, erosion, and bank side destruction; moderation of surface and ground water withdrawals to maintain natural flow regimes; increase of stormwater management and reduction of stormwater flows into the systems; preservation of headwater springs and streams; regulation of off-road vehicle use; and reduction of other watershed and floodplain disturbances that release sediments, pollutants, or nutrients into the water.

Participation in the above SHAs and CCAAs are strictly voluntary on the part of private landowners, who can opt out of the agreement at any time. These agreements provide added benefits for the recovery of the Neosho mucket and rabbitsfoot, but do not guarantee long-term protection of habitat. The proposed critical habitat for the Neosho mucket and rabbitsfoot includes only the stream channel within the ordinary high water line (owned by the State). Thus, the properties enrolled in the SHAs and CCAAs are not proposed for designation as critical habitat for the Neosho mucket or the rabbitsfoot.

One of the primary threats to the two mussel species is destruction or modification of their habitat (77 FR 63440, October 16, 2012, p. 63455). The Neosho mucket and rabbitsfoot are vulnerable to a wide variety of threats including siltation, industrial and municipal effluents, modification of stream channels, impoundments, pesticides, heavy metals, invasive species, and the loss of host fish. Chief among the causes of decline in distribution and abundance of the Neosho mucket and rabbitsfoot, and in no particular order of ranking, are impoundment, channelization, sedimentation, chemical contaminants, mining, and oil and natural gas development. Conservation of the two mussel species depends upon protection of their few

remaining habitats and watersheds because most are fragmented, small, and isolated. The majority of extant rabbitsfoot populations are marginal and small (78 percent), and isolated (80 percent), with only two small (5 percent) and four of 11 viable populations (36 percent) not isolated from another viable population (77 FR 63440, October 16, 2012). The patchy distributional pattern of populations in short river reaches makes them more susceptible to extirpation from single catastrophic events, such as toxic chemical spills (Watters and Dunn 1995, p. 257) or drought.

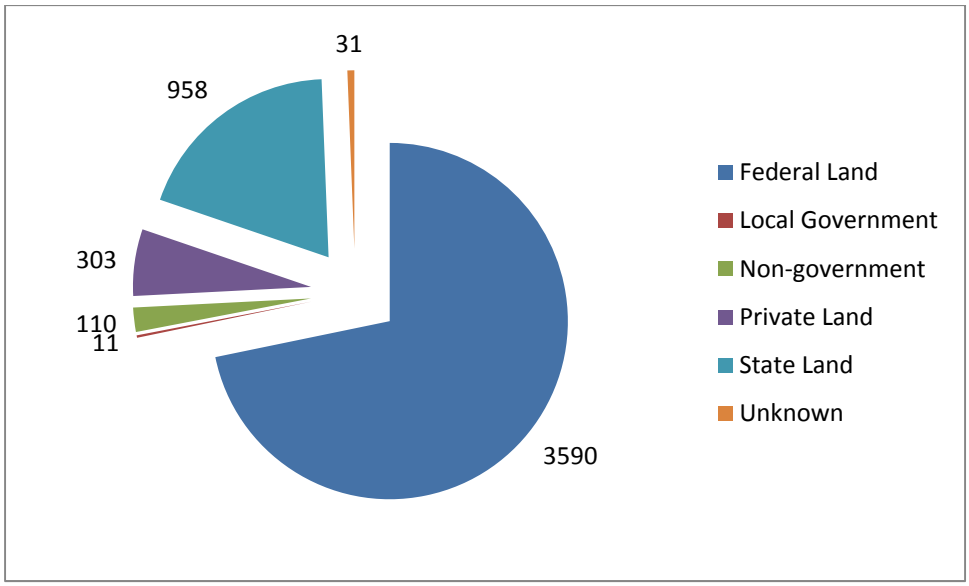
The two mussel species have benefited from protections afforded other co-occurring federally listed species having similar habitat. For example, 843 informal and formal consultations under the ESA have been conducted from 2007 to 2012 on activities in the study area for the two mussels. Other direct and indirect conservation of the Neosho mucket and rabbitsfoot habitat is currently undertaken by Federal, state, and local agencies, non-governmental entities, and private landowners that manage lands for the protection and restoration of a variety of terrestrial and aquatic species. The protected lands in the areas where activities hold the most potential to impact the two mussel species are discussed below by major river basin. Conservation lands consisting of parks, forests, wildlife reserves and preserves, and Wild and Scenic Rivers comprise a database of protected lands managed by the U.S. Geological Survey (USGS) that is the basis for this analysis (USGS 2011, http://gapanalysis.usgs.gov/padus/data/download/). Table 7 presents the protected lands directly overlapping or bordering proposed critical habitat. Named protected lands are individually identified parcels in the data set. The majority of protected lands is federally owned or controlled (Figure 6). In this analysis, only the study area in the vicinity of Unit RF7 did not contain any protected lands as defined by the USGS.

Table 7: Protected lands within the Study Areas for proposed critical habitat

Proposed Critical Habitat Unit	State	River Basin	Protected Lands within the Study Areas for Proposed Critical Habitat
NM1	AR, OK	Illinois River	Wedington Wildlife Management Area in the Ozark St. Francis National Forest, AR; Cookson Hill Nature Preserve, Corps lands for Tenkiller Fairy Lake, OK
NM2	MO, KS	Neosho River	Elk River access parcel, MO
NM3	KS, MO	Arkansas River	Wildcat Glade Natural Area, four Shoal Creek accesses, MO
NM4	KS, MO	Arkansas River	Spring River Wildlife Area, KS; three Spring River accesses, MO
NM5	MO	Arkansas River	--
NM6	KS	Verdigris River	Fall River State Park
NM7	KS	Arkansas River	--
NM8	KS	Neosho River	--
RF1	KS, MO	Arkansas River	Spring River Wildlife Area, KS
RF2	OK	Arkansas River	--
RF3	KS	Arkansas River	--

RF4a	AR	Red River	Muddy Creek Wildlife Management Area, Big Fork Creek Natural Area, Black Fork Mountain Wilderness Area, Ouachita National Forest
RF4b	AR	Red River	--
RF5	AR	Red River	Jenkins Ferry State Park
RF6	AR, OK	Red River	Pond Creek National Wildlife Refuge, Ouachita National Forest, AR; Ouachita National Forest, Little River National Wildlife Refuge, OK
RF7	AR	White River	--
RF8a	AR	White River	Jacksonport State Park, Henry Gray/Hurricane Lake Wildlife Management Area
RF8b	AR	White River	Cache River and White River National Wildlife Refuges
RF9	AR	White River	Shirley Bay Raney Brake, Old Davidsonville State Park
RF10	AR	White River	Harold Alexander Spring River Wildlife Management Area
RF11	AR	White River	--
RF12	AR	White River	--
RF13	AR	White River	Buffalo River National Wild and Scenic River and National Park
RF14	MO	Lower Mississippi River	Corps managed Wappapello Lake, privately held conservation lands for Wappapello Lake, Sam A. Baker State Park, one access to St. Francis River
RF15	MS	Lower Mississippi River	--
RF16	MS	Tennessee River	Natchez Trace Parkway and National Scenic Trail, Pickwick Reservoir retained lands, Tishomingo State Park
RF17	MS	Lower Mississippi River	--
RF18	AL	Tennessee River	Fern Cave National Wildlife Refuge, Alabama Land Trust
RF19	TN	Tennessee River	Columbia Greenway, Natchez Trace Parkway and National Scenic Trail, Williamsport Wildlife Management Area, Yanahli Wildlife Management Area, Duck River State Natural Area
RF20a	TN	Tennessee River	Shiloh National Battlefield
RF20b	KY	Tennessee River	Kentucky Dam Village State Resort Park

RF21	IL, KY	Ohio River, Cumberland River	Ballard Wildlife Management Area, West Kentucky Wildlife Management Area, Thornton-Lansing Road Nature Preserve, KY; Fort Massac Land and Water Reserve, Halesia Nature Preserve, Lino Laird Ravine, Chestnut Hills Nature Preserve, Ohio River Hillerman protected riverscape, IL.
RF22	KY	Ohio River	15 Green River Watershed Conservation Preserve easements, Mammoth Cave National Park
RF23	PA	Ohio River	French Creek Preserve, Western Pennsylvania Conservation Program four enrolled parcels, State game land
RF24	PA	Ohio River	State game land, Clear Creek State Forest
RF25	PA	Ohio River	Erie National Wildlife Refuge
RF26	IN	Ohio River	Four Tippecanoe River public accesses, Freeman/Sherman Gamebird Habitat Area, Horseshoe Bend Natural Area, Prophetstown State Park
RF27	OH	Ohio River	Mohawk Reservoir, reserved lands, Muskingam Watershed Conservancy
RF28	OH	Ohio River	--
RF29	IL	Ohio River	--
RF30	OH	Lower Great Lakes	Fish Creek Wildlife Area
RF31	KY, TN	Cumberland River	--
RF32	PA	Ohio River	Shenango Lake Recreation Area



Source: USGS 2011, http://gapanalysis.usgs.gov/padus/data/download/.

Figure 7. Ownership categories and number of named protected land parcels.

The study area for Units RF3 and NM7 is in Kansas and includes large protected lands such as the Kansas Army Ammunition Plant, three reclaimed mine wildlife areas, and the Neosho Wildlife Area. No protected lands overlap or border these units.

Many of the protected lands in the USGS inventory prohibit activities detrimental to wildlife, improve water quality, and preserve water quantity important to aquatic species such as the Neosho mucket and rabbitsfoot. However, multiple-use activities such as recreation, crop production, facility development, or extractive resource activities are also approved uses of these lands. Further, maintenance activities may adversely affect aquatic species if improperly applied. For example, the use of pesticides and herbicides, and soil disturbing activities that may contribute to sedimentation of nearby waters are often permitted on many protected lands.

Arkansas River

In the Arkansas River Basin, 120 separately named parcels of protected lands are within the study area for critical habitat Units NM3, NM4, NM5, RF1, RF2, RF3, and NM7. The study area for Units NM3, NM4, NM5, and RF1 is in Kansas and Missouri. Large protected lands in this study area include the Shawnee Trail State Conservation Area and Robert E. Talbot Conservation Area in Missouri and various reclaimed mines in Kansas. One protected land borders Unit RF1, five overlap or border Unit NM3, and four overlap or border Unit NM4 (Table 7).

Large protected lands in the study area for Unit RF2 in Oklahoma include Greater Flint Hills Conservation Preserve, the Osage, Candy, and Skiatook Wildlife Areas, and several lakes managed by the Corps; however, no protected lands overlap or border this unit.

Cumberland River

This basin includes the eastern portion of the study area for Unit RF21 and the study area of Unit RF31. A total of five named protected lands are found in the study areas: Bissel Bluff State Natural Area and Bald Knob Glade Conservation Preserve in Kentucky are in the Unit RF21 study area, whereas the Unit RF31 study area contains the Cedar Hill Swamp Wildlife Management Area and two parcels managed by the Farmers Home Administration as wildlife areas, both in Tennessee. No protected lands overlap or border Unit RF21 in the portion within the Cumberland River basin or Unit RF31.

Illinois River

Forty-two named protected lands are within the study area for Unit NM1 in Arkansas and Oklahoma. Large protected lands in the study area include Natural Falls State Park, Ozark Plateau National Wildlife Refuge, Cookson Hills Nature Preserve, and Tenkiller Fairy Lake in Oklahoma; Wedington Wildlife Management Area, Prairie Grove Battlefield State Park, Logan Cave National Wildlife Refuge, Chensey Prairie Natural Area, and National Military Park in Arkansas; and Ozark St. Francis National Forest in both states. Protected lands overlapping or bordering Unit NM1 include the Wedington Wildlife Management Area within the Ozark St. Francis National Forest in Arkansas, and Cookson Hill Nature Preserve and lands managed by the Corps for Tenkiller Fairy Lake in Oklahoma (Table 7).

Lower Great Lakes

Thirty-eight named protected lands are within the study area for Unit RF30. This study area occurs in the Lower Great Lakes river basin (Indiana and Ohio). Large protected lands in the Unit RF30 study area in Indiana include the Douglas Woods Conservation Preserve, Douglas Glade Nature Preserve, and the Fish Creek Ecosystem Preserve. The Fish Creek Wildlife Area is the only protected land directly overlapping and bordering Unit RF30 in Ohio (Table 7), and the only other protected land in the state in the study area is Mud Lake Bog Nature Preserve.

Lower Mississippi

Units RF14, RF15, and RF17 are located in the Lower Mississippi River basin in Missouri and Mississippi. There are 120 named protected lands within the study area for these units, of which 92.5 percent (or 111) are associated with Unit RF14. Large protected lands in the Unit RF14 study area in Missouri include Mark Twain National Forest, Coldwater Conservation Area and Sam A. Baker State Park. Four protected lands overlap or directly border Unit RF14 (Table 7).

There are only nine protected lands within the study area for Units RF15 and RF17, the largest of which is the Natchez Parkway National and Scenic Trail, and none overlap or directly border these proposed critical habitat units.

Neosho River

The study area for Units NM2 and NM8 occurs within the Neosho River Basin in Arkansas, Missouri, and Kansas, with only a small portion of Unit NM2 study area extending into Oklahoma. A total of 49 named protected lands occur in the study area of Units NM2 and NM8. Large protected lands include the National Military Park, Flag Spring Conservation Area, Fort Crowder Conservation Area, Camp Crowder, Huckleberry Ridge Conservation Area, and Elk River Breaks Woodland in the Unit RF2 study area in Missouri, whereas no protected lands are within this Unit's study area in Oklahoma. Tallgrass Prairie National Preserve, Greater Flint Hills Conservation Preserve, and Chase State Fishing and Wildlife Area are the large protected lands in the Unit NM8 study area in Kansas. The only protected land overlapping or bordering

either proposed critical habitat unit in the Neosho River basin is a small parcel for access to the Elk River directly bordering Unit NM2 in Missouri (Table 7).

Ohio River

The Ohio River Basin which encompasses portions of Illinois, Indiana, Ohio, Kentucky, Pennsylvania, and New York includes the study areas for the west half of Unit RF21, Units RF22-RF29 and RF32. A total of 781 named protected lands occur in the study area have activities. Large protected lands in the study area of RF21include Shawnee National Forest and Cache River Land and Water Reserve. Eight protected lands overlap or border Unit RF21 (Table 7).

Green River Watershed Conservation Preserve and Mammoth Cave National Park are large protected lands in the Unit RF22 study area in Kentucky. Unit RF22 is overlapped or bordered by 16 protected lands (Table 7). Large protected lands within the study area for Units RF23 and RF25 include the Erie National Wildlife Refuge, various parcels of Pennsylvania State game lands, and Woodcreek Cock Lake managed by the Corps. Unit RF23 is overlapped or bordered by six protected lands and Unit RF25 is entirely within the Erie National Wildlife Refuge (Table 7).

The study area for Unit RF24 is within Pennsylvania and New York. Within its study area the Allegheny National Forest is a large protected land occurring in both states. Pennsylvania State game land, Hickory Creek Wilderness Area, Oil Creek State Park and Tionesta Lake are other large protected lands in this study area. Unit RF24 is overlapped or bordered by a parcel of state game land and Clear Creek State Forest in Pennsylvania (Table 7). Unit RF26 along the Tippecanoe River is in two separate segments entirely within Indiana. Large protected lands in the study area include the Winamac Fish and Wildlife Area and Tippecanoe River State Park Unit RF26 is overlapped or bordered by seven protected lands (Table 7).

The study area for Unit RF27 in Ohio is large in relation to the proposed critical habitat (see Figure 2). Large protected lands within this area include Kokosing Lake Wildlife Area and lands managed by the Corps for Mohawk Reservoir, Mohican River Wildlife Area, Mohican Memorial State Forest, and Mohican Memorial State Park. Unit RF27 is overlapped by Mohawk Reservoir lands and the Muskingam Watershed Conservancy (Table 7).

Within the Unit RF28 study area in Ohio, the only protected lands are the Milton Center Railroad Prairie Conservation Area and Big Darby Creek Conservation Area, neither of which is near Unit RF28.

The study area for Unit RF29 is in Illinois and Indiana. The only protected lands within its study area are Jordan Creek of the North Fork Nature Preserve, and the North Fork of the Vermillion River Conservation Area in Illinois, and the Kirsch and Knob View Gamebird Habitat areas in Indiana. No protected lands overlap or border Unit RF29.

A total of only four protected lands are within the study area of Unit RF32 in western Pennsylvania, including Pymatuning State Park, lands enrolled in the Northwest Pennsylvania Conservation Program, state game land, and Shenango Lake Recreation Management Area which overlaps the majority of Unit RF32 (Table 7).

Red River

Units RF4a, RF4b, RF5, and RF6 are within the Red River Basin encompassing portions of Arkansas and Oklahoma. The USGS database lists 179 named protected lands in the study area for these proposed critical habitat units.

Protected lands in the Unit RF4a study area in Arkansas include Muddy Creek Wildlife Management Area, Big Fork Creek Natural Area, and Black Fork Mountain Wilderness Area. Additionally, Ouachita National Forest directly overlaps this unit (Table 7).

Unit RF4b lies entirely within Arkansas. Large protected lands in the study area include Crater of Diamonds State Park and Lake Greeson Wildlife Management Area. No protected lands overlap or border Unit RF4b.

Also entirely within Arkansas, the study area for Unit RF5 contains only eight protected lands including Flatside National Wilderness Area, Lake Winona Early Research Natural Area, Marks' Mills State Park, McCloy Park, Ouachita National Forest, Warren Prairie Natural Area, Wayside Park, Winona Wildlife Management Area, and Jenkins Ferry State Park, the latter directly bordering Unit RF5 (Table 7).

Unit RF6 extends into Arkansas and Oklahoma. Protected lands within the Oklahoma study area include Beavers Bend State Resort Park, lands managed by the Corps for Broken Bow Lake, Oklahoma State Trust Lands, Hochatown State Park, Ouachita National Forest and Little River National Wildlife Refuge, of which the latter two overlap Unit RF6 (Table 7). In Arkansas, protected lands in the study area include Howard County Wildlife Management Area, Pine Creek Wildlife Management Area, Wayside Park, and Pond Creek National Wildlife Refuge, the latter of which overlaps Unit RF6.

Tennessee River

The study area for Units RF16, RF18, RF19, RF20a, and RF20b is within the Tennessee River basin and encompasses portions of Mississippi, Alabama, Tennessee, and Kentucky. A total of 84 named protected lands are within the study area. Unit RF16 winds along the border of Mississippi and Alabama. The study area includes large protected lands such as those managed by the Alabama Land Trust, Bear Creek, Little Bear Creek, Upper Bear Creek and Clear Creek Reservoir retained lands, and Lauderdale and Freedom Hills Wildlife Management areas. Unit RF16 is also overlapped by three additional protected lands (Table 7).

The study area for Unit RF18 lies within Alabama and Tennessee. The study area has protected lands including Alabama Land Trust managed lands, Fern Cave National Wildlife Refuge, Cathedral Caverns State Park, Walls of Jericho State Natural Area in Tennessee and Walls of Jericho wildlife tract in Alabama, and the James D. Martin Skyline Wildlife Management Area in Tennessee. This unit is overlapped or bordered by Fern Cave National Wildlife Refuge and a parcel of Alabama Land Trust land.

The reach of Duck River occupied by the rabbitsfoot Unit RF19 lies in central Tennessee. Nine protected lands in the study area include Autney Hollow and Stillhouse Hollow Falls State Natural Areas, Devil's Backbone State Park, Langford Branch State Natural Area, the Middle Tennessee State University Wildlife Management Area, Columbia Greenway, Natchez Trace Parkway and National Scenic Trail, Williamsport Wildlife Management Area, Yanahli Wildlife Management Area, and Duck River State Natural Area. Five of these protected lands overlap or directly border Unit RF19 (Table 7).

Unit RF20a in Tennessee is bordered by Shiloh National Battlefield (Table 7). Other protected lands within the study area include Chambers Creek Wildlife Management Area, Pickwick Landing State Park, Walker Branch Damselfly and Dragonfly Preserve, and land managed by the Tennessee Valley Authority (TVA).

Unit RF20b includes the stretch of the Tennessee River extending from the Kentucky Dam to the Ohio River in Kentucky. Protected lands in the study area include Kentucky Reservoir managed by the Corps, Clarks River National Wildlife Refuge, Cypress Creek Swamp Conservation Preserve, and Kaler Bottoms Wildlife Management Area. Unit RF20b is bordered by Kentucky Dam Village State Resort Park (Table 7).

Verdigris River

The study area for Unit NM6 occurs in the Verdigris River basin, Kansas. The only protected land overlapping or bordering this unit is Fall River State Park (Table 7). Other protected lands in the study area include Toronto Lake managed by the Corps and nearby Toronto Lake State Park, Wilson and Woodson State Fishing Lakes, and the latters' respective designated wildlife areas.

White River

Units RF8a, RF8b, RF9, RF10, RF11, RF12 and RF13 occur in the White River basin. The study area includes 3,598 parcels of named protected lands in Arkansas. The majority of these are associated with the Ozark National Wild and Scenic River in Unit RF9 study area and the Buffalo National Wild and Scenic River/Buffalo National Wilderness Area in the Unit RF13 study area.

Protected lands in the Unit RF8a study area include Departee Creek Wildlife Management Area, Jamestown Wildlife Management Area, and a wayside park managed by the Arkansas Department of Transportation. Two protected lands also border Unit RF8a, including Jacksonport State Park and Henry Gray/Hurricane Lake Wildlife Management Area.

Many protected lands are within the study area surrounding Unit RF8b, of which larger ones include the Cache River National Wildlife Refuge, White River National Wildlife Refuge, both of which directly overlap or border Unit RF8b, and the Wattensaw Wildlife Management Area and Dagmar Wildlife Management Area.

Unit RF9 large protected lands include the Mark Twain National Forest and the Ozark National Scenic Riverway. Protected lands overlapping or bordering Unit RF9 include Shirley Bay Raney Brake and Old Davidsonville State Park (Table 7).

The study area for RF10 and RF11 lays along the main stem Spring River and the South Fork Spring River in Arkansas. Large protected lands in this area include the Cover Prairie Conservation Area, Rock Creek Natural Area, Tingler Prairies Natural Area, Vanderhoef Memorial State Forest, Warm Fork Conservation Area, and the White Fork Conservation Area. In addition, Unit RF10 is bordered by the Harold Alexander/Spring River Wildlife Management Area, while no protected lands overlap or border Unit RF11 (Table 7).

Unit RF12 is a stretch of the Strawberry River in Arkansas. The only protected lands in the study area are the Harold Alexander/Spring River Wildlife Management Area and a wayside park managed by the Arkansas Department of Transportation, neither overlapping nor bordering the unit.

Unit RF13 comprises two segments of the Buffalo River in Arkansas. The Buffalo River is a National Wild and Scenic River and National Park (Table 7). Other large protected lands within the study area surrounding Unit RF13 include Dismal Hollow Early Research Natural Area, Gene Rush/Buffalo River Wildlife Management Area, Leatherwood National Wilderness Area, Ozark National Forest, Richland Creek National Wild and Scenic River, Sylamore Wildlife Management Area, and Upper Buffalo National Wilderness Area.

3.2.2 Effects on the Neosho Mucket and Rabbitsfoot

3.2.2.1 No Action Alternative

As described above in section 3.1.3, the No Action Alternative is defined as listing of the Neosho mucket as an endangered species and rabbitsfoot as a threatened species in accordance with the proposed rule (77 FR 63440, October 16, 2012) without designating critical habitat. Under existing conditions, section 7 consultation with the Service under the ESA would be triggered under the jeopardy standard when a proposed Federal action is likely to adversely affect either of the two listed mussel species. The section 7 consultation process begins with a determination of the effects on a listed species by a Federal action agency. If the Federal action agency determines that there would be no effect on listed species, then the section 7 consultation process concludes at that point. If the Federal action agency determines that listed species may be affected, then consultation with the Service is initiated. Once it is determined that the proposed Federal action may adversely affect (also termed likely to adversely affect) a listed species, the Federal action agency and the Service may enter into informal section 7 consultation. Informal consultation is an optional process for identifying affected species, determining potential effects, and exploring ways to modify the action to remove or reduce adverse effects on listed species. During this process the Service may make suggestions concerning project modifications, which then can be adopted by the action agency.

The informal section 7 consultation process concludes in one of two ways: (1) the Service concurs in writing that the Proposed Action is not likely to adversely affect listed species, or (2) the Service determines that adverse effects are likely to occur. Formal consultation is initiated when it is determined that the proposed Federal action is likely to adversely affect listed species. Formal consultation concludes with a biological opinion issued by the Service on whether the proposed Federal action is likely to jeopardize the continued existence of a listed species. Generally, consultations are formally concluded with the issuance of the Biological Opinion.

Under the No Action Alternative, any proposed activity with a Federal nexus that may adversely affect (likely to adversely affect) the Neosho mucket and rabbitsfoot would trigger section 7 consultation under the jeopardy standard pursuant to the ESA. Section 7 consultation under the No Action Alternative for the adverse modification standard would only occur where the Neosho mucket and rabbitsfoot are listed and overlapped by federally designated critical habitat for another listed species. Critical habitat of the federally listed oyster mussel (Duck River dartersnapper), Cumberlandian combshell, and yellowcheek darter overlap the rabbitsfoot's distribution in three locations (*cf.* section 3.2.1) (50 CFR 17.95(f) and 17.95(e)). Many of the habitat elements relevant to conservation of the rabbitsfoot are currently considered in section 7 consultations for the overlapping species' critical habitat. However, the PCEs to support other overlapping species may not be identical to those needed by the Neosho mucket and rabbitsfoot. The conservation value of critical habitat designation for the two mussel species within other

overlapping species' critical habitat, therefore, may not be realized with the No Action Alternative. Critical habitat designation provides a regulatory mechanism, through section 7 consultation, to evaluate the effects of proposed actions on key habitat features within areas that are essential to the conservation of the species. Thus, changes to important habitat characteristics (the PCEs) could be tracked to ensure that critical habitat retains its value, capability, and potential for conservation of the two mussel species.

There are also non-regulatory aspects of critical habitat designation that could contribute to conservation of the two mussel species, such as informing the public and private sector of areas that are important for species recovery, focusing attention on specific geographic areas that are essential to conservation of the Neosho mucket and rabbitsfoot, identifying areas that may require special management considerations or protection, and providing protection to areas where significant threats to the species have been identified to help avoid accidental damage to such areas. These benefits to the two species may not be realized in areas of proposed critical habitat units that overlap with other species' designated critical habitat under the No Action Alternative. As discussed in section 3.2, the majority of protected conservation lands in the watersheds where activities would most likely affect the proposed critical habitat for the Neosho mucket and rabbitsfoot are under Federal ownership or control. However, many conservation lands are under other government or private ownership that may also receive these non-regulatory benefits of critical habitat designation.

3.2.2.2 Proposed Action Alternative

Under the Proposed Action, the listing of the two species with designation of critical habitat would have some beneficial conservation effects to the Neosho mucket and rabbitsfoot mussels beyond protections afforded only by their listing under the ESA as endangered and threatened species, respectively. The Proposed Action would have the effect of requiring section 7 consultation when proposed Federal actions may affect PCEs within the boundaries of the proposed critical habitat designation. With the designation of critical habitat for the two species, consultation on activities with a Federal nexus that potentially diminish the PCEs would require evaluation of potential impacts to each specific PCE. An adverse modification would occur if the effect of an action is severe enough to diminish the value of the habitat for the survival and recovery of the species. If the action also would affect the remaining populations, population size, reproduction and recruitment to the extent that the likelihood of survival in the wild is appreciably reduced, then a jeopardy determination also would result (Service 2012a, p. 3). However, because the ability of the two mussel species to exist is so closely tied to the quality of their habitat, in most cases, significant alterations of their habitat would also result in a jeopardy determination. Recommendations to avoid a jeopardy or adverse modification determination would have little to no differences.

Critical habitat designation provides a mechanism to ensure that habitat characteristics and functions essential for conservation of the Neosho mucket and rabbitsfoot are retained in the critical habitat units. In general, critical habitat designation is correlated with increased efforts to conserve listed species. Critical habitat designation helps to improve populations of listed species and increases knowledge about population trends and status. Taylor *et al.* (2005, p. 360) found that species with designated critical habitat in place for two or more years were more likely to be improving and less likely to be declining than species without designated critical habitat. However, in an economic analysis of factors contributing to conservation status of listed species by Kerkvliet and Langpap (2007, p. 499) did not find critical habitat to be a significant variable.

More recently, Gibbs and Currie (2012, p. 2) studied the effect of Federal critical habitat designation by comparing species status before and after designation and whether the effect of designation is stronger for species that are specifically threatened with habitat loss. They found species' recovery scores were not significantly related to whether, or how long, critical habitat had been designated. However, they indicate their findings suffered from poor species recovery data.

Non-regulatory aspects of critical habitat designation that would contribute to conservation of the two mussel species could be realized with implementation of the Proposed Action. These benefits may include informing the public and private sector of areas that are important for species recovery and where conservation actions may be most effective, including non-federal lands. Critical habitat designation focuses attention to and awareness of specific geographic areas that are essential to conservation of the two mussel species. Critical habitat also identifies areas that may require special management considerations or protection, and may help provide protection to areas where significant threats to the species have been identified to help avoid accidental damage to such areas. When a Federal agency proposes an action and can see that the action is located within the boundaries of a critical habitat unit, they can plan their projects in a proactive fashion consistent with section 7(a)(1) of the ESA.

Special Management Considerations or Protection

When designating critical habitat, the Service assesses whether the specific areas within the geographic area occupied by the species at the time of listing contain features which are essential to the conservation of the species and which may require special management. The units the Service proposes to designate as critical habitat for the Neosho mucket and rabbitsfoot would require some level of management to address the current and future threats to the physical and biological features and PCEs of these species.

Special management considerations or protections may be required to eliminate, or to reduce to negligible levels, the threats affecting each proposed critical habitat unit. For example, the physical and biological features of proposed Unit NM1 (Illinois River) require special management considerations or protection to address changes in stream channel stability associated with urban development and clearing of riparian areas due to land use conversion in the watershed; alteration of water chemistry or water and sediment quality; and changes in stream bed material composition and quality from activities that would release sediments or nutrients into the water, such as urban development and associated construction projects, livestock grazing, confined animal operations, and timber harvesting. Other units impounded by dams (such as Unit RF21, Ohio River) may require special management of channel stability and channelization associated with dam tail water releases (77 FR 63440, p. 63479 and p. 63482). However, in the case of SHAs and CCAAs that would include the Neosho mucket and rabbitsfoot prior to the final rule being in place, enrolled landowners are assured that if additional conservation measures are necessary to respond to changed circumstances (such as the listing of the Neosho mucket and the rabbitsfoot), the Service would not require such measures in addition to those provided for in the agreements without the consent of the landowner if a species becomes listed.

3.3 **Water Resources**

3.3.1 Existing Conditions

3.3.1.1 Navigation

The Rivers and Harbor Act (33 U.S.C. 401,403,407 *et seq*.) and section 404 of the Clean Water Act (CWA) require authorization from the Corps for the construction of any structure in or over navigable waters of the U.S., as well as the excavation/dredging or deposition of material in these waters or any obstruction or alteration in navigable water. Channelization and channel modification include river and stream channel engineering undertaken for flood control, navigation, drainage improvement, and reduction of channel migration potential (USEPA 2007, p. 3-1).

Dredging and channelization activities to promote navigation have profoundly altered riverine habitats nationwide. Hartfield (1993, pp. 131–139), Neves *et al.* (1997, pp.71–72), and Watters (2000, pp. 268–269) reviewed the specific upstream and downstream effects of channelization on freshwater mussels. Channelization affects a stream physically by accelerating erosion, increasing sediment bed load, reducing water depth, decreasing habitat diversity, inducing geomorphic (natural channel) instability, and eliminating riparian canopy. It also affects streams biologically by decreasing fish and mussel diversity, changing species composition and abundance, decreasing biomass, and reducing growth rates (Hartfield 1993, pp. 131–139). Channel modification for navigation has been shown to increase flood heights (Belt 1975, p. 684), partly as a result of an increase in stream bed slope (Hubbard *et al.* 1993, p. 137). While channelization can decrease flooding in the channelized area, flood events up and downstream are often more severe (USEPA 2007 p. 3-1), conveying large quantities of sediment, potentially with adsorbed contaminants, into streams. Channel maintenance often results in increased turbidity and sedimentation that often smothers mussels (Stansbery 1970, p. 10). Because mussels are relatively immobile, they require a stable substrate to survive and reproduce and are particularly susceptible to channel instability (Neves *et al.* 1997, p. 72) and alteration.

Habitat effects due to channelization are a significant and ongoing threat to the Neosho mucket and rabbitsfoot. Channel maintenance operations for commercial navigation have affected habitat for the rabbitsfoot in many large rivers rangewide. Periodic navigation maintenance activities (such as dredging and snag removal) may continue to adversely affect this species in the lower portions of the Ohio, Tennessee, and White Rivers, which represent 44 percent of the viable rabbitsfoot populations. In the Tennessee River, a plan to deepen the navigation channel has been proposed (Hubbs 2009, pers. comm.), and dredging of shoals is proposed on a 3-10 year rotation, depending on location (Corps No Date, p. 1). Some rabbitsfoot streams, such as the Verdigris River, were “straightened” to decrease distances traversed by barge traffic. Hundreds of miles of many midwestern (Eel, North Fork Vermilion, and Embarras Rivers) and southeastern (Paint Rock and St. Francis Rivers and Bear Creek) streams with rabbitsfoot populations were channelized decades ago to reduce the probability and frequency of flood events. Channel and bank degradation and loss of natural flow regimes have led to the loss of stable substrates in numerous rivers with commercial navigation throughout the range of rabbitsfoot. While dredging and channelization have had a greater effect on the rabbitsfoot, the Neosho mucket has been affected by these activities in the Verdigris River.

Navigational alterations on the Ohio River began in 1830, and now include 21 lock and dam structures stretching from Pittsburgh, Pennsylvania, to Olmsted, Illinois, near its confluence with the Mississippi River. Lock and dam structures convert riverine habitat to unsuitable static habitat for mussels and inhibit movement of their fish hosts. Numerous Ohio River tributaries also have been altered by lock and dam structures. For example, a 116 rkm (72 rmi) stretch of the Allegheny River in Pennsylvania has been altered with nine locks and dams from Armstrong County to Pittsburgh. A series of six locks and dams were constructed on the lower half of the Green River decades ago that extend upstream to the western boundary of Mammoth Cave National Park, Kentucky. The declines of rabbitsfoot populations are attributable to navigational locks and dams on the Ohio, Allegheny, Monongahela, Muskingum, Kentucky, Green, Barren, and White rivers; navigational locks and dams are widespread throughout the species range.

In accordance with section 10 of the Rivers and Harbors Act (33 U.S.C § 403), construction of any non-federal dam that does not produce power in or over any navigable water of the U.S. is regulated by the Corps. Various agencies of the Federal government also construct and operate locks and dams, such as the Corps, Bureau of Reclamation (BOR) and the TVA. The Corps also constructs and maintains Federal mooring structures to aid commercial traffic during lockages, provide berthing during delays, assist in transiting difficult stretches of the river, and provide other assistance to navigation. The Service reviews and comments on the effects to fish and wildlife from activities proposed to be undertaken or permitted by these Federal agencies. The Federal Energy Regulatory Commission (FERC) is the lead Federal agency under NEPA (18 CFR Part 380) for evaluating the potential environmental impacts of issuing licenses under the Federal Power Act (16 U.S.C., Chapter 12) to privately-owned dams for the purpose of hydropower production. As a Federal agency, FERC undertakes section 7 consultation with the Service to consider the potential effects of licensing hydropower dams on listed species and critical habitats. FERC-regulated dams are discussed in detail in Section 3.4, Energy Development and Production.

According to the 2006 National Atlas of the U.S. major dams database (National Atlas of the United States 2006, http://nationalatlas.gov/mld/dams00x.html), only seven navigation lock and dam systems are located within proposed critical habitat and adjacent consultation areas for the two mussel species. These structures are summarized in Table 8 and described below. Over the last five years, 16 section 7 consultations involving navigation activities were conducted in the areas most likely to affect proposed critical habitat for the two mussel species, none of which were formal.

Cumberland River Basin

Barkley Dam is the only navigational dam in the Cumberland River Basin in the study area for proposed critical habitat for the rabbitsfoot. It impounds the Cumberland River, forming Lake Barkley within the study area potentially affecting Unit RF21. The dam is near where the Cumberland River converges with the Ohio River in Kentucky, and is about 16 kilometers (km) (10 miles) upstream of Unit RF21 in the Ohio. The Barkley Dam is operated by the Corps' Nashville District.

Table 8. Study area navigational locks and dams

River Basin	Stream	State	Dam Name	Study Area
Cumberland	Cumberland	KY	Barkley Dam	RF21

River Basin	Stream	State	Dam Name	Study Area
River	River			
Ohio River	Ohio River	KY	Ohio River Lock and Dam 52	RF21
Ohio River	Ohio River	KY	Ohio River Lock and Dam 53	RF21
Ohio River	Allegheny River	PA	Kinzua Dam	RF24
Tennessee River	Tennessee River	TN	Pickwick Landing Dam	RF20a
Tennessee River	Tennessee River	KY	Kentucky Dam	RF20b
White River	White River	AR	White River Lock and Dam No. 1	RF8a

Source: USEPA 2012a;
National Atlas of the United States 2006, http://nationalatlas.gov/mld/dams00x.html

Ohio River

Three navigational dams are located in the Ohio River Basin within the study area. Ohio River Lock and Dam Number 52 and 53 are in proposed critical habitat for Unit RF21 on the Illinois-Kentucky state line and operated by the Corps' Louisville District. The Kinzua Dam is located in the RF24 study area (Allegheny River in Pennsylvania). It impounds Allegheny Reservoir, operated by U.S. Army Corps of Engineers, and is also a hydroelectric generator discussed in section 3.4.

Tennessee River

Two navigational locks and dams are located in the Tennessee River Basin within the study area for Units RF20a and RF20b. Pickwick Landing Dam is in Unit RF20a and Kentucky Dam is in Unit 20b, both located on the Tennessee River. These dams, operated by TVA, also generate hydropower, discussed further in section 3.4. A new lock is being added to Kentucky Dam and is scheduled for completion in 2012 (Corps 2011, p. 1).

3.3.1.2 Water Supply and Management

Human activities have changed the natural flow of rivers and streams, resulting in river and stream hydrology and geomorphology that are a combination of natural and artificial processes. These activities include construction of dams and reservoirs, flood control and diversion structures, and surface and ground water withdrawals for water supply for drinking water, irrigation and industrial processes.

Critical habitat designation has the potential to affect water supply and management operations if it causes the following:

- Limits reservoir capacity to avoid impacts on designated habitat
- Requires the release of otherwise stored and delivered water
- Requires purchase of replacement water at increased cost

- Disrupts established water contracts and rights

This section presents the existing water supply and management conditions in the study area surrounding proposed critical habitat and activities that potentially may impact the Neosho mucket and rabbitsfoot, and where designated critical habitat may impact water supply and management actions.

Impoundments have eliminated a large portion of the Neosho mucket and rabbitsfoot populations and habitat throughout their historical range. Inundation by reservoir construction has eliminated their habitat as both species do not tolerate impounded conditions. Further, release of flows from impoundments has profound effects on native freshwater mussels that have adapted to natural seasonally variable flows, impacting their recruitment, and destabilizing channel bottoms through scouring (Service 2010b, p. 26). Dam construction has a secondary effect of fragmenting the range of freshwater mussels by leaving relict habitats and populations isolated upstream or between structures, as well as creating extensive areas of deep uninhabitable, impounded waters. These isolated populations are unable to naturally recolonize suitable habitat downstream and become prone to further extirpation from random events, such as severe drought, chemical spills, or unauthorized discharges (Layzer *et al.* 1993, pp. 68–69; Cope *et al.* 1997, pp. 235–237; Neves *et al.* 1997, pp. 63–75; Watters 2000, pp. 264–265, 268; Miller and Payne 2001, pp. 14–15; Pringle *et al.* 2000, pp. 810–815; Watters and Flaute 2010, pp. 3–7). Most of the remaining Neosho mucket and rabbitsfoot populations are small and geographically isolated, and, thus, are susceptible to genetic drift and inbreeding depression (77 FR 63604, October 16, 2012, p. 63463). Habitat effects due to impoundment are a substantial and ongoing threat to the Neosho mucket and rabbitsfoot.

Natural temperature regimes in the streams inhabited by the two mussels can be altered by impoundments and tail water releases from dams, industrial and municipal effluents, and changes in riparian habitat. Exact critical thermal limits for normal biological processes and survival of many freshwater mussel species are unknown. However, Pandolfo *et al.* (2010, pp. 961–965) reported lethal temperatures for glochidia and juveniles of several species, including some in the same genus (*Lampsilis*) as the Neosho mucket. High temperatures can reduce dissolved oxygen concentrations in the water, impairing respiration and inhibiting reproduction. High temperatures also increase metabolism, resulting in reduced glycogen (energy) stores inhibiting growth (Fuller 1974, pp. 240–241). Low temperatures can significantly delay or prevent metamorphosis (Watters and O'Dee 1999, pp. 454–455). Water temperature increases have been documented to shorten the period of glochidial encystment to host fish, reduce righting speed (various reflexes that tend to bring the body into normal position in space and resist forces acting to displace it out of normal position), increase oxygen consumption, and slow burrowing and movement responses (Fuller 1974, pp. 240–241; Bartsch *et al.* 2000, p. 237; Watters *et al.* 2001, p. 546; Schwalb and Pusch 2007, pp. 264–265). Several studies have documented the influence of temperature on the timing aspects of mussel reproduction (Gray *et al.* 2002, p. 156; Allen *et al.* 2007, p. 85; Steingraeber *et al.* 2007, pp. 303–309; Galbraith and Vaughn 2011, pp. 193–201). Peak glochidial releases are associated with water temperature thresholds that can be thermal minimums or maximums, depending on the species (Watters and O'Dee 2000, p. 136).

Temperature regime alterations in streams, such as those described above, are an ongoing direct threat to the Neosho mucket and rabbitsfoot, and indirectly impact host fish. This threat is likely to continue and increase in the future due to additional water supply and management projects and as land use conversion to urban uses increases in the Neosho mucket and rabbitsfoot ranges.

Diversion structures typically are low dams designed to divert river flows into canals and their distribution systems. Unlike the dams described above, water storage is not the primary function of water diversions. These structures, along with canals and lateral distribution ditches, direct water to agricultural areas, urban water treatment facilities, and industrial users. During low-flow conditions, diversion structures usually divert some or all of a river-flow from the river, potentially dewatering downstream reaches and resulting in the loss of riparian habitat. The return of irrigation water to stream channels can produce sufficient, sustained, continuous flows, and, in some instances, raises groundwater levels. However, return water also picks up pollutants such as sediment, pesticides, herbicides, and fertilizer while irrigating crops and landscaping, and introduces them to streams in return flows.

Groundwater to surface water interaction is complex. Groundwater is recharged by surface precipitation and concentration in interior basin lakes, playas, and wetlands. Conversely, dropping water tables in certain conditions may also dry up surface water, reducing stream flows and stream connectivity. Groundwater withdrawals can significantly lower the water table, as is the case for rabbitsfoot in the Lower Mississippi River Basin (Service 2010b, p. 29).

As previously described, various agencies of the Federal government construct and operate dams and reservoirs, such as the Corps, BOR and TVA, and/or permit their construction in navigable waters of the U.S. (*e.g.*, section 10 of the Rivers and Harbors Act regulated by the Corps), generate power (FERC), or disturb waters of the U.S. (*e.g.*, section 404 permitting by the Corps). Water withdrawals from the surface and/or groundwater for irrigation, municipal water, or industrial processing would require a Federal permit under section 404 when disturbance to waters of the U.S. would occur, or if a reserved Federal or tribal water right were involved. All these actions would require consultation under section 7 of the ESA if a listed species and/or designated critical habitat was present, and if a determination of “may affect” is made.

The National Atlas of major dams of the U.S. database indicates a total of 189 impoundment, flood control, debris control, recreational, irrigation, drinking and industrial water supply and tailings dams with impoundments are in the study area for the two mussels (National Atlas of the United States 2006, http://nationalatlas.gov/mld/dams00x.html). Some dams in the national database are multipurpose and are also discussed under the navigation and hydropower dam sections of this analysis. Additional inspection of proposed critical habitat via ArcGIS Explorer® imagery found a few more dams, not listed in the national inventory, that are included in our analysis.

Of the 43 units of proposed critical habitat for the two mussels, 19 have water supply and management dams either within or immediately upstream of proposed critical habitat. Over the last five years, one formal section 7 consultation involving the removal of a dam and 81 informal and technical assistance consultations involving water management and restoration for aquatic species similar to the two mussels were completed in the study area. Table 5 summarizes known water supply and management dams and quantity of water withdrawals from surface and groundwater in the study area surrounding proposed critical habitat for the two mussels. There are no impounded streams or dams in the study area of Units RF7, RF15, RF18, RF28, RF29, and RF31. The USGS compiled a dataset of U.S. water use in 2005 that includes categories of use such as drinking water, and many categories of irrigation and industrial uses. Table 9 provides the total estimated surface and groundwater withdrawals for the counties comprising the study area (USGS 2005, http://water.usgs.gov/watuse/data/2005/). In addition, Table 10 presents dams directly within or immediately upstream of proposed critical habitat units.

Table 9. Water supply and management dams and quantity of water withdrawals in the study area[1]

River Basin	State	Study Area for Proposed Critical Habitat Units	Number of Dams	Quantity of Water Withdrawals (Million gallons per day)[2]
Arkansas River	KS,	NM3/NM4/RF1	2	204.08
	MO	NM3	2	
	OK	RF2	23	145.08
	KS	NM7/RF3	7	177.41
Cumberland River	KY	RF21	1	9.31
	KY	RF31	0	1003.07
Illinois River	AR	NM1	5	479.68
Lower Great Lakes	IN	RF30	2	19.82
Lower Mississippi River	MO	RF14	4	29.82
	AR	RF15	0	1396.36
	MS	RF15	0	
	MS	RF17	4	445.28
Neosho River	AR	NM2	8	491.56
	KS	NM8	9	99.00
Ohio River	IL	RF21	2	1331.53
	KY	RF21	2	
	KY	RF22	2	39.52
	PA	RF23/25	3	113.96
	PA	RF24	7	841.86
	NY	RF24	1	
	IN	RF26	1	239.29
	OH	RF27	6	281.31
	OH	RF28	0	51.90
Ohio River	IL, IN	RF29	0	29.54
	IN	RF29	0	
	PA	RF32	2	255.39
Red River	AR	RF4a	2	17.62
	AR	RF4b	7	437.42
	AR	RF5	13	1335.41
	AR	RF6	3	59.88
	OK	RF6	2	
Tennessee River	AL	RF16	4	1393.8
	AL	RF18	0	1603.09
	TN	RF19	13	1444.19
	TN	RF20a	1	40.09
	KY	RF20b	1	1352.76
Verdigris River	KS	NM6	11	22.92

White River	AR	RF7	0	15.02
	AR	RF8a	1	1979.92
	AR	RF8b	3	6787.48
	AR,	RF9	2	2463.39
	MO	RF9	32	
	AR	RF10/11	8 (7/1)	403.59
	AR	RF12	10	365.48
	AR	RF13	1	1185.68

Source: USGS 2005, http://water.usgs.gov/watuse/data/2005/;
National Atlas of the United States 2006, http://nationalatlas.gov/mld/dams00x.html
Notes: [1] 2005 water withdrawal data is for total counties comprising study areas
[2] Fresh and saline surface and groundwater withdrawals

Table 10. Water supply and management dams within or immediately upstream of proposed critical habitat units

River Basin	**Critical Habitat Unit**	**Number of Dams**
Arkansas	NM3	3
	NM7	4
	RF2	1
	RF3	1
Illinois River	NM1	1
Ohio River	RF21	2
	RF22	1
	RF23	2
	RF26	1
	RF27	1
	RF32	1
Red River	RF4b	1
Tennessee River	RF19	3
	RF20a	1
	RF20b	1
Verdigris River	NM6	7
White River	RF11	1
	RF12	1

Source: USGS 2005, http://water.usgs.gov/watuse/data/2005/;
National Atlas of the United States 2006, http://nationalatlas.gov/mld/dams00x.html

Arkansas River

Thirty-four water supply and management dams are located in the study area of critical habitat Units NM3, NM4, NM5, and RF1 in Kansas and Missouri, Units NM7 and RF3 in Kansas, and Unit RF2 in Oklahoma. Eight of these dams are federally owned, one is owned by the State of Oklahoma, nine are owned by local governments, seven are privately owned, and eight are of unknown ownership. Of these, a total of nine dams are located within the mainstem streams of

proposed designated critical habitat Units NM3, NM4, NM5, NM7, RF1, RF2, and RF3 (Table 10).

According to USGS 2005 data, 526.57 million gallons per day (mgal/d) of both surface and groundwater were withdrawn for multiple uses in the counties encompassing the study areas in this river basin.

Cumberland River

The only water supply and management dam in this river basin is the federally owned Barkley Dam impounding the Cumberland River in the Unit RF21 study area. This dam is multipurpose and discussed in sections describing navigational and hydropower dams for Unit RF21. The study area of Unit RF31 is also in the Cumberland River Basin in central Kentucky. No water supply or management dams were found in the RF31 study area. Surface and groundwater withdrawals in the counties comprising the two study areas in this river basin totaled 1,019.62 mgal/d in 2005.

Illinois River

Five water supply and management dams are located in the study area for Unit NM1. One is an unknown low-head dam. The Little Flint Creek dam is owned by a public utility (Southwestern Electric Power Company), the Moore Creek dam is owned by the city of Lincoln, the Blair Creek dam is owned by the city of Prairie Grove, and Bud Kid Creek dam is owned by the Arkansas Game and Fish Commission. Water withdrawals in counties comprising the Unit NM1 study area in this river basin totaled 479.68 mgal/d in 2005.

Lower Great Lakes

There are two water supply and management dams in the Unit RF30 study area in Indiana. Both state-owned dams impound Hamilton Lake. Surface and groundwater withdrawals in the counties of the Unit RF30 study area totaled 19.82 mgal/d in 2005.

Lower Mississippi River

Study areas for Unit RF14 in Missouri and RF17 in Mississippi are within this major river basin. Eight water supply and management dams impound waters in this watershed. Four are in the Unit RF14 study area, including Asarco Lake Dam, ISP Minerals Primary Dam, Nims Lake Dam and Seven Lakes Dam #1. The other four dams are in the RF17 study area and include Frederick Branch #2, Lake Caroline, Stockett Dam #2 and Humphrey Farm Lake dams. All eight water supply and management dams are privately owned. No such dams are located in the Unit RF15 study area. In 2005, water withdrawals in the counties of Units RF14, RF15 and RF17 totaled 1,871.46 mgal/d.

Neosho River

Seventeen water supply and management dams are in the Unit NM2 study area in Arkansas and Unit NM8 study area in Kansas. Of these, only the Marion Lake dam on the Cottonwood River in Kansas is federally owned. One of the remaining dams is owned by the State of Kansas, five are owned by local governments, and eight are privately owned. In 2005, both surface and groundwater withdrawals in the Units NM2 and NM8 study area counties in this river basin totaled 590.56 mgal/d.

Ohio River

The study area in this river basin includes Unit RF21 in Illinois and Kentucky, Unit RF22 in Kentucky, Units RF23 and RF25 in Pennsylvania, Unit RF24 in Pennsylvania and southwest New York, Unit RF26 in Indiana, Unit RF27 and RF 28 in Ohio, Unit RF29 in Illinois and Indiana, and Unit RF32 in Pennsylvania. Twenty-six water supply and management dams are within the study area surrounding these units. Of these, 14 are federally owned, four are state owned, two are owned by local governments, five are privately owned, and one is of unknown ownership. Water supply and management dams directly within or immediately upstream of proposed critical habitat include the multipurpose Ohio River Dam and Lock 52 and 53 in Unit RF21 (federally owned), Green River Lake Dam (federally owned) in Unit RF22, Union City Dam (federally owned) and an unidentified dam in Unit RF23, the Oakdale Dam (owned by a public utility) in Unit RF26, Mohawk Dam (federally owned) within Unit RF27, and the Pymatuning Dam (owned by the Commonwealth of Pennsylvania) in Unit RF32. No water supply or management dams are within the study areas of Units RF28 and RF29. Water withdrawals in the counties comprising the study area totaled 3,184.3 mgal/d in 2005.

Red River

In this river basin, 27 water supply and management dams are in the study area of Units RF4a, RF4b and RF5 in Arkansas and Unit RF6 in Arkansas and Oklahoma. Remmel Dam owned by a public utility (Energy Arkansas, Inc.) in Unit RF4b (Ouachita River) is the only dam that directly affects proposed critical habitat in this river basin. Of the remaining 26 dams, nine are federally owned, one is owned by the State of Arkansas, six are owned by local governments, and 10 are privately owned. Water withdrawals in the counties comprising the study area in this river basin totaled 1,850.33 mg/d in 2005.

Tennessee River

Units RF16 and RF18 in Alabama, Units RF19 and RF 20a in Tennessee, and Unit RF20b in Kentucky are within this river basin. Nineteen water supply and management dams are located within the study area of these units, except for Unit RF18, where no such dams are located. Three of these dams are located in the Duck River that directly affect Unit RF19. These dams include Normandy Dam (federally owned), Old Columbia Dam (local government owned), and an unidentified dam. The Tennessee River at the upstream extent of Unit RF20a is impounded by the federally owned Pickwick Landing Dam. The Tennessee River at the upstream extent of Unit RF20b is impounded by the Kentucky Dam, a multipurpose facility also discussed in the navigation and hydropower sections (*cf.* section 3.3.1.1 and 3.4.1.1). The remaining 14 water supply and management dams include four that are federally owned and 10 under private ownership. In 2005, water withdrawals in the counties comprising the study area in this river basin totaled 5,833.93 mgal/d.

Verdigris River

The Unit NM6 study area occurs in the Verdigris River basin in Kansas and includes 11 water supply and management dams. The Fall River at the upstream extent of Unit NM6 is impounded by Fall River Lake Dam (federally owned). There also are six small unidentified low-head dams on the Fall and Verdigris Rivers. Other water supply and management dams in the study area include the Woodson Lake State Park Dam and Wilson County State Lake Dam owned by the state, Thayer City Dam, and federally owned Toronto Lake Dam. In 2005, water withdrawals in the counties comprising the study area in this river basin totaled 22.92 mgal/d.

White River

In this river basin, 57 water supply and management dams are within the study area for proposed critical habitat Units RF8a, RF8b, RF10, RF11, RF12, and RF13 in Arkansas, and Unit RF9 in Arkansas and Oklahoma. The study area of Unit RF7 in Arkansas does not contain any water supply and management dams. The upstream extent of Unit RF8a terminates at the foot of White River Lock and Dam #1, owned by Independence County. One unidentified low-head dam affects Unit RF11 on the South Fork Spring River and one impacts Unit RF12 on the Strawberry River. Of the remaining 54 dams, two are federally owned, two are state owned, 24 are owned by local governments, 12 are privately owned, two are owned by utilities, and 12 are of unknown ownership. In 2005, water withdrawals in the counties comprising the study area in this river basin totaled 13,200.56 mgal/d.

3.3.1.3 Water Quality

Degraded water quality is a central reason for the decline of freshwater mussels (Neves *et al.* 1997, p. 60). Neosho mucket and rabbitsfoot are both found within medium to large river drainages exposed to a variety of landscape uses contributing to degraded water quality. Excessive sediments are believed to adversely affect riverine mussel populations requiring clean, stable streams (Ellis 1936, pp. 39–40; Brim Box and Mossa 1999, p. 99). Specific biological effects include reduced feeding and respiratory efficiency from clogged gills, disrupted metabolic processes, reduced growth rates, limited burrowing activity, physical smothering, and disrupted host fish attraction mechanisms (Ellis 1936, pp. 39–40; Marking and Bills 1979, p. 210; Vannote and Minshall 1982, pp.4105–4106; Waters 1995, pp. 173–175; Hartfield and Hartfield 1996, p. 373). Mussels may also be indirectly affected if high turbidity levels substantially reduce the amount of available light for photosynthesis, impacting the production of certain food items (Kanehl and Lyons 1992, p. 7).

Chemical contaminants are ubiquitous in the environment and are considered a major threat in the decline of mussel species (Richter *et al.* 1997, p. 1081; Strayer *et al.* 2004, p. 436; Wang *et al.* 2007, p. 2029; Cope *et al.* 2008, p. 451). Pathways of exposure to all four critical life stages of mussels have been studied (Cope *et al.* 2008, p. 451), and the effects of particular contaminants such as heavy metals, ammonia, polychlorinated biphenyls, pesticides, and excess nutrients are being studied as summarized in the published rule (77 FR 63440, pp. 63458–63460). Potential effects from contaminant exposure may result in death, reduced growth, altered metabolic processes, or reduced reproduction in freshwater mussels.

Natural temperature regimes can be altered by impoundments, tailwater releases from dams, industrial and municipal effluents, and changes in riparian habitat. Exact critical thermal limits for survival and normal functioning of many freshwater mussel species are unknown. But as discussed previously (*cf.* sections 3.3.1.1 and 3.3.1.2), water temperature that is either too high (as commonly occurs in municipal or industrial effluent) or too low (*i.e.*, dam tailwater), can slow mussel growth, reduce glycogen stores, impair respiration, inhibit reproduction, reduce righting speed, increase oxygen consumption, and slow burrowing and movement responses (Fuller 1974, pp. 240–241; Watters and O'Dee 1999, pp. 454–455; Bartsch *et al.* 2000, p. 237; Watters and O'Dee 2000, p. 136; Watters *et al.* 2001, p. 546; Gray *et al.* 2002, p. 156; Allen *et al.* 2007, p. 85; Schwalb and Pusch 2007, pp. 264–265; Steingraeber *et al.* 2007, pp. 303–309; Galbraith and Vaughn 2011, pp. 193–201).

The principal law governing pollution of the nation's water resources is the Federal Water Pollution Control Act of 1972, better known as the Clean Water Act (CWA). The U.S. Environmental Protection Agency (EPA) utilizes water quality standards, permitting requirements, and monitoring to protect water quality. The EPA sets the standards for water pollution abatement for all waters of the U.S. under CWA programs, but, in most cases, gives qualified states the authority to issue and enforce permits. The CWA provides the authority to establish water quality standards, control discharges into surface and subsurface waters (including groundwater), develop waste treatment management plans and practices, and issue permits for discharges under the National Pollutant Discharge Elimination System (NPDES).

As a way to identify those bodies of water where water quality has been degraded and does not meet minimum water quality standards, Section 303(d) of the CWA established a process for states to identify those waters within its boundaries that do not meet clean water standards. Waters that do not meet clean water standards are classified under the CWA as "Impaired Waters". Impaired waters cannot support one or more designated uses (*e.g.*, swimming, the protection and propagation of aquatic life, drinking, and industrial supply). Once a stream segment is listed as impaired, the state must complete a plan to address the issue causing the impairment. States then develop total maximum daily loads (TMDLs) for priority waters that identify the amount of a specific pollutant from various sources that may be discharged to a water body, but still ensure that water quality standards are met for that body of water. Completion of the plan is generally all that is required to remove the stream segment from the 303(d) impaired water list and does not mean that water quality has changed. Once the TMDL is completed and approved by EPA (2012b, http://water.epa.gov/ lawsregs/lawsguidance/cwa/tmdl/intro.cfm), the stream segment is placed on the 305(b) list of impaired streams with a completed TMDL.

No specific provision exists for consideration of listed species or critical habitat in section 303(d) of the CWA, but states may opt to evaluate either the presence of listed species or critical habitat as a potential factor in listing a stream as impaired. EPA reviews the proposed criteria and consults with the Service to determine potential effects on listed species and critical habitat. Similarly, a number of states have adopted procedures to evaluate listed species and their critical habitat consistent with Federal procedures. For example, the State of Arkansas requires NPDES permit applicants to obtain Endangered Species Clearance from the Service's Arkansas Field Office, which conducts a consultation in the form of a technical assistance each time it issues a clearance (Industrial Economic, Inc. 2013, p. 3-11). A complete list of NPDES-authorized State programs is available online at EPA's NPDES website, accessed at http://cfpub.epa.gov/npdes/statestats.cfm?view=specific. Of the states containing proposed critical habitat for the Neosho mucket and rabbitsfoot mussels, only Oklahoma has a partial program; it has not been authorized to issue permits for activities associated with oil and gas exploration, drilling, operations, and pipelines, and for Concentrated Animal Feeding Operations and certain other discharges from agriculture (USEPA 2003, p.2).

Only nine major NPDES-permitted facilities are within a quarter mile of proposed critical habitat for the two mussel species (USEPA 2013, http://www.epa.gov/enviro/geo_data.html.), some of which discharge into streams occupied by the Neosho mucket and rabbitsfoot (Table 11). Based upon EPA's EnviroFacts database, 136 major NPDES-permitted facilities are within the study area of proposed critical habitat units (Table 12). The most major NPDES-permitted facilities in the study area occur in Unit RF24 with 14, followed by NM3, NM4, NM5, and RF1 with 13, and

RF9 with 10. There are no major NPDES-permitted facilities in the study area comprising Units NM6, RF1, RF7, RF12, RF13, RF16, RF18, RF22, and RF28.

Table 11. Major NPDES[1] permitted facilities within a quarter mile of proposed critical habitat

Proposed Critical Habitat Unit	River Basin	State	Stream	Facility Name
NM1	Illinois River	OK	Illinois River	Tahlequah Water Pumping and Treatment Facility
NM3	Arkansas River	MO	Shoal Creek	Neosho-Shoal Creek Waste Water Treatment Plant
NM4	Arkansas River	MO	Spring River	Carthage Waste Water Treatment Plant
RF2	Arkansas River	OK	Verdigris River	Terra Nitrogen Company/Verdigris
RF4b	Red River	AR	Ouachita River	Malvern Wastewater Treatment Plant
RF8a	Arkansas River	AR	White River	Batesville Wastewater Treatment Plant
RF19	Tennessee River	TN	Duck River	Ucar Carbon Company - Columbia
RF23	Ohio River	PA	French Creek	Cambridge Area Joint Authority Sewage Treatment Plant
RF24	Ohio River	PA	Allegheny River	Franklin Wastewater Treatment Plant

Source: USEPA 2013, http://www.epa.gov/enviro/geo_data.htm
Note: [1]NPDES = National Pollutant Discharge Elimination System

Table 12. Number of major NPDES[1] permitted facilities within study areas

Study Area for Critical Habitat Units	River Basin	State	Number of NPDES[1]-permitted Facilities
NM1	Arkansas River	AR	6
	Arkansas River	OK	1
NM2	Neosho River	AR	2
	Neosho River	MO	1
NM3/NM4/NM5/RF1	Arkansas River	KS	1
	Arkansas River	MO	12
NM7/RF3	Arkansas River	KS	3
RF2	Arkansas River	OK	5
RF4a	Red River	AR	1
RF4b	Red River	AR	7
RF5	Red River	AR	6
RF6	Red River	AR	1
	Red River	OK	3
RF8a	White River	AR	4
RF8b	White River	AR	3

Study Area for Critical Habitat Units	River Basin	State	Number of NPDES[1]-permitted Facilities
NM1	Arkansas River	AR	6
	Arkansas River	OK	1
NM2	Neosho River	AR	2
	Neosho River	MO	1
NM3/NM4/NM5/RF1	Arkansas River	KS	1
	Arkansas River	MO	12
NM7/RF3	Arkansas River	KS	3
RF2	Arkansas River	OK	5
RF4a	Red River	AR	1
RF4b	Red River	AR	7
RF5	Red River	AR	6
RF6	Red River	AR	1
	Red River	OK	3
RF8a	White River	AR	4
RF9	White River	AR	1
	White River	MO	9
RF10/RF11	White River	MO	1
RF14	Lower Mississippi River	MO	4
RF15	Lower Mississippi River	MS	3
RF17	Lower Mississippi River	MS	6
RF19	Tennessee River	TN	7
RF20a	Tennessee River	TN	1
RF20b	Tennessee River	KY	7
RF21	Ohio River	IL	3
	Cumberland River	KY	4
RF22	Ohio River	KY	2
RF23/RF25	Ohio River	PA	5
RF24	Ohio River	NY	4
	Ohio River	PA	10
RF26	Ohio River	IN	5
RF27	Ohio River	OH	4
RF29	Ohio River	IL	1
RF31	Cumberland River	TN	1
RF32	Ohio River	PA	2
Total			136

Source: USEPA 2013, http://www.epa.gov/enviro/geo_data.htm
Note: [1]NPDES = National Pollutant Discharge Elimination System

Every two years, states must publish lists (referred to as 303(d) lists) of those rivers, streams, and lakes that do not meet their designated uses because of excess pollutants. Monitored pollutants commonly include sediment, pesticides and herbicides, metals, excess nutrients (fertilizer), various chemicals including petroleum-derived, pathogens, and emerging varieties of contaminants such as pharmaceuticals. In addition, water temperature, acidity, conductivity, turbidity (light penetration) and level of dissolved oxygen are monitored. Common sources of sediment are from instream disturbances of the substrate (*i.e.*, channelization, dredging, in stream mining), discharging fill, loaded runoff from adjacent lands, and irrigation return flows. Runoff and irrigation return flows also may contain other chemical pollutants and excess nutrients, the latter of which contributes to algal blooms that decrease the level of dissolved oxygen in waters (eutrophication) essential for sustaining most aquatic life. Accidental spills are also a source of pollutants and are potentially the most catastrophic to aquatic resources. Effluent from industrial and municipal sources may include chemical and pathogenic pollutants and may alter water temperature. As discussed previously, tailwater releases from dams also may alter water temperature (*cf.* sections 3.3.1.1 and 3.3.1.2).

Table 13 lists proposed critical habitat with 303(d) impaired waters and causes for impairment. Based upon EPA's (2012c, http://www.epa.gov/waters/data/downloads.html#303(d)) 303(d) database, all but two (Units NM2 and NM6) of the Neosho mucket's proposed critical habitat units are impaired due to sedimentation, heavy metals, pathogens, turbidity, dissolved oxygen depletion, and ammonia and phosphorous (common fertilizers). Twenty-two of the 35 proposed rabbitsfoot critical habitat units are designated as impaired by a wide variety of contaminants. The only study area with no designated impaired waters is Unit RF7. The study area of Unit NM6 contains only one impaired waterbody, Woodson Lake located in the Woodson Wildlife Area managed by the State of Kansas; the cause of its impairment is sedimentation (USEPA 2012b, http://www.epa.gov/waters/data/downloads.html#303(d)). The following rabbitsfoot proposed critical habitat units are not classified as impaired: RF1, RF4a, RF7, RF8a, RF8b, RF9, RF11, RF18, RF20a, RF20b, RF25, RF29, and RF32. The Service's TAILS data indicates 93 section 7 consultations occurred from 2007 to 2012 concerning water treatment management activities (wastewater, stormwater), none of which were formal (Service 2012b). Past section 7 consultation for many other activities that may alter water chemistry or quality (*e.g.*, temperature, pH, contaminants, conductivity, turbidity, and excess nutrients) are summarized in the other resource sections evaluated in this EA, such as dams for multiple purposes, agricultural practices, and mining.

Table 13. Impaired proposed critical habitat

Proposed Critical Habitat Unit	River Basin	Impaired River	State	Impairment Causes
NM1	Illinois River	Illinois River	OK	*E. coli*[1], fecal coliform, phosphorus, lead, turbidity
			AR	Sedimentation/siltation, *E. coli*
NM3	Arkansas River	Shoal Creek	MO	*E. coli*
			KS	Cadmium, zinc, copper, lead
NM4	Arkansas River	Spring River	MO	*E. coli*
NM5	Arkansas River	North Fork Spring River	MO	*E. coli*, ammonia, dissolved oxygen

Proposed Critical Habitat Unit	River Basin	Impaired River	State	Impairment Causes
NM7	Arkansas River	Neosho River	KS	Lead, zinc, and TMDLs[2] on copper, fecal coli, total phosphorous
NM8	Neosho River	Cottonwood River	AR	Total suspended solids
RF2	Arkansas River	Verdigris River	OK	Enterococcus bacteria, turbidity
RF3	Arkansas River	Neosho River	KS	Lead, zinc, and TMDLs for copper
RF4b	Red River	Ouachita River	AR	Zinc, mercury
RF5	Red River	Saline River	AR	Salinity total dissolved solids (chlorides/sulfates), sedimentation/siltation, mercury, copper, lead
RF6	Red River	Little River	OK	Dissolved oxygen, turbidity
RF10	White River	Spring River	AR	Dissolved oxygen, sediment
RF12	White River	Strawberry River	AR	Fecal coliform, sedimentation/siltation
RF13	White River	Buffalo River	AR	Dissolved oxygen
RF14	Lower Mississippi River	St. Francis River	MO	Chlorophyll *a*, nitrogen, phosphorous, water temperature
RF15	Lower Mississippi River	Big Sunflower River	MS	Pesticides, nutrients, sedimentation/ siltation
RF16	Tennessee River	Bear Creek	MS	Biological impairment
RF17	Lower Mississippi River	Big Black River	MS	Pesticides, sedimentation/siltation, bacteria, acidity
RF19	Tennessee River	Duck River	TN	Dissolved oxygen, phosphate nutrients
RF21	Ohio River	Ohio River	OH	Mercury, PCBs[3]
RF22	Ohio River	Green River	KY	Mercury, fecal coliform
		N. Fork Vermillion	IL	Fecal coliform
RF23	Ohio River	French Creek	PA	Mercury, nutrients
RF24	Ohio River	Allegheny River	PA	Mercury
RF26	Ohio River	Tippecanoe River	IN	PCBs, *E. coli*
RF27	Ohio River	Walhonding River	OH	Pathogens, PCBs
RF28	Ohio River	Little Darby Creek	OH	PCBs
RF30	Lower Great Lakes	Fish Creek	OH	Siltation
RF31	Tennessee River	Red River	TN	Nitrates, habitat alterations (riparian), substrate alterations

Source: EPA 2012c, http://www.epa.gov/waters/data/downloads.html#303(d)

Notes: [1]*E. coli* = *Escherichia coli*

[2]TMDLs= Total maximum daily loads

[3]PCBs = polychlorinated biphenyls

3.3.1.4 Sand and Gravel Mining

Instream and alluvial gravel mining has been implicated in the destruction of mussel populations (Hartfield 1993, pp. 136–138; Brim Box and Mossa 1999, pp. 103–104). Negative effects associated with gravel mining include stream channel modifications (altered habitat, disrupted flow patterns, sediment transport), water quality modifications (increased turbidity, increased temperature), macroinvertebrate population changes (elimination or favoring invasive species), and changes in fish populations, resulting from adverse effects to spawning and nursery habitat and food web disruptions (Kanehl and Lyons 1992, pp. 4–10). Floodplain mining changes large tracts of floodplain into open-water ponds, typically separated from the channel by a strip of unmined land with a water level frequently equal to that of the main river (Kondolf 1997 p. 545). As such, contamination of the channel may occur since floodplains are hydrologically linked to the channel through alluvial groundwater. Moreover, mines located on floodplains are subject to "pit capture" (Kondolf 2006, p. 545). This is a phenomenon that occurs during flooding that effectively converts off-channel mines to in-channel mines when the land that separates the pit from the channel is breached, at which time the impacts associated with instream mining can be expected.

Sand and gravel for construction is one of the most widely used natural resources in the U.S. (Bolen 2003, p. 1) and occurs throughout the states with proposed critical habitat. The USGS estimates that in 2011 approximately 790 million metric tons of sand and gravel for construction were produced in the U.S. from about 6,400 mining operations (USGS 2012a, http://minerals.usgs.gov/minerals/pubs/commodity/). Ohio is one of the leading producers of construction sand and gravel. In addition, approximately 30 million metric tons of industrial sand and gravel were produced at 116 mining operations nationally (USGS 2012b, http://minerals.usgs.gov/minerals/pubs/commodity/). This material is primarily used as hydraulic fracturing sand, well packing and cementing, glass making, and foundry sand. Illinois and Oklahoma are among the top-producing states of industrial sand and gravel. Currently, no operations within the U.S. mine for industrial silica (quartz crystal) (USGS 2012c, http://minerals.usgs.gov/minerals/pubs/commodity/).

In general, non-energy mining activities are regulated by the states. Instream mining activities permits are issued by the Corps if activities include the addition, placement, or redistribution of dredged or excavated materials within waters of the U.S in accordance with section 404 of the CWA. Waters of the U.S. include rivers, lakes, streams, intermittent and ephemeral creeks, natural ponds, and adjacent wetlands, with the exception of navigable waters. Navigable waters are subject to the guidelines of section 10 of the Rivers and Harbors Act of 1899 that requires authorization for any activity in or around navigable water that could affect the navigable capacity or condition of the waterway. Activities that operate under state programs, and do not have a Federal nexus (*i.e.*, receives Federal funds or authorization), are not required to seek section 7 consultation. Non-energy mining activities may lead to section 7 consultations if endangered or threatened species are present in the location proposed for mining with a Federal nexus. Between 2007 and 2012, there were five requests for technical assistance for instream sand and gravel dredging. During the same time frame, there were four informal section 7 consultations and seven requests for technical assistance for non-energy mining activities (*i.e.*, sand and gravel, metals, other minerals) (Service 2012a).

Gravel mining activities continue to be a localized threat in several streams with viable rabbitsfoot populations (Ohio, Tennessee, White, Strawberry, and Little rivers). In the lower Tennessee River, instream mining occurs in 18 reaches totaling 77.1 rkm (47.9 rmi) between the Duck River confluence and Pickwick Landing Dam (Hubbs 2010, pers. comm.). The Mine Safety and Health Administration (MSHA) Mine Database (2013, http://www.msha.gov/OpenGovernmentData/OGIMSHA.asp) indicates there are approximately 1,355 active, intermittent, or temporarily idled upland sand and gravel mines in states with proposed critical habitat, of which 50 are in the study area for seven proposed critical habitat units (Table 14). Four mines are immediately adjacent to and one is upstream of proposed critical habitat units; these are discussed in more detail below. The remaining 42 mines are upland and/or over a mile distant from proposed critical habitat units.

Table 14. Active, intermittent and temporarily idled upland sand and gravel mines in study areas by river basin and state

River Basin and Study Area	State	Number of Mines
Arkansas River		
NM3/NM4/NM5/RF1	MO	1
Cumberland River		
RF21[1]	KY	1
Neosho River		
NM8	KS	1
Ohio River		
RF22	KY	1
RF23/RF25	PA	1
RF24	NY	7
RF26	IN	3
RF27	OH	7
RF32	PA	3
Red River		
RF4b	AR	5
RF5	AR	3
RF6	AR	4
	OK	1
Tennessee River		
RF20a	TN	2
RF20b	KY	1
White River		
RF8a	AR	1
RF8b	AR	3
RF9	MO	2
Total		47

Source: MSHA 2013, http://www.msha.gov/OpenGovernmentData/OGIMSHA.asp

Note: [1]This activity straddles Units RF20b and RF21; however, since the majority of the mine is within Unit RF21, it is only counted once within this study area.

The sand and gravel mines descriptions below were obtained from the MSHA (2013, http://www.msha.gov/OpenGovernmentData/OGIMSHA.asp) Mine Data Set. Information for this data set is obtained from the legal identification form that is completed by the mine operator; hence, some errors occur with missing or incorrect location information (*e.g.*, Global Positioning System (GPS) coordinates and classification). As such, the Mines Data Set may not accurately reflect all mine locations within the proposed critical habitat study area.

Arkansas River

One active sand and gravel mine is within Arkansas River Basin study area. This mine is located in the study area for Unit NM3 in Shoal Creek near Joplin, Missouri.

Ohio River

Within the Ohio River Basin study area there is one active sandstone mine on the Walhonding River located approximately 10 rkm (6 rmi) upstream of Unit RF27.

Red River

Two sand and gravel mines are in the Red River Basin study area. One intermittent mine is in the Unit RF4b study area within a quarter mile of the Ouachita River. This facility is located near the town of Donaldson in Hot Spring County, Arkansas in the northern portion of the study area. The other is an active mine located on the bank of the Little River within a quarter mile of the eastern end of Unit RF6 near the town of Ashdown in Little River County, Arkansas.

White River

On the Middle White River there is one crushed stone mine within a quarter mile of Unit RF8a. This active mine is located in the City of Newport in Jackson County, Arkansas.

3.3.1.5 Metal and Mineral Mining

As with sand and gravel mining, metal and mineral mining is largely regulated by the states. Federal permitting is only required for those activities subject to either section 404 of the CWA or section 10 of the Rivers and Harbors Act, as discussed in section 3.4.1.4. Activities regulated by the state or those without a Federal nexus (*i.e.*, receives Federal funds or authorization), are not required to seek section 7 consultation. Non-energy mining activities may lead to section 7 consultations if threatened or endangered species are present in the location proposed for mining and a Federal nexus exists. Past consultations for non-energy section 7 consultations are discussed in section 3.3.1.4, Sand and Gravel Mining.

Metal mining is associated with the loss of Neosho mucket and rabbitsfoot from Center and Shoal Creeks and Spring River in Missouri (Obermeyer *et al.* 1997, p. 114). A strong negative correlation has been documented between the distribution and abundance of native mussels, including the Neosho mucket, and the concentrations of lead, zinc and cadmium in sediments in the Spring River (Angelo *et al.* 2007, pp. 477–493). Metal mining discharges also have the same hazard relating to decreasing receiving water pH that is associated with coal mining (*cf.* section 3.4.1.3). In addition, mining that occurs on floodplains also has the potential to impact water quality through contamination of alluvial groundwater, as well as pit capture during flood events (*cf.* section 3.3.1.4).

The MSHA (2013, http://www.msha.gov/OpenGovernmentData/OGIMSHA.asp) Mine Data Set indicates there are approximately 1,939 active, intermittent, or temporarily idled mineral mines (other than sand and gravel mines) in states with proposed critical habitat, of which 95 are located in the study area of 29 proposed critical habitat units (Table 15). With the exception of construction sand and gravel, limestone was the most mined non-energy mineral within the proposed critical habitat study area in 2011 (Table 16). In 2011, approximately 3,900 quarries and 93 underground mines produced an estimated 1,110 million metric tons of crushed stone; about 70 percent was limestone and dolomite (USGS 2012d, http://minerals.usgs.gov/minerals/pubs/commodity/). Missouri, Illinois, Ohio, Indiana, Kentucky, and Pennsylvania were the second through seventh-top producers of crushed stone in 2011, respectively. Other major commodities that were mined include metal ores, clays, and various dimension stone[1].

Table 15. Active, intermittent and temporarily idled upland metal and mineral mines in the study area by river basin and state

River Basin and Study Area	State	Number of Mines
Arkansas River		
NM3/NM4/NM5/RF1	KS	1
	MO	8
NM7/RF3	KS	7
RF2	OK	9
Cumberland River		
RF21[1]	KY	5
RF31	TN	1
Illinois River		
NM1	AR	3
Lower Mississippi River		
RF14	MO	5
Neosho River		
NM2	AR	1
	MO	2
NM8	KS	2
Ohio River		
RF21	IL	1
	KY	1
RF22	KY	4
RF23/RF25	PA	1
RF24	PA	2
RF26	IN	1
Ohio River (cont'd)		
RF27	OH	2
RF32	PA	1
Red River		
RF4b	AR	4
RF5	AR	10
RF6	OK	1
Tennessee River		
RF16	AL	1
RF19	TN	6
RF20a	KY	1
Verdigris River		
NM6	KS	2
White River		
RF8a	AR	1
RF8b	AR	3
RF9	AR	3
	MO	9
RF10/RF11	AR	1
	MO	1
RF12	AR	3
RF13	AR	1
Total		104

Source: MSHA 2013, http://www.msha.gov/OpenGovernmentData/OGIMSHA.asp

1 Dimension stone are blocks or slabs of stone or rock that is quarried and shaped to specific sizes and shapes.

Note: [1]This activity straddles Units RF20b and RF21; however, since the majority of the mine is within Unit RF21, it is only counted once within this study area.

Table 16. Type and number of metal and mineral mines in the study area for proposed critical habitat units by state

Commodity	State	Number of mines
Aluminum Ore-Bauxite	AR	4
Common Clays (NEC)[1]	OK	1
Common Shale	OK	1
Crushed, Broken Limestone[2] (NEC)	AL, AR, IL, IN, KS, KY, MO, OK, PA, TN	68
Crushed, Broken Sandstone	OH, PA	4
Crushed, Broken Stone (NEC)	AR, OH, OK	8
Crushed, Broken Traprock	AR, MO	2
Dimension[3] Limestone	KS, OK	2
Dimension Quartzite	AR	1
Dimension Sandstone	AR	1
Dimension Stone (NEC)	AR, KS	3
Fire Clay	AR	2
Fluorspar	KY	1
Lead-Zinc Ore	MO	5
Quartz, Crystal	AR	1
Total		104

Source: MSHA 2013, http://www.msha.gov/OpenGovernmentData/OGIMSHA.asp
Notes: [1]NEC: Not elsewhere classified
[2]Includes cement plants with limestone pits.
[3] Blocks or slabs of stone or rock that is quarried and shaped to specific sizes and shapes.

Metal mining (*i.e.*, aluminum ore-bauxite and iron/zinc ore, etc.) occurred at nine mines within the proposed critical habitat study areas (Table 16). In 2011, 345,000 metric tons of lead concentrates were mined in the U.S. from sites in Missouri, Alaska, and Idaho (USGS 2012e, http://minerals.usgs.gov/minerals/pubs/commodity/). Thirty are active, intermittent, or temporarily idled metal mines are in the study area; of these, nine are in the study area for Units RF5 and RF9. Four aluminum ore-bauxite mines are in the Unit RF5 study area and five lead-zinc ore mines within the RF9 study area. During the last several years less than 1 percent of aluminum ore-bauxite for aluminum production has been mined in the U.S. (USGS 2012f, p. 10.1), with all recent aluminum ore-bauxite mining occurring at a few surface mines in Arkansas (USEPA 2012d, http://www.epa.gov/rpdweb00/tenorm/aluminum.html).

The following discusses the mineral and metal mines located in the proposed critical habitat study area. The mineral and metal mine descriptions below were obtained from the MSHA (2013, http://www.msha.gov/OpenGovernmentData/OGIMSHA.asp) Mine Data Set. Information

for this data set is obtained from the legal identification form that is completed by the mine operator; hence, some errors occur with missing or incorrect location information (*e.g.*, GPS coordinates and classification). As such, the Mines Data Set may not accurately reflect all mine locations within the proposed critical habitat study area.

Arkansas River

Of the 25 active metal and mineral mine operations within the Arkansas River Basin study area, two are within a quarter mile of proposed critical habitat. Of the latter, one crushed limestone mine is near Unit NM4 located in Jasper County, Missouri near the town of Carthage. The other is a cement plant with an associated limestone pit in Allen County, Kansas near Unit NM7.

Ohio River

There are 13 active limestone mines in the Ohio River Basin study area. Only one is within a quarter mile of critical habitat, namely Unit RF22 in Green County, Kentucky near the city of Greensburg.

Red River

Fifteen active metal and mineral mines are in the Red River Basin study area. Of these, only one is near proposed critical habitat, within a quarter mile of Unit RF6 in McCurtain County, Oklahoma near the city of Idabel.

Tennessee River

Only one active limestone mine is located in the Tennessee River Basin study area and it is within a quarter mile of Unit RF20b in Livingston County, near Grand Rivers, Kentucky.

Verdigris River

In the Verdigris River Basin study area there is one active limestone mine and it is located within a quarter mile of Unit NM6. This facility is in Wilson County, Kansas near the city of Fredonia.

White River

There are 22 active metal and mineral mines in the White River Basin study area. Only two mines are near proposed critical habitat. Both are active limestone mines in Lawrence County, Arkansas, one within a quarter mile of Unit RF9 near the town of Powhatan and the other within a quarter mile of Unit RF10 near the city of Black Rock.

3.3.1.6 Industrial Development and Urbanization Infrastructure

Industrial development and urbanization infrastructure can physically destroy and alter freshwater mussel habitat. Construction and maintenance of transportation and utilities infrastructure degrades water quality through siltation and is associated with destruction, modification, and curtailment of species habitat and range. For example, bridges may require substrate disturbance to place piers and energy dissipaters, dikes, riprap and other infrastructure to prevent erosion of bridge structures. Construction of roads, highways, pipelines, and related facilities also contributes to degradation of water quality through increased runoff of contaminated stormwater. Urban wastewater and stormwater point and non-point discharges from urban and industrial sources impact water quality through sedimentation, chemical and biological contaminants, turbidity, altered water temperature, and available dissolved oxygen (*cf.* section 3.3.1.3). Stored industrial fuel, compounds and by-products are sources for accidental

spills potentially contaminating adjacent waterways. Urban areas are sources of transportation and industrial air emissions contaminating nearby waters.

To evaluate the degree of urbanization and industrialization within the study area associated with proposed critical habitat for the two mussel species, this analysis utilizes metropolitan and micropolitan statistical data gathered from the 2010 U.S. Census (USCB 2012a, http://www.census.gov/geo/maps-data/data/tiger-data.html). The U.S. Office of Management and Budget establishes criteria for defining metropolitan and micropolitan statistical areas. The general concept is a core area containing a substantial population nucleus (*i.e.*, metropolitan area), together with adjacent communities having a high degree of economic and social integration with that core (*i.e.*, micropolitan area). Each metropolitan statistical area must have at least one urbanized area of 50,000 or more inhabitants, whereas each micropolitan statistical area must have at least one urban cluster of at least 10,000 but less than 50,000 inhabitants (USCB 2012b, p. 1). Table 17 presents the data for the study area by river basin. The study area with the exception of Unit RF7 has either a metropolitan or micropolitan area within its boundary; the latter is thus in a predominately rural area less likely to have major industrialization or urban infrastructure. Although metropolitan and micropolitan statistical areas are technically in the study area associated with Units RF4a, RF6, and RF12, they are within short distances of the study area limits. The majority (62 percent) of study area watersheds are affected by metropolitan areas with 50,000 or more inhabitants.

Table 17. Metropolitan and micropolitan statistical areas in the study area by river basin

River Basin	Study Area	Metropolitan Statistical Area[1]	Micropolitan Statistical Area[1]
Arkansas River	NM3/NM4/NM5/RF1	Joplin, MO; Springfield, MO	Pittsburg, KS; Branson, MO
	NM7/RF3	--[2]	Parsons, KS; Pittsburg, KS
	RF2	Tulsa, OK	Bartlesville, OK
Cumberland	RF21	--	Paducah KY, IL
	RF31	Nashville-Davidson-Murfreesboro-Franklin, TN; Clarksville, KY, TN	--
Illinois River	NM1	Fayetteville-Springville-Rogers AR, MO; Fort Smith, AR,OK	Tahlequa, OK
Lower Great Lakes	RF30	--	Auburn, IN; Angola, IN
Lower Mississippi River	RF14	--	Farmington, MO
	RF15	--	Indianola, MS Cleveland, MS; Clarksdale, MS
	RF17	Jackson, MS	Vicksburg, MS; Yazoo City, MS; Greenwood, MS; Starkville, MS
Neosho River	NM2	Fayetteville-Springville-Rogers AR, MO; Joplin, MO	--
	NM8	Wichita, KS	Emporia, KS; McPherson, KS
Ohio River	RF21	--	Paducah KY,IL
	RF22	Bowling Green, KY; Elizabethtown, KY	Glasgow, KY; Campbellsville, KY
	RF23/RF25	Youngstown-Warren-Boardman OH-PA; Erie, PA	Oil City, PA; Meadville, PA

River Basin	Study Area	Metropolitan Statistical Area[1]	Micropolitan Statistical Area[1]
	RF24	Youngstown-Warren-Boardman OH-PA; Pittsburgh, PA; Erie, PA	Oil City, PA; Meadville, PA; Warren, PA; Bradford, PA; St. Marys, PA; Jamestown-Dunkirk-Fredonia, NY; Olean, NY
	RF26	Lafayette, IN; Chicago-Joliet-Naperville IL-IN-WI; Fort Wayne, IN	Logansport, IN; Peru, IN; Warsaw, IN; Plymouth, IN
Neosho River	NM2	Fayetteville-Springville-Rogers AR, MO; Joplin, MO	--
	NM8	Wichita, KS	Emporia, KS; McPherson, KS
Ohio River	RF21	--	Paducah KY,IL
	RF22	Bowling Green, KY; Elizabethtown, KY	Glasgow, KY; Campbellsville, KY
	RF23/RF25	Youngstown-Warren-Boardman OH-PA; Erie, PA	Oil City, PA; Meadville, PA
	RF24	Youngstown-Warren-Boardman OH-PA; Pittsburgh, PA; Erie, PA	Oil City, PA; Meadville, PA; Warren, PA; Bradford, PA; St. Marys, PA; Jamestown-Dunkirk-Fredonia, NY; Olean, NY
	RF26	Lafayette, IN; Chicago-Joliet-Naperville IL-IN-WI; Fort Wayne, IN	Logansport, IN; Peru, IN; Warsaw, IN; Plymouth, IN
	RF27	Columbus, OH; Mansfield, OH; Cleveland-Elyria-Mentor, OH	Mount Vernon, OH; Coshocton, OH; Ashland, OH; Wooster, OH
	RF28	Springfield, OH; Columbus, OH	Urbana, OH
	RF29	Danville, IL; Lafayette, IN	--
	RF32	Youngstown-Warren-Boardman OH-PA	Meadville, PA
Red River	RF4a	--	Roseville, AR
	RF4b	Hot Springs, AR; Little Rock-North Little Rock-Conway, AR	Hope, AR; Camden, AR; Arkadelphia, AR
	RF5	Hot Springs, AR; Pine Bluff, AR	--
	RF6	Fort Smith, AR	--
Tennessee River	RF19	Nashville-Davidson-Murfreesboro-Franklin, TN	Tullahoma, TN; Shelbyville, TN; Lewisburg, TN; Columbia, TN
	RF20a	--	Corinth, MS
	RF20b	--	Paris, TN; Murray, KY; Mayfield, KY; Paducah KY,IL
Verdigris River	NM6	--	Coffeyville, KS
White River	RF7	--	--
	RF8b	Little Rock-North Little Rock-Conway, AR; Jonesboro, AR	Searcy, AR; Forrest City, AR; Paragould, AR; Poplar Bluff, AR
	RF8a	--	Searcy, AR; Batesville, AR; Paragould, AR
	RF9	--	Batesville, AR; Paragould, AR; Poplar Bluff, AR; West Plains, MO
	RF12	--	Batesville, AR

River Basin	Study Area	Metropolitan Statistical Area[1]	Micropolitan Statistical Area[1]
	RF13	Fayetteville-Springville-Rogers AR, MO	Harrison, AR; Russellville, AR; Mountain Home, AR

Source: USCB 2012a, http://www.census.gov/geo/maps-data/data/tiger-data.html.
Notes: [1]Metropolitan and Micropolitan Statistical Area = defined by the U.S. Office of Management and Budget and applied to Census data. These are core areas containing a substantial population nucleus (i.e., metropolitan area), together with adjacent communities having a high degree of economic and social integration with that core (i.e., micropolitan area). Each metropolitan statistical area must have at least one urbanized area of 50,000 or more inhabitants. Each micropolitan statistical area must have at least one urban cluster of at least 10,000 but less than 50,000 inhabitants. Thus, these integrated statistical areas may occur in the present study areas without the cities being located in the study area
[2] -- = none present

Federal expenditures and permit authorizations are required for some types of industrial and urbanization infrastructure. Many states and local governments utilize Federal funds for construction of transportation infrastructure, including highway, airport, and rail construction. Construction of interstate pipelines and transmission lines are regulated by FERC, as is the construction of hydroelectric dams (*cf.* section 3.4.1.1). The EPA regulates destruction of waters of the U.S. and discharge to these waters; air emissions; pesticide and toxic chemical use, storage, and disposal; and hazardous substance disposal. Federal agencies regulating these activities consult with the Service on potential impacts to species and their habitats listed under the ESA. For example, based on section 7 consultation history involving aquatic species with habitat needs similar to the Neosho mucket and rabbitsfoot in the study area, from 2007 to 2012 27 percent of consultations were prompted by transportation and utility actions, and approximately 18 percent involved land development activities (*cf.* section 3.1.4) (Service 2012a). Seven of 13 formal section 7 consultation cases concerned transportation projects.

3.3.2 Effects on Water Resources

3.3.2.1 No Action Alternative

Under the No Action Alternative, section 7 consultation on effects of water supply and management projects would continue to be required under the jeopardy standard when there is a Federal nexus (*e.g.*, Federal lands, permitting, or funding is involved). Water projects with a Federal nexus affecting navigation, water supply, water quality, instream gravel and sand mining, metal mining, or industrial development and urbanization infrastructure could: (1) alter the hydrology or water quality of the two mussels' habitats (*e.g.*, dredging and discharge of fill material; channelization, diversion, alteration, or withdrawal of surface or groundwater flow; erecting dams and other structures impounding water; release or dumping of toxic chemicals, silt, or biological pollutants); and (2) destabilize the stream channel (*e.g.*, channelization, dredging and mining) and would likely trigger formal consultation under the jeopardy standard. Since the Neosho mucket and rabbitsfoot would be listed under the ESA, their entire historic range would be subject to section 7 consultations under the jeopardy standard.

Stream segments occupied by the Neosho mucket and rabbitsfoot would continue to be subject to section 7 consultation for water resource projects under the adverse modification standard of analysis where their range is overlapped by designated critical habitat for another species, such

as the oyster mussel, Cumberlandian combshell mussel, and yellowcheek darter. The adverse modification analysis must take into account habitat values (PCEs) of designated critical habitat essential for the recovery of the protected species. There would likely be no difference in the conservation measures needed to protect these species' critical habitat from those implemented to ensure the survival and recovery of the Neosho mucket and rabbitsfoot. Water resources, therefore, would not be adversely affected under this alternative.

3.2.2.2 Proposed Action Alternative

The Proposed Action would not result in an increase in section 7 consultations on water resources based solely on the presence of designated critical habitat for the two mussel species. The addition of an adverse modification analysis to section 7 consultations, however, would be required. This alternative would not have adverse impacts on water resources because consultations would still occur absent critical habitat designation under the No Action Alternative, and conservation measures or project modifications required to avoid adverse modification or destruction of critical habitat are anticipated to be the same as protections provided by listing the Neosho mucket and rabbitsfoot. Based upon information provided by the Service's Field Offices, it is unlikely future consultations with Federal agencies regulating currently authorized water actions would occur as a result of critical habitat designation alone, and the Service does not expect to recommend additional conservation measures for any of the previously evaluated activities to protect against adverse modification of critical habitat above and beyond what would be required to protect against jeopardy of the species.

The economic analysis projects over the next 20 years approximately 20 formal section 7 consultations, 796 informal consultations, and 122 technical assistance consultations concerning water flow management (quantity) would occur in 28 of the proposed critical habitat units in 12 states: Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, and Tennessee (Industrial Economics, Inc. 2013, pp. 3-9–3-10). The most expected section 7 consultation cases involving water quantity actions are likely to occur in Unit RF19 study area in Tennessee due to increasing demand for additional water supplies. Similarly, approximately two formal and 52 informal consultations, and 149 requests for technical assistance for water quality actions over the next 20 years are forecast to occur in 24 of the proposed critical habitat units located in 11 states: Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, Oklahoma, Pennsylvania, and Tennessee (Industrial Economics, Inc. 2013, pp.3-10–3-13). The greatest number of water quality actions requiring section 7 consultation is expected to occur in the Unit RF2 study area near the Tulsa, Oklahoma metropolitan area.

Two formal and nine informal section 7 consultations on sand and gravel mining activities over the next 20 years are forecast for nine of the proposed critical habitats (NM1, NM3, NM7, RF8a, RF8b, RF9, RF10, RF20a, and RF21) (Industrial Economics, Inc. 2013, p. 3-16). Industrial Economics, Inc. (2013, p. 3-20) forecasts most formal section 7 consultations regarding the two mussel species within the next 20 years will involve transportation and utility actions (109) in all 12 states with proposed critical habitat, with an additional 736 requests for informal consultation and 522 requests for technical assistance from the Service regarding these project types. Overall, Units NM1 (Illinois River) and RF2 (Verdigris River) are expected to generate the greatest amount of incremental impacts to future transportation and utilities activities over the next 20 years. The City of Tulsa is within the study area for Unit RF2, and is expected to continue expanding during the next 20 years, with a related increase inconsultations on transportation and

utilities associated with urbanization. Similarly, the Unit NM1 study area encompasses the City of Fayetteville-Springdale, Arkansas, currently the third-largest city in Arkansas (Industrial Economics, Inc. 2013, p. 3-21).

The outcome of future consultations would depend on the details of water project proposals and the analysis of effects. Outcomes of consultations for critical habitat also may include conservation measures or reasonable and prudent alternatives to avoid adverse modification. However, these would not likely be any different than those needed to avoid jeopardizing the Neosho mucket and rabbitsfoot. Some additional effort is likely to be required as part of section 7 consultation administrative activities for the water projectsadditional hours spent in communication with the Service and on activities such as report-writing and project documentation. Increased administrative costs to the Service, the action agencies, and any project proponent involved in the consultation process based solely on the presence of designated critical habitat would be negligible compared to the No Action Alternative (*cf.* section 3.5.1.3).

Past water management consultations involving critical habitat of other similar listed mussel species provides a basis for what can be expected in the future. Typical project modifications have included surveys and/or relocation for affected species, monitoring of species in the course of construction and reporting to regulatory agencies, and propagating affected species to augment their population. Other examples of possible project modifications to water resource management projects that could be sought to avoid adverse modification include:

- Best management practices (BMPs) for erosion and sedimentation control
- Timing restrictions
- Limiting the scope of instream work
- Right of way adjustments for avoidance
- Limiting the number of activity sites such as for sand and gravel mining
- Design modification such as avoiding instream piers when constructing bridges
- Modifying operations to enhance fish passage and mimic of natural flows

These project modifications and conservation measures would help conserve habitat value (physical and biological features and primary constituent elements) of the two mussel species, as well as natural stream hydrology and geomorphology, and would have beneficial effects on water quality. The following discusses specific impacts to water management activities based on past consultations and conferences.

<u>Navigation</u>

Under the Proposed Action navigational resources would not be impacted by the designation of critical habitat for the Neosho mucket and rabbitsfoot. All navigational dams and locks regardless of ownership would be subject to regulation by the Corps in accordance with section 404 of the CWA and section 10 of the Rivers and Harbors Act (33 U.S.C § 403), if they do not also produce hydropower. Those navigational dams that also produce power would be subject to periodic re-permitting by FERC. Dredging and channelization projects in waters of the U.S. would still require 404 permits from the Corps and new navigational dams and locks or changes to operations of existing navigational dams and locks would continue to require Federal permits from these agencies, prompting consultation with the Service under the ESA for listing of and designated critical habitat for the two mussel species.

The impacts of dredging and channelization of rivers and streams and new construction of navigation facilities that may adversely affect the Neosho mucket or rabbitsfoot proposed critical habitat would likely be minimized by measures to decrease turbidity and sedimentation and manage any interruptions to river flow. These measures could include increased monitoring and enforcement of BMPs for sediment and erosion control in upland areas, restoring riparian vegetation, use of turbidity curtains for instream projects to reduce sedimentation, operating equipment in a manner to minimize take, relocating listed mussels within the footprint of channel project construction, using upland areas for disposing of dredged material rather than instream, and implementing mussel surveying and monitoring plans. Operation of navigation dams and locks that interrupt the flow of water would require establishment of minimum flows and possibly scheduled releases. Obsolete structures that prevent host fish or mussel passage also may be removed to facilitate habitat connectivity. Finally, invasive species control measures may be necessary to conserve Neosho mucket and rabbitsfoot designated critical habitat.

Water Supply and Management

Under the Proposed Action water supply and management would not be expected to be impacted by the designation of critical habitat for the Neosho mucket and rabbitsfoot. As stated above, all dams regardless of ownership are subject to regulation by the Corps in accordance with section 404 of the CWA and section 10 of the Rivers and Harbors Act (33 U.S.C § 403), and FERC, if they also produce power. Disturbance of U.S. waters for construction of water supply projects would still require 404 permits under the CWA from the Corps, and any proposed action that could impact a federally reserved water right would be regulated by the administering Federal agency. The recommended project modifications and conservation measures for water supply activities that may impact designated habitat of the two mussel species are largely the same as those discussed for navigation, relating to interruptions of water flow, turbidity, and sedimentation. In addition to the previously discussed measures, water withdrawals may require modification to maintain minimum flows downstream.

Water Quality

A Federal nexus prompting consultation with the Service concerning strictly water quality treatment actions under the Proposed Action is limited to EPA consultation on administration of states' 303(d) programs and the issuance of NPDES permits to discharging facilities. Other Federal nexus actions with water quality impacts evaluated in this document include construction and operation of dams; navigation projects such as dredging and channelization; mining; agricultural production and forestry; industrial, municipal, and private land development; and energy development. Project modifications and conservation recommendations concerning activities with potential impacts to water quality and designated habitat for the two mussels would likely include: limiting instream activity and stream crossings by equipment and pipelines; use of turbidity curtains, sediment control fencing and soil erosion BMPs; controlling and monitoring discharges from industrial and municipal sources (*i.e.*, limiting contaminants, diverting wastewater into nonerodible areas for filtering or cooling prior to discharge); establishing minimum flow criteria; natural channel and riparian restoration; and implementation of mussel surveying and monitoring plans. These project modifications and conservation recommendations to maintain critical habitat would be no different than those needed to maintain the viability of the two mussel species as being listed species under the ESA.

Sand and Gravel Mining

The designation of critical habitat under the Proposed Action is not likely to have any additional effect on sand and gravel mining. Federal permits or authorization of sand and gravel mining would continue as it currently occurs under the No Action Alternative. While most sand and gravel activities are regulated by states and very few have a Federal nexus, any activity subject to section 404 CWA or section 10 Rivers and Harbors Act permitting with the potential for adverse effects to federally listed species would require the Corps to consult with the Service as specified by section 7 of the ESA. As discussed above, impacts from sand and gravel mining result primarily from increased sedimentation and stream channel modification from instream activities. The recommended project modifications and conservation measures for sand and gravel mining that may impact designated habitat of the two mussel species would be the same as those discussed for navigation and water quality, relating to changes of water flow, project modifications to minimize in stream modification, turbidity, sedimentation, and erosion control, and mussel surveys, relocation, population augmentation and monitoring.

Metal and Mineral Mining

The designation of critical habitat would not have any additional effect on metal and mineral mining. As with sand and gravel mining, regulation and permitting of metal and mineral mining would not change from the No Action Alternative. Any activity subject to section 404 of the CWA or section 10 of the Rivers and Harbors Act that may pose adverse effects to federally listed species would require section 7 consultation by the Corps. Impacts from metal and mineral mining include increased sedimentation from runoff and pit capture, as well as acid mine drainage and increased metal concentrations from metal mining similar to those discussed for coal mining (*cf.* section 3.4.2.2). The recommended project modifications and conservation methods for metal and mineral mining that may impact the designated habitat for the two mussel species would be the same as those discussed for water quality, namely, project modifications to minimize turbidity, sedimentation and promote erosion control. In addition, the conservation methods to mitigate the impacts of acid mine drainage and increased metal concentration in receiving waters include diversion of runoff away from exposed waste rock and tailings or channeling contaminated water into holding ponds for evaporation or treatment, water control pumps or subsurface drainage to reduce underground seepage and move contaminated ground water to holding ponds or treatment plants, properly designed tailings disposal areas and tailing impoundments, and the use of constructed wetlands for treating acid mine water (USEPA 1995, pp.57–59).

Industrial Development and Urbanization Infrastructure

Critical habitat designation for the Neosho mucket and rabbitsfoot is not expected to impact industrial development or urban infrastructure. Federal permits and authorizations would still be required for transportation, utilities, and industry. Based on consultation history, conservation measures or alternatives recommended to avoid jeopardy for the mussel species, associated with industrial and urbanization activities include re-siting, if feasible, mussel surveys, relocation, propagation, and monitoring; controlling point and non-point discharges to receiving waters adversely impacting water quality; restricting timing of activities; and implementing invasive species control measures.

3.4 **Energy Development and Production**

3.4.1 Existing Conditions

3.4.1.1 Hydropower

The decline of freshwater mussels is primarily a result of the modification and destruction of habitat from human activities such as dams, sedimentation, and degraded water quality (Neves *et al.* 1997, p. 60). As discussed in Section 3.3, Water Resources, freshwater mussel declines downstream of dams are associated with the changes and fluctuations of flow regimes, channel scouring and bank erosion, reduced dissolved oxygen levels and water temperatures, and alterations of resident fish assemblages (Williams *et al.* 1992, p. 7; Layzer *et al.* 1993, p. 69; Neves *et al.* 1997, pp. 63–64; Watters 2000, pp. 265–266; Pringle *et al.* 2000, pp. 810–815).

Federal agencies are required to incorporate environmental considerations into planning and decision-making, and to assess the environmental impacts of and alternatives to any major action with the potential to significantly affect the environment (42 U.S.C. 4321 *et seq*.). Section 7 of the ESA requires all Federal agencies to consult with the Service on any action, including issuance of a permit, which may affect a federally endangered or threatened species or their critical habitat. Federal agencies that operate or permit hydropower facilities are required to consider the impacts of their actions on the human environment and threatened and endangered species. Under the 1944 Flood Control Act, the Corps was authorized to construct dams as a means to produce electricity, provide flood control, maintain navigation, increase water supply, and provide recreational areas (Corps 2012, p. 2). Today, the Corps is the nation's largest water developer and generates a quarter of the U.S. hydropower (Corps 2012, p. 2).

FERC is the lead Federal agency for issuing licenses under the Federal Power Act (16 U.S.C., Chapter 12) to privately owned dams for the purpose of hydropower production. In accordance with NEPA (18 CFR Part 380), FERC evaluates the potential environmental impacts of the projects. As a Federal agency, FERC undergoes section 7 consultation with the Service in accordance with the ESA to consider the potential effects of licensing hydropower dams on federally listed species and their critical habitat. The FERC hydropower licenses are valid for 30, 40, or 50 years, depending on the extent of proposed new development or environmental mitigation and enhancement measures. Consequently, FERC undertakes consultation with the Service during the initial license application phase of a project and as the license is re-issued throughout the life of the project. FERC may also issue exemptions from licensing to two types of small hydroelectric projects: (1) A small conduit hydroelectric facility up to 15 megawatts (MW), or in applicable instances up to 40 MW may be eligible for a Conduit Exemption; and (2) A small hydroelectric project of 5 MW or less may be eligible for a 5 MW Exemption (FERC 2004, p. 6-1). FERC maintains up-to-date records of dam licenses and exemptions (FERC 2011, http://www.ferc.gov/industries/hydropower.asp). Between 2007 and 2012, there were three section 7 consultations for hydropower projects within the subject proposed critical habitat units or study area: (1) one technical assistance in 2010 at Pickwick Dam in the Tennessee River Basin (Unit RF20a); (2) one informal consultation in 2012 at Kinzua Dam in the Ohio River Basin (Unit RF24); and, (3) one informal consultation for the relicensing of the Taum Sauk Dam in the White River Basin (Unit RF9) (Service 2012b; Davidson 2012, pers. comm.). Non-federal dams that do not produce power in or over any navigable water of the U.S. require authorization from

the Secretary of the Army, acting through the Corps. These types of dams are discussed in Section 3.3.1, Water Resources.

Existing hydropower dams for which there is a Federal nexus (those that are either managed by Federal agencies or permitted by FERC) and that within the study area (area within the watershed where activities may have direct, indirect, and/or cumulative effects on the proposed critical habitat unit) are associated with proposed critical habitat for the Neosho mucket and rabbitsfoot are described below and summarized in Table 18.

Ohio River Basin

The Oakdale Dam is a non-federal hydropower dam across the Tippecanoe River that forms Lake Freeman in Indiana. Unit RF26 is comprised of two stream reaches, one upstream of Lakes Schaefer and Freeman and one downstream of Lake Freeman. Oakdale Dam forms the upstream boundary of the reach downstream of Lake Freeman. Oakdale Dam is on a 30-year schedule for relicensing (Table 18). Kinzua Dam on the Allegheny River is federally owned and operated by the Corps Pittsburgh District. Kinzua Dam is not located in proposed critical habitat Unit RF24, but does form the upstream boundary of the study area. The power plant is operated currently by First Energy Corporation; it is on a 50-year relicensing schedule. The Seneca Tribe has applied for the relicense and has been issued a preliminary permit (FERC 2012; https://www.ferc.gov/industries/hydropower/gen-info/licensing/pre-permits.asp). Informal section 7 consultation was undertaken in 2012 concerning the potential impacts of relicensing of this dam to listed species.

Red River Basin

There are five hydropower facilities in the Red River Basin, two in Oklahoma and three in Arkansas. The Pine Creek and Broken Bow Dams in Oklahoma are both operated by the Corps' Tulsa District. Pine Creek Dam forms Pine Creek Lake on the Little River, in the study area upstream of Unit RF6. Broken Bow Dam is on a tributary to the Little River (Mountain Fork Little River). The Mountain Fork Little River converges with the Little River in Unit RF6 and is in the study area. In Arkansas, DeGray and Narrows Dams are operated by the Corps' Vicksburg District, while Remmel Dam is owned and operated by Entergy Arkansas, Inc. DeGray Dam forms Lake DeGray on the Caddo River, a tributary converging with the Ouachita River in Unit RF4b. Narrows Dam forms Lake Greeson on the Little Missouri River and also converges with the Ouachita River in Unit RF4b. Both dams are within the study area. Remmel Dam forms Lake Catherine on the Ouachita River. It is located upstream of proposed Unit RF4b, and in the study area for the unit. Remmel Dam is up for relicensing every 50 years.

Tennessee River Basin

Proposed critical habitat Units RF20a and RF20b are located downstream of two federally owned hydroelectric facilities on the Tennessee River, Pickwick Landing Dam and Kentucky Dam. Both dams are federally owned hydroelectric facilities operated by Tennessee Valley Authority, were completed in 1938 and 1944 respectively, prior to implementation of the ESA in 1973. Information about each facility is included in Table 18. Barkley Dam, which is operated by the Corps' Nashville District, forms Lake Barkley on the Cumberland River, a tributary converging with the Ohio River upstream of Unit RF21. Barkley Dam is not located in Unit RF21, but forms the upstream boundary of the study area.

White River Basin

White River Lock and Dam Number 1 is a municipal dam located on the White River in Arkansas. It forms the upstream boundary of Unit RF8a. The license for the White River Dam is renewed every 50 years (Table 18). The Taum Sauk Lower and Upper (Pumped Storage) hydropower facilities are owned and operated by Union Electric Company on the East Fork Black River in Missouri. Taum Sauk Lower and Upper Dams are not located in unit RF9, but do occur in the study area. The 50-year license was issued in 1965 and is currently undergoing the permit reissuance process. An informal consultation has been accomplished and no changes are expected to need further consultations or concerns for proposed critical habitat (Davidson 2012, pers. comm.)

Table 18. Hydropower facilities in the study area for proposed critical habitat units

River Basin	River / Stream	State	Study Area	Hydropower Facility Name	Owner/Operator (Affiliation)	Plant Capacity (megawatts)	FERC License Renewal Schedule / Due Date
Tennessee River	Tennessee	TN	Unit RF20a	Pickwick Landing Dam	Tennessee Valley Authority (Federal)	240.0	NR[1]
Tennessee River	Tennessee	KY	Unit RF20b	Kentucky Dam	Tennessee Valley Authority (Federal)	218.6	NR
Cumberland River	Cumberland	KY	Unit RF20b	Barkley Dam	Corps[2], Nashville District (Federal)	32.5	NR
Ohio River	Tippecanoe	IN	Unit RF26	Oakdale Dam	Northern Indiana Public Service Company (Municipal)	9.2	30-year / 09-30-2037
Ohio River	Allegheny	PA	Unit RF24	Kinzua Dam and Seneca Pumped Storage Reservoir	First Energy Corporation (Private)	432	50-year / 11-30-2015
White River	White	AR	Unit RF8a	White River Lock & Dam No 1	Independence County, AR (Municipal)	4.3	50-year / 01-31-2036
White River	East Fork Black	MO	Unit RF9	Taum Sauk Lower and Upper (Pumped Storage) Dams	Union Electric Company. (Private)	408.0	50-year/in progress
Red River	Little	OK	Unit RF6	Pine Creek Lake Dam	Corps[2], Tulsa District (Federal)	6.4	NR
Red River	Mountain Fork	OK	Unit RF6	Broken Bow Dam	Corps[2], Tulsa District (Federal)	100.0	NR
Red River	Caddo	AR	Unit RF4b	DeGray Dam	Corps[2], Vicksburg District (Federal)	68.0	NR
Red River	Little Missouri	AR	Unit RF4b	Narrows Dam	Corps[2], Vicksburg District (Federal)	25.5	NR
Red River	Ouachita	AR	Unit RF4b	Remmel Dam	Entergy Arkansas (Private)	9.3	50-year / 02-08-2053
Arkansas River	Grand	OK	Unit RF2	Fort Gibson Dam	Corps[2], Tulsa District (Federal)	24.3	NR

Source: USEPA 2012a, http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html;
National Atlas of the United States 2006, http://nationalatlas.gov/mld/dams00x.html;
FERC 2012, http://www.ferc.gov/industries/hydropower.asp.

Notes: [1]Not Required, [2]U.S. Army Corps of Engineers

3.4.1.2 Oil and Gas

As previously discussed in Section 3.3, Water Resources, freshwater mussel declines are associated with degraded water quality due to nonpoint source pollution from a multitude of land-based sources that reach waterways and contain an array of contaminants, including hydrocarbons (Neves *et al.* 1997, pp. 63–72; Obermeyer *et al.* 1997, pp. 110–113; Lindmeyer *et al* 2009, p. 4). Oil and gas exploration and extraction activities can result in increased siltation, altered hydrograph[2], and changed water quality and quantity (77 FR 63604, October 16, 2012, p. 63461). These impacts can occur even at considerable distances from the well field as contaminants are carried downstream from the original source (77 FR 63604, October 16, 2012, p. 63461). Contaminants associated with oil and gas development also include heavy metals, chlorides, and dissolved solids (Service 2010b, p. 24).

In 2011, Oklahoma was the 5th largest producer of crude oil, producing an estimated 74.6 thousand barrels of oil, with Kansas and Mississippi ranked 9th and 12th, respectively (U.S. Energy Information Agency 2012a,b). Pennsylvania, Oklahoma, and Ohio were ranked 4th, 5th, and 6th with the number of active gas wells in 2010 (U.S. Energy Information Agency 2012c). New technology such as hydraulic fracturing and horizontal drilling has allowed for the expansion of oil and gas extraction from shale that has led to the dramatic increase of natural gas extraction in Arkansas, Oklahoma, and Pennsylvania, where critical habitat for the Neosho mucket and rabbitsfoot is proposed (Service 2010a, pp. 23, 24, 31, 34). While the majority of oil and natural gas production occurs away from streams and rivers, the infrastructure necessary to support production (*e.g.*, roads and pipelines) frequently intersects or occurs near waterbodies, and can increase sediment and pollutant loading into waterways.

Oil and natural gas development is regulated by the Federal government when the proposed activity involves Federal lands. Additionally, permits are issued by FERC for international or interstate oil pipeline construction under the Interstate Commerce Act (FERC 2013a, p. 1), and/or regulation of natural gas pipeline, storage, and liquefied natural gas facility construction under the Natural Gas Act (FERC 2013b, p. 1). Section 7 consultation history from 2007 to 2012 recorded 131 consultations in Alabama, Arkansas, Illinois, Kentucky, Mississippi, Ohio, Oklahoma, Pennsylvania, and Tennessee, with the majority occurring in Pennsylvania, concerning oil and gas actions and potential impacts to similar aquatic species in the study area, none of which were formal (Service, 2012b). States are primarily responsible for regulating oil and gas activities and several chose to consult informally with the Service on potential impacts to species and critical habitat (Industrial Economics, Inc. 2013, p. 4-12).

Table 19 presents the number of oil and natural gas wells in the study area recorded by the 13 individual states for the two mussel species. Types of wells included in this study include oil and natural gas exploratory and production wells, but also ancillary wells such as injection sites and geologic sequestration wells. Every attempt was made to only include active wells; however, completeness and currency of the data set is so variable among the states that the total number of active wells presented is only a rough approximation.

Based upon data provided by the states with proposed critical habitat, an estimated total of 42,419 oil and gas wells were found in the study area of Arkansas, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, New York, Ohio, Pennsylvania, and Tennessee. Of these, the

2 Graph showing changes in the discharge of a river over a period of time.

majority were located in the Unit RF24 study area in Pennsylvania (16,283), Unit NM7 and RF3 in Kansas (12,500), and Unit RF23 and 25 in Pennsylvania (3,799). Of the data set, 887 oil or gas wells were located within one quarter mile of proposed critical habitat units for the two mussel species.

Table 19. Number of oil and gas wells in study area by river basin and state

River Basin	Unit Study Area	State	Study Area Number of Oil and Gas Wells
Arkansas River	NM3/NM4/NM5/RF1	KS	8
		MO	1
	NM7/RF3	KS	12,500
	RF2	KS	1
Cumberland River	RF31	KY	72
		TN	10
Illinois River	NM1	AR	16
Lower Mississippi River	RF17	MS	59
Neosho River	NM2	AR	2
		MO	8
	NM8	KS	431
Ohio River	RF21	IL	3
		KY	3
	RF22	KY	2,367
	RF23/RF25	PA	3,799
	RF24	NY	1,604
		PA	16,283
	RF26	IN	93
	RF27	OH	118
	RF32	PA	1,199
Red River	RF4b	AR	17
	RF5	AR	2
Tennessee River	RF19	TN	1
Verdigris River	NM6	KS	3,685
White River	RF7	AR	46
	RF8a	AR	6
	RF8b	AR	85
Total			42,419

Sources:

- Arkansas Oil and Gas Commission 2012, http://www.geostor.arkansas.gov/G6/Home.html.
- Geological Survey of Alabama 2012, http://www.ogb.state.al.us/ogb/gis_data.aspx.
- Illinois State Geological Survey 2013, http://www.isgs.illinois.edu/nsdihome/webdocs/st-geolb.html.

- Indiana Geological Survey 2012, pers. comm.
- Kansas Geological Survey 2013, http://www.kgs.ku.edu/Magellan/Qualified/index.html.
- Kentucky Geological Survey 2008, http://www.uky.edu/KGS/emsweb/data/kyogshape.html.
- Mississippi Oil and Gas Board 2010, http://www.maris.state.ms.us/HTM/DownloadData/Statewide.html.
- Missouri Department of Natural Resources 2012, http://msdis.missouri.edu/data/datalist.html#list.
- New York Department of Environmental Conservation, Oil and Gas 2013, http://www.dec.ny.gov/cfmx/extapps/GasOil/.
- Ohio Department of Natural Resources 2009, http://www.dnr.state.oh.us/geosurvey/tabid/7768/Default.aspx.
- Oklahoma Corporation Commission 2012, http://www.occeweb.com/og/ogdatafiles2.htm.
- Pennsylvania Department of Environmental Quality 2012, http://www.portal.state.pa.us/portal/server.pt/community/oil_and_gas_reports/20297.
- Tennessee Department of Environment and Conservation 2012, pers. comm.

3.4.1.3 Coal Mining

Coal mining activities can result in heavy metal-rich drainage and sedimentation of receiving waters. Contaminants such as polycyclic aromatic hydrocarbons (PAHs) and heavy metals are common in coal mining sediments and can be toxic to mussels when released into streams (Ahlstedt and Tuberville 1997, p. 75). Similarly, low pH commonly associated with mine runoff can reduce glochidial attachment rates on host fish (Huebner and Pynnonen 1990, pp. 2350–2353). Previous studies have demonstrated that rabbitsfoot populations in some portions of the upper Ohio River in Kentucky, Pennsylvania, and West Virginia; the lower Ohio River in eastern Illinois; and the upper Cumberland River in Kentucky and Tennessee have been affected by mine drainage (Ortmann 1909 in Butler 2005, p. 102; Gordon 1991, pp. 4–5; Layzer and Anderson 1992 in Butler 2005, p. 102).

The Office of Surface Mining Reclamation and Enforcement (OSMRE) has generally delegated the responsibility for regulating coal mining on lands within their jurisdiction to states, with OSMRE performing an oversight capacity (30 U.S.C. § 1201). While some states may receive funding assistance from OSMRE, this action is not considered a major Federal action according to section 102(2)(C) of NEPA, and as such, does not require section 7 consultation (Department of the Interior 2004, p. 4). Surface coal mines in states with proposed critical habitat for the two mussel species, with the exception of Tennessee, are responsible for regulating surface coal mining under the Surface Mining Control and Reclamation Act of 1977 (SMCRA). In Tennessee, OSMRE has been the primary regulatory agency since 1984 when the state repealed its surface mining law (OSMRE 2009, http://www.arcc.osmre.gov/FOs/KFO/KFO.shtm).

Proposed critical habitat for the two mussel species are within several major coal fields; the states of Alabama, Kentucky, Ohio, Pennsylvania and Tennessee are within the Eastern Province, a major coal field that produces 40 percent of U.S. coal (USGS 1996). Eleven of the states with proposed critical habitat have mines currently producing coal (Table 20). In 2011, these states produced approximately 27 percent of the U.S. total, with Kentucky and Tennessee being the third and fourth largest producers, respectively, in the nation (U.S. Energy Information

Agency 2012d, http://www.eia.gov/coal/annual/). Between 2007 and 2012, two informal section 7 consultations for coal mining projects occurred, both within Unit RF24. One occurred in 2010 regarding the K & A Mine in Venango County, Pennsylvania concerning the northern riffleshell mussel (*Epioblasma torulosa rangiana*); the other in 2008 for an acid mine drainage TMDL determination for the Town Run watershed in Pennsylvania in relation to the clubshell mussel (*Pleurobema clava*) (Service 2012b).

The following locations of active coal mines in the proposed critical habitat study area were obtained from MSHA (2013, http://www.msha.gov/OpenGovernmentData/OGIMSHA.asp) Mines Data Set. The Mines Data Set lists all coal, metal, and nonmetal mines under MSHA's jurisdiction[3].

Table 20. Coal mines and statewide 2011 production data for states with proposed critical habitat

Coal-Producing State	Number of Mines	2011 Production (thousand tons)
Alabama	52	19,071
Arkansas	2	133
Illinois	24	37,770
Indiana	28	37,426
Kansas	1	37
Kentucky	400	108,766
Mississippi	1	2,747
Missouri	2	465
Ohio	46	28,166
Oklahoma	6	1,145
Pennsylvania	242	59,182
Total	804	294,908
U.S. Total	1,325	1,095,628

Source: U.S. Energy Information Agency 2012d, http://www.eia.gov/coal/annual/

Lower Mississippi

The Red Hills Mine is a 2,350 ha (5,809 ac) lignite coal strip operation (North American Coal 2006, http://www.nacoal.com/operations/redhills.html) to the Red Hills Power Plant that is currently under a 30-year contract to supply the plant and is located in the Unit RF 17 study area. The mine was established in 1997 to supply coal electricity to TVA. The Red Hills Mine is

3 The MSHA obtains its data from the Legal ID form that is completed by the mine operator. Some of the data within Mines Data Set was missing or incorrect (i.e., GPS coordinates). As such, the Mines Data Set may not accurately reflect all active mine and facility locations within the proposed critical habitat study areas.

approximately 161 km (100 miles) upstream of Unit RF17 in the center of Choctaw County, Mississippi.

Ohio River Basin

There are two active coal mines in the Unit RF24 study area. The K & A Mine (also known as Kingsley Mine) is a 27 ha (68 ac) bituminous coal strip mining operation in Venango County, Pennsylvania (The Pennsylvania Bulletin 2010, p. 3). The K & A Mine lies approximately 0.8 km (0.5 miles) south of the proposed critical habitat. The Ancient Sun Strip Saylor-McKinney is a 25 ha (62 ac) bituminous coal surface mine in Clarion County, Pennsylvania (The Pennsylvania Bulletin 2012, p. 17). The Ancient Sun mine partially extends across the southern border of the Unit RF24 study area.

Tennessee River Basin

Two active mine facilities occur in the Unit RF20b study area. The Grand Rivers Terminal is an active coal facility located on the Tennessee River in Livingston County, Kentucky. It overlaps the upstream boundary of the Unit RF20b study area; approximately 1.4 km (0.9 miles) from proposed critical habitat. This 17 ha (43 ac) facility has a storage capacity of one million tons of coal, petroleum coke (petcoke)[4], and limonite ore, with an annual throughput of 12 million tons (Kinder-Morgan 2009, http://www.kindermorgan.com/business/terminals/midwest/MW-GrandRivers2009Mar.pdf; Union Pacific No Date, http://www.uprr.com/customers/energy/ports/d_griver.shtml). The other mine operation in the Unit RF20b study area is Calvert City Terminal in Marshall County, Kentucky. This facility, which opened in 2002, is a coal terminal facility on the Tennessee River. The Calvert City Terminal has the capacity to store two million tons of coal and has an annual throughput of 12 million tons (SCH Services 2012, http://www.sch-ces.com/cct.html).

3.4.2 Effects on Energy Development and Production

3.4.2.1 No Action Alternative

Under the No Action Alternative, stream segments occupied by the two mussel species would be subject to section 7 consultations regardless of the area's status as critical habitat. Section 7 consultation regarding effects of hydropower generation and oil, gas, and coal exploration and production on the two mussel species would be required under the jeopardy standard when there is a Federal nexus (*e.g.*, Federal lands, permitting, or funding is involved) and a determination of may affect. These determinations would likely be made for energy projects that could: (1) alter the hydrology or water quality of the two mussels' habitats (*e.g.*, impoundments, dams, water withdrawals, release or dumping of sediment or chemicals, alteration of water temperature and acidity, turbidity); and (2) destabilize the stream channel (*e.g.*, dam construction, access construction, pipelines) and would likely trigger formal consultation under the jeopardy standard for the two mussel species as well as other co-occurring aquatic species that are listed under the ESA. The effects of section 7 consultation on hydropower production and oil, gas, and coal projects with a Federal nexus would be similar to existing conditions, where consultations address potential effects on co-occurring aquatic species that are already federally listed and/or have designated critical habitat, such as for the oyster mussel (Duck dartersnapper), Cumberlandian combshell, and yellowcheek darter (*cf.* section 3.1.2). As such, many of the

4 Carbonaceous material obtained from petroleum cracking and refinery coker processing.

habitat elements relevant to conservation of the two mussel species are currently considered in section 7 consultations for these other species.

3.4.2.2 Proposed Action Alternative

Designation of critical habitat for the two mussel species is unlikely to increase the number of section 7 consultations for hydropower or energy development actions involving these species. All proposed critical habitat is occupied by one or both of the mussel species, thus activities with the potential for impacts to the Neosho mucket and rabbitsfoot would require section 7 consultations under the jeopardy standard due to their listing under the ESA. Further, if consultations were to occur, it is unlikely that additional conservation measures would be proposed to address critical habitat, beyond those that would be proposed to avoid jeopardy of the species.

The Proposed Action would likely only cause minor increases in the time required by Federal agency staff to conduct a section 7 consultation, and project proponents to address adverse impacts to critical habitat of the two mussel species (*cf.* section 3.5.1.3). Some additional effort would likely be required as part of section 7 consultation to describe the potential for energy projects to result in adverse modification, reflected in additional hours spent in communication with the Service and on activities such as report-writing and project documentation.

Future section 7 consultations concerning hydropower actions are included in the water supply forecast (*cf.* section 3.3.2). However, no new hydropower projects within the study area are known in the near term, and the Service does not expect to re-open consultation with previously permitted hydropower facilities based on the designation of critical habitat alone (Industrial Economics, Inc. 2013, p. 3-9). Industrial Economics, Inc. forecasts 287 section 7 consultations concerning oil and gas actions would occur over the next 20 years (Industrial Economics, Inc. 2013, p. 3-19). Of these, approximately 19 would be formal consultations, 181 would be informal, and 87 would be requests for technical assistance. Future section 7 consultations concerning oil and gas are expected to occur in the study area for 16 of the proposed critical habitat units located in the following states: Alabama, Arkansas, Illinois, Kentucky, Mississippi, Ohio, Oklahoma, Pennsylvania, and Tennessee. Unit RF2 (Verdigris River), Unit RF24 (Allegheny River) and Unit RF25 (Muddy Creek) are expected to generate the greatest potential to influence future oil and gas activity over the next 20 years, largely due to enhanced recovery of shale deposits. In the event gas prices increase, a greater number of consultations may occur. The economic analysis projects approximately 32 informal section 7 consultations on coal mining activities over the next 20 years (Industrial Economics, Inc. 2013, p. 3-15). Consultations are expected to increase over the next 20 years in the Unit RF5 study area, and may double, due to the presence of untapped lignite resources. There is also the potential for lignite mining to occur in the study area for Units RF15, RF16, and RF17 because of untapped resources; but, due to the uncertainty of when future mining may occur, section 7 consultations are projected to remain the same as past consultations for these three study areas.

The outcome of future consultations would depend on the details of energy project proposals and the analysis of effects. Energy development and production activities may require modifications to avoid affecting the two mussels' critical habitat potentially designated under the Proposed Action. Many of the measures implemented to minimize impacts to water flow, water quality, and channel stability from energy projects are the same as those discussed in section 3.3.2.2 (*i.e.*, timing water releases and withdrawals to maintain flow and fish passage, erosion control

measures, design changes to minimize disturbance in stream). Similarly, mussel surveys, relocation, population augmentation, and monitoring have been required. The following discusses specific impacts to energy development and production activities based on past consultations and conferences.

Hydropower

Hydropower would not be impacted any differently by the designation of critical habitat for the Neosho mucket and rabbitsfoot under the Proposed Action. Hydropower projects include new power development and production as well as permit reissuance and modifications to flow rates and release schedules. Hydropower dams in private or local government ownership would continue to be regulated by FERC, and as such, subject to section 7 consultation under the jeopardy standard. Currently, there are no new hydropower facilities or modifications to existing hydropower facilities with a Federal nexus known to be planned for the proposed critical habitat units or study area. Potential impacts to any of the proposed critical habitat units or the two mussel species from the production of hydropower would be related to habitat destruction and changes in quantity of stream flow and water quality. Project modifications and conservation measures would be similar to those described for dredging and channelization and navigation and water supply dams (*cf.* section 3.3.2).

Oil and Gas

Potential impacts to any of the proposed critical habitat units or the two mussel species from oil and gas production would be related to changes in the quantity of stream flow and water quality. These impacts could result from surface spills (such as above ground pipeline leaks), subsurface leakage from wells or pipelines into groundwater that feed streams, alteration of surface or ground water flow from installation of wells or pipelines, non-point discharges from access roads and stream crossings, and channel disturbance from pipeline construction. Oil and gas development and production activities would continue to be primarily state regulated, with Federal land managing agencies and the FERC regulating a smaller subset of such activities. As such, oil and gas development with the designation of critical habitat for the two mussels would not be impacted any differently from the No Action Alternative. In addition to mussel surveys, population management and monitoring and BMPs to control sedimentation and other water quality impacts, past project modifications and conservation measures implemented for oil and gas-type projects include limiting instream disturbance (*i.e.*, directional boring), access road and pipeline BMPs, storage of fuel and chemicals at least 30 meters (100 feet) from waterbodies, prohibition of the use of herbicides and pesticides for right of way management, and contingency plans for uncontrolled releases of drilling mud (Industrial Economics, Inc. 2013, p. 4-13).

Coal Mining

There would be no additional section 7 consultations under the adverse modification standard for coal mining projects with a Federal nexus. As with the No Action Alternative, all proposed critical habitat units are occupied by one or both of the two mussel species and any coal mining projects with a Federal nexus would trigger section 7 consultations under the jeopardy standard. Potential impacts from coal mining activities include degradation of water and sediment quality. These impacts could result primarily from acid mine drainage, a result of the formation of sulfuric acid that occurs from multiple chemical and microorganism-mediated reactions of iron-sulfide minerals found in mine tailings after being exposed to air. The increased acid, as well as aluminum, manganese, zinc and other constituents are transported to receiving waters through

subsurface ground water flow or surface runoff (Sams and Beer 2000, pp. 3–4). In accordance with a Biological Opinion issued by the Service in 1996, surface coal mining and reclamation operations are conducted under the provisions of SMRCA and the terms and conditions of the Biological Opinion (Service 1996, p. 10). Under this rule, the operator must promptly notify the regulatory authority of the presence of a protected species within the permit area. Timing restrictions, installation of riparian buffers to filter sediments and pollutant offloading to nearby waters, use and maintenance of haul road sumps, secondary containment of sedimentation ponds, deep mine water discharge control and treatment, and coal pile runoff control are examples of conservation measures specific to this industry.

3.5 Socioeconomic Conditions and Environmental Justice

Regulations for implementing NEPA require analysis of social effects when they are interrelated with effects on the physical or natural environment (40 CFR § 1508.14). Federal agencies are also required to "identify and address disproportionately high and adverse human health or environmental effects" of their programs and actions on minority populations and low-income populations, as directed by Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations). Minority populations may be characterized by race or ethnicity. The 2010 U.S. Census accounted for persons of Hispanic or Latino descent separate from racial groups, such as white, black or African American, Asian, and Native American. Therefore, for this analysis, both racial minority and Hispanic or Latino categories are considered when making environmental justice determinations.

3.5.1 Existing Conditions

3.5.1.1 Land Use

Descriptions of land ownership acreage for the following discussion were obtained from the 2010 Protected Areas Database of the United States (USGS 2010, http://www.databasin.org/protected-center/features/PAD-US-CBI) and the descriptions of land cover and use were obtained from the 2006 National Land Cover Database (USGS 2006, http://seamless.usgs.gov/nlcd.php).

The study area comprising all proposed critical habitat for the two mussel species totals over 13.9 million ha (34.31 million ac) in 13 states. Approximately 1.10 million ha (2.73 million ac) are government owned (*e.g.*, Federal, state, and local) or owned by private entities for the purpose of conservation (*e.g.*, The Nature Conservancy, Audubon Society, Western Pennsylvania Conservancy) (Appendix 2). The remaining area (12.78 million ha (31.58 million ac)) is privately owned[5]. As discussed in Section 3.2, certain lands in the study area fall within protected conservation lands. These conservation lands consist of areas such as parks, forests, wildlife reserves and preserves, and wild and scenic rivers (*cf.* section 3.2.1).

5 Private land herein is defined as privately owned land that does not belong to a private entity for the express purpose of conservation; whereas private conservation lands are those lands that would be owned by private organizations such as The Nature Conservancy and National Audubon Society for conservation. Conservation programs such as the Conservation Reserve Program, Wildlife Habitat Incentives Program, Environmental Quality Incentives Program, and others may still be practiced on private land.

Of the government-owned lands, the Federal government controlled about 700,000 ha (1.72 million ac) in 2010 (USGS 2010, http://www.databasin.org/protected-center/features/PAD-US-CBI). These lands were administered by the Fish and Wildlife Service, National Park Service, Forest Service, Corps, TVA, and Department of Defense. Uses included wildlife refuges; wildlife management areas; wild, scenic, and recreation rivers; national forests; national parks, monuments, and battlefields; research natural areas; military reservations; and Corps land and water projects. States were the next largest government landowner in the study areas, controlling about 342,465 ha (846,249 ac). State uses included highway and transportation rights-of-way; parks and recreation areas; cultural and historic areas; conservation, natural, and wildlife management areas; and state forests. There were also about 25,493 ha (62,872 ac) jointly owned by state and Federal agencies. About 33,769 ha (83,446 ac) were owned by private conservation groups such as the Nature Conservancy and the National Audubon Society (*cf.* section 3.1.2).

Within the study area, common private land uses included timber harvest operations and agricultural activities such as pasture lands for livestock, crop and forage production, and confined livestock farms (77 FR 63440, October 16, 2012, pp. 63479–63484). The majority of the land in the study area is primarily forested, followed by agricultural lands (Table 21) (USGS 2006, http://seamless.usgs.gov/nlcd.php). The study area also includes several grass and scrub/shrub lands, as well as active urban development. Appendix 2 provides a breakdown of land cover for each proposed critical habitat study area by river basin.

Arkansas River

The study areas for Units NM3, NM4, NM5, RF1, NM7, RF3, and RF2 in the Arkansas River Basin contain approximately 1.85 million ha (4.57 million ac). In 2010, the majority of land was privately held (1.80 million ha (4.45 million ac) or 97.4 percent). Of the remaining 47,872 ha (118,294 ac), approximately 18,067 ha (44,644 ac) is owned by the states of Kansas, Missouri, and Oklahoma and are used for state parks, wildlife management, conservation, cultural and historic sites, and hunting and fishing lands. The Federal government owned 14,103 ha (34,850 ac), the majority of which are Corps project lands and military reservations. Private conservation organizations owned 14,544 ha (35,938 ac) and 1,158 ha (2,861 ac) belonged to local governments.

Land uses in the study area in 2006 were predominantly for agricultural production (Table 21). There was approximately 1.04 million ha (2.56 million ac) in agricultural use, mostly in pasture and hay lands, and to a lesser extent, crop cultivation. After agriculture, grassland and shrub/scrub and forest lands accounted for the most common land cover in the study area. Developed land accounted for about 8.1 percent of land use, the most common were developed open spaces associated with residential and recreational areas. In addition, metal mining operations are common in the study area. The Tri-State Mining Area, which covers approximately 15,000 km^2 (5,800 mi^2) in Kansas, Missouri, and Oklahoma, is in the Arkansas River Basin (*cf.* section 3.3.1.5) (Service 2010b, p. 11; 2010c, p. 32).

Cumberland River

Approximately 265,926 ha (657,118 ac) comprise the study area for a portion of Unit RF21 and all of Unit RF31 in the Cumberland River Basin. In 2010, all but 54 ha (134 ac) was private land. The excepted acres were owned by the Tennessee Wildlife Resources Agency and The Nature Conservancy for use as a state wildlife management area.

In 2006, over 66 percent of the land in this study area was agricultural, used for crop and forage production and pasture (Table 21). Forest land, primarily deciduous forest, was the next principal land cover. In this study area, about 6.2 percent of the land was developed open spaces that commonly include single family homes and open recreational areas such as parks and golf courses.

Illinois River

Within the Illinois River Basin, the Unit NM1 study area covers about 342,444 ha (846,198 ac). The majority of this land (about 323,683 ha (799,837 ac)) was privately owned in 2010. The Federal government owned 12,406 ha (30,657 ac) for use as national forests, wildlife management areas and refuges, and Corps water projects. Another 5,808 ha (14,351 ac) was owned by private conservation organizations. The states of Arkansas and Oklahoma owned the remaining 547 ha (1,352 ac) for natural areas, cultural and historic sites, state parks, and highway rest areas.

In 2006, the land in this study area was primarily agricultural and forested. The study area in the Illinois River Basin drains two of the fastest growing counties in Arkansas (Service 2010c, p 9). Of the entire proposed critical habitat study area, the lands in Unit NM1 were the most developed. In 2006, about 10.5 percent of the acreage was developed land, although it was primarily open space development associated with single family residents and recreational areas and low intensity consisting of suburban-type developments.

Lower Great Lakes

The study area comprising Unit RF30 within the Lower Great Lakes Basin consists of about 28,241 ha (69,786 ac) and approximately 97.6 percent was privately owned in 2010. Private conservation organizations (*i.e.*, The Nature Conservancy and Acres Land Trust) owned the majority of the remaining 611 ha (1,510 ac). The Indiana and Ohio Departments of Natural Resources owned 1.6 ha (3.9 ac) and 72.8 ha (180.1 ac), respectively, that are used primarily as nature and wildlife preserves.

The primary use for the land in this basin in 2006 was agricultural production. Of the proposed critical habitat study area, Unit RF30 had the largest proportion of wetlands, covering nearly 16 percent of the study area. Developed land accounted for about 6.4 percent and was largely open development.

Table 21. 2006 land use acreage in the proposed critical habitat study area by river basin

River Basin	Agriculture[1] ha (ac)[8]	Barren Land[2] ha (ac)[8]	Developed[3] ha (ac)[8]	Forested[4] ha (ac)[8]	Grasslands and Shrub/Scrub[5] ha (ac)[8]	Open Water[6] ha (ac)[8]	Wetlands[7] ha (ac)[8]
Arkansas River	1,034,026 (2,555,134)	2,702 (6,690)	150,638 (372,324)	297,536 (735,277)	318,818 (787,817)	20,464 (50,567)	26,634 (65,815)
Cumberland River	175,315 (433,214)	348 (859)	16,320 (40,328)	67,850 (167,661)	2,389 (5,904)	213 (526)	2,327 (5,749)
Illinois River	150,968 (373,051)	765 (1,890)	36,048 (89,076)	138,336 (341,910)	13,217 (32,661)	909 (2,246)	2,066 (5,105)
Lower Great Lakes	19,115 (47,235)	None Listed	1,793 (4,431)	2,032 (5,021)	227 (561)	535 (1,323)	4,493 (11,102)
Lower Mississippi River	438,494 (1,083,542)	1,117 (2,760)	75,462 (186,471)	567,787 (1,403,031)	105,481 (260,649)	13,969 (34,517)	115,098 (284,413)
Neosho River	197,523 (488,091)	611 (1,510)	33,007 (81,563)	134,343 (331,969)	247,301 (611,094)	2,600 (6,425)	4,809 (11,884)
Ohio River	1,014,387 (2,506,604)	1,334 (3,296)	153,943 (380,401)	980,933 (2,423,939)	57,038 (140,944)	28,270 (69,856)	48,410 (119,624)
Red River	231,102 (571,066)	2,140 (5,288)	109,263 (269,995)	1,314,328 (3,247,776)	195,903 (484,087)	12,791 (31,607)	234,391 (579,193)
Tennessee River	357,191 (882,637)	1,140 (2,818)	65,555 (161,991)	556,797 (1,375,876)	68,884 (170,216)	7,324 (18,097)	23,593 (58,300)
Verdigris River	124,576 (307,835)	303 (749)	10,848 (26,805)	28,929 (71,484)	55,581 (137,343)	1,347 (3,329)	1,902 (4,699)
White River	1,358,140 (3,356,036)	3,980 (9,836)	164,074 (405,435)	1,932,587 (4,775,526)	61,001 (150,737)	34,702 (85,751)	209,266 (517,108)
Total	5,100,872 (12,604,529)	14,446 (35,696)	822,962 (2,033,584)	6,021,523 (14,879,508)	1,125,842 (2,782,015)	123,123 (304,244)	672,990 (1,662,994)

Source: USGS 2006, http://seamless.usgs.gov/nlcd.php

Notes:

[1]Includes cultivated crops, defined as areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. This class also includes all land being actively tilled; pasture and hay land; and areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Crop, pasture, and hay vegetation accounts for more than 20 percent of the total vegetation in these areas.

[2]Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15 percent of total cover in these areas.

[3]Developed lands are those areas that include a mixture of constructed materials and vegetation. The level of development is dependent on the amount of impervious surface coverage (Developed open space – less than 20 percent; low intensity –20 to 49 percent; medium intensity –50 to 79 percent; and high intensity –80 to 100 percent).

[4]Includes:

- Deciduous forests - areas dominated by trees generally greater than 5 meters (16 feet) tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.
- Evergreen forests - areas dominated by trees generally greater than 5 meters (16 feet) tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.
- Mixed forests - areas dominated by trees generally greater than 5 meters (16 feet) tall, and greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.

[5]Includes grasslands that are areas dominated by graminoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing. It also includes shrub/scrub land that are areas dominated by shrubs; less than 5 meters (16 feet) tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.

[6]All areas of open water, generally with less than 25 percent cover, vegetation, or soil.

[7]Includes emergent herbaceous wetlands, areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water. Also included are woody wetlands, areas where forest or shrub land vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

[8]ha – hectares / ac – acres

Lower Mississippi

The study area for Units RF14, RF15, and RF17 consist of approximately 1.32 million ha (3.26 million ac). In 2010, approximately 1.27 million ha (3.14 million ac) of that was private land. The Federal government owned about 93,083 acres that were primarily used for national forests and parkways, wildlife refuges, wilderness areas, and Corps water projects. The Missouri Department of Conservation and Department of Natural Resources owned 10,027 ha (24,777 ac) in the study area comprising Unit RF14. This land was primarily used for state parks, natural areas, cultural and historic sites, and state recreational access areas. Similarly, the Mississippi Department of Wildlife, Fisheries, and Parks owned 220 ha (543 ac) in the Unit RF17 study area for a state park. All of the land in the Unit RF15 study area is privately owned.

In the Unit RF14, RF15, and RF17 study area, forests comprised the majority of land use in 2006. Row crop agriculture and pasture land was also common, comprising about 33 percent of land use. Developed land accounted for about 5.7 percent of land use, most of that being open space development. In addition, metal mining and smelting are common in the Unit RF14 study area (Service 2010b, p 28).

Neosho River

The Units NM2 and NM8 study area comprises approximately 0.62 million ha (1.53 million ac), nearly 0.61 million ha (1.51 million ac) were private lands in 2010. Of the remaining land, the majority (about 4,942 ha (12,212 ac)) was owned by The Nature Conservancy. The Missouri Department of Conservation and Department of Natural Resources owned about 3,664 ha (9,054 ac) for state parks, natural areas, and recreational access areas. The Kansas Department of Wildlife and Parks owned 200 ha (494 ac) for state wildlife management and fishing and hunting lands. The National Park Service and Corps own the remaining land for a national military park and Corps water projects, respectively.

In 2006, the primary land cover in the Unit NM2 study area was agricultural, chiefly pasture and hay lands. The Unit NM8 study area was principally comprised of grasslands and crop production land. Other common land uses in the study area included urban development, poultry farms, and mineral mining (77 FR 63440, October 16, 2012, p. 63479). The second largest concentration of poultry production in Missouri occurs in the Elk River Basin of the Unit NM2 study area (Service 2010c, p. 9).

Ohio River

The Ohio River basin study area consists of over 2.29 million ha (5.66 million ac) for Units RF22, RF23, RF25, RF24, RF26, RF27, RF28, RF29, and RF32, and a portion of RF21. In 2010, about 2.10 million ha (5.20 million ac) were privately owned. The Federal government owned about 111,026 ha (274,350 ac), the majority owned by the Forest Service for national forests in the Unit RF21 and RF24 study area. The remaining Federal acres were used as national wildlife refuges, national parks, and Corps' national recreation areas. Kentucky, Illinois, Indiana, Pennsylvania, and Ohio combined own about 71,936 ha (177,757 ac), most was state forests, parks, nature preserves, and game land. There were about 3,454 ha (8,535 ac) owned by local governments in this study area that were principally county parks and conservation areas. Private conservation organizations owned about 1,398 ha (3,454 ac).

The primary land use of the Ohio River basin study area in 2006 was crop and forage production and pasture land. Forest land also comprised a large proportion of the land in overall study area;

and, in some of the individual Unit study areas (*i.e.*, Units RF22, RF23, RF25, RF24, and RF32); forest lands covered a greater portion of land than agriculture. About 6.7 percent of the lands in the study area were developed, the majority of which were open space. Other common land uses include sand and gravel mining in the study area for Unit RF21 (Service 2010b, p. 45) (*c.f.* section 3.3.1.4) and oil and gas production in the Unit RF24 study area (*c.f.* section 3.4.1.2) (77 FR 63440, October 16, 2012, pp. 63482–63483).

Red River

Units RF4a, RF4b, RF5, and RF6 study area consists of about 2.10 million ha (5.19 million ac). In 2010, approximately 1.95 million ha (4.83 million ac) were private land. The largest public landowner in this area was the Federal government with about 76,142 ha (188,150 ac). The majority of government lands were used as national forests, wilderness areas, and wildlife refuges. There were also smaller areas used for land and water projects, natural research areas and a military installation. The State of Arkansas owned approximately 44,129 ha (109,046 ac), the majority used as wildlife management areas. State of Arkansas land also was used for state parks and forests, highway and transportation right of way, and natural heritage areas. The State of Oklahoma owned about 769 ha (1,900 ac) in the Unit RF6 study area used as state parks and wildlife management areas. There were 23,768 ha (58,731 ac) jointly owned by the Forest Service and Oklahoma Department of Wildlife Conservation as a wildlife management area in the Unit RF6 study area. The Nature Conservancy owned about 1,204 ha (2,975 ac) in the Unit RF4b and Unit RF5 study areas.

Forested land made up the majority of the land in this study area in 2006. The study area comprising Unit RF5 was used extensively for silviculture activities (Service 2010b, p. 34). Agricultural lands made up the next largest use of study area lands, primarily used for pasture land, although row crops were also produced. Development, mainly open space and low intensity, comprised about 5.2 percent of the land use in this study area. In addition to the common private land uses described above, oil and gas development is prevalent in the Unit RF4a study area (Service 2010b, p. 34). Similarly, the study area of Unit RF5 contains several bauxite mines undergoing reclamation.

Tennessee River

The study area for Units RF16, RF18, RF19, RF20a and RF20b in the Tennessee River Basin consist of approximately 1.08 million ha (2.67 million ac). Approximately 1.04 million ha (2.57 million ac) were privately owned in 2010. The states of Alabama, Mississippi, Tennessee and Kentucky owned the next largest proportion of land within this study area. The states of Alabama and Tennessee had the majority of acreage, primarily used for wildlife management areas, parks and natural areas. The Federal government owned about 12,808 ha (31,650 ac), most was operated by the Service as a wildlife refuge in the Unit RF20b study area.

In 2006, the majority of land in this study area was forested; only the Unit RF20b study area had a greater amount of land used for agricultural production. Grasslands and scrub/shrub comprised about 6.4 percent of the land cover. Similarly, about 6.1 percent of the land was developed, with the greatest level of development occurring in the Unit RF20b study area. Other land uses in the study area includes strip and gravel mining operations in the Units RF16, RF18, and RF20a study area (Service 2010b, pp. 27–28).

Verdigris River

The study area comprising Unit NM6 in the Verdigris River Basin consists of approximately 223,562 ha (552,434 ac). In 2010, all but 1,545 ha (3,817 ac) was privately-owned land. The State of Kansas owned about 3,816 acres that was used for state parks, wildlife management areas and outdoor recreation access. The Corps owned just over a half acre for land and water projects.

The majority of land in the Unit NM6 study area was used for agricultural purposes in 2006, principally as pasture land. Grasslands, followed by forest lands, were the next most common land cover types in the study area. The majority of the developed land in the study area consisted of open space development.

White River

The study area for Units RF7, RF8a, RF8b, RF9, RF10/RF11, RF12, and RF13 consists of about 3.76 million ha (9.30 million ac). In 2010, over 3.16 million ha (7.81 million ac) were under private ownership. Of all the river basins containing proposed critical habitat, the study area in the White River Basin contained the largest proportion of public land. The Federal government was the largest owner of this land, controlling over 0.43 million ha (1.06 million ac). The majority of this acreage was operated by the Forest Service as national forests, wildlife management areas, wilderness and natural areas, wild and scenic rivers, and research natural areas. The remaining land was operated by the National Park Service, the Service, and Corps for such uses as national parks, wildlife refuges, and land and water projects. The states of Arkansas and Missouri owned about 167,487 ha (413,869 ac), primarily as wildlife management and conservation areas, and to a lesser extent as state parks and forests, highway rest areas, and other natural and wilderness areas.

Most of the 3.76 million ha (9.30 million ac) of land in this study area were forest and agricultural lands in 2006. Urban development is a major feature in the study area comprising Units RF10, RF11 and RF13. In addition to the common land uses, natural gas development is also common in the study area comprising Units RF7, RF8a, and RF9 (77 FR 63440, October 16, 2012, p. 634819). Additionally, sand and gravel mining are common throughout the White River Basin Units RF8a and RF8b (Service 2010b, pp. 29–31).

3.5.1.2 Communities

Communities may be affected by Federal actions through the relocation of businesses and residences, or changes in access to services such as medical assistance, schools, and law enforcement, and social services such as community recreation centers, religious institutions, or grocery stores. Thirty-three proposed critical habitat units are immediately adjacent to one or more communities. These communities range in size from a population of 28 in Gilbert, Arkansas to over 50,000 in Joplin, Missouri. The remaining ten proposed critical habitat units range from a 0.4 to 4.8 km (0.25 to 3 miles) distant to the nearest community. The communities that are closest to each proposed critical habitat unit, along with their population and approximate distance from their respective units, are shown in Appendix 2.

Table 22. Populations and percent of the state population of the counties in the proposed critical habitat study area

State	Population of Counties within the Study Areas[1]	Percent of State Population
Alabama	622,449	13.2%
Arkansas	2,403,768	83.7%
Illinois	167,793	1.3%
Indiana	602,519	9.4%
Kansas	308,627	11.0%
Kentucky	427,579	10.0%
Mississippi	737,683	25.1%
Missouri	661,662	11.2%
New York[2]	215,222	1.1%
Ohio	951,288	8.3%
Oklahoma	1,078,641	29.3%
Pennsylvania	665,880	5.3%
Tennessee	1,341,156	21.5%

Source: USCB 2010a, http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml; USCB 2010b, http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

Notes: [1]This represents the populations of all counties that have some portion of their boundaries within a proposed critical habitat study area.

[2]The are no proposed critical habitat units in New York; two counties, Cattaraugus and Chautauqua, are within the Unit RF24 study area.

3.5.1.3 Economy

A separate economic analysis was conducted to assess the potential incremental economic effects of designating critical habitat for the two mussels (Industrial Economics, Inc. 2013). The baseline for the economic analysis was established as listing of the two species under the ESA "without critical habitat" and is summarized below as the existing condition. The incremental impacts from listing "with critical habitat" describe the reported incremental conservation efforts and associated economic impacts expected to occur specifically from the designation of critical habitat for the two mussels, and are discussed in section 3.5.2, Effects on Socioeconomic Conditions and Environmental Justice. The economic analysis time frame is 20 years extending from 2013 to 2032. The primary focus of the economic analysis is not on baseline costs, since these would not be affected by the Proposed Action. Instead, the focus of this analysis is on monetizing the incremental impacts forecast to result from the proposed critical habitat designation, discussed in section 3.5.2.

The primary protection currently for the two mussel species is the listing of the species under the Act. The mussels and their habitat also receive protection from other Federal statutes and regulations such as section 404 of the CWA permitting, section 10 of the Rivers and Harbors Act permitting, and SHAs and CCAAs, as well as state laws and land and resource management plans. Common conservation efforts to avoid jeopardy to the species include mussel surveys,

mussel relocation, monitoring and reporting, mussel propagation and population augmentation, BMPs for erosion and sediment control, timing restrictions, limitation of instream work, and others. The economic activities assessed by the economic analysis are water flow management; water quality management; timber, agriculture, and grazing; mining (e.g., instream sand and gravel, coal mining); oil and gas development; transportation and utilities; development and recreation; and other (e.g., prescribed burns, bank stabilization, riparian restoration). The economic analysis estimated that average costs for conservation efforts are:

- Mussel surveys - $54,000 per project
- Mussel relocation - $67,000 per project
- Monitoring and reporting - $39,000 per effort
- Mussel propagation and population augmentation - $30,000 per project
- BMPs for erosion and sediment control - $46,000 per project
- Timing restrictions - $120,000 per project
- Limiting project scope or instream work - $74,000 per project
- Other efforts – project specific

It should be noted individual project impacts would vary depending on several factors such as activity size, location, scope, and mussel presence in the project area. Common conservation measures for activities such as BMPs for water quality management and timber, agriculture, and grazing projects frequently incur no additional cost to a project proponent since they are required regardless of the absence or presence of a threatened or endangered species or habitat. More extensive projects may require pre-construction mussel surveying (up to $100,000 per project), relocation efforts (up to $440/mussel), monitoring ($18,000 annually per project), and population propagation efforts ($54,000 per population), where instream impacts are unavoidable. In addition, the need to limit the scope or to redesign a project to avoid instream impacts or time constraints in some cases may incur additional costs.

3.5.1.4 Environmental Justice

The populations from the 2010 census of the states and counties that lie within the study area are shown in Table 22. Selected Census 2010 population demographics of counties within study area are compared to the demographics of each state in Table 23. The demographics selected for comparison include the composition of populations in 2010 based on: (1) race, (2) persons of Hispanic or Latino origin, and (3) persons with income below the poverty level. The purpose of selecting these demographics is for making a determination as to whether or not implementation of the Proposed Action would disproportionately adversely affect minority or low-income groups in accordance with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.

In 2010, the percentage of white persons in counties in the study area was higher than the statewide percentage in all states, with the exception of Mississippi and Oklahoma (Table 23). In Mississippi, black or African American persons were the majority in counties in the study areas and the percentage was 5.6 percent higher than the statewide percentage. In Oklahoma, while white persons were still the majority in the study area counties, the white population of these counties was 4.7 percent less than the statewide white population. In addition, the American

Indian population in Oklahoma was 3.8 percent higher in the counties in study area than statewide.

In seven of the states, the difference between the Hispanic or Latino population of counties in the study area and statewide is nearly equal, being less than one half of one percent (Table 23). The remaining six states had differences greater than one half of one percent. Only Alabama had a Hispanic or Latino population in counties in the study area greater than the statewide population. The remaining five states had Hispanic or Latino populations in the counties in the study area that were less than the statewide population. In Illinois and New York, the difference of Hispanic or Latino county populations in the study area was substantially lower, by 11.2 percent and 12.6 percent respectively, than the statewide population.

Each year the U.S. Census Bureau defines the national poverty thresholds that are measured in terms of household income dependent upon the number of persons within a household. Individuals falling below the poverty threshold are considered low-income individuals. The poverty threshold for an individual established in 2010 by the U.S. Census Bureau was $11,139 (USCB 2010c, http://www.census.gov/hhes/www/poverty/data/threshld/index.html). The U.S. Census Bureau's definition of poverty areas are census tracts having poverty rates of 20 percent or more (Bishaw 2011, p. 1).

In 2010, persons living below the poverty level in counties in the study area of Alabama, Arkansas, and Kentucky were nearly equal to statewide poverty levels, all being within one half of one percent (Table 23). In seven of the states, the percentage of persons living below the poverty level was greater in counties in the study area than statewide. However, none of these differences were substantial, all exhibiting less than a 5 percent difference. Indiana, Ohio, and Tennessee counties in the study area had fewer persons living below the poverty level than statewide, although these differences were not substantial with less than a 2.5 percent difference. In 2010, of the 1,186 census tracts that fall in the study area for all proposed critical habitat, 32.5 percent (385) were classified as poverty areas (Figures 7 and 8) (USCB 2010f, http://www.census.gov/geo/www/tiger/tgrshp2010/tgrshp2010.html). The average percentage of census tracts designated as poverty areas for all the states with proposed critical habitat was 32.7 percent.

Table 23. Demographic characteristics of state and counties located in the proposed critical habitat study area

State and Counties within Study Areas[1]	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Population Below Poverty Level[2]
Alabama	69.9%	26.1%	0.5%	1.1%	0.0%	1.0%	1.3%	3.4%	17.1%
Counties	77.2%	15.3%	0.8%	1.5%	0.1%	3.1%	2.1%	5.6%	17.6%
Arkansas	78.5%	15.5%	0.7%	1.2%	0.1%	2.3%	1.8%	5.9%	18.0%
Counties	78.8%	13.7%	0.7%	1.2%	0.2%	3.4%	2.0%	6.4%	19.3%
Illinois	71.7%	14.6%	0.2%	4.5%	0.0%	7.3%	1.7%	15.2%	12.6%
Counties	86.8%	9.0%	0.3%	0.5%	0.0%	1.6%	1.8%	4.0%	16.0%
Indiana	85.1%	8.9%	0.2%	1.5%	0.0%	2.3%	1.9%	5.6%	13.5%
Counties	91.5%	1.8%	0.3%	2.1%	0.0%	2.7%	1.6%	5.9%	12.1%
Kansas	85.1%	5.8%	0.9%	2.4%	0.1%	2.9%	2.9%	9.8%	12.4%
Counties	91.7%	2.1%	1.5%	0.6%	0.1%	1.3%	2.8%	4.5%	14.0%
Kentucky	88.5%	7.7%	0.2%	1.1%	0.1%	0.9%	1.5%	2.7%	17.7%
Counties	91.9%	4.9%	0.2%	0.5%	0.0%	0.9%	1.5%	2.3%	17.8%
Mississippi	59.9%	37.0%	0.5%	0.8%	0.0%	0.8%	1.0%	2.4%	21.2%
Counties	45.7%	51.3%	0.4%	0.9%	0.0%	0.9%	0.8%	1.9%	25.8%
Missouri	83.4%	11.5%	0.4%	1.6%	0.1%	1.0%	2.1%	3.4%	14.0%
Counties	92.8%	1.5%	1.0%	0.6%	0.2%	1.7%	2.1%	3.6%	18.6%
New York[3]	66.4%	15.6%	0.3%	7.2%	0.0%	8.4%	2.1%	17.1%	14.2%
Counties	92.7%	2.0%	1.5%	0.6%	0.0%	1.4%	1.9%	4.5%	16.6%

State and Counties within Study Areas[1]	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Population Below Poverty Level[2]
Alabama	69.9%	26.1%	0.5%	1.1%	0.0%	1.0%	1.3%	3.4%	17.1%
Counties	77.2%	15.3%	0.8%	1.5%	0.1%	3.1%	2.1%	5.6%	17.6%
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Counties	86.8%	9.0%	0.3%	0.5%	0.0%	1.6%	1.8%	4.0%	16.0%
Indiana	85.1%	8.9%	0.2%	1.5%	0.0%	2.3%	1.9%	5.6%	13.5%
Counties	91.5%	1.8%	0.3%	2.1%	0.0%	2.7%	1.6%	5.9%	12.1%
Kansas	85.1%	5.8%	0.9%	2.4%	0.1%	2.9%	2.9%	9.8%	12.4%
Counties	91.7%	2.1%	1.5%	0.6%	0.1%	1.3%	2.8%	4.5%	14.0%
Kentucky	88.5%	7.7%	0.2%	1.1%	0.1%	0.9%	1.5%	2.7%	17.7%
Counties	91.9%	4.9%	0.2%	0.5%	0.0%	0.9%	1.5%	2.3%	17.8%
Mississippi	59.9%	37.0%	0.5%	0.8%	0.0%	0.8%	1.0%	2.4%	21.2%
Counties	45.7%	51.3%	0.4%	0.9%	0.0%	0.9%	0.8%	1.9%	25.8%
Missouri	83.4%	11.5%	0.4%	1.6%	0.1%	1.0%	2.1%	3.4%	14.0%
Counties	92.8%	1.5%	1.0%	0.6%	0.2%	1.7%	2.1%	3.6%	18.6%
New York[3]	66.4%	15.6%	0.3%	7.2%	0.0%	8.4%	2.1%	17.1%	14.2%
Counties	92.7%	2.0%	1.5%	0.6%	0.0%	1.4%	1.9%	4.5%	16.6%
State and Counties within Study Areas[1]	**White**	**Black or African American**	**American Indian and Alaska**	**Asian**	**Native Hawaiian and Other Pacific**	**Some Other Race**	**Two or More Races**	**Hispanic or Latino**	**Populatio n Below Poverty**

State and Counties within Study Areas[1]	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Population Below Poverty Level[2]
Alabama	69.9%	26.1%	0.5%	1.1%	0.0%	1.0%	1.3%	3.4%	17.1%
Counties	77.2%	15.3%	0.8%	1.5%	0.1%	3.1%	2.1%	5.6%	17.6%
Arkansas	78.5%	15.5%	0.7%	1.2%	0.1%	2.3%	1.8%	5.9%	18.0%
Counties	78.8%	13.7%	0.7%	1.2%	0.2%	3.4%	2.0%	6.4%	19.3%
Illinois	71.7%	14.6%	0.2%	4.5%	0.0%	7.3%	1.7%	15.2%	12.6%
Counties	86.8%	9.0%	0.3%	0.5%	0.0%	1.6%	1.8%	4.0%	16.0%
Indiana	85.1%	8.9%	0.2%	1.5%	0.0%	2.3%	1.9%	5.6%	13.5%
Counties	91.5%	1.8%	0.3%	2.1%	0.0%	2.7%	1.6%	5.9%	12.1%
Kansas	85.1%	5.8%	0.9%	2.4%	0.1%	2.9%	2.9%	9.8%	12.4%
Counties	91.7%	2.1%	1.5%	0.6%	0.1%	1.3%	2.8%	4.5%	14.0%
Kentucky	88.5%	7.7%	0.2%	1.1%	0.1%	0.9%	1.5%	2.7%	17.7%
Counties	91.9%	4.9%	0.2%	0.5%	0.0%	0.9%	1.5%	2.3%	17.8%
Mississippi	59.9%	37.0%	0.5%	0.8%	0.0%	0.8%	1.0%	2.4%	21.2%
Counties	45.7%	51.3%	0.4%	0.9%	0.0%	0.9%	0.8%	1.9%	25.8%
Missouri	83.4%	11.5%	0.4%	1.6%	0.1%	1.0%	2.1%	3.4%	14.0%
Counties	92.8%	1.5%	1.0%	0.6%	0.2%	1.7%	2.1%	3.6%	18.6%
New York[3]	66.4%	15.6%	0.3%	7.2%	0.0%	8.4%	2.1%	17.1%	14.2%
Counties	92.7%	2.0%	1.5%	0.6%	0.0%	1.4%	1.9%	4.5%	16.6%
			Native		**Islander**			**(of any race)**	**Level[2]**

State and Counties within Study Areas[1]	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Population Below Poverty Level[2]
Alabama	69.9%	26.1%	0.5%	1.1%	0.0%	1.0%	1.3%	3.4%	17.1%
Counties	77.2%	15.3%	0.8%	1.5%	0.1%	3.1%	2.1%	5.6%	17.6%
Arkansas	78.5%	15.5%	0.7%	1.2%	0.1%	2.3%	1.8%	5.9%	18.0%
Counties	78.8%	13.7%	0.7%	1.2%	0.2%	3.4%	2.0%	6.4%	19.3%
Illinois	71.7%	14.6%	0.2%	4.5%	0.0%	7.3%	1.7%	15.2%	12.6%
Counties	86.8%	9.0%	0.3%	0.5%	0.0%	1.6%	1.8%	4.0%	16.0%
Indiana	85.1%	8.9%	0.2%	1.5%	0.0%	2.3%	1.9%	5.6%	13.5%
Counties	91.5%	1.8%	0.3%	2.1%	0.0%	2.7%	1.6%	5.9%	12.1%
Kansas	85.1%	5.8%	0.9%	2.4%	0.1%	2.9%	2.9%	9.8%	12.4%
Counties	91.7%	2.1%	1.5%	0.6%	0.1%	1.3%	2.8%	4.5%	14.0%
Kentucky	88.5%	7.7%	0.2%	1.1%	0.1%	0.9%	1.5%	2.7%	17.7%
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Mississippi	59.9%	37.0%	0.5%	0.8%	0.0%	0.8%	1.0%	2.4%	21.2%
Counties	45.7%	51.3%	0.4%	0.9%	0.0%	0.9%	0.8%	1.9%	25.8%
Missouri	83.4%	11.5%	0.4%	1.6%	0.1%	1.0%	2.1%	3.4%	14.0%
Counties	92.8%	1.5%	1.0%	0.6%	0.2%	1.7%	2.1%	3.6%	18.6%
New York[3]	66.4%	15.6%	0.3%	7.2%	0.0%	8.4%	2.1%	17.1%	14.2%
Counties	92.7%	2.0%	1.5%	0.6%	0.0%	1.4%	1.9%	4.5%	16.6%
Ohio	83.4%	12.1%	0.2%	1.6%	0.0%	0.9%	1.8%	2.9%	14.2%
Counties	93.3%	3.6%	0.2%	0.7%	0.0%	0.6%	1.5%	1.6%	12.1%

State and Counties within Study Areas[1]	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Population Below Poverty Level[2]
Alabama	69.9%	26.1%	0.5%	1.1%	0.0%	1.0%	1.3%	3.4%	17.1%
Counties	77.2%	15.3%	0.8%	1.5%	0.1%	3.1%	2.1%	5.6%	17.6%
Arkansas	78.5%	15.5%	0.7%	1.2%	0.1%	2.3%	1.8%	5.9%	18.0%
Counties	78.8%	13.7%	0.7%	1.2%	0.2%	3.4%	2.0%	6.4%	19.3%
Illinois	71.7%	14.6%	0.2%	4.5%	0.0%	7.3%	1.7%	15.2%	12.6%
Counties	86.8%	9.0%	0.3%	0.5%	0.0%	1.6%	1.8%	4.0%	16.0%
Indiana	85.1%	8.9%	0.2%	1.5%	0.0%	2.3%	1.9%	5.6%	13.5%
Counties	91.5%	1.8%	0.3%	2.1%	0.0%	2.7%	1.6%	5.9%	12.1%
Kansas	85.1%	5.8%	0.9%	2.4%	0.1%	2.9%	2.9%	9.8%	12.4%
Counties	91.7%	2.1%	1.5%	0.6%	0.1%	1.3%	2.8%	4.5%	14.0%
Kentucky	88.5%	7.7%	0.2%	1.1%	0.1%	0.9%	1.5%	2.7%	17.7%
Counties	91.9%	4.9%	0.2%	0.5%	0.0%	0.9%	1.5%	2.3%	17.8%
Mississippi	59.9%	37.0%	0.5%	0.8%	0.0%	0.8%	1.0%	2.4%	21.2%
Counties	45.7%	51.3%	0.4%	0.9%	0.0%	0.9%	0.8%	1.9%	25.8%
Missouri	83.4%	11.5%	0.4%	1.6%	0.1%	1.0%	2.1%	3.4%	14.0%
Counties	92.8%	1.5%	1.0%	0.6%	0.2%	1.7%	2.1%	3.6%	18.6%
New York[3]	66.4%	15.6%	0.3%	7.2%	0.0%	8.4%	2.1%	17.1%	14.2%
Counties	92.7%	2.0%	1.5%	0.6%	0.0%	1.4%	1.9%	4.5%	16.6%
Oklahoma	74.0%	7.3%	7.1%	1.7%	0.1%	2.7%	7.2%	8.2%	16.2%
Counties	69.3%	7.4%	10.9%	1.7%	0.1%	4.1%	6.6%	7.9%	19.1%

State and Counties within Study Areas[1]	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Population Below Poverty Level[2]
Alabama	69.9%	26.1%	0.5%	1.1%	0.0%	1.0%	1.3%	3.4%	17.1%
Counties	77.2%	15.3%	0.8%	1.5%	0.1%	3.1%	2.1%	5.6%	17.6%
Arkansas	78.5%	15.5%	0.7%	1.2%	0.1%	2.3%	1.8%	5.9%	18.0%
Counties	78.8%	13.7%	0.7%	1.2%	0.2%	3.4%	2.0%	6.4%	19.3%
Illinois	71.7%	14.6%	0.2%	4.5%	0.0%	7.3%	1.7%	15.2%	12.6%
Counties	86.8%	9.0%	0.3%	0.5%	0.0%	1.6%	1.8%	4.0%	16.0%
Indiana	85.1%	8.9%	0.2%	1.5%	0.0%	2.3%	1.9%	5.6%	13.5%
Counties	91.5%	1.8%	0.3%	2.1%	0.0%	2.7%	1.6%	5.9%	12.1%
Kansas	85.1%	5.8%	0.9%	2.4%	0.1%	2.9%	2.9%	9.8%	12.4%
Counties	91.7%	2.1%	1.5%	0.6%	0.1%	1.3%	2.8%	4.5%	14.0%
Kentucky	88.5%	7.7%	0.2%	1.1%	0.1%	0.9%	1.5%	2.7%	17.7%
Counties	91.9%	4.9%	0.2%	0.5%	0.0%	0.9%	1.5%	2.3%	17.8%
Mississippi	59.9%	37.0%	0.5%	0.8%	0.0%	0.8%	1.0%	2.4%	21.2%
Counties	45.7%	51.3%	0.4%	0.9%	0.0%	0.9%	0.8%	1.9%	25.8%
Missouri	83.4%	11.5%	0.4%	1.6%	0.1%	1.0%	2.1%	3.4%	14.0%
Counties	92.8%	1.5%	1.0%	0.6%	0.2%	1.7%	2.1%	3.6%	18.6%
New York[3]	66.4%	15.6%	0.3%	7.2%	0.0%	8.4%	2.1%	17.1%	14.2%
Counties	92.7%	2.0%	1.5%	0.6%	0.0%	1.4%	1.9%	4.5%	16.6%
Pennsylvania	82.9%	10.7%	0.1%	2.6%	0.0%	2.0%	1.6%	5.2%	12.4%
Counties	92.1%	4.8%	0.2%	0.7%	0.0%	0.7%	1.5%	2.1%	13.6%

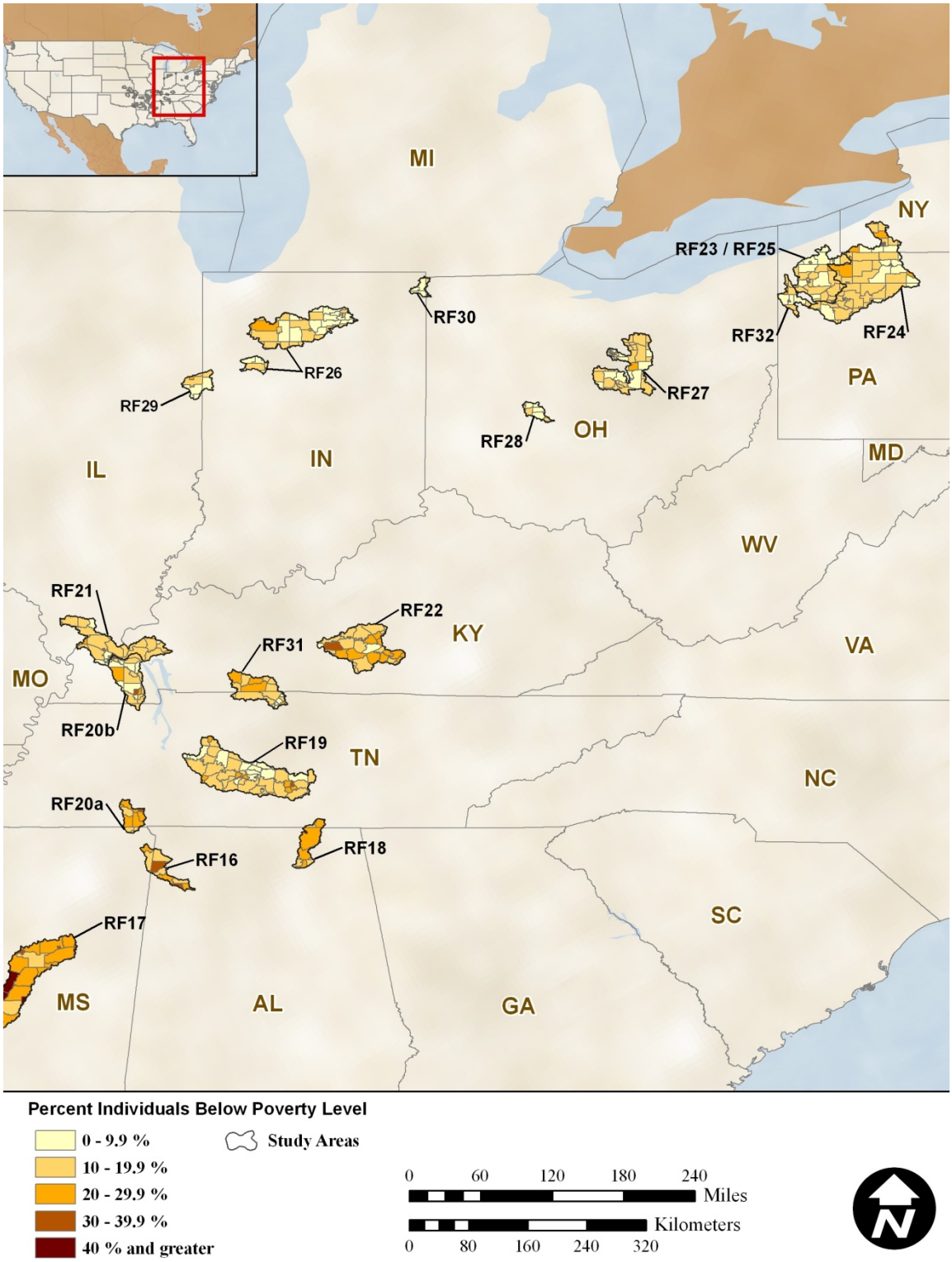
State and Counties within Study Areas[1]	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Population Below Poverty Level[2]
Alabama	69.9%	26.1%	0.5%	1.1%	0.0%	1.0%	1.3%	3.4%	17.1%
Counties	77.2%	15.3%	0.8%	1.5%	0.1%	3.1%	2.1%	5.6%	17.6%
Arkansas	78.5%	15.5%	0.7%	1.2%	0.1%	2.3%	1.8%	5.9%	18.0%
Counties	78.8%	13.7%	0.7%	1.2%	0.2%	3.4%	2.0%	6.4%	19.3%
Illinois	71.7%	14.6%	0.2%	4.5%	0.0%	7.3%	1.7%	15.2%	12.6%
Counties	86.8%	9.0%	0.3%	0.5%	0.0%	1.6%	1.8%	4.0%	16.0%
Indiana	85.1%	8.9%	0.2%	1.5%	0.0%	2.3%	1.9%	5.6%	13.5%
Counties	91.5%	1.8%	0.3%	2.1%	0.0%	2.7%	1.6%	5.9%	12.1%
Kansas	85.1%	5.8%	0.9%	2.4%	0.1%	2.9%	2.9%	9.8%	12.4%
Counties	91.7%	2.1%	1.5%	0.6%	0.1%	1.3%	2.8%	4.5%	14.0%
Kentucky	88.5%	7.7%	0.2%	1.1%	0.1%	0.9%	1.5%	2.7%	17.7%
Counties	91.9%	4.9%	0.2%	0.5%	0.0%	0.9%	1.5%	2.3%	17.8%
Mississippi	59.9%	37.0%	0.5%	0.8%	0.0%	0.8%	1.0%	2.4%	21.2%
Counties	45.7%	51.3%	0.4%	0.9%	0.0%	0.9%	0.8%	1.9%	25.8%
Missouri	83.4%	11.5%	0.4%	1.6%	0.1%	1.0%	2.1%	3.4%	14.0%
Counties	92.8%	1.5%	1.0%	0.6%	0.2%	1.7%	2.1%	3.6%	18.6%
New York[3]	66.4%	15.6%	0.3%	7.2%	0.0%	8.4%	2.1%	17.1%	14.2%
Counties	92.7%	2.0%	1.5%	0.6%	0.0%	1.4%	1.9%	4.5%	16.6%
Tennessee	78.8%	16.6%	0.2%	1.4%	0.0%	1.4%	1.5%	4.2%	16.5%
Counties	84.8%	8.8%	0.4%	1.6%	0.1%	2.2%	2.1%	5.1%	15.7%

Source: USCB 2010d, http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml;
USCB 2010e, http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

[1]This information reflects the racial, ethnic, and poverty level for all counties that have some portion of their boundaries within a proposed critical habitat study area that surround proposed critical habitat units.

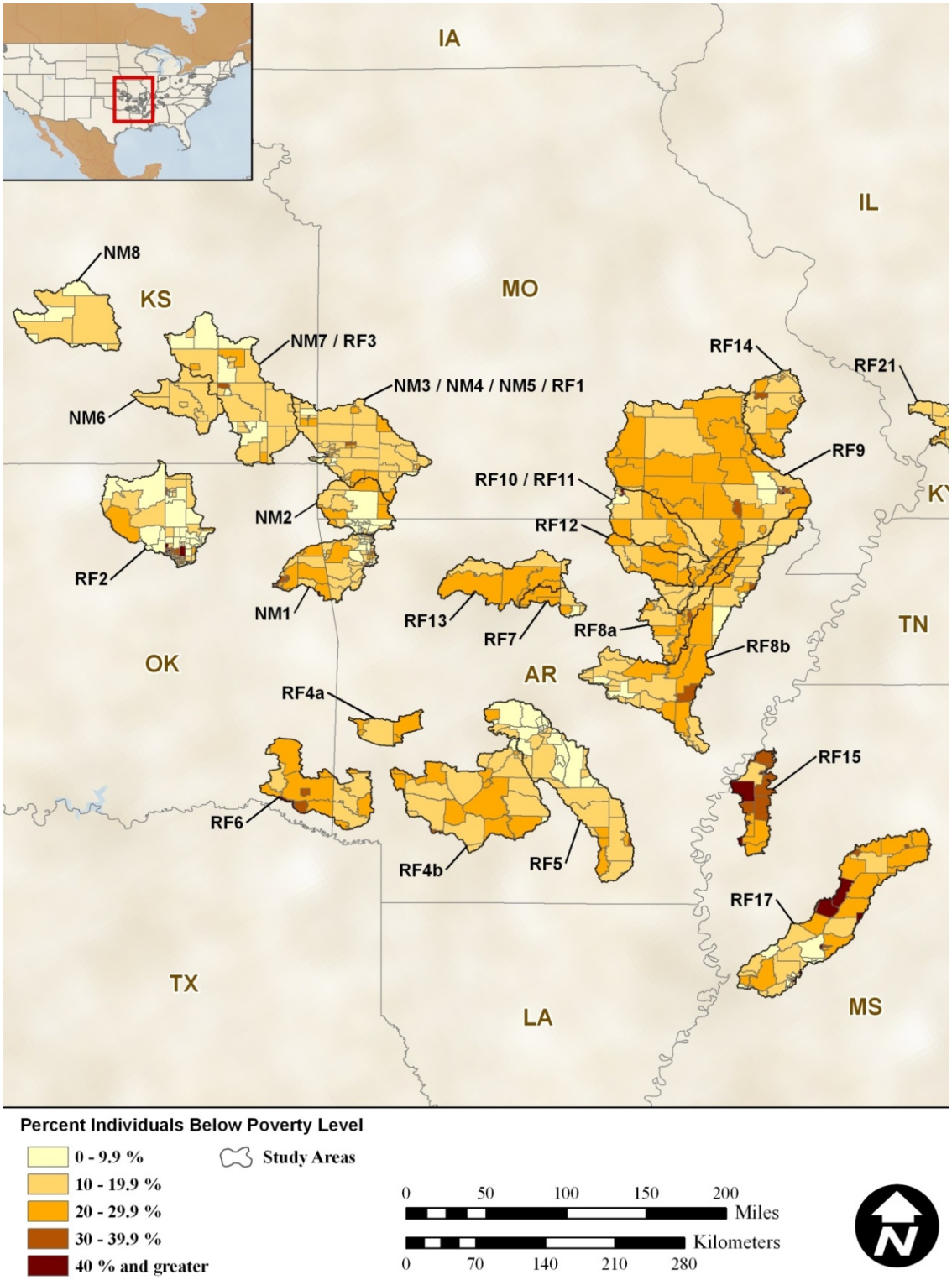
[2]The Below Poverty Level percentage is the average of the counties within proposed critical habitat study area(s) in a state.

[3]The are no proposed critical habitat units in New York; two counties (Cattaraugus and Chautauqua) are within one proposed critical habitat study area.



Source: USCB 2010f, http://www.census.gov/geo/www/tiger/tgrshp2010/tgrshp2010.html

Figure 8. Poverty levels of the census tracts in the proposed critical habitat study area for the eastern region. Census tracts that have a poverty level above 20 percent are classified as poverty areas by the U.S. Census Bureau (Bishaw 2011, p. 1)



Source: USCB 2010f, http://www.census.gov/geo/www/tiger/tgrshp2010/tgrshp2010.html

Figure 9. Poverty levels of the census tracts in the proposed critical habitat study area for the western region. Census tracts that have a poverty level above 20 percent are classified as poverty areas by the U.S. Census Bureau (Bishaw 2011, p. 1)

3.5.2 Effects on Socioeconomic Conditions and Environmental Justice

3.5.2.1 No Action Alternative

Under the No Action Alternative section 7 consultation under the jeopardy standard would still be required on projects with a Federal nexus that have the potential to affect habitat occupied by one or both of the mussel species, but without additional consideration of critical habitat and associated PCEs. Actions on private lands that have the potential to result in take of any listed species would be subject to section 10 of the ESA. Furthermore, the development of a Habitat Conservation Plan would be required as part of the application to the Service for an incidental take permit. Under the No Action Alternative, section 7 consultations under the adverse modification standard would only be required in locations where stream sections occupied by Neosho mucket and rabbitsfoot are overlapped by designated critical habitat of another species (*i.e.*, oyster mussel, Cumberlandian combshell mussel, and yellowcheek darter). As some of the habitat requirements of these species are shared by the Neosho mucket and rabbitsfoot, the latter may benefit from additional protections afforded by adverse modification analysis.

Conservation measures may be required under the No Action Alternative for activities to avoid jeopardy to the Neosho mucket and rabbitsfoot upon their listing under the ESA. Individual project economic impacts may vary widely depending on a variety of factors such as project size, location, and presence of either mussel. Some conservation efforts to avoid jeopardy to either of the two mussels would not add more cost to a project proponent since they would be required regardless of the presence of the Neosho mucket or rabbitsfoot, such as erosion control BMPs, or they limit project scope without impacting the project purpose and need. However, as described above, those projects with unavoidable instream impacts may require more extensive conservation efforts with more substantial costs.

3.5.2.2 Proposed Action Alternative

Land ownership and use in and surrounding the proposed critical habitat units are not expected to change as a result of the designation of critical habitat under the Proposed Action. An increase in section 7 consultations for land use due to the presence of designated critical habitat for the two mussel species is not expected to occur compared to consultations expected for presence of the species alone. In addition, the designation of critical habitat would require an adverse modification analysis to section 7 consultations. However, conservation measures or project modifications required to avoid adverse modification or destruction of critical habitat would be the same as protections provided by listing of the Neosho mucket and rabbitsfoot and requirements of section 7 of the ESA.

Designation of critical habitat under the Proposed Action would not impact community services or cohesion. This is because there would be no displacement of businesses or residences, and resources such as schools, law enforcement, medical services, and social services would not change.

The economic analysis assessed the potential economic effects of designating critical habitat for the Neosho mucket and rabbitsfoot (Industrial Economics, Inc. 2013). The following discussion summarizes the findings of the economic analysis which considered only those costs attributable to the designation of critical habitat. Incremental impacts of the designation for each economic activity were identified by reviewing past section 7 consultation rates within the areas proposed for critical habitat designation. These data were obtained from the Service’s TAILS database

(Service 2012b). Representatives from each of the Service's field offices in the 12 states with proposed critical habitat were interviewed to confirm the accuracy and completeness of the data collected from TAILS and to obtain any additional information in order to estimate future section 7 consultation activity. Where proposed critical habitat for the two mussel species overlap (*i.e.* RF1 overlaps NM4, RF3 overlaps NM7), costs associated with forecasted consultations were apportioned evenly across the units.

The economic analysis considered the economic efficiency and distributional effects that may result from efforts to protect the Neosho mucket and rabbitsfoot mussels and their habitat. Economic efficiency reflects the "opportunity costs" associated with the commitment of resources needed to accomplish species and habitat conservation. These costs include such aspects as a change to property market value due to any potential limitation of activities that may take place as a result of the presence of the species and costs incurred by a Federal agency for section 7 consultation. The distributional effects analysis addresses the distribution of impacts associated with critical habitat designation and the potential impacts of habitat conservation on local and regional economies, small entities, and the energy industry.

The key conclusion of the economic analysis is that the designation of critical habitat is not expected to generate additional requests for project modification in any of the proposed critical habitat units beyond what would be required to avoid jeopardy to the two mussels. The Service's incremental effects memorandum states that in occupied habitat "project modifications that minimize effects to Neosho mucket and rabbitsfoot also would minimize effects to the [physical and biological features] associated with critical habitat" and "economic impacts from conservation efforts that avoid adverse modification of critical habitat coincidental to avoid jeopardizing the species would generally be coextensive with the effects of the Neosho mucket and rabbitsfoot listing and within the regulatory baseline" (Service 2012a, p. 3). Every proposed critical habitat unit is occupied by at least one of the two mussel species and as such additional requests for project modification in any of the units are not expected. The incremental economic impacts of the designation are limited to additional administrative costs to the Service, Federal agencies and third parties for considering critical habitat as part of the forecast section 7 consultations. Overall, the estimated economic costs specifically because of the critical habitat designation range from $4.4 million to $5.9 million over the 20-year analysis time-frame, or from $290,000 to $390,000 annually from 2013 and 2032.

Activities related to transportation, utilities, and to timber, agriculture, and grazing would likely have the greatest incremental impacts. Section 7 consultations for transportation and utility related activities are expected to occur in 35 of the proposed critical habitat units and in every state with proposed critical habitat, with total incremental economic impacts of these activities expected to be $1.4 million from 2013 to 2032. The greatest incremental economic impacts to transportation and utilities are expected in Units NM1 and RF2, ranging from $160,000 to $220,000, respectively, over the next 20 years; this is primarily because of the proximity and rate of expansion of major cities within the study areas (Fayetteville-Springdale, Arkansas in the NM1 study area and Tulsa, Oklahoma in the RF2 study area). Section 7 consultation for timber, agriculture, and grazing activities are expected to occur in 23 of the proposed critical habitat units in Alabama, Arkansas, Illinois, Kansas, Mississippi, Missouri, Oklahoma, and Pennsylvania, with total economic incremental impacts expected to be $960,000 during the study period of 20 years. The greatest incremental impacts to these activities are expected in Units

RF8b (White River) and RF9 (Black River) at $160,000 over the next 20 years due to new Natural Resources Conservation Service (NRCS) Farm Bill program work.

The expected incremental costs for the other activities over the next 20 years are expected to be $190,000 for water flow management, $120,000 for water quality management, $71,000 for mining, $300,000 for oil and gas development, $760,000 for land development and recreation, and $530,000 for other activities[6].

Units NM1 (Illinois River) and RF2 (Verdigris River) are expected to incur the greatest overall incremental economic impacts over the next 20 years at $400,000 and $500,000, respectively. It is anticipated that section 7 consultation would occur for all assessed activities in these units. In addition, a relatively large number of future section 7 consultations are expected for these units related to development, transportation, and utilities. In terms of incremental costs per river mile, consultations regarding activities in Unit NM8 (Cottonwood River) are expected to generate larger incremental economic impacts than other units at $29,000 per river mile. The higher per river mile cost is a function of the small size of Unit NM8 in terms of river miles (it is the smallest among the units), yet its study area is comparable in size to other units.

Analysis of the distributional impacts of proposed critical habitat designation on small entities[7] determined the only costs expected to be borne by third parties as a result of the Proposed Action are portions of the total cost of each section 7 consultation action (formal, informal, or technical assistances). The economic analysis concluded that the proportion of small entities that may be affected ranges from 0.1 percent for timber, agriculture, and grazing activities, to 3.1 percent for oil and gas development. Assuming a third party only participates in a single consultation in any year, the average annual cost incurred by each affected entity is approximately $420, which constitutes less than 0.03 percent of annual revenue for any industries involved in the affected activity types. Similarly, the Proposed Action is unlikely to affect energy production in the U.S., is unlikely to have direct or substantial indirect Federalism implications, and does not place an enforceable duty upon State, local, or Tribal governments, or the private sector. Private landowners may also be third parties in activities that require section 7 consultation for section 404 permitting, such as timber or agriculture projects. However, for any entity having greater than $47,000 in annual revenue, the financial burden would be less than 1 percent of annual revenue.

The economic analysis indicated there may be potential direct and ancillary benefits associated with the Proposed Action. These include improved water quality as a result of the implementation of BMPs, and erosion control and the aesthetic benefits from water quality improvements that would increase visitation to a region for recreational uses. Furthermore, conservation efforts undertaken for the two mussels may result in improvements to ecosystem health benefiting other coexisting species, including other threatened and endangered species.

As no measurable detrimental effects from the designation of critical habitat in regards to communities or individuals (*e.g.*, loss of homes, businesses, or jobs; disruption of community

6 These include activities such as animal and biological control, prescribed burns, land clearing, bank stabilization, and habitat or shoreline restoration.

7 Defined in the Regulatory Flexibility Act as small businesses as defined under section 3 of the Small Business Act, small governments having jurisdiction over populations less than 50,000, and small organizations that are not-for-profit enterprises and are independently owned and operated and not dominant in its field.

services or community cohesion; incurring associated costs) would occur, there would be no disproportionate adverse effects on low-income or minority populations. The Proposed Action is in compliance with E.O. 12898.

3.6 Cumulative Effects

Cumulative effects are the effects from other projects that are not part of this Proposed Action, which may have an additive effect when combined with the effects expected from the Proposed Action. The geographic extents for which cumulative effects are considered vary for each resource. The past, present, and reasonably foreseeable future actions in the proposed critical habitat analysis area that, combined with the Proposed Action, could contribute to cumulative effects include:

- effects of listing, critical habitat designation, and section 7 consultations for other species and other designated critical habitats; and
- existing land management policies and plans.

Effects of proposed critical habitat designation on most resource areas generally consist primarily of the potential for minor increases in Federal agency staff effort during section 7 consultations to incorporate critical habitat considerations and addition of discretionary conservation measures to reduce impacts to PCEs. These potential impacts are not likely to result in substantial cumulative effects, when added to the effects of existing section 7 consultations for other species and existing land management plans and policies.

3.7 Relationship Between Short-Term and Long-Term Productivity

Proposed designation of critical habitat is a programmatic policy that would have no effect on short-term or long-term productivity.

3.8 Irreversible and Irretrievable Commitment of Resources

Irreversible commitments of resources are those effects that cannot be reversed. For example, the extinction of a species is an irreversible commitment. Irretrievable commitments of resources are those that are lost for a period of time, but may be reversed, such as building a shopping center on farmland. The land cannot be used for farming again until the pavement is removed and soils are restored to productivity. Designation of critical habitat for Neosho mucket and rabbitsfoot would result neither in irreversible or irretrievable commitments of resources.

CHAPTER 4 ANALYSIS OF SIGNIFICANCE

The primary purpose of preparing an environmental assessment under NEPA is to determine whether a proposed action would have significant impacts on the human environment. If significant impacts may result from a proposed action, then an environmental impact statement is required (40 CFR §1502.3). Whether a proposed action exceeds a threshold of significance is determined by analyzing the *context* and the *intensity* of the proposed action (40 CFR §1508.27).

Context refers to the setting of the proposed action and potential impacts of that action. The context of a significance determination may be society as a whole (human, national), the affected region, the affected interests, or the locality. Intensity refers to the severity of the impacts.

The context of short and long-term impacts of the proposed designation of critical habitat for the Neosho mucket and rabbitsfoot includes forty-three proposed units covering a total of 3,443 rkm (2,139 rmi) in Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, and Tennessee. Impacts of critical habitat designation, although long term, would be small.

Under regulations of the Council of Environmental Quality (CEQ), intensity is determined by considering 10 criteria (CFR 40 §1508.27[b]): (1) beneficial and adverse impacts; (2) the degree of impacts on health and safety; (3) impacts on the unique characteristics of the area; (4) the degree to which the impacts would likely be highly controversial; (5) the degree to which the proposed action would impose unique, unknown, or uncertain risks; (6) the degree to which the proposed action might establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration; (7) whether the proposed action is related to other actions, which cumulatively could produce significant impacts; (8) the degree to which the proposed action might adversely affect locales, objects, or structures eligible for listing in the National Register of Historic Places; (9) the degree to which the proposed action might adversely affect an endangered or threatened species or its habitat, as determined to be critical under the ESA of 1973; and (10) whether the proposed action threatens a violation of Federal, state, or local law.

Potential impacts on environmental resources, both beneficial and adverse, would be minor. Impacts of critical habitat designation on natural resources within the areas proposed as Neosho mucket and rabbitsfoot critical habitat were analyzed and discussed in Chapter 3 of this EA. Applying the analysis of impacts to the significance criteria identified above, the Service concludes that the adverse impacts of critical habitat designation would not be significant, based on the following judgments:

- The potential impacts may be both beneficial and adverse, but minor.
- There would be no impacts on public health or safety from the proposed designation of critical habitat and no impacts on unique characteristics of the geographic area.

- Potential impacts on the quality of the environment are not likely to be highly controversial, and no project modifications would be required that would not be required in jeopardy consultations for the same action.

- Potential impacts from critical habitat designation on the quality of the environment are unlikely to be highly controversial and do not involve any uncertain, unique, or unknown risks.

- The designation of critical habitat by the Service for the conservation of endangered and threatened species is not a precedent-setting action with significant effects. The agency has designated critical habitat for hundreds of other species.

- The proposed action is not related to other actions which cumulatively could produce significant impacts. There would not be significant cumulative impacts because, as described in section 3.5 of this EA, the cumulative impacts would be limited to section 7 consultation outcomes and subsequent effects on other species. Cumulative impacts of this designation and other Federal actions on land management activities on private lands would not occur because actual land management restrictions only apply where a Federal permit, license, or funding may be required, and the conservation measures that would accompany a Federal permit, license, or funding would not impose major restrictions on management activities.

- Critical habitat designation would not adversely affect an endangered or threatened species or its habitat. Designation will have long-term, beneficial, conservation-related impacts on Neosho mucket and rabbitsfoot and recovery through maintenance of PCEs in the event a section 7 consultation occurs.

- Significant cultural, historical, or scientific resources are not likely to be affected proposed designation of critical habitat.

- Proposed critical habitat designation may have a beneficial effect on Neosho mucket and rabbitsfoot.

- Proposed critical habitat designation would not violate any Federal, state, or local laws. The designation of critical habitat to the maximum extent prudent and determinable is required by law in order to comply with the ESA.

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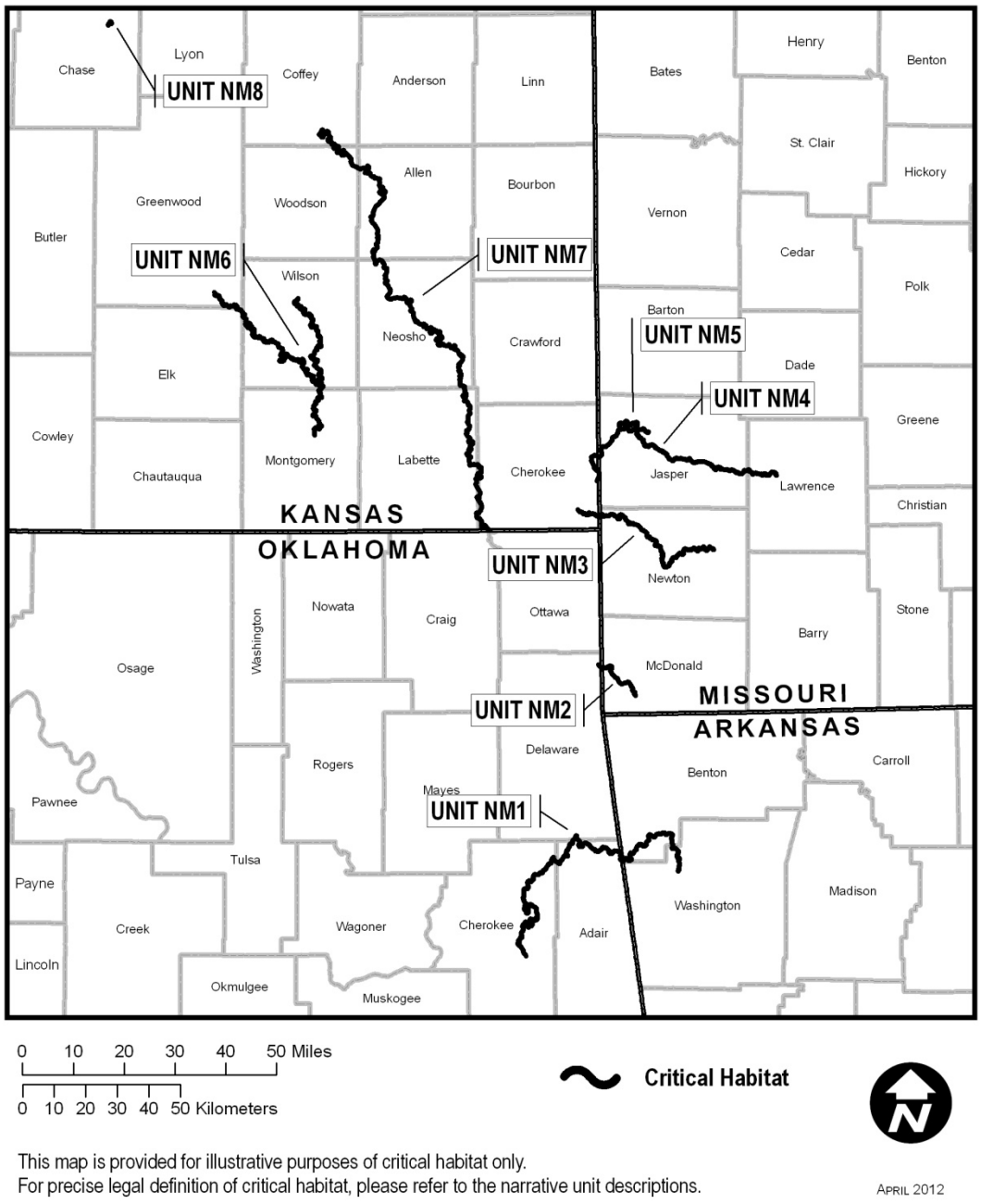
APPENDIX 1

MAPS OF CRITICAL HABITAT UNITS FOR NEOSHO MUCKET AND RABBITSFOOT

Index map of critical habitat units for Neosho mucket



0 10 20 30 40 50 Miles

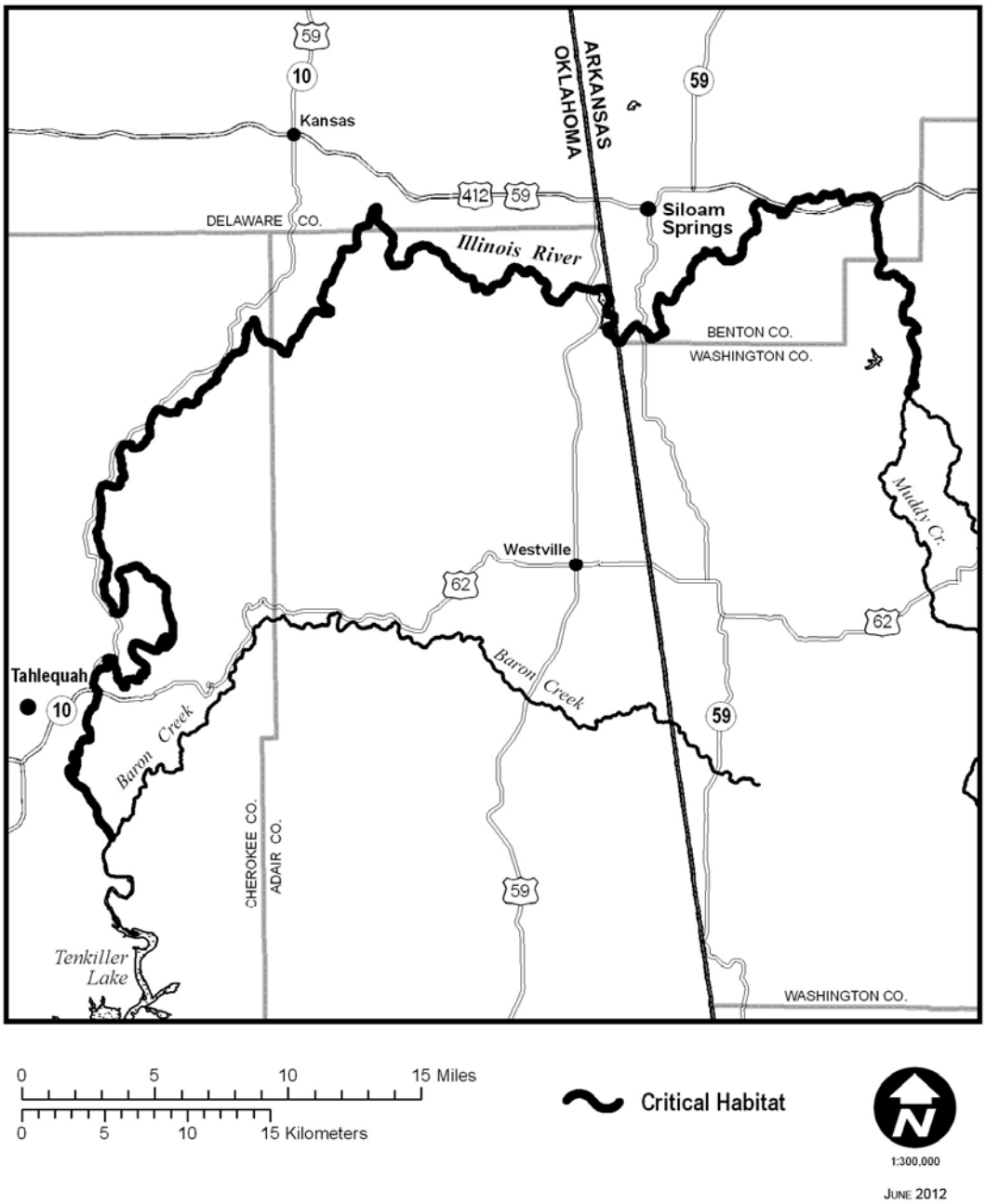
0 10 20 30 40 50 Kilometers

Critical Habitat

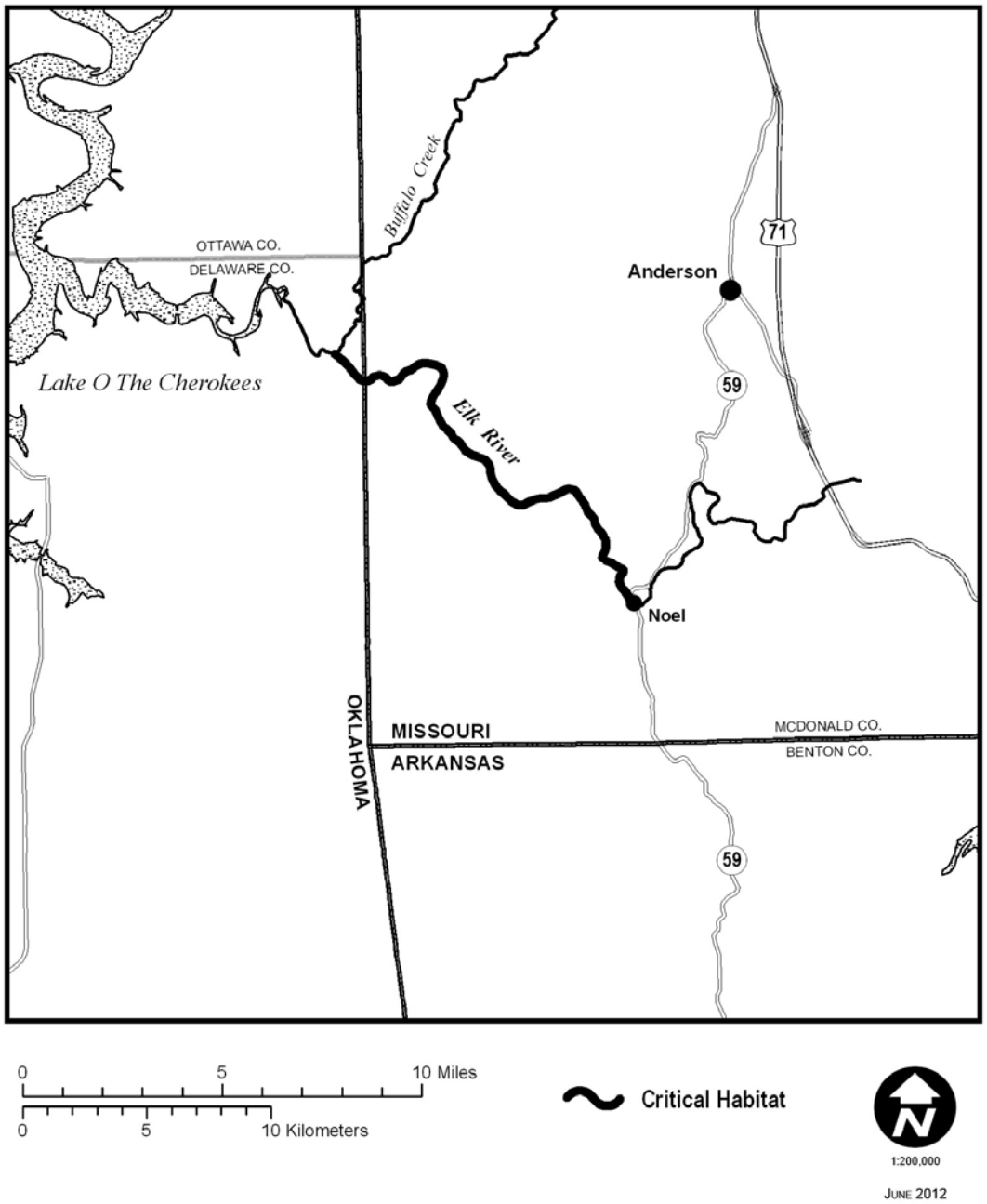
This map is provided for illustrative purposes of critical habitat only.
For precise legal definition of critical habitat, please refer to the narrative unit descriptions.

April 2012

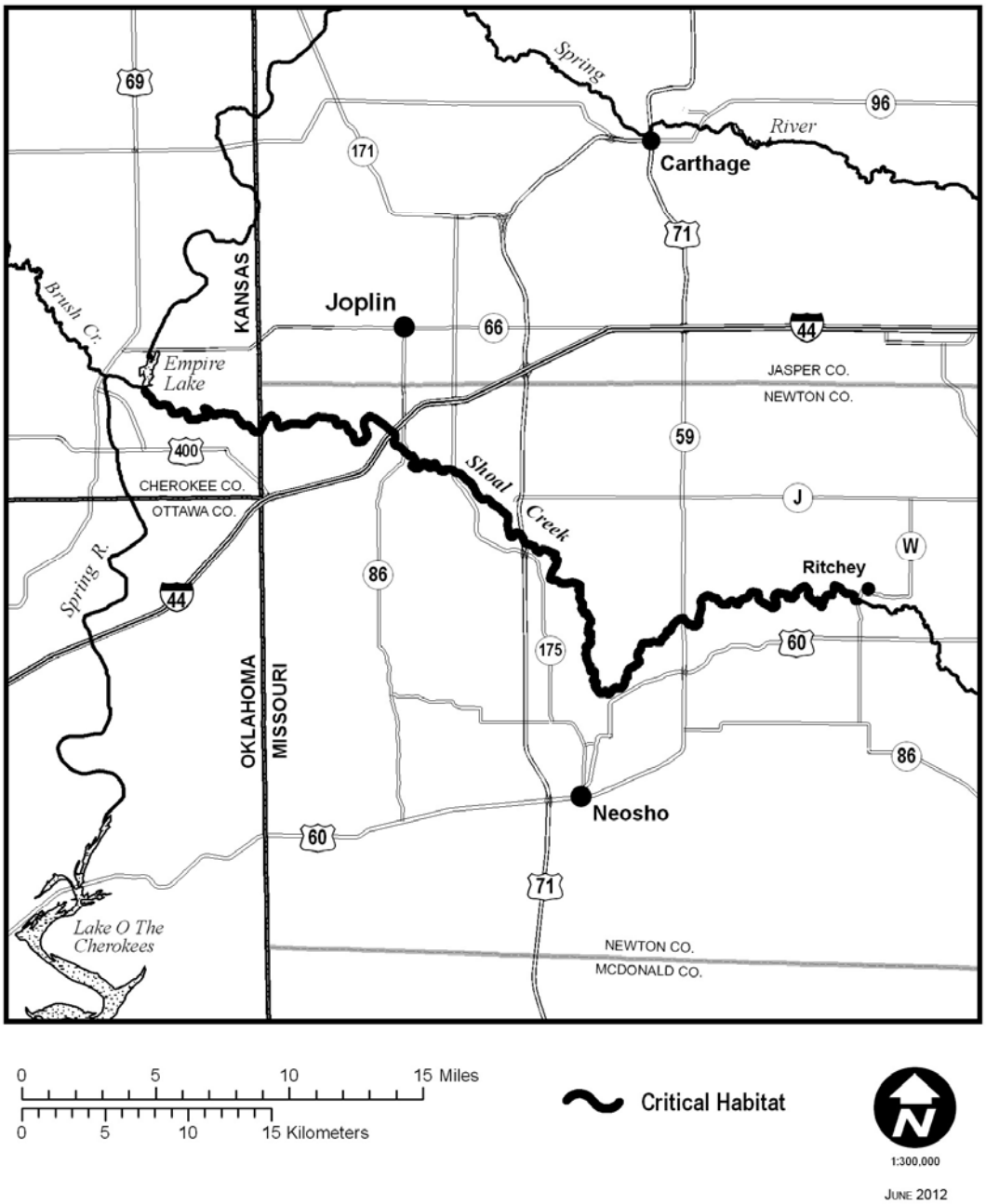
Map of Unit NM1 (Illinois River) of critical habitat for Neosho mucket



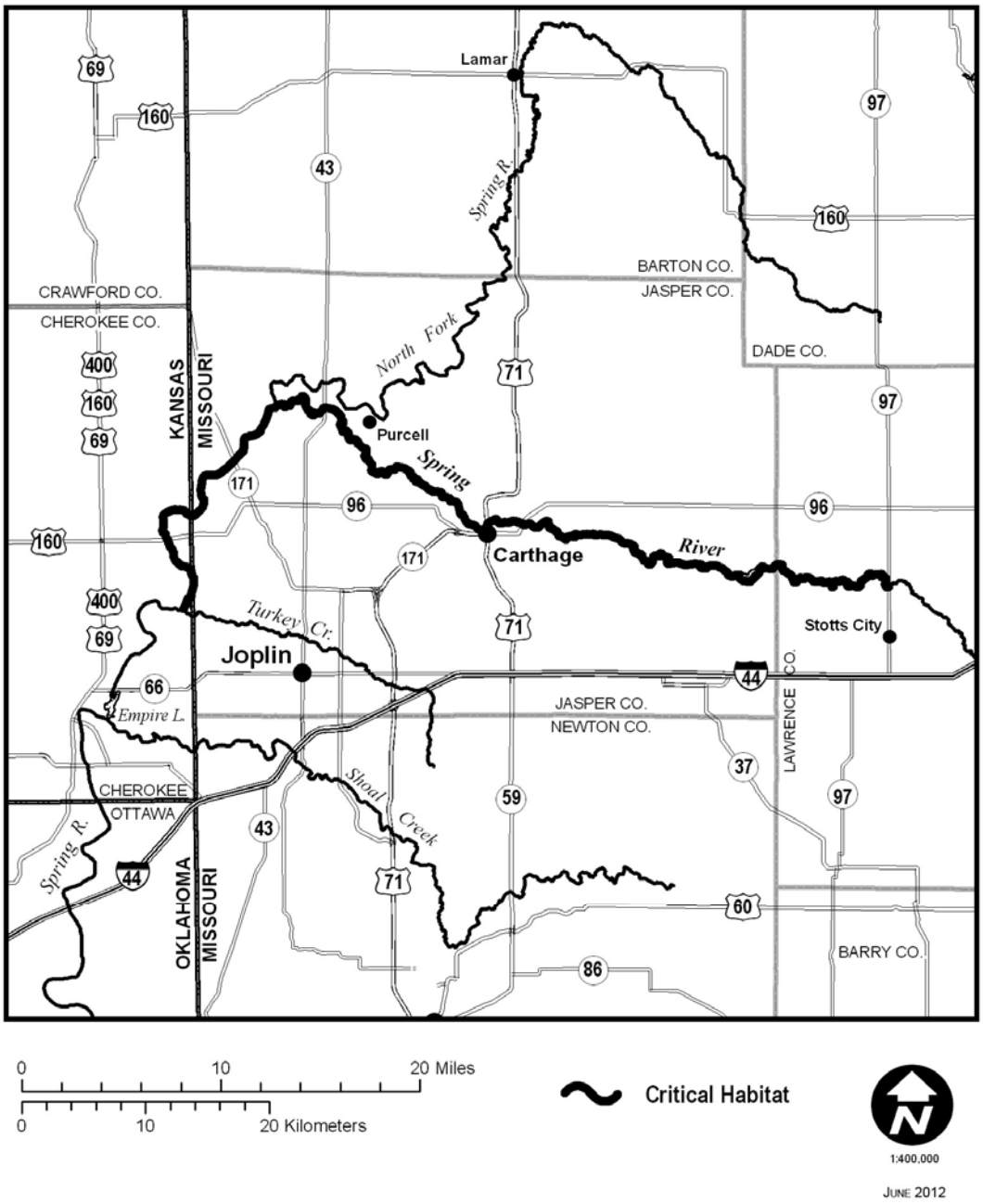
Map of Unit NM2 (Elk River) of critical habitat for Neosho mucket



Map of Unit NM3 (Shoal Creek) of critical habitat for Neosho mucket



Map of Unit NM4 (Spring River) of critical habitat for Neosho mucket



0 10 20 Miles

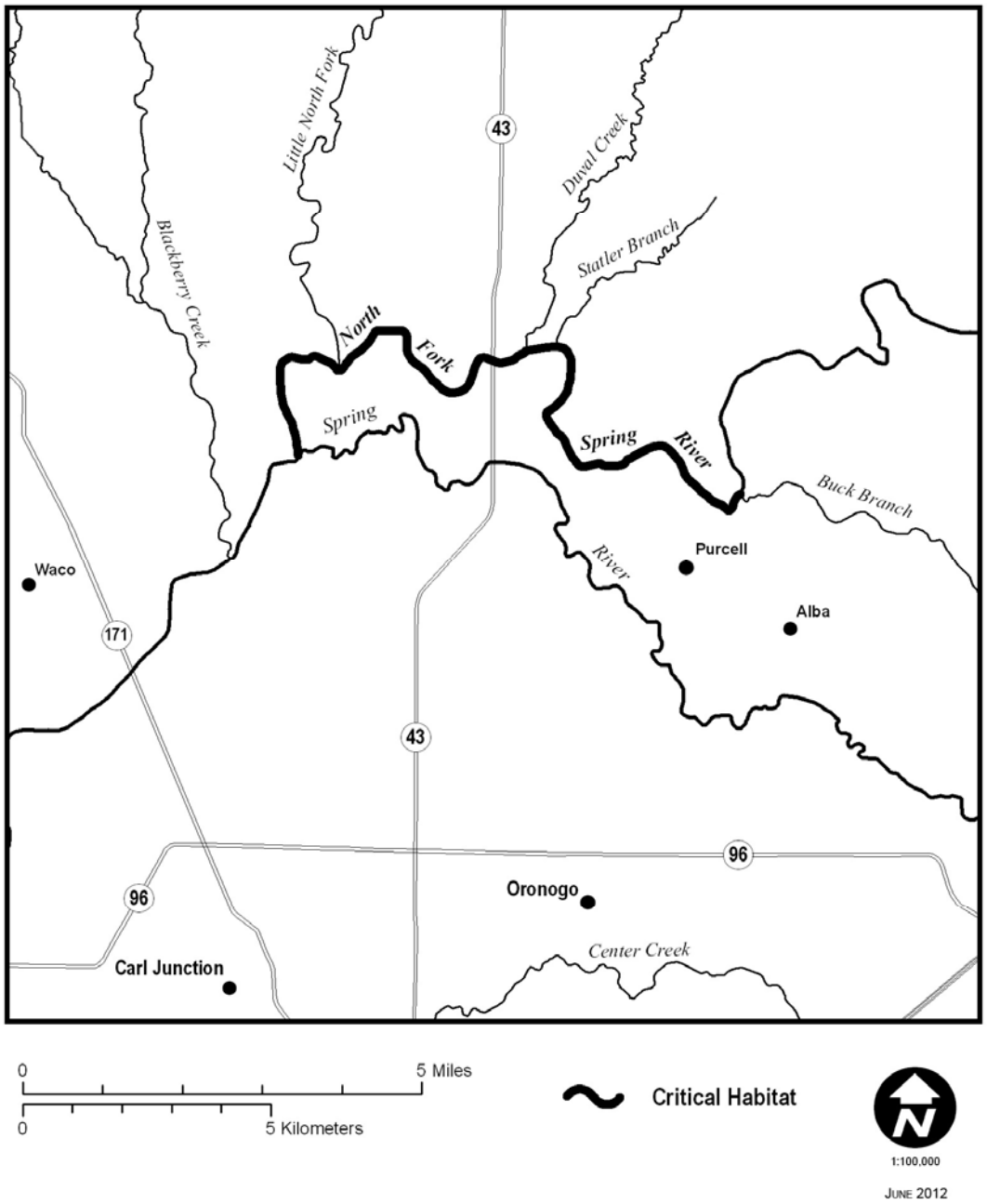
0 10 20 Kilometers

Critical Habitat

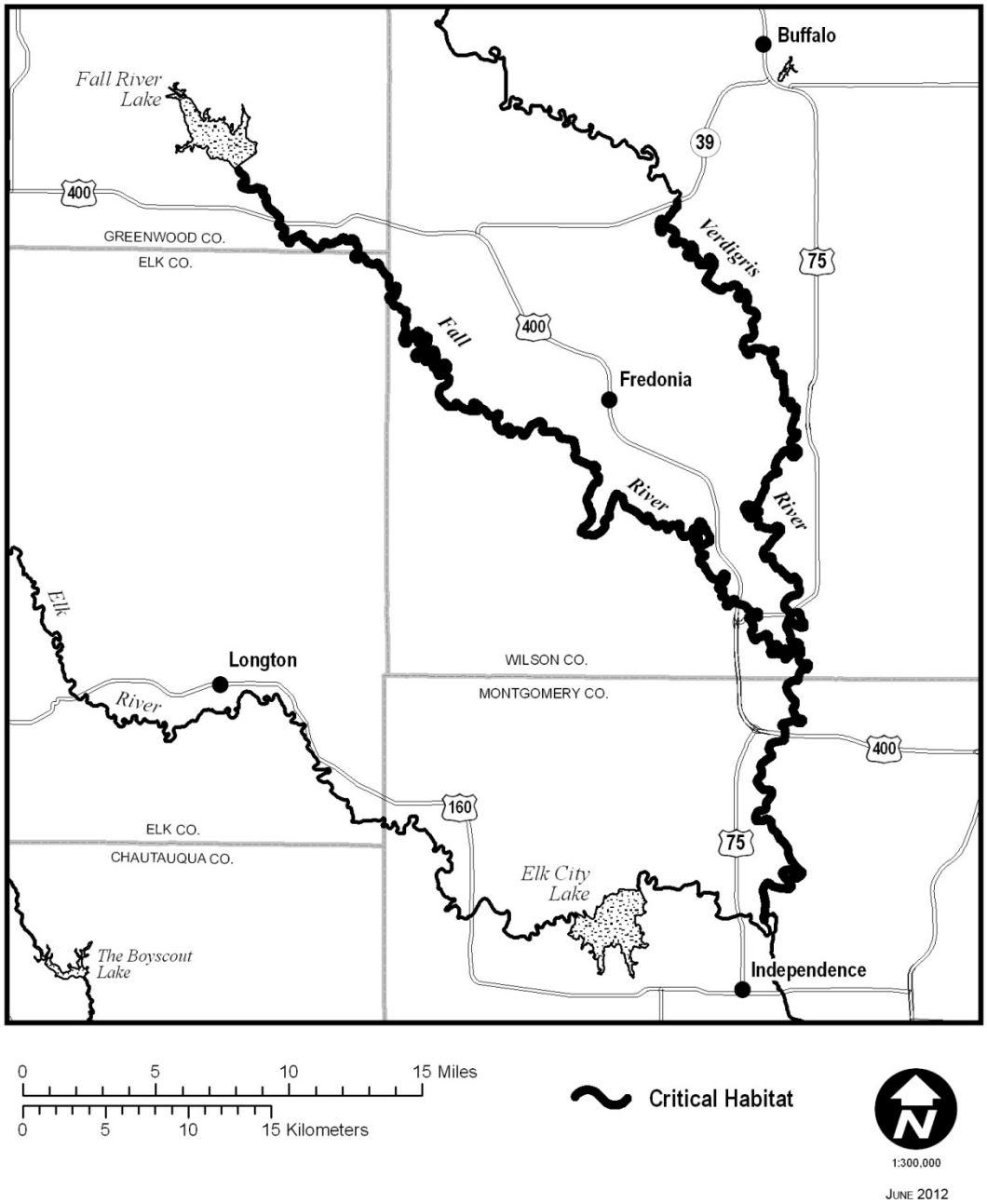
1:400,000

June 2012

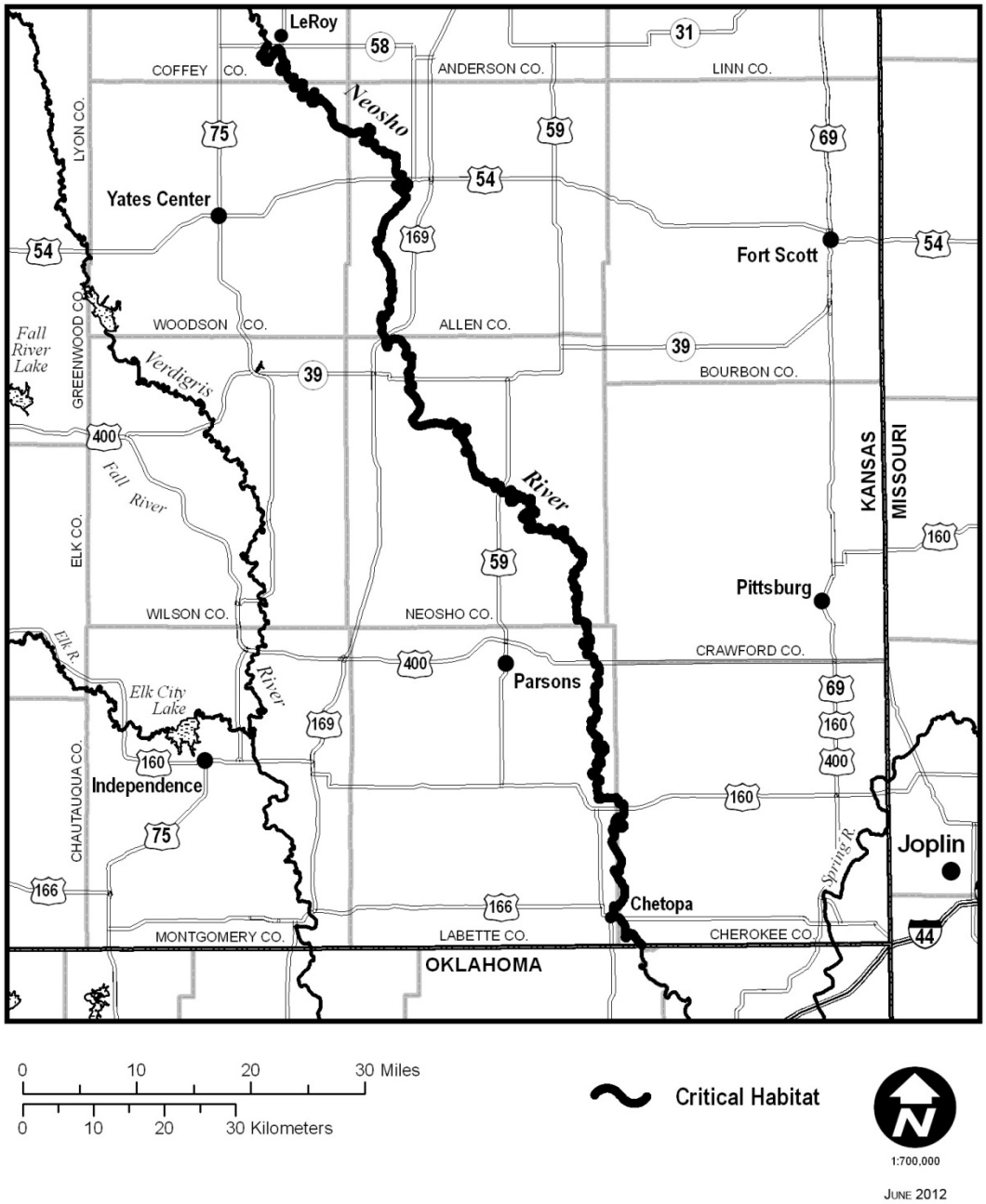
Map of Unit NM5 (North Fork Spring River) of critical habitat for Neosho mucket



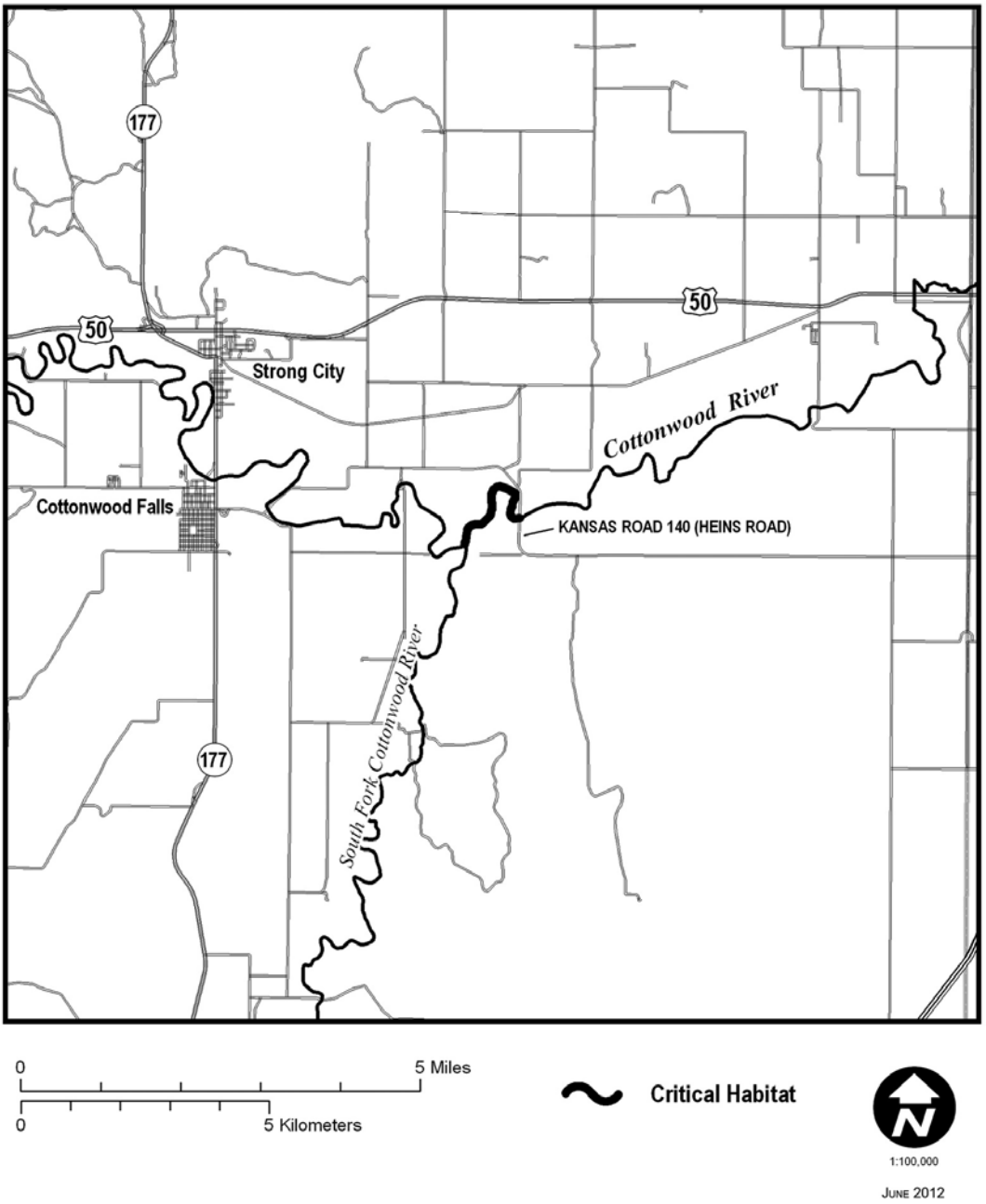
Map of Unit NM6 (Fall & Verdigris Rivers) of critical habitat for Neosho mucket



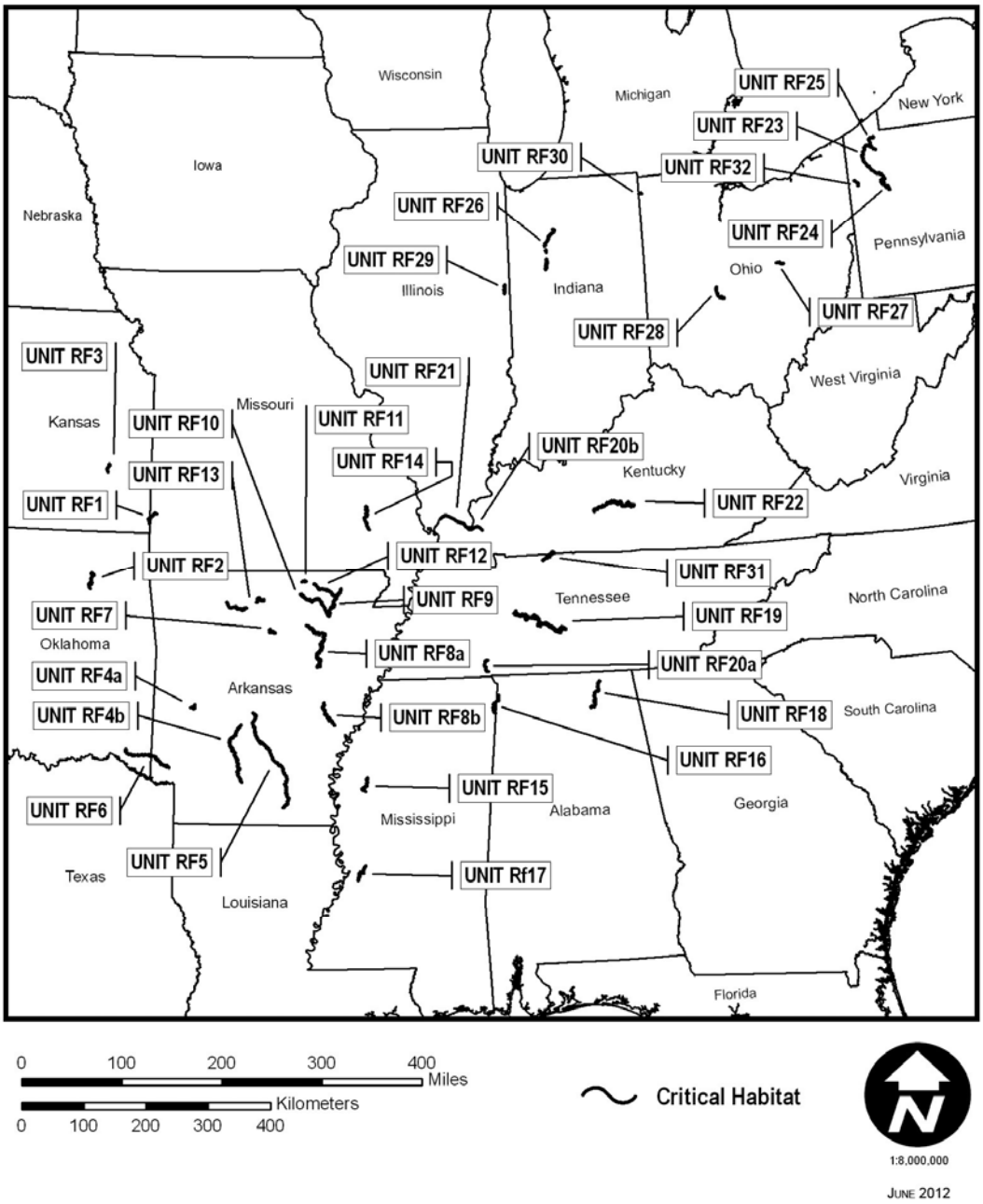
Map of Unit NM7 (Neosho River) of critical habitat for Neosho mucket



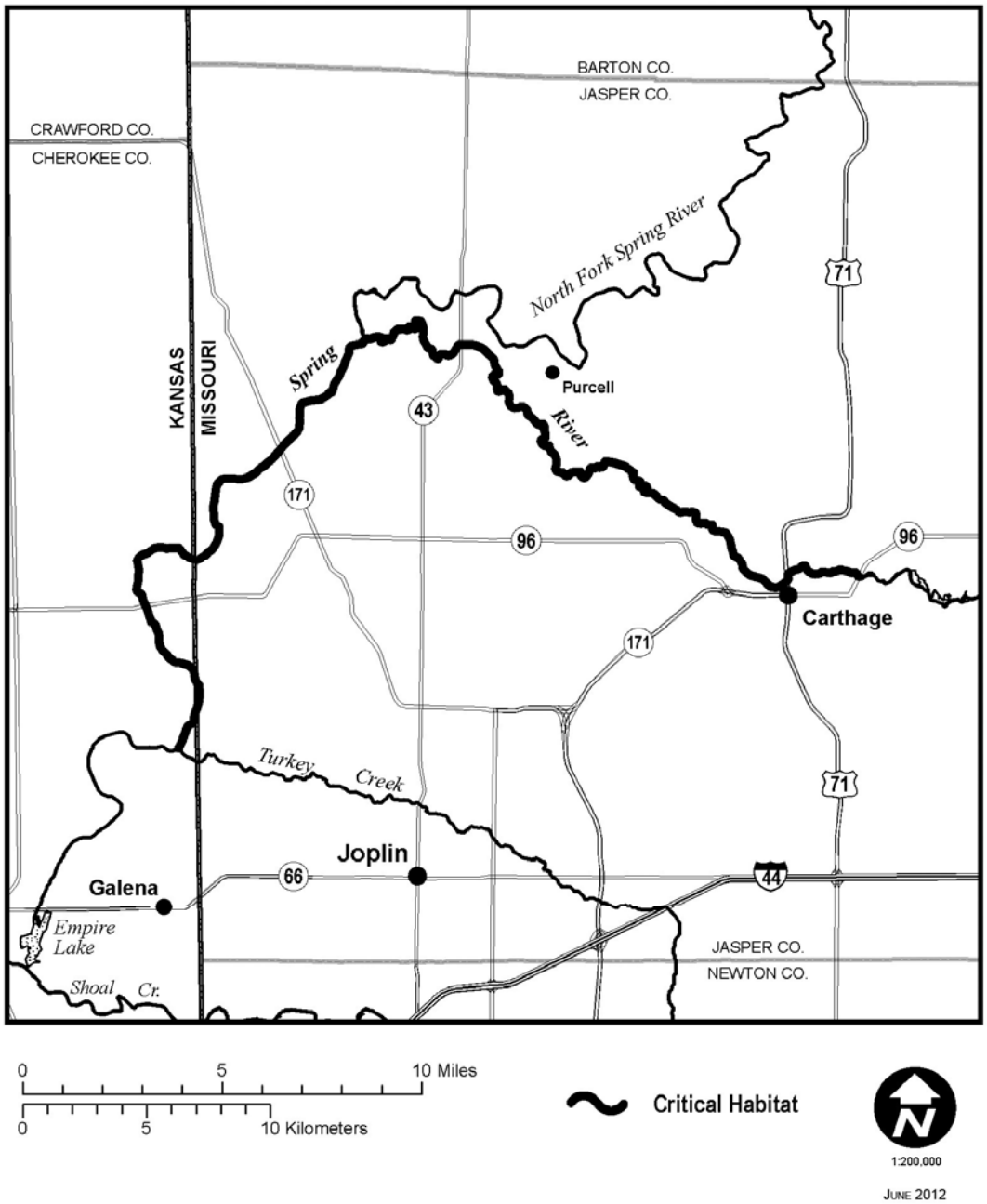
Map of Unit NM8 (Cottonwood River) of critical habitat for Neosho mucket



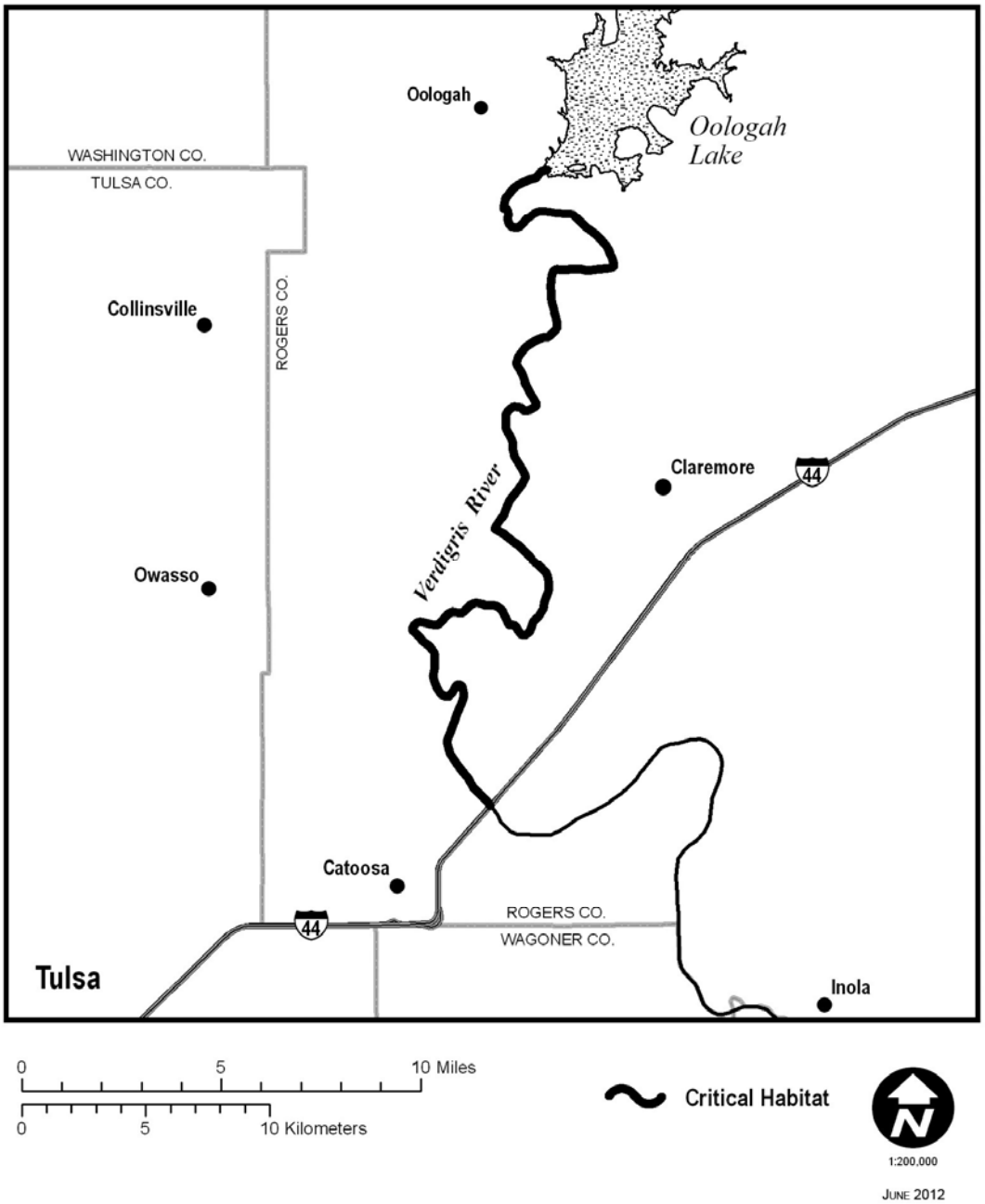
Index map of critical habitat units for Rabbitsfoot



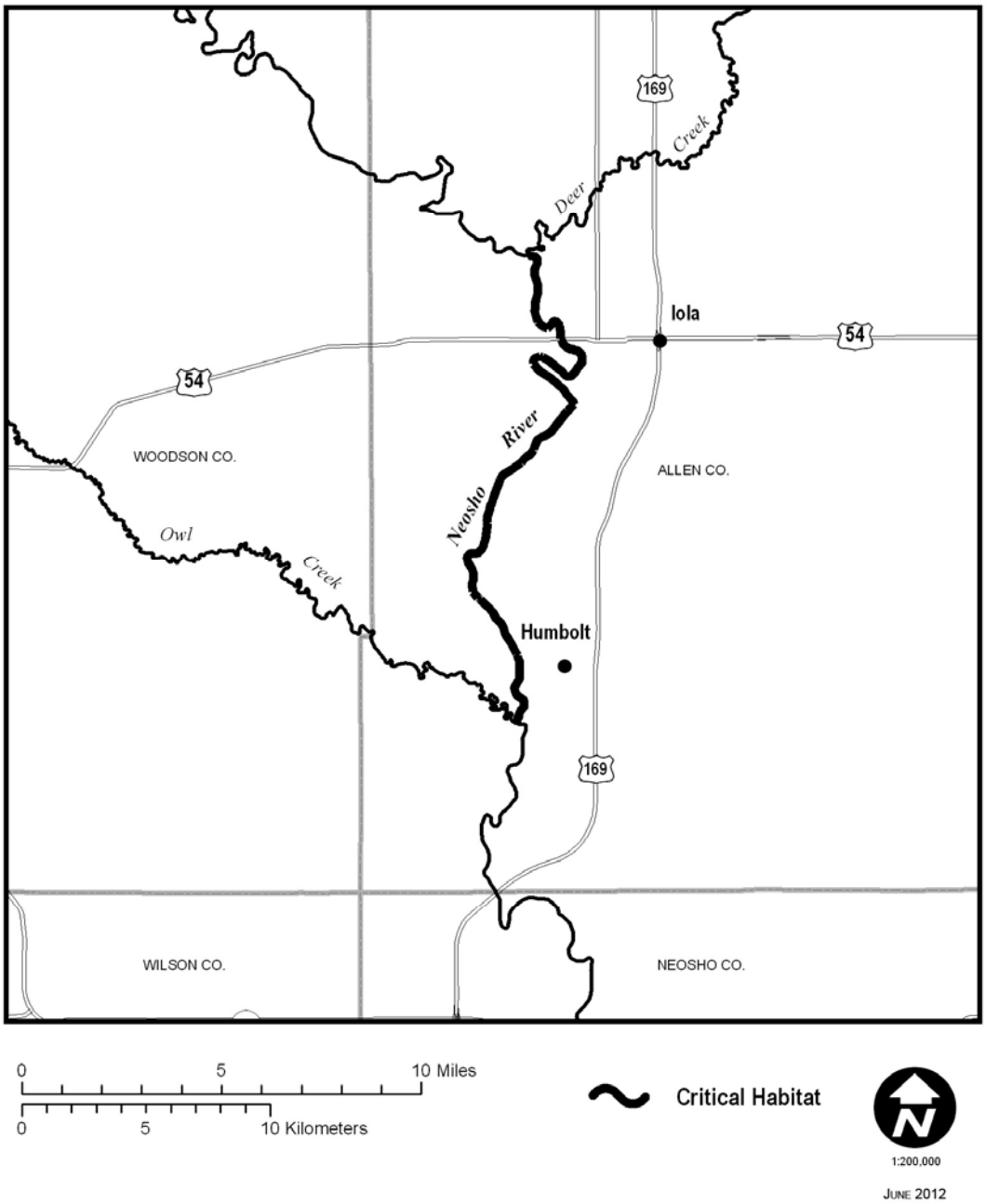
Map of Unit RF1 (Spring River) of critical habitat for Rabbitsfoot



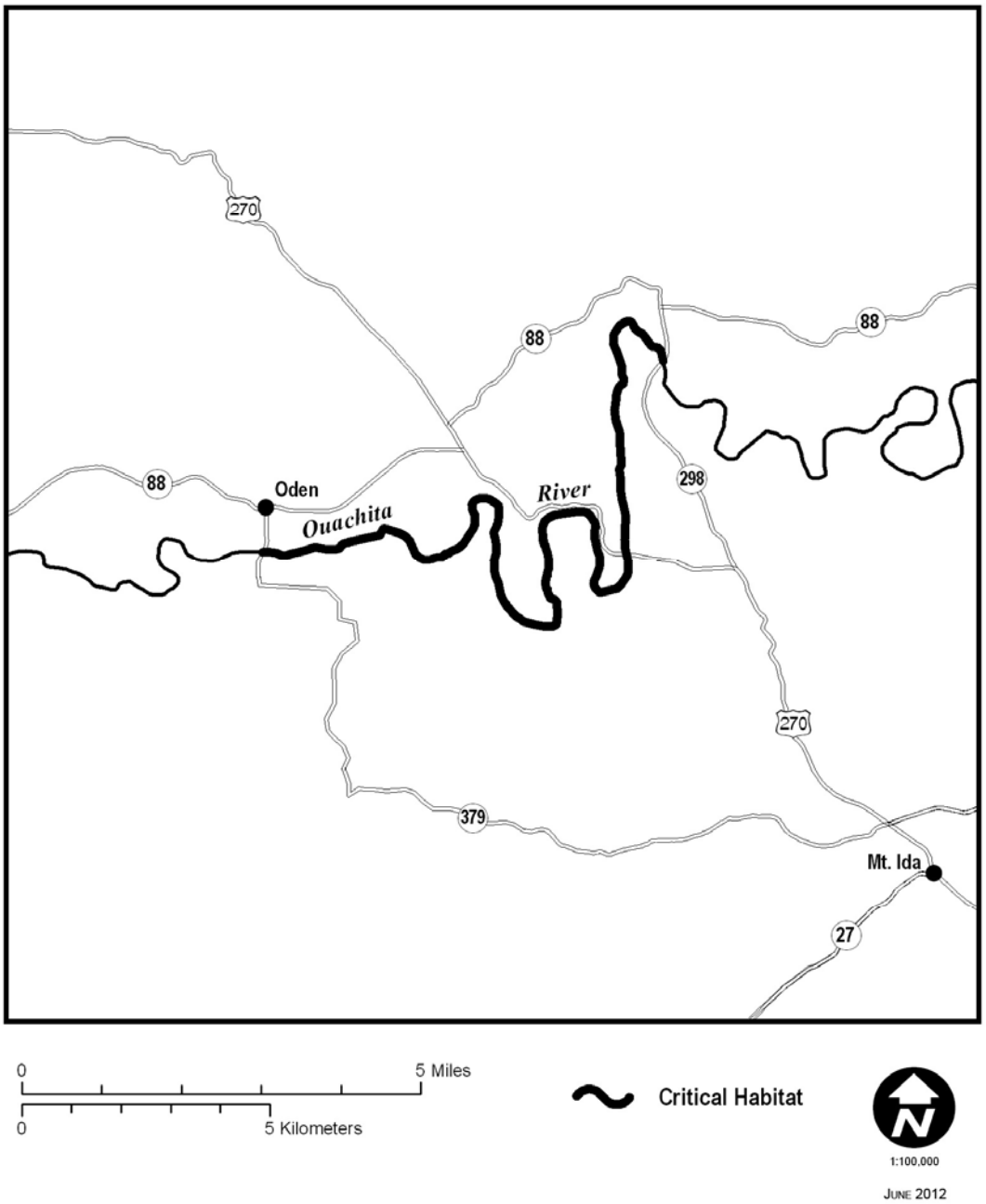
Map of Unit RF2 (Verdigris River) of critical habitat for Rabbitsfoot



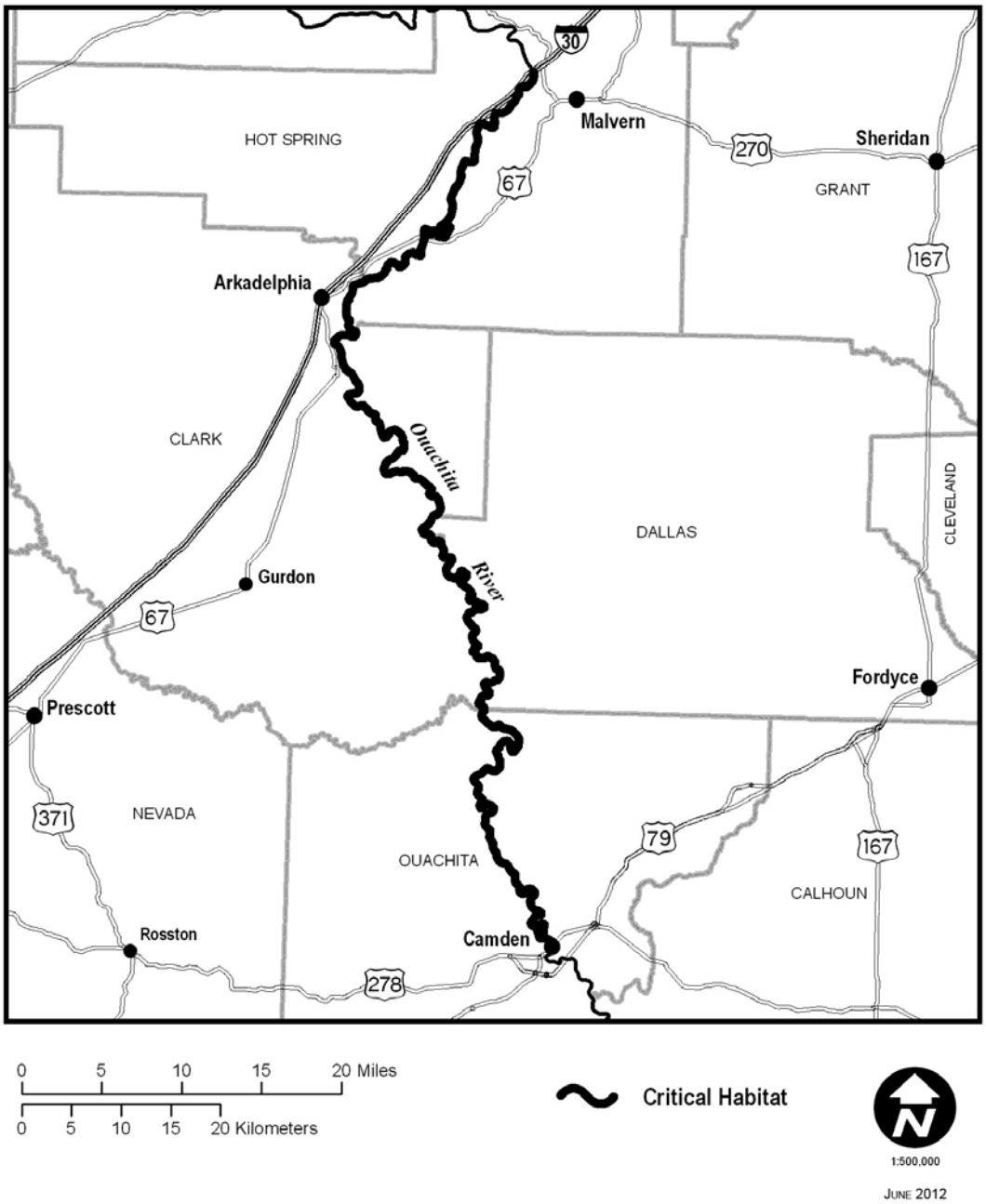
Map of Unit RF3 (Neosho River) of critical habitat for Rabbitsfoot



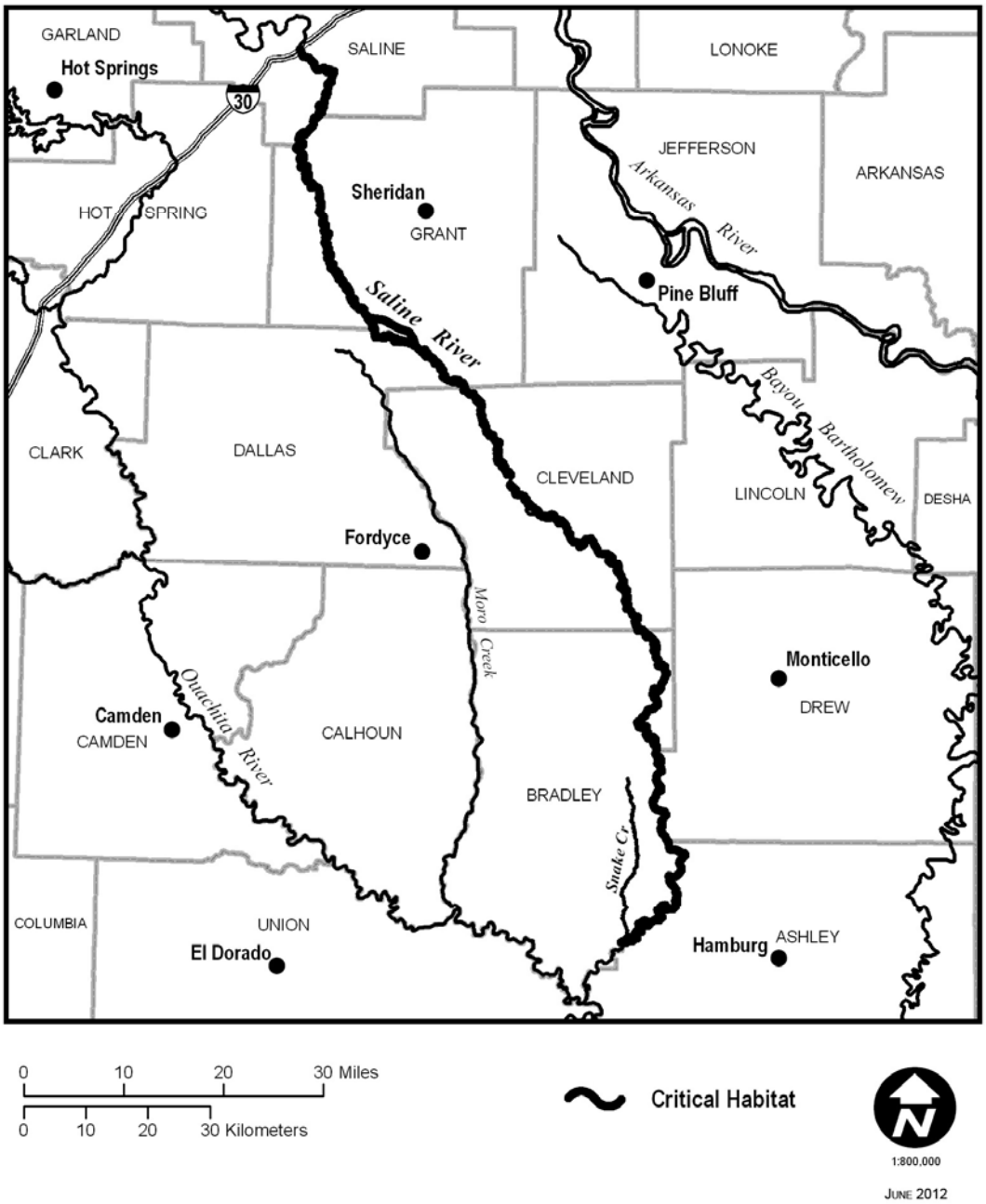
Map of Unit RF4a (Ouachita River) of critical habitat for Rabbitsfoot



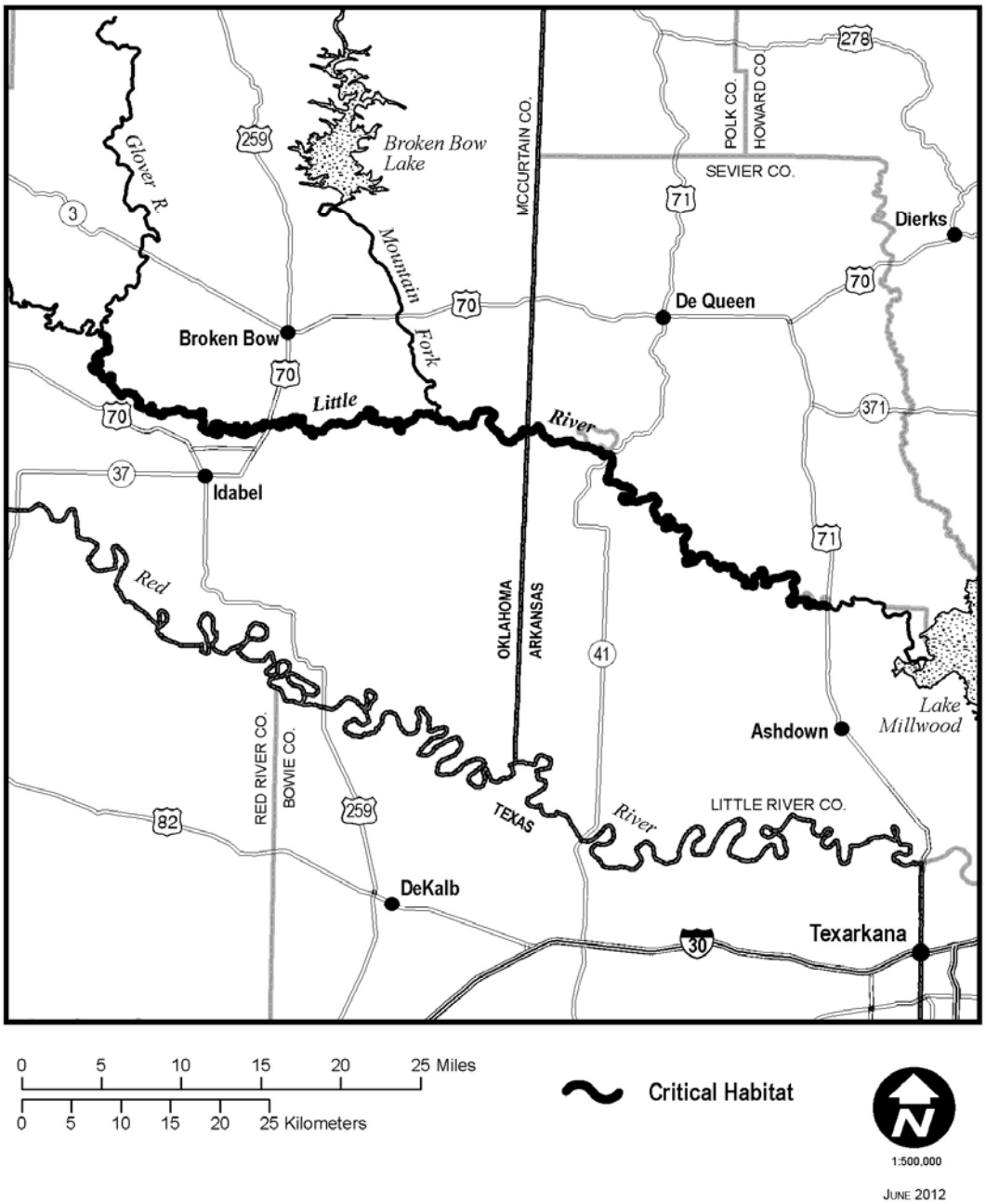
Map of Unit RF4b (Ouachita River) of critical habitat for Rabbitsfoot



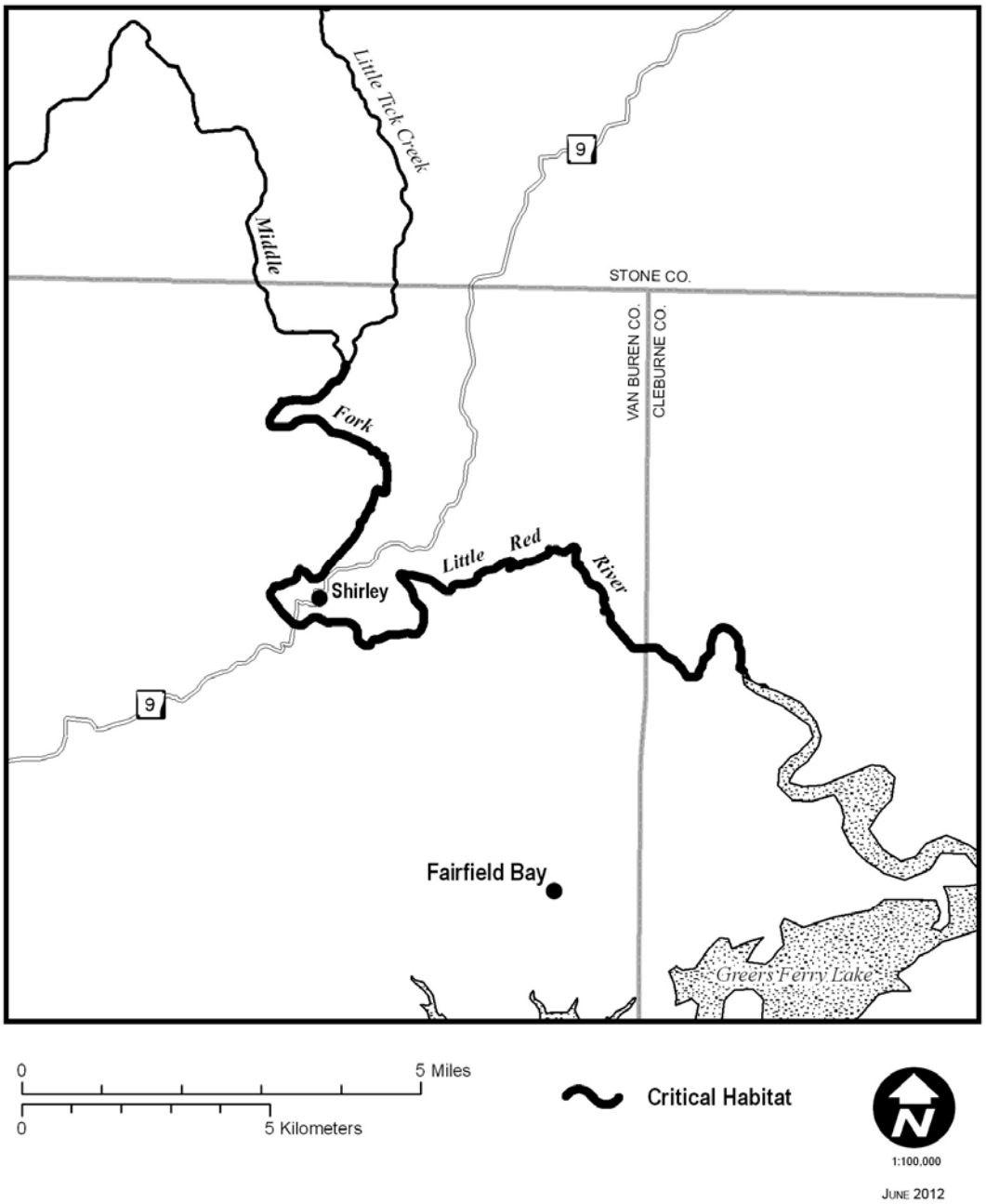
Map of Unit RF5 (Saline River) of critical habitat for Rabbitsfoot



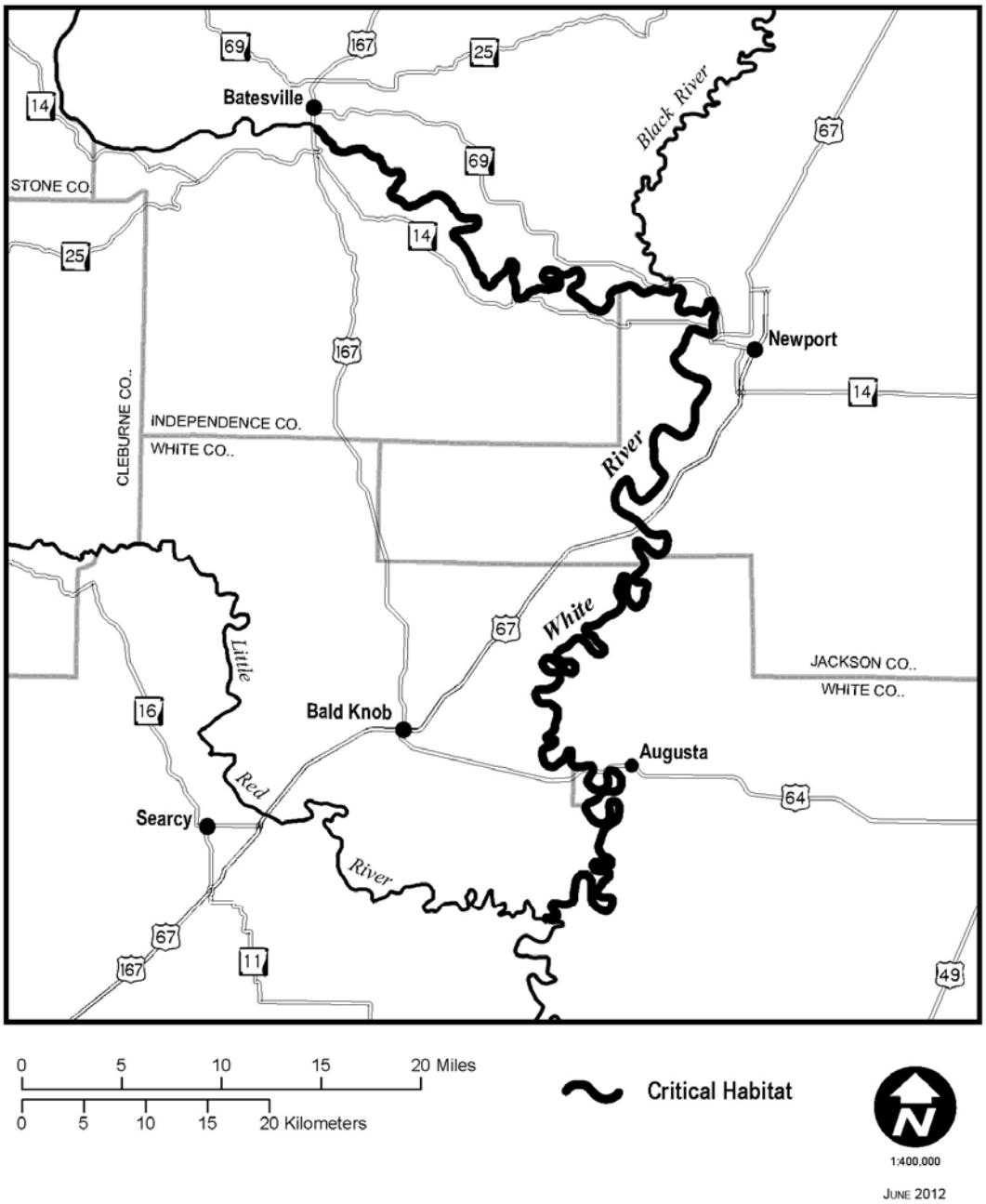
Map of Unit RF6 (Little River) of critical habitat for Rabbitsfoot



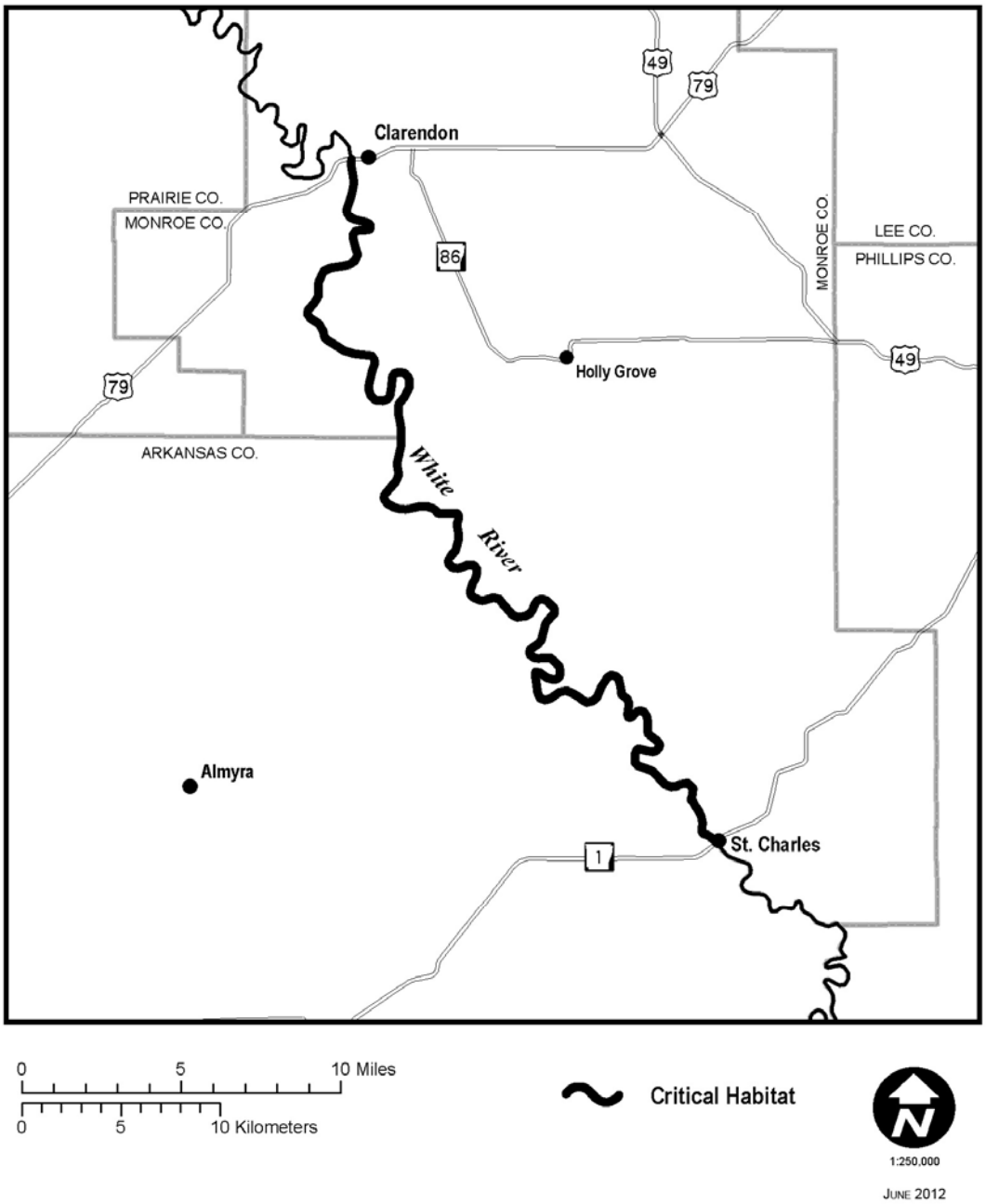
Map of Unit RF7 (Middle Fork Little Red River) of critical habitat for Rabbitsfoot



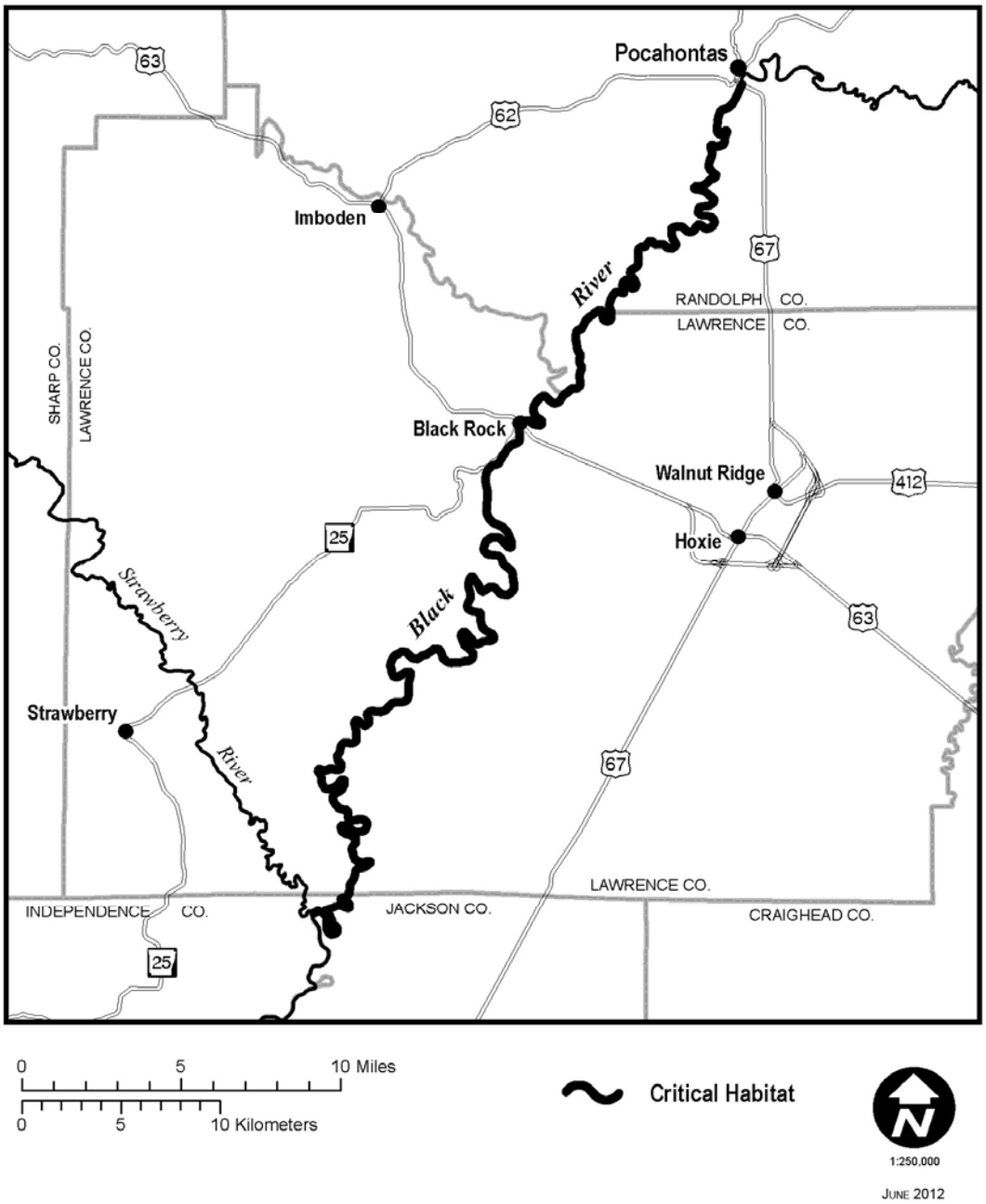
Map of Unit RF8a (White River) of critical habitat for Rabbitsfoot



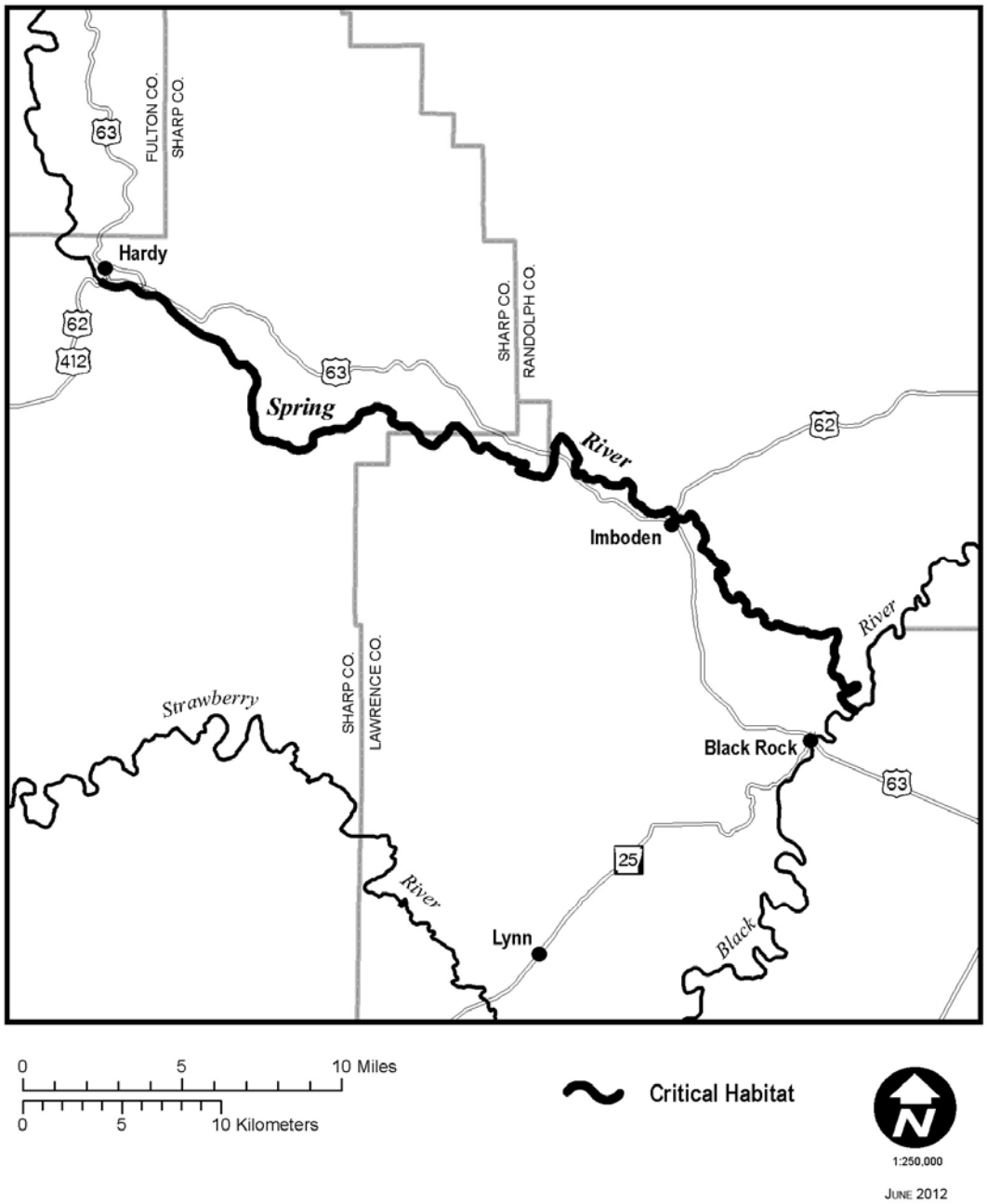
Map of Unit RF8b (White River) of critical habitat for Rabbitsfoot



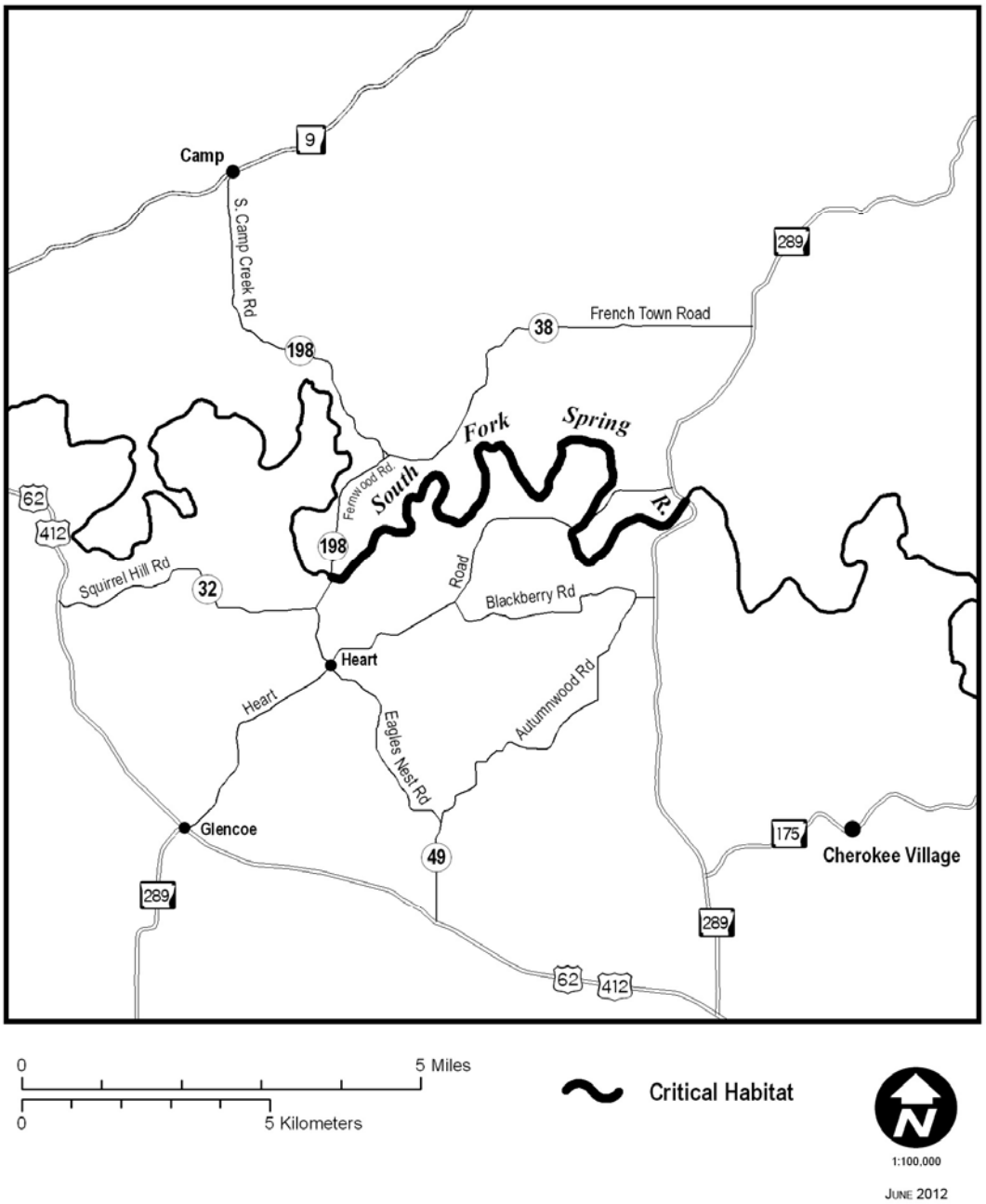
Map of Unit RF9 (Black River) of critical habitat for Rabbitsfoot



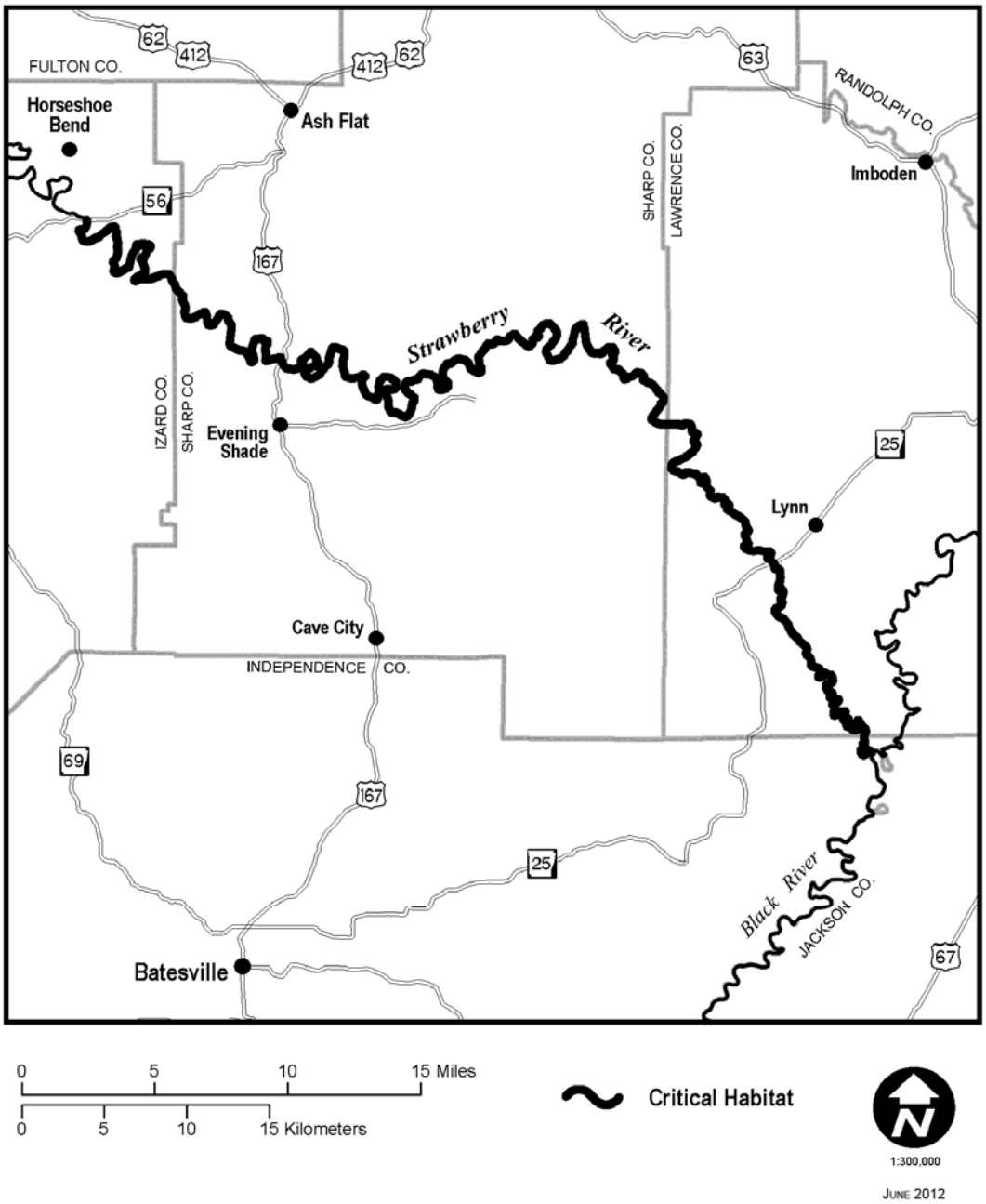
Map of Unit RF10 (Spring River) of critical habitat for Rabbitsfoot



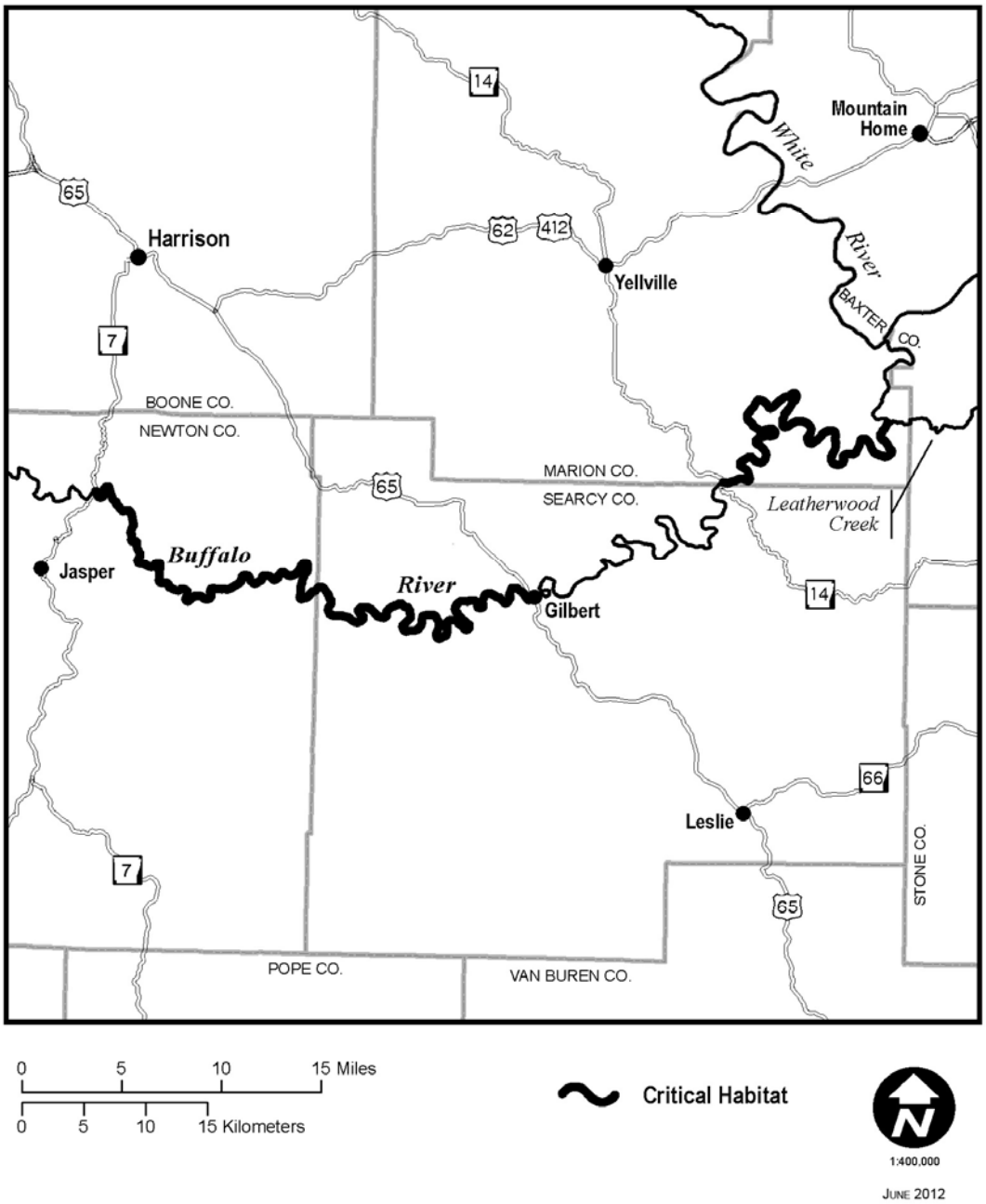
Map of Unit RF11 (South Fork Spring River) of critical habitat for Rabbitsfoot



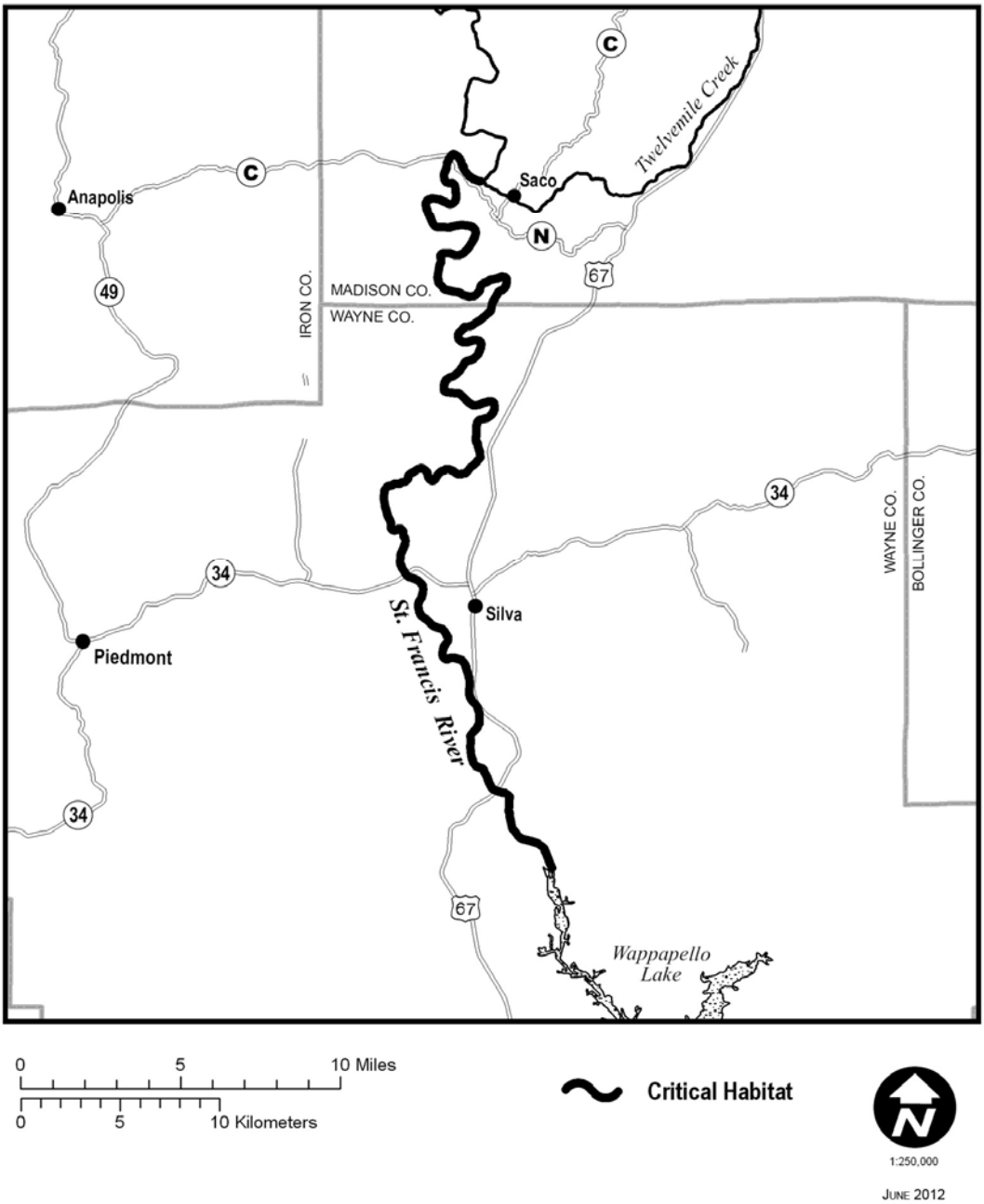
Map of Unit RF12 (Strawberry River) of critical habitat for Rabbitsfoot



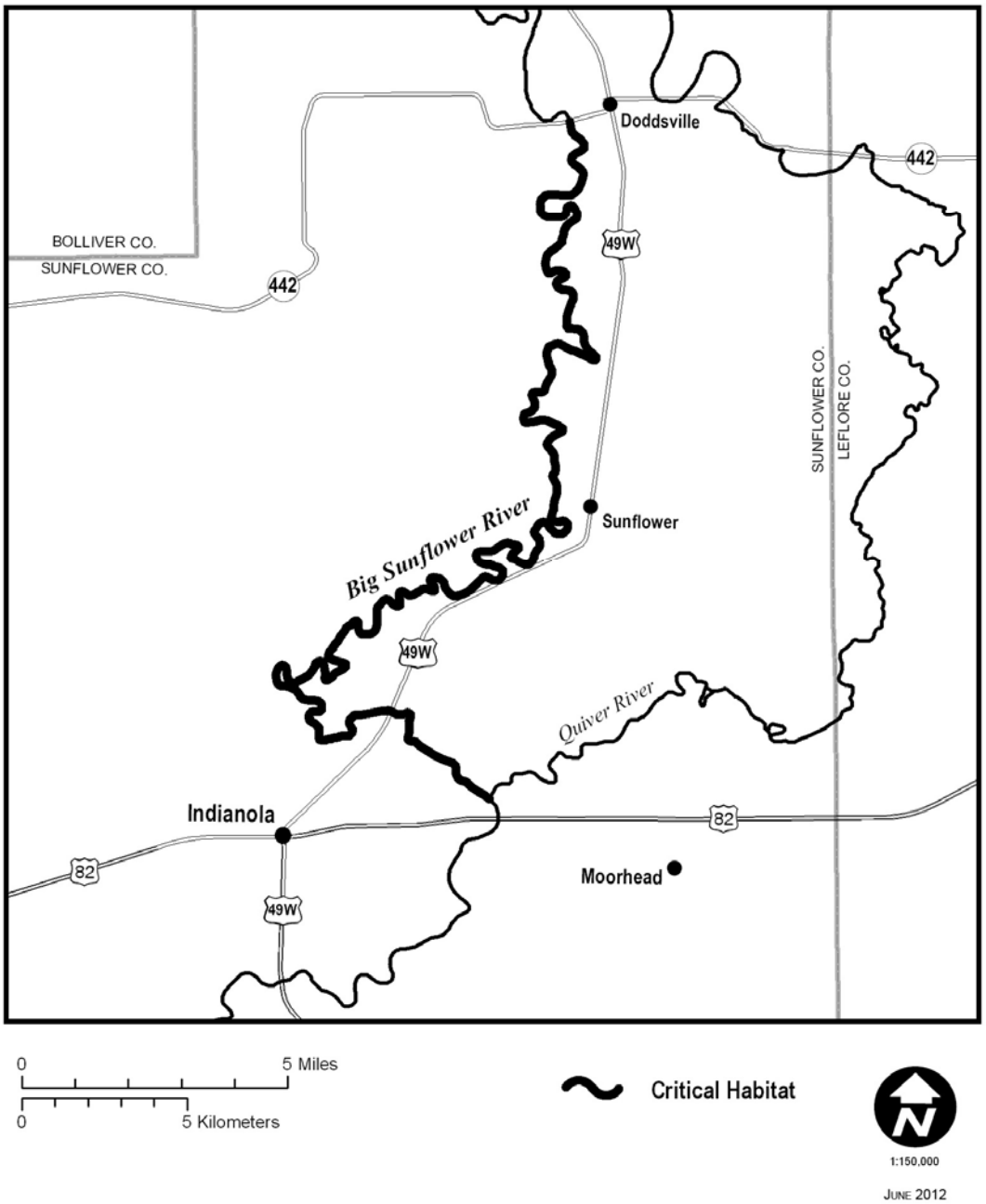
Map of Unit RF13 (Buffalo River) of critical habitat for Rabbitsfoot



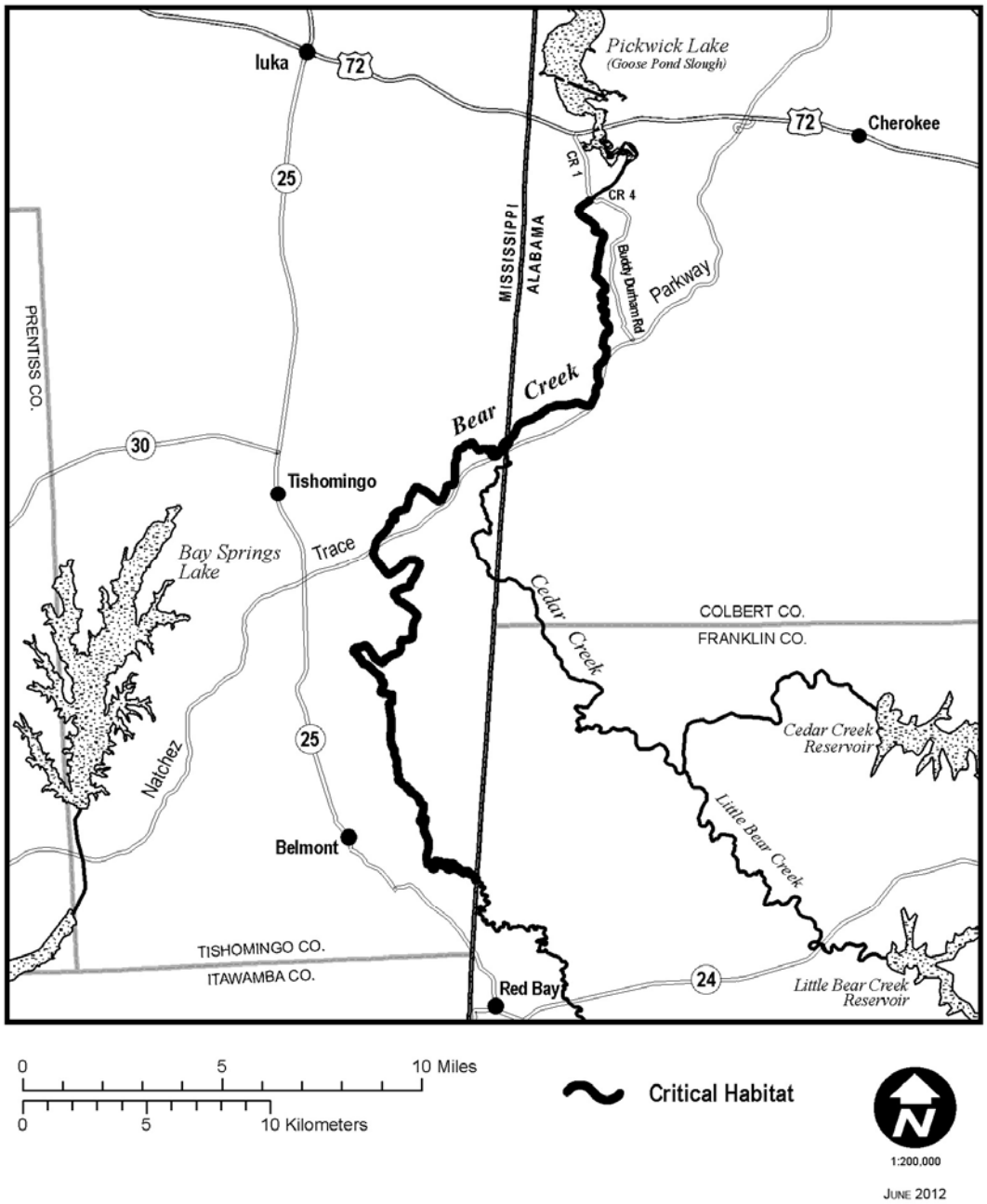
Map of Unit RF14 (St. Francis River) of critical habitat for Rabbitsfoot



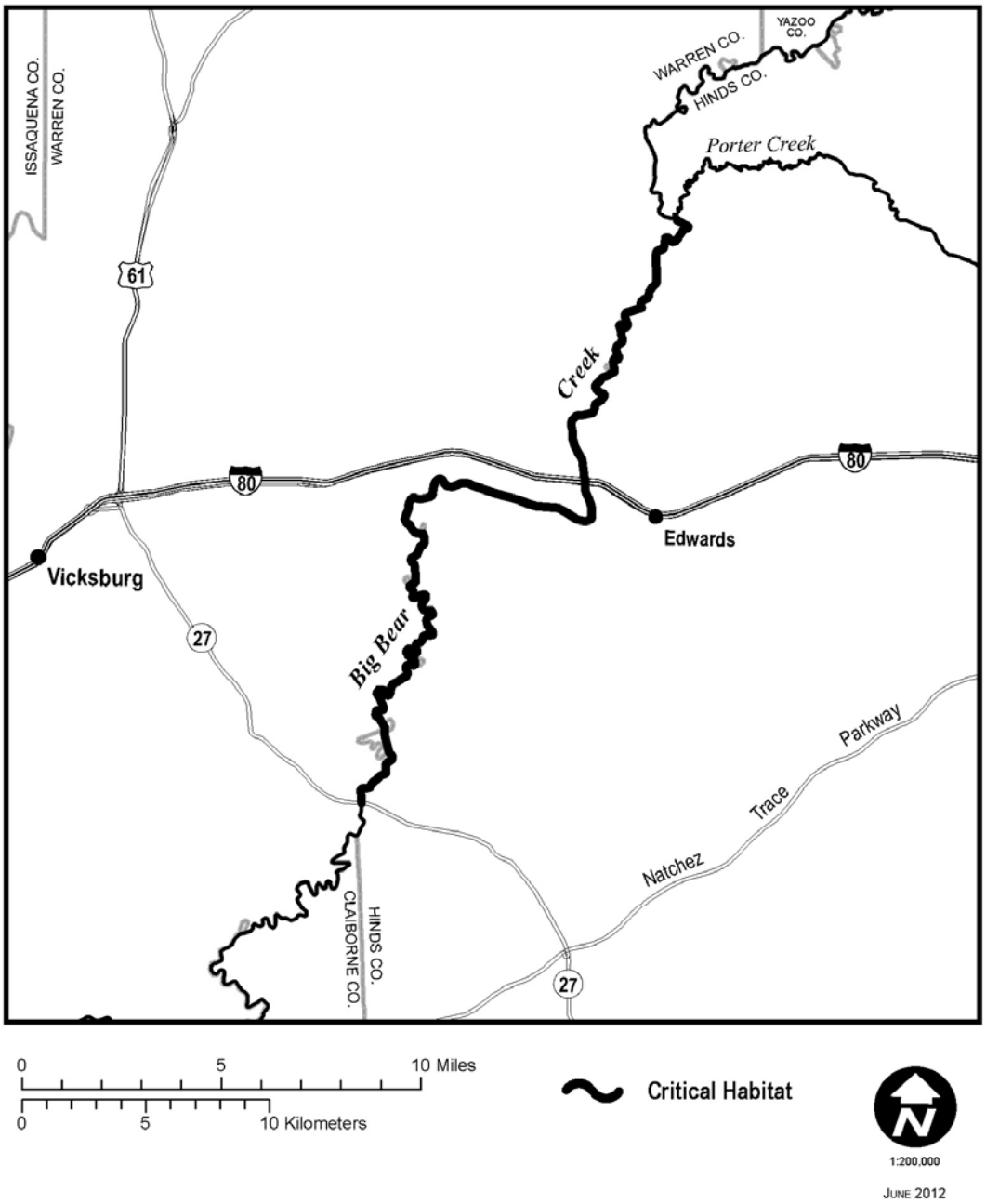
Map of Unit RF15 (Big Sunflower River) of critical habitat for Rabbitsfoot



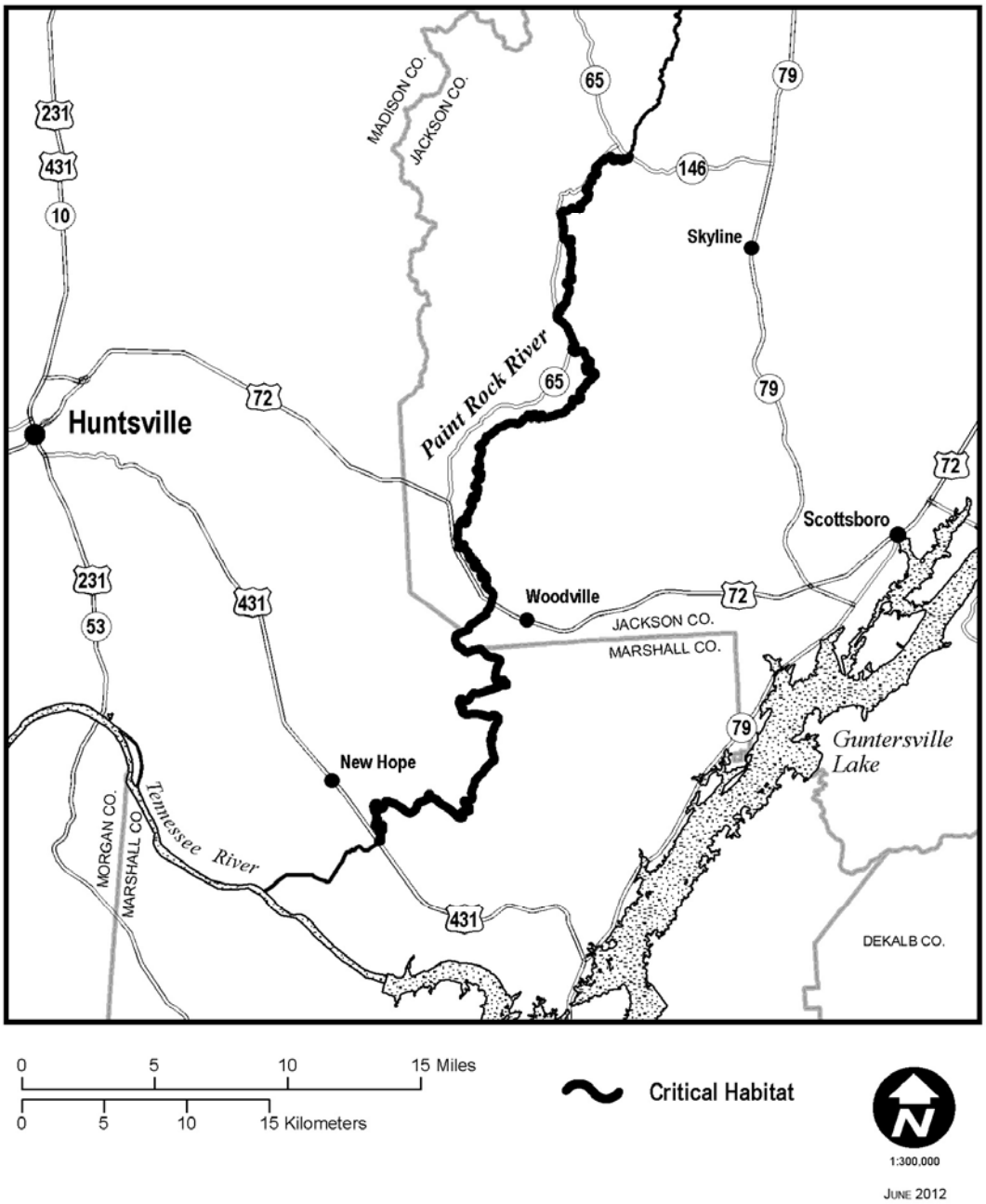
Map of Unit RF16 (Bear Creek) of critical habitat for Rabbitsfoot



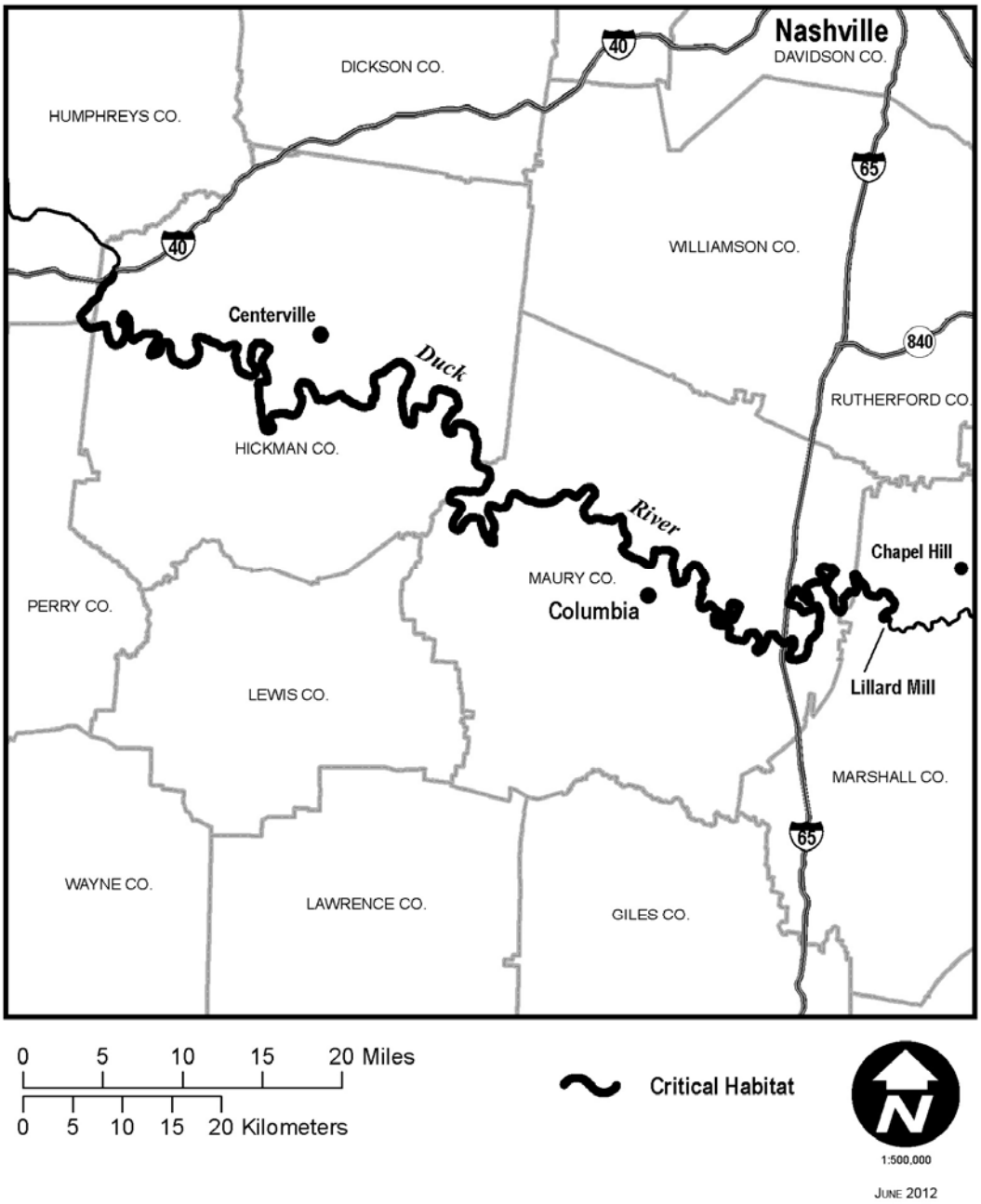
Map of Unit RF17 (Big Black River) of critical habitat for Rabbitsfoot



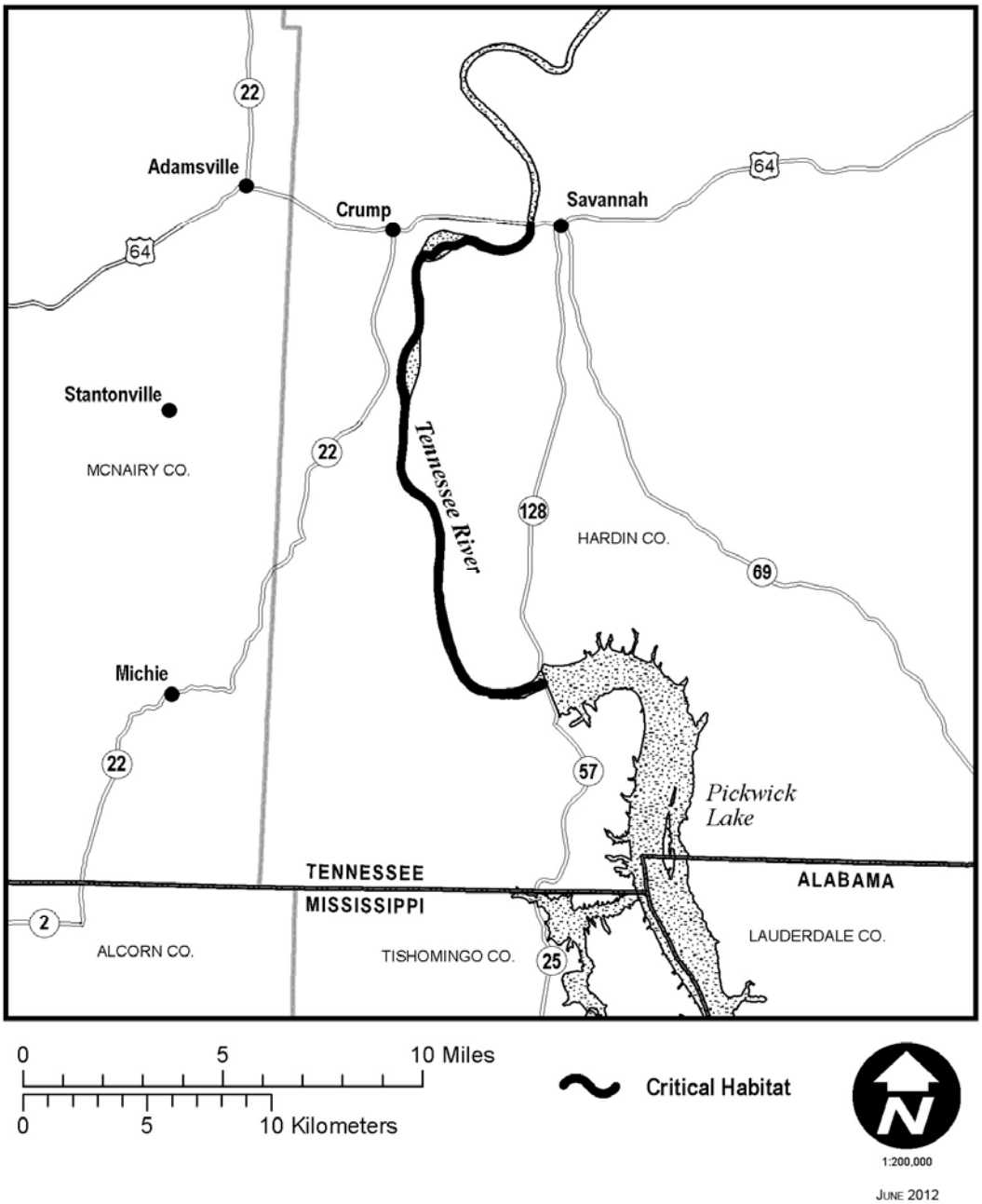
Map of Unit RF18 (Paint Rock River) of critical habitat for Rabbitsfoot



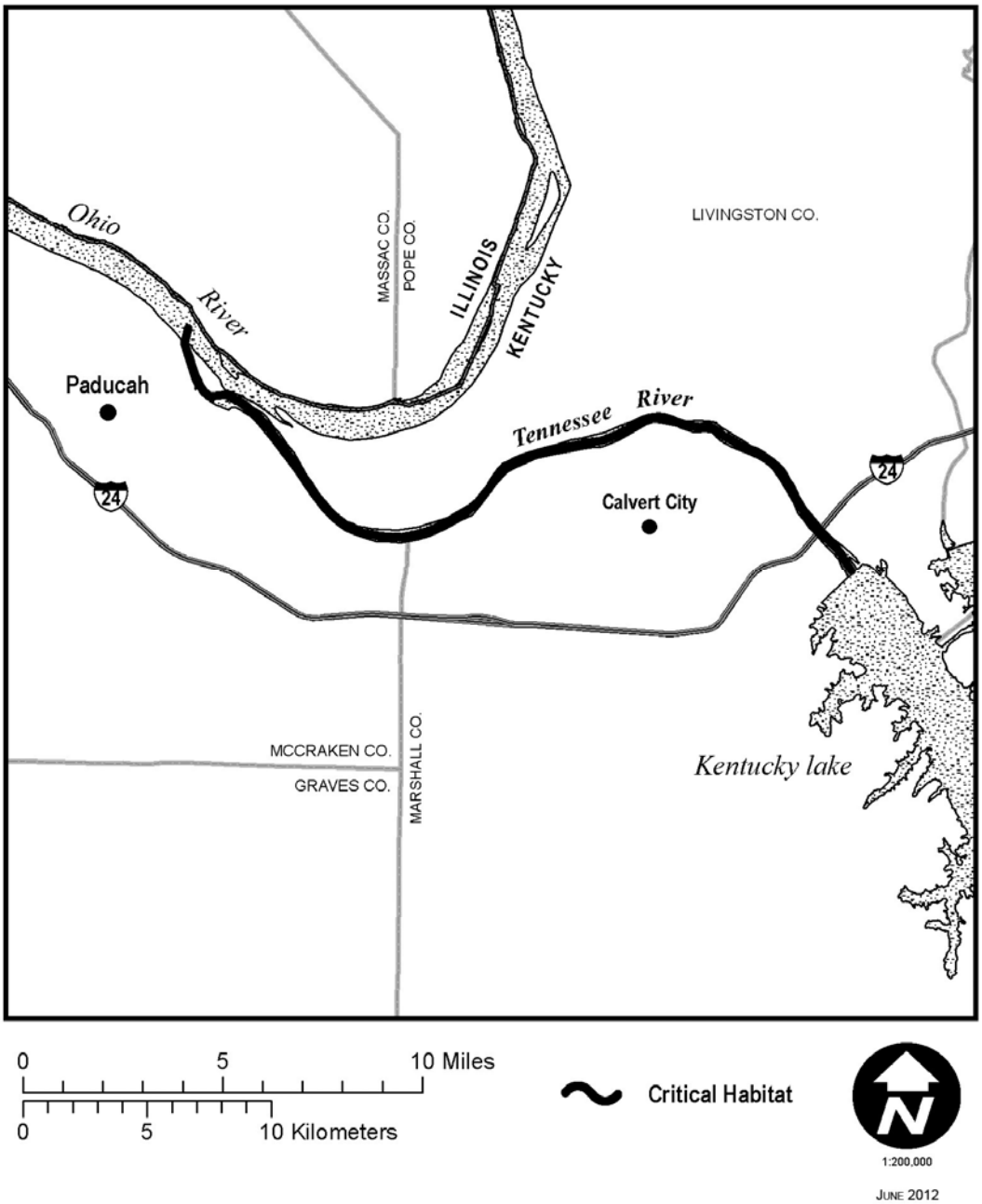
Map for Unit RF19 (Duck River) of critical habitat for Rabbitsfoot



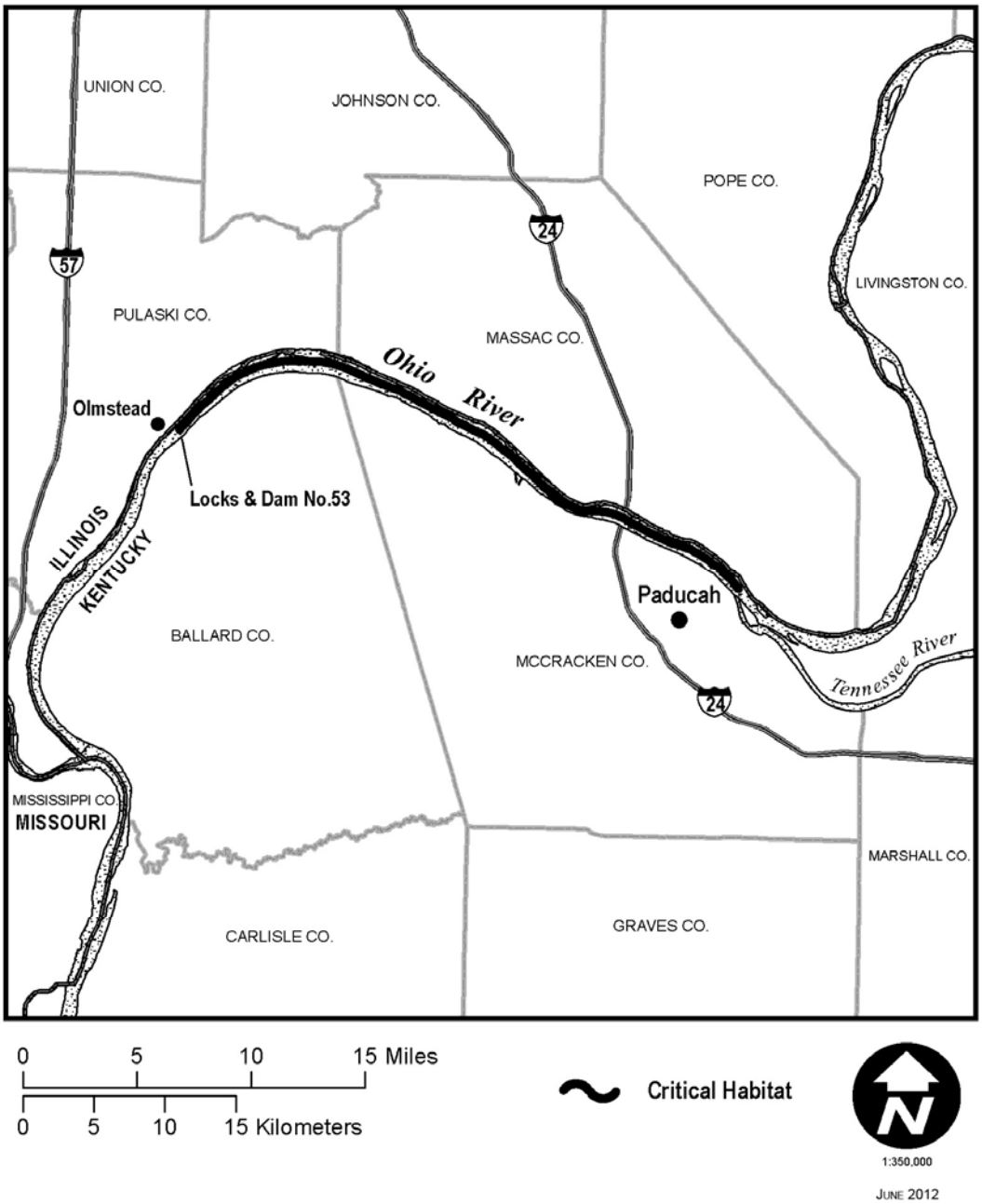
Map for Unit RF20a (Tennessee River) of critical habitat for Rabbitsfoot



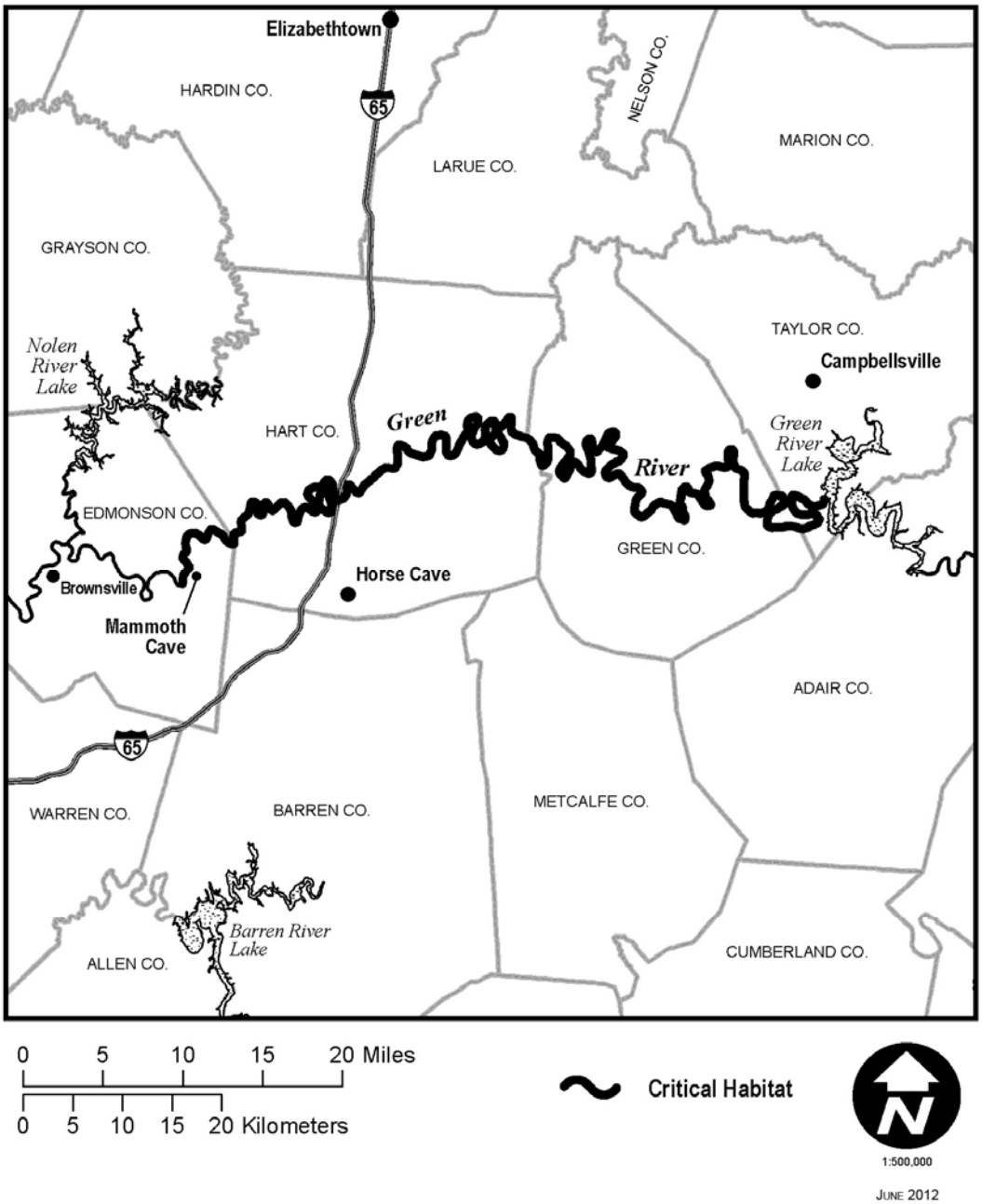
Map for Unit RF20b (Tennessee River) of critical habitat for Rabbitsfoot



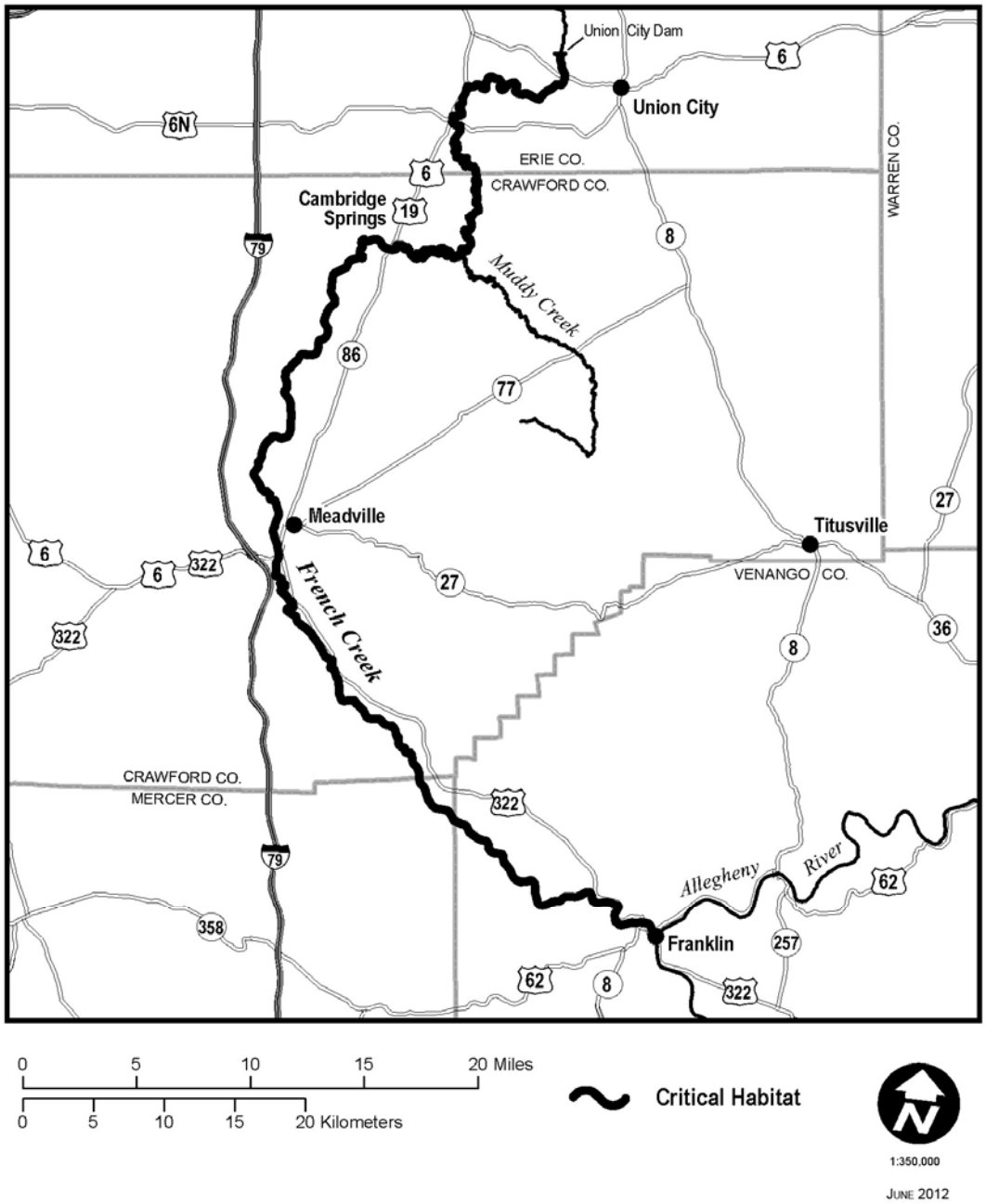
Map for Unit RF21 (Ohio River) of critical habitat for Rabbitsfoot



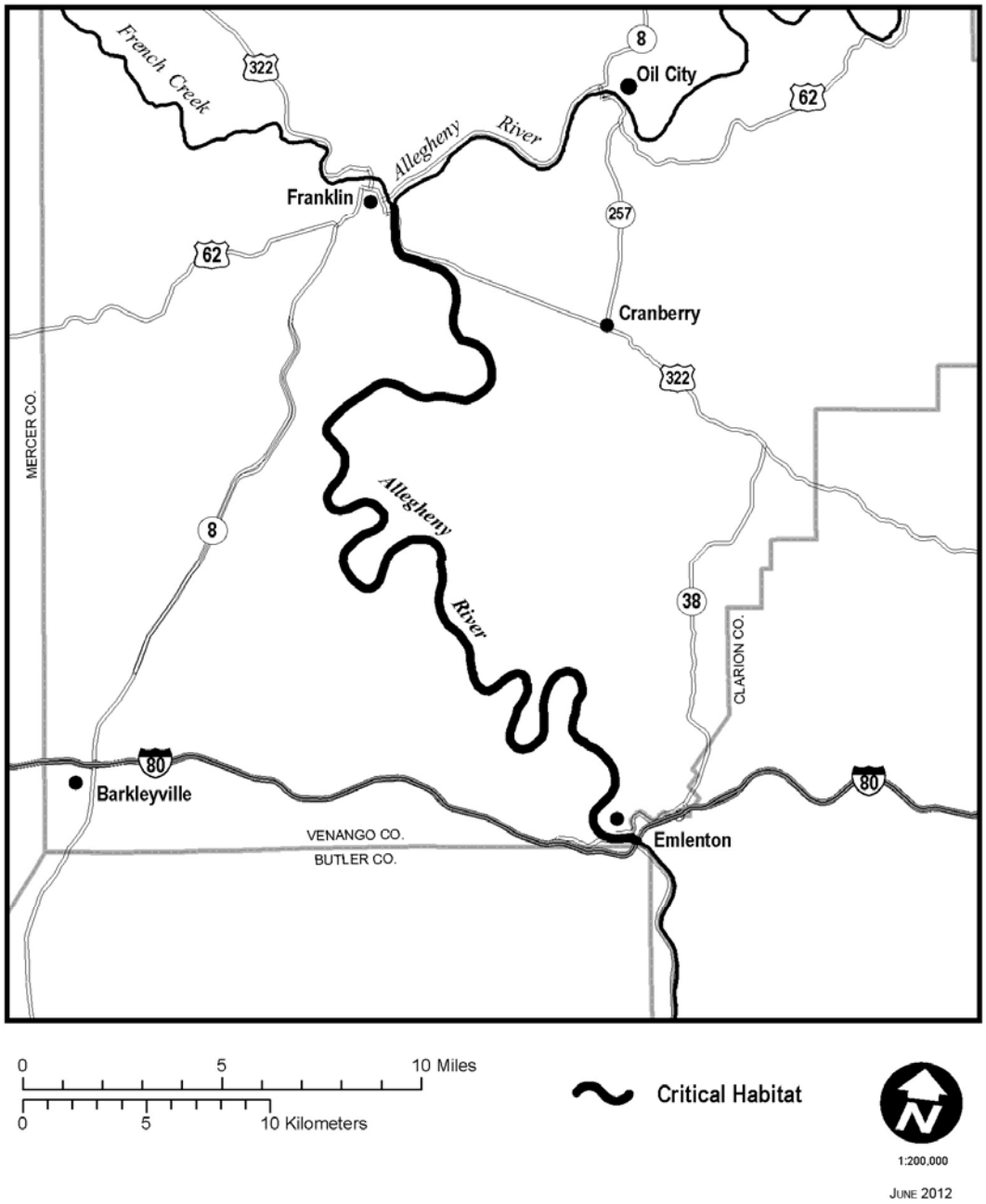
Map for Unit RF22 (Green River) of critical habitat for Rabbitsfoot



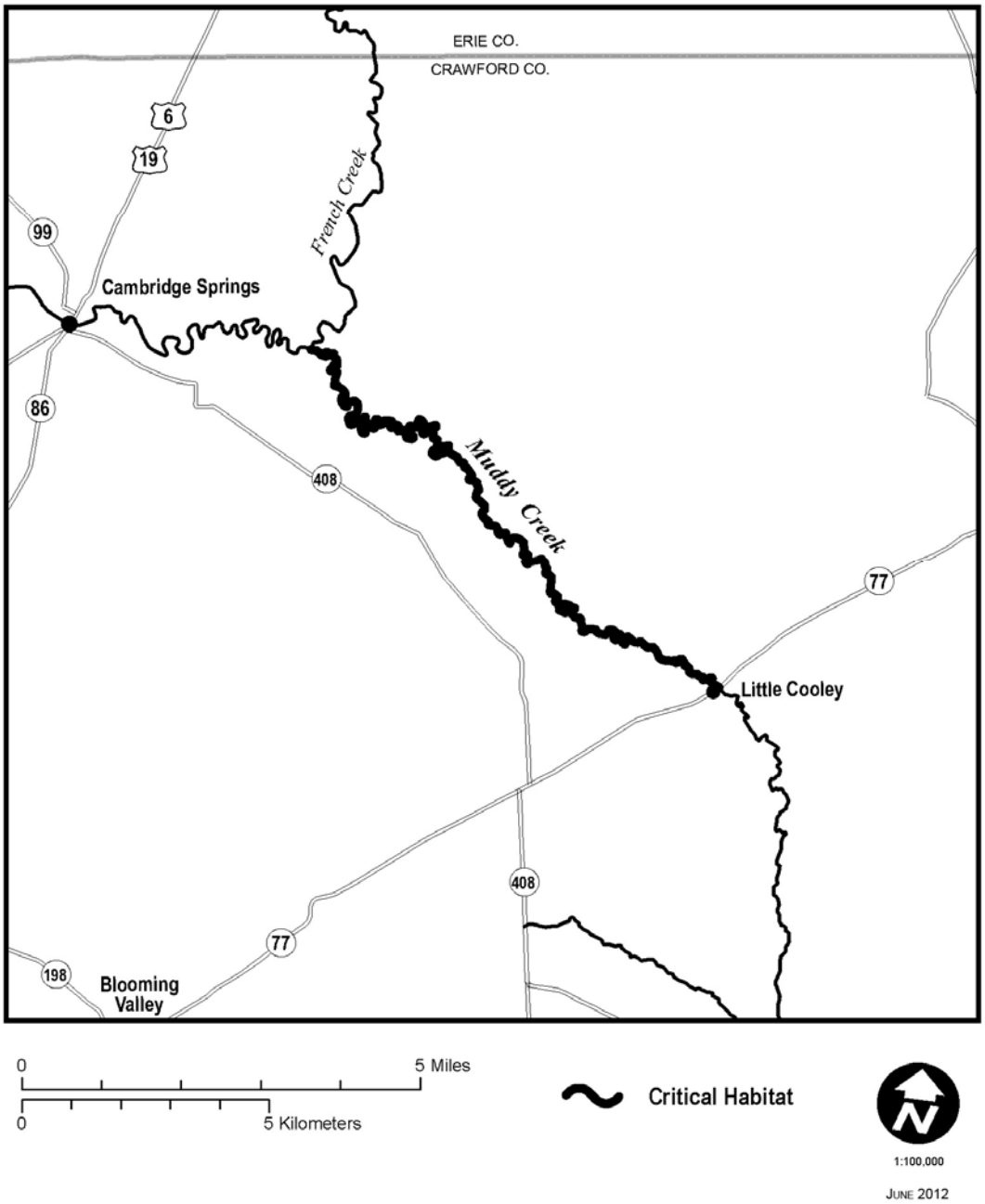
Map for Unit RF23 (French Creek) of critical habitat for Rabbitsfoot



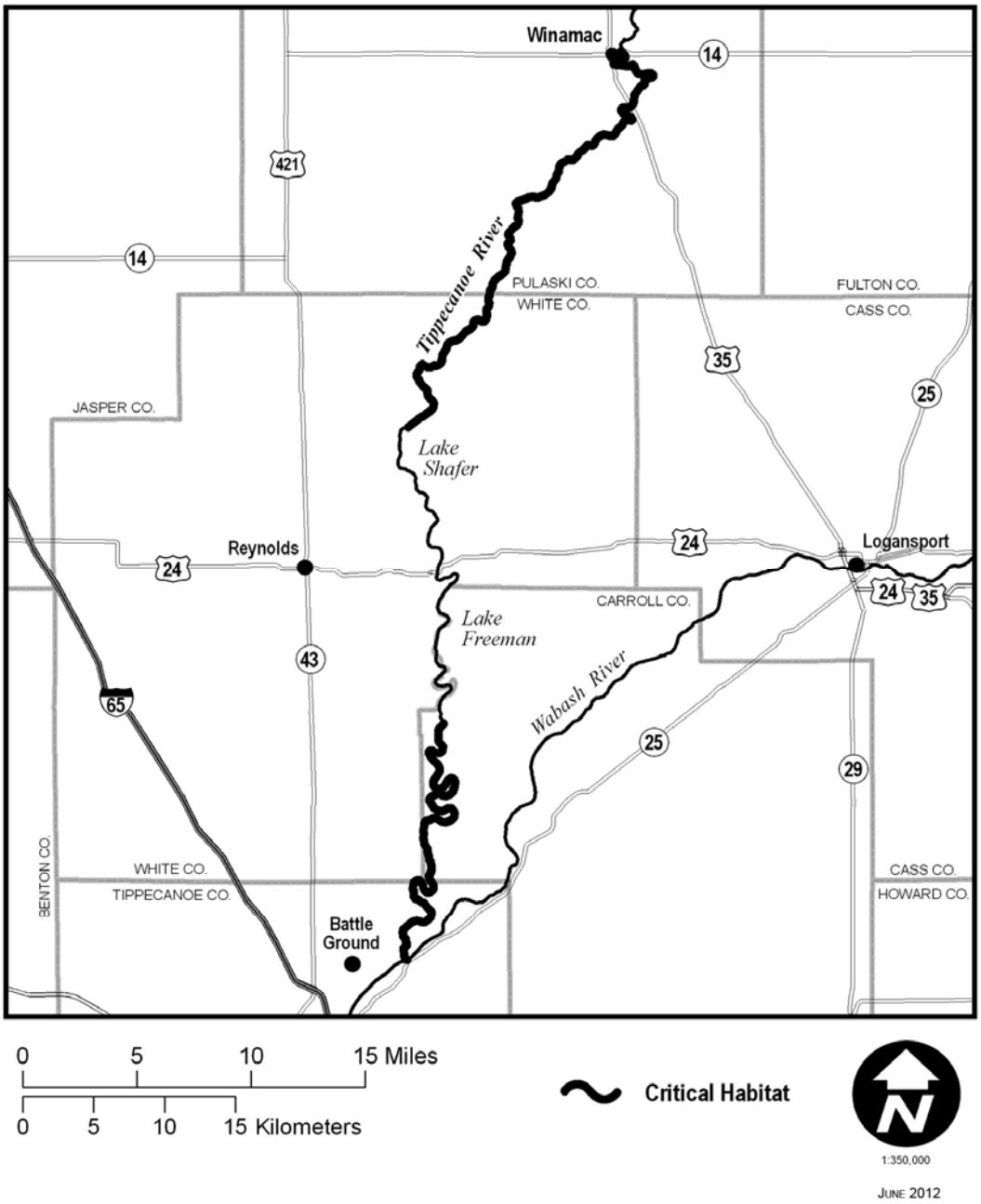
Map of Unit RF24 (Allegheny River) of critical habitat for Rabbitsfoot



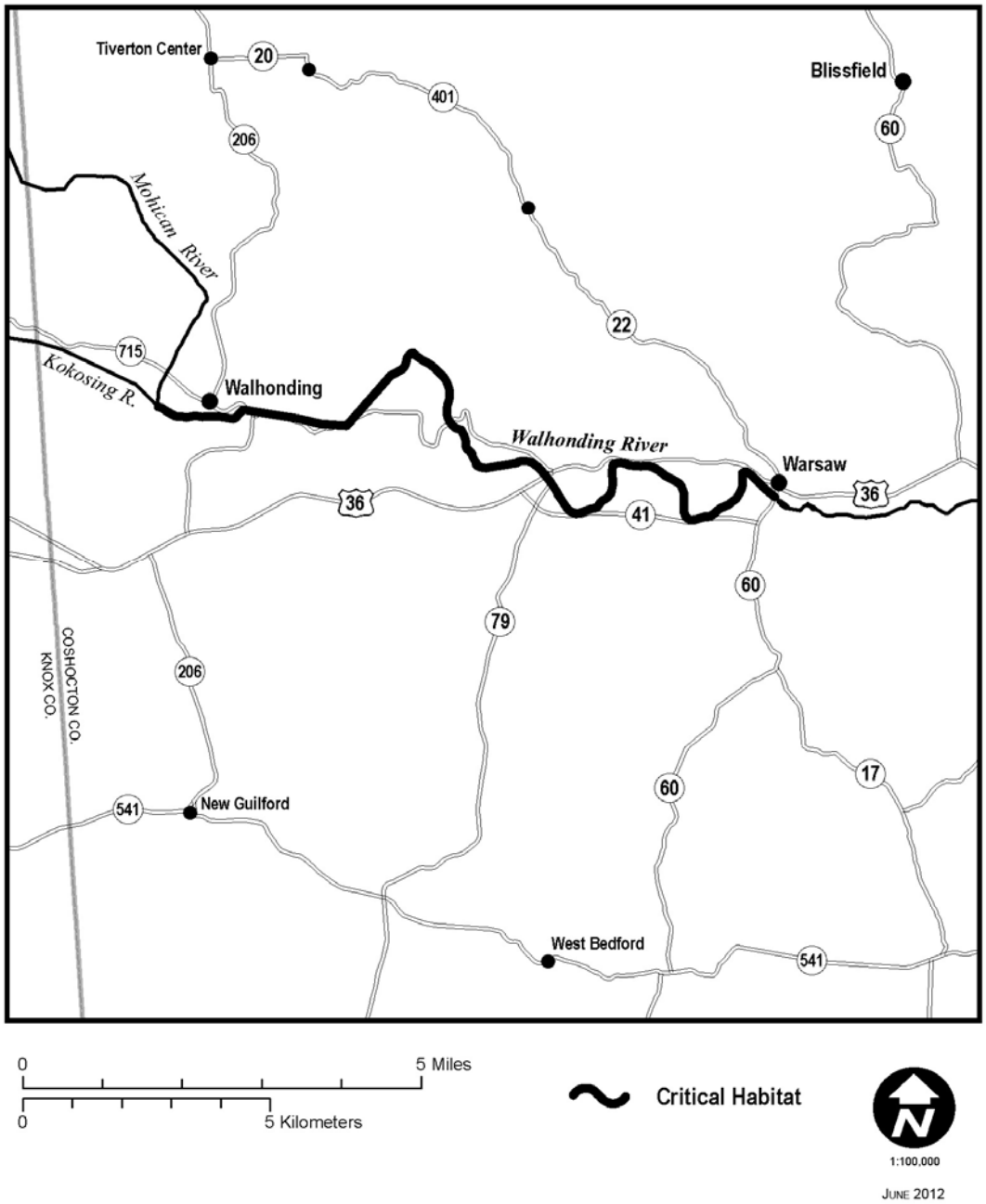
Map of Unit RF25 (Muddy Creek) of critical habitat for Rabbitsfoot



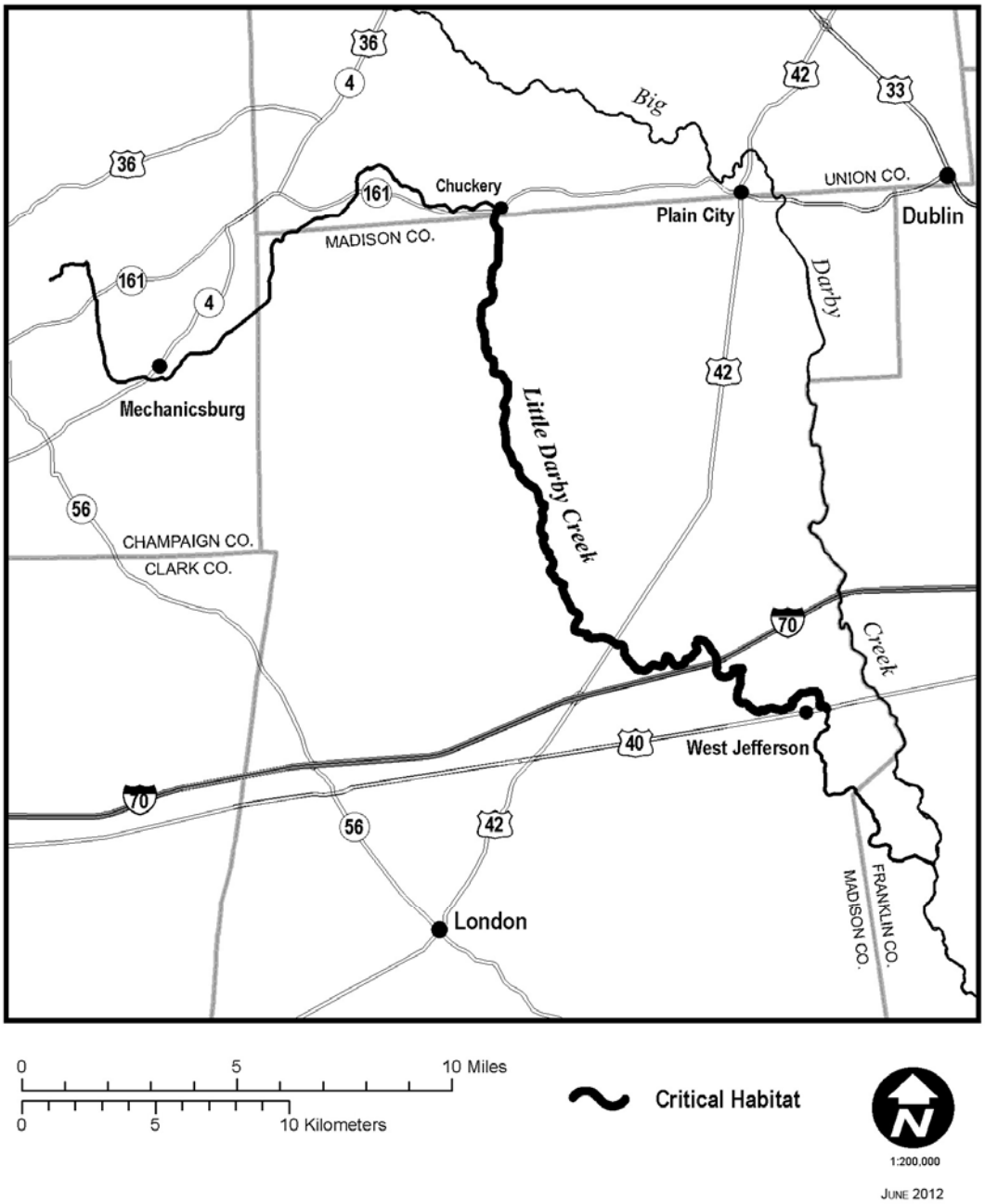
Map of Unit RF26 (Tippecanoe River) of critical habitat for Rabbitsfoot



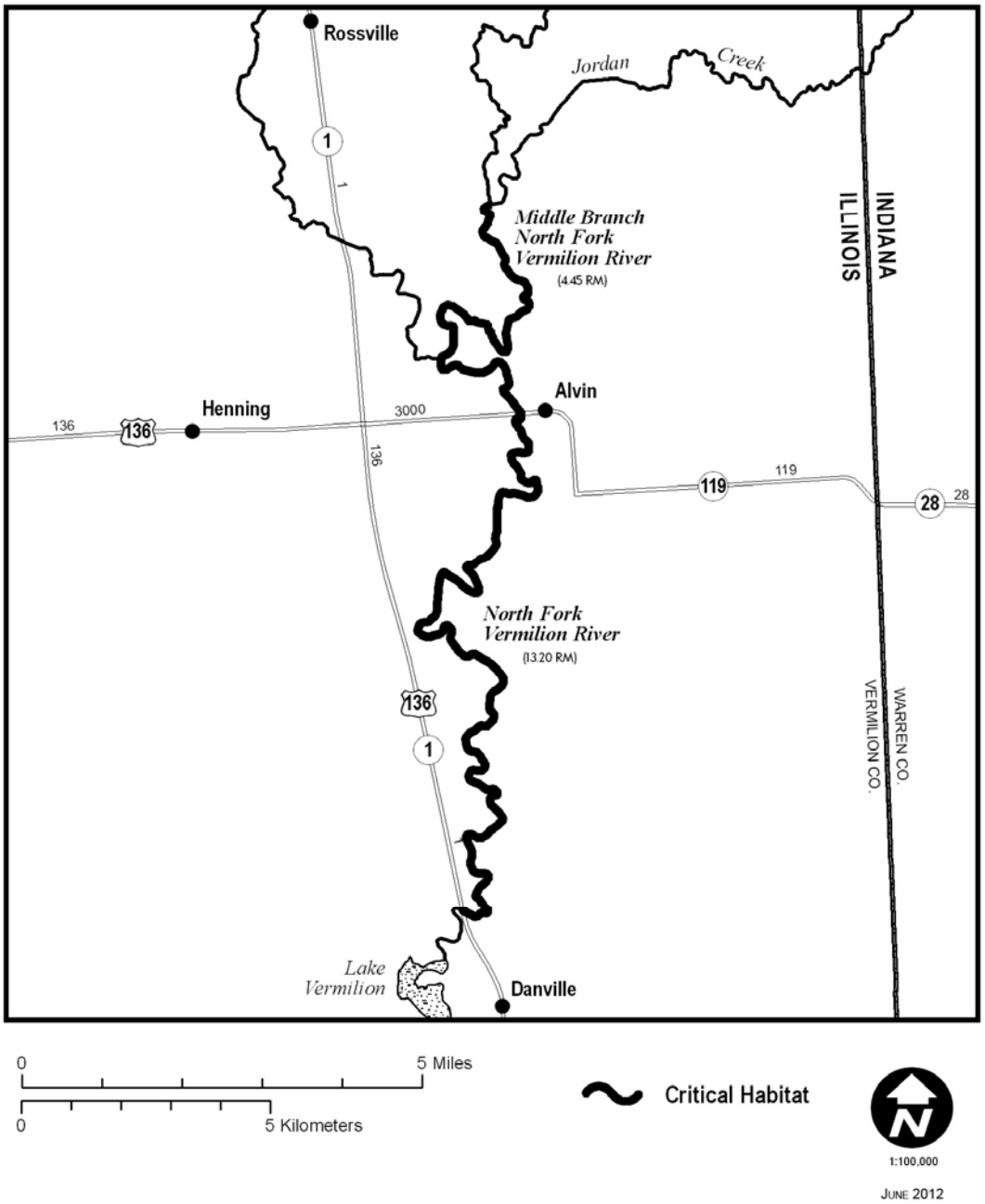
Map of Unit RF27 (Walhonding River) of critical habitat for Rabbitsfoot



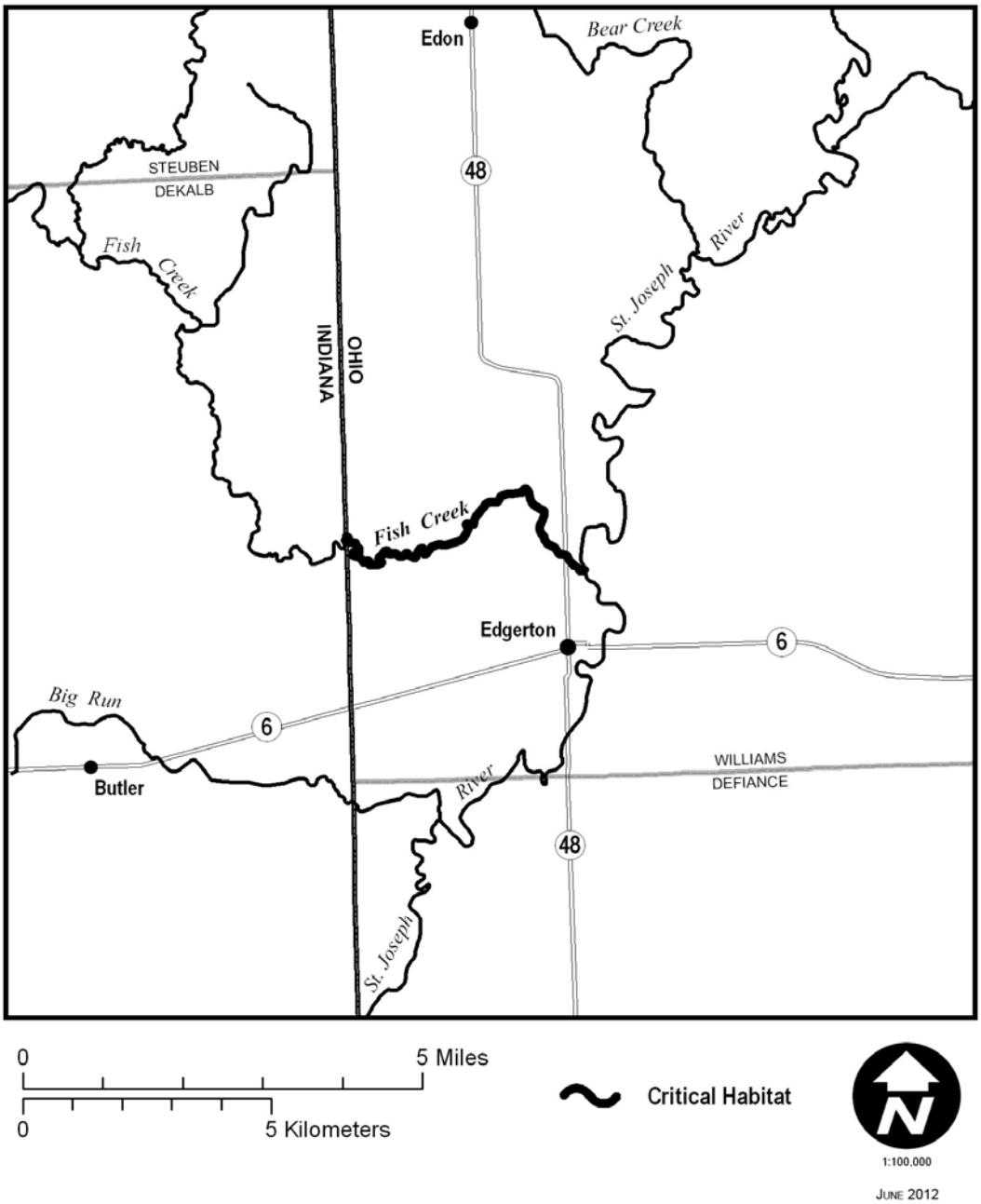
Map of Unit RF28 (Little Darby Creek) of critical habitat for Rabbitsfoot



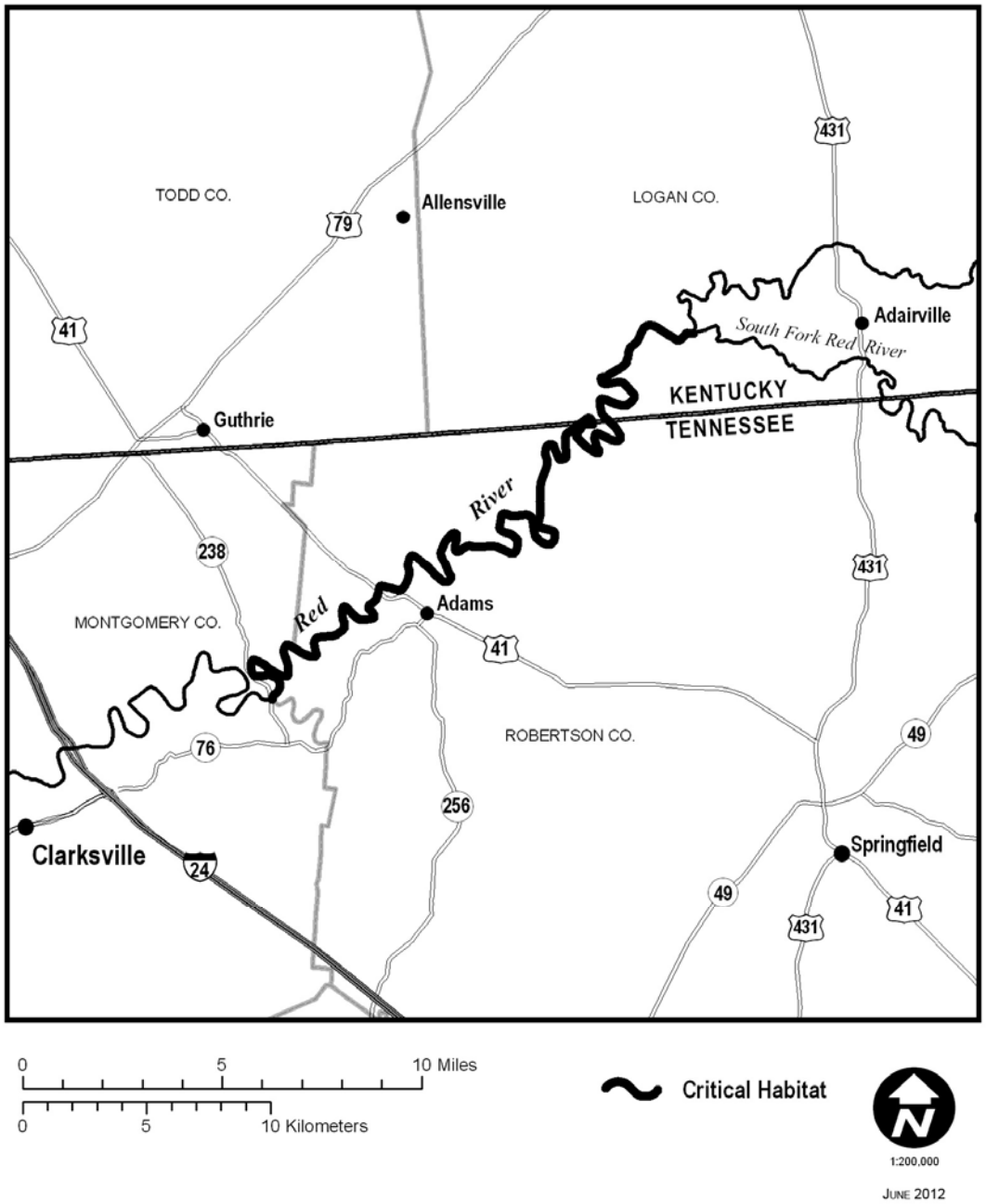
Map for Unit RF29 (North Fork Vermilion River and Middle Branch Vermilion River) of critical habitat for Rabbitsfoot



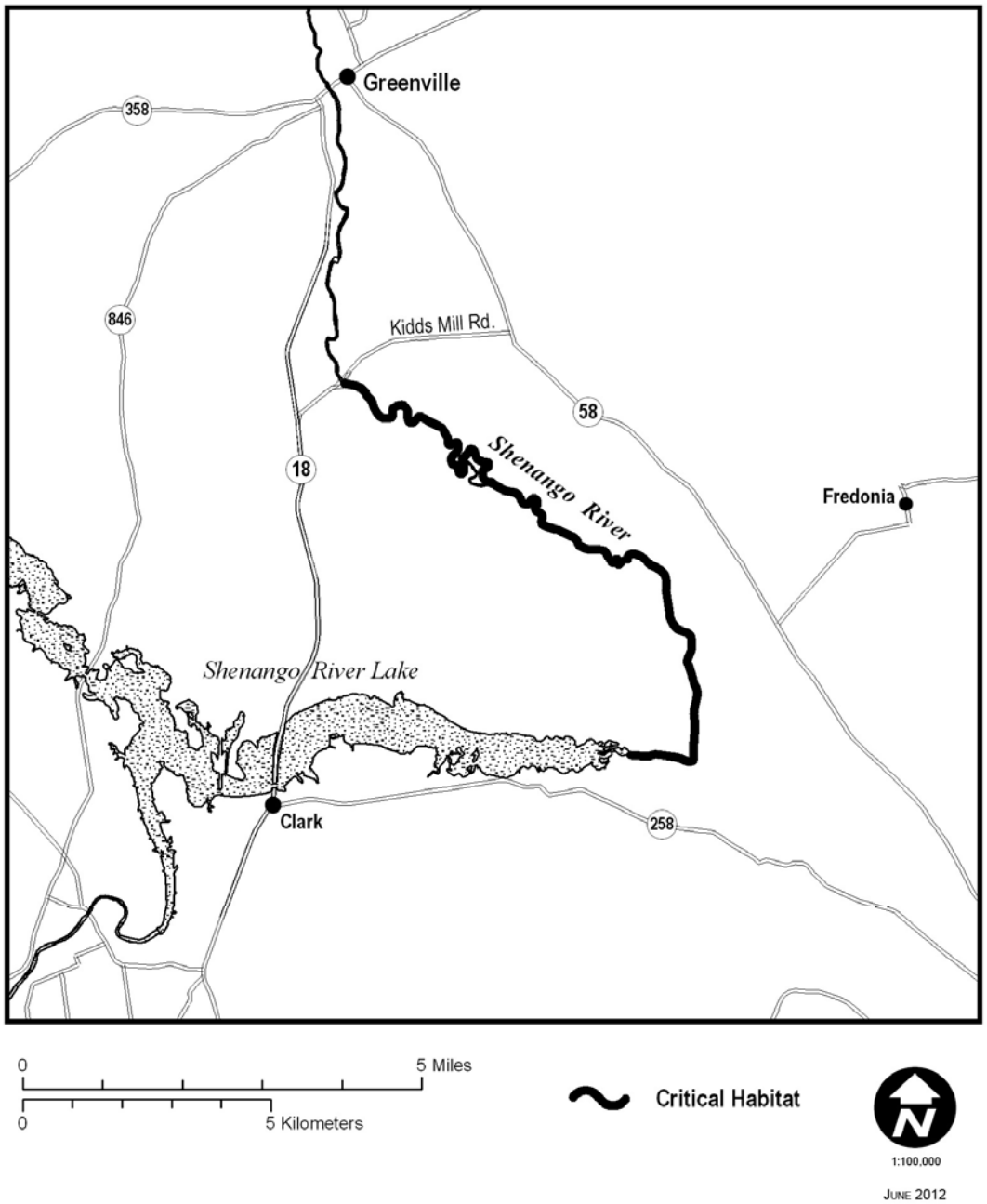
Map of Unit RF30 (Fish Creek) of critical habitat for Rabbitsfoot



Map of Unit RF31 (Red River) of critical habitat for Rabbitsfoot



Map of Unit RF32 (Shenango River) of critical habitat for Rabbitsfoot



APPENDIX 2

STUDY AREA LOCATION DESCRIPTIONS

APPENDIX 2. STUDY AREA LOCATION DESCRIPTIONS

River Basin	State	Stream	Study Area	HUC 12 Number
Arkansas River	MO,KS	Shoal Creek, Spring River, North Fork Spring River	Unit NM3/NM4/NM5/RF 1	110702070701, 110702070702, 110702070506, 110702070502, 110702070508, 110702070304, 110702070504, 110702070503, 110702070106, 110702070505, 110702070607, 110702070608, 110702070904, 110702070105, 110702070703, 110702070706, 110702070802, 110702070102, 110702070704, 110702070801, 110702070405, 110702070705, 110702070902, 110702070601, 110702070602, 110702070803, 110702070806, 110702070101, 110702070104, 110702070103, 110702070603, 110702070604, 110702070107, 110702070901, 110702070606, 110702070605, 110702070501, 110702070805, 110702070507, 110702070305, 110702070303, 110702070307, 110702070804, 110702070310, 110702070301, 110702070404, 110702070311, 110702070306, 110702070205, 110702070201, 110702070302, 110702070402, 110702070401, 110702070403, 110702070206, 110702070308, 110702070202, 110702070204, 110702070309, 110702070203
Arkansas River	OK	Verdigris River	Unit RF2	110701070208, 110701060603, 110701070302, 110701070203, 110701060504, 110701070102, 110701060604, 110701060606, 110701070210, 110701070206, 110701070211, 110701070212, 110701060502, 110701070305, 110701070205, 110701070403, 110701060505, 110701060409, 110701060507, 110701060506, 110701060703, 110701060607, 110701060701, 110701060605, 110701060704, 110701060702, 110701070207, 110701060503, 110701060707, 110701050201, 110701070213, 110701070306, 110701070303, 110701060710, 110701050202, 110701060708, 110701070104, 110701030508, 110701070401, 110701060709, 110701060711, 110701050204, 110701060601, 110701060602, 110701070101, 110701050205, 110701070209, 110701070103, 110701050203, 110701070105, 110701070201, 110701060705, 110701070202, 110701070404, 110701070301, 110701070405, 110701070204, 110701070402, 110701070214, 110701070307, 110701060501, 110701070304, 110701060706

River Basin	State	Stream	Study Area	HUC 12 Number
Arkansas River	KS	Neosho River	Unit NM7/RF3	110702050501, 110702050304, 110702050205, 110702050403, 110702050404, 110702050602, 110702040202, 110702050402, 110702040104, 110702050303, 110702050603, 110702050107, 110702040502, 110702050201, 110702050105, 110702050302, 110702040501, 110702050203, 110702040105, 110702050103, 110702040406, 110702050106, 110702040505, 110702050104, 110702050301, 110702050101, 110702050108, 110702050109, 110702040305, 110702040206, 110702050204, 110702040306, 110702040303, 110702040404, 110702040201, 110702050102, 110702040401, 110702040504, 110702040403, 110702040503, 110702040407, 110702050401, 110702040405, 110702040402, 110702040204, 110702040304
Cumberland River	KY, TN	Red River	Unit RF31	051302060704, 051302060202, 051302060702, 051302060201, 051302060705, 051302060701, 051302060301, 051302060101, 051302060102, 051302060305, 051302060304, 051302060303, 051302060204, 051302060203, 051302060703, 051302060205, 051302060302
Illinois River	AR, OK	Illinois River	Unit NM1	111101030602, 111101030504, 111101030202, 111101030606, 111101030607, 111101030103, 111101030204, 111101030704, 111101030603, 111101030702, 111101030605, 111101030102, 111101030403, 111101030706, 111101030604, 111101030402, 111101030707, 111101030201, 111101030601, 111101030703, 111101030101, 111101030303, 111101030301, 111101030501, 111101030705, 111101030701, 111101030305, 111101030203, 111101030502, 111101030304, 111101030801, 111101030802, 111101030708, 111101030803, 111101030401, 111101030503, 111101030804, 111101030709, 111101030302, 111101030710
Lower Great Lakes	OH	Fish Creek	Unit RF30	041000030401, 041000030402, 041000030403, 041000030404, 041000030405, 041000030406
Lower Mississippi River	MO	St. Francis River	Unit RF14	080202020403, 080202020407, 080202020302, 080202020101, 080202020304, 080202020210, 080202020206, 080202020208, 080202020506, 080202020207, 080202020301, 080202020209, 080202020503, 080202020507, 080202020102, 080202020303, 080202020402, 080202020406, 080202020501, 080202020103, 080202020502, 080202020205, 080202020405, 080202020404, 080202020204, 080202020203, 080202020401, 080202020201, 080202020202
Lower Mississippi River	MS	Big Sunflower River	Unit RF15	080302070200, 080302070100, 080302070300, 080302070500, 080302070400

River Basin	State	Stream	Study Area	HUC 12 Number
Lower Mississippi River	MS	Big Black River	Unit RF17	080602020203, 080602010106, 080602010501, 080602020303, 080602010201, 080602020507, 080602020205, 080602020702, 080602020503, 080602020506, 080602020604, 080602020405, 080602010203, 080602010904, 080602020704, 080602010703, 080602010604, 080602020603, 080602010403, 080602020707, 080602021002, 080602020905, 080602020102, 080602020904, 080602020701, 080602010303, 080602020705, 080602010801, 080602010705, 080602010503, 080602010404, 080602010605, 080602010306, 080602010701, 080602010702, 080602010202, 080602010304, 080602010804, 080602020101, 080602020403, 080602010602, 080602010102, 080602010802, 080602010902, 080602010901, 080602010601, 080602020601, 080602010502, 080602010803, 080602010704, 080602020103, 080602010402, 080602020401, 080602010401, 080602020803, 080602020501, 080602020202, 080602010603, 080602020304, 080602020508, 080602020703, 080602020302, 080602020706, 080602020301, 080602010302, 080602020407, 080602021001, 080602020504, 080602020804, 080602020801, 080602020802, 080602010105, 080602020903, 080602020901, 080602010101, 080602020902, 080602010103, 080602010301, 080602020602, 080602020201, 080602020204, 080602010305, 080602010104, 080602020404, 080602020406, 080602020402, 080602020505, 080602010903, 080602020502
Neosho River	MO, OK	Elk River	Unit NM2	110702080101, 110702080102, 110702080103, 110702080104, 110702080105, 110702080106, 110702080107, 110702080108, 110702080109, 110702080201, 110702080202, 110702080203, 110702080204, 110702080205, 110702080206, 110702080301, 110702080302, 110702080303, 110702080304, 110702080305, 110702080306, 110702080307, 110702080401, 110702080402, 110702080403, 110702080501, 110702080502, 110702080503, 110702080504, 110702080505, 110702080506
Neosho River	KS	Cottonwood River	Unit NM8	110702030101, 110702030204, 110702020203, 110702030103, 110702030401, 110702030205, 110702020106, 110702020405, 110702020204, 110702030104, 110702020108, 110702020403, 110702020302, 110702020303, 110702020404, 110702030303, 110702020401, 110702030304, 110702020107, 110702020205, 110702030202, 110702030203, 110702020402, 110702030302, 110702030301, 110702030201, 110702020202, 110702020201, 110702020301, 110702030102, 110702030305

River Basin	State	Stream	Study Area	HUC 12 Number
Ohio River, Cumberland River	IL, KY	Ohio River	Unit RF21	051402060102, 051402060101, 051402030905, 051402060202, 051402060701, 051402060201, 051402060506, 051402060504, 051402060505, 051402060401, 051302050708, 060400051005, 051302050805, 051302050806, 051302050807, 051402060304, 060400060502, 051402060303, 051402060301, 051402060302, 051302050802, 051302050803, 051302050804, 051302050801, 051402060702, 051402060509, 051402060507, 051402060508, 051402060402, 051402060503, 051402060502, 051402060501
Ohio River	KY	Green River	Unit RF22	051100010308, 051100010412, 051100011301, 051100010803, 051100010601, 051100010205, 051100010605, 051100010502, 051100010501, 051100010705, 051100010806, 051100010702, 051100010602, 051100010606, 051100010404, 051100010709, 051100010403, 051100010603, 051100011302, 051100010708, 051100010804, 051100010410, 051100010406, 051100010607, 051100010801, 051100010604, 051100010409, 051100010609, 051100010704, 051100010701, 051100010706
Ohio River	PA	French Creek, Muddy Creek	Unit RF23/RF25	050100040803, 050100040905, 050100040909, 050100040702, 050100040906, 050100040701, 050100040603, 050100040602, 050100040904, 050100040601, 050100040903, 050100040902, 050100040402, 050100040703, 050100040807, 050100040802, 050100040801, 050100040501, 050100040901, 050100040806, 050100040907, 050100040804, 050100040502, 050100040908, 050100040805, 050100040303, 050100040401, 050100040201, 050100040202
Ohio River	PA	Allegheny River	Unit RF24	050100011001, 050100011002, 050100011003, 050100011004, 050100011101, 050100011102, 050100011103, 050100011104, 050100011105, 050100011106, 050100011107, 050100011108, 050100011207, 050100011209, 050100020207, 050100020301, 050100020302, 050100020303, 050100020304, 050100020305, 050100020407, 050100020501, 050100020502, 050100020503, 050100020504, 050100020505, 050100020506, 050100020507, 050100020508, 050100030101, 050100030102, 050100030103, 050100030104, 050100030105, 050100030106, 050100030201, 050100030202, 050100030301, 050100030302, 050100030303, 050100030304, 050100030305, 050100030401, 050100030402, 050100030403, 050100030404, 050100030405, 050100030406, 050100030501, 050100030502, 050100030503, 050100030601, 050100030602, 050100030603, 050100030604, 050100030605, 050100030606, 050100030701, 050100030702, 050100030703, 050100030802, 050100030803, 050100030804, 050100030901, 050100030902, 050100030903, 050100030904, 050100030905, 050100030906, 050100030907, 050100030908, 050100030909,

River Basin	State	Stream	Study Area	HUC 12 Number
Ohio River	IN	Tippecanoe River	Unit RF26	051201060201, 051201060202, 051201060203, 051201060204, 051201060205, 051201060301, 051201060302, 051201060303, 051201060304, 051201060305, 051201060401, 051201060402, 051201060403, 051201060404, 051201060405, 051201060406, 051201060407, 051201060408, 051201060409, 051201060501, 051201060502, 051201060503, 051201060504, 051201060505, 051201060506, 051201060507, 051201060508, 051201060509, 051201060601, 051201060602, 051201060603, 051201060604, 051201060605, 051201060606, 051201060607, 051201060608, 051201060701, 051201060702, 051201060703, 051201060704, 051201060705, 051201060801, 051201060802, 051201060803, 051201060804, 051201060805, 051201060901, 051201060902, 051201060903, 051201060904, 051201061001, 051201061002, 051201061003, 051201061004, 051201061005, 051201061006, 051201061007, 051201061008, 051201061201, 051201061202, 051201061208, 051201061302, 051201061303, 051201061305, 051201061306, 051201061307, 051201061308, 051201061309
Ohio River	OH	Walhonding River	Unit RF27	050400020203, 050400020204, 050400020205, 050400020404, 050400020405, 050400020501, 050400020502, 050400020503, 050400020601, 050400020602, 050400020603, 050400020604, 050400020605, 050400020606, 050400020701, 050400020702, 050400020703, 050400020801, 050400020802, 050400020803, 050400020804, 050400020805, 050400020806, 050400030101, 050400030102, 050400030103, 050400030201, 050400030202, 050400030203, 050400030301, 050400030302, 050400030303, 050400030304, 050400030305, 050400030306, 050400030307, 050400030402, 050400030403, 050400030901, 050400030902, 050400030905
Ohio River	OH	Little Darby Creek	Unit RF28	050600012001, 050600012002, 050600012003, 050600012004, 050600012005, 050600012006
Ohio River	IL	North Fork Vermilion River and Middle Branch North Fork Vermilion River	Unit RF29	051201090701, 051201090702, 051201090703, 051201090704, 051201090705, 051201090706, 051201090801, 051201090802, 051201090803, 051201090804, 051201090805
Ohio River	PA	Shenango River	Unit RF32	050301020102, 050301020104, 050301020105, 050301020201, 050301020202, 050301020203, 050301020401, 050301020402, 050301020403, 050301020404

River Basin	State	Stream	Study Area	HUC 12 Number
Tennessee River	KY	Tennessee River	Unit RF20b	051302050708, 060400051005, 051302050806, 051302050807, 060400060502, 060400060505, 060400060504, 060400060405, 060400060503, 060400060501, 060400060304, 060400060305, 060400060404, 060400060303, 060400060403, 060400060302, 051302050804, 060400060102, 060400060402, 060400060401, 060400060105, 060400060103 060400060101, 060400060301, 060400060205, 060400060204, 060400060203, 060400060104, 060400060202, 060400060201
Red River	AR	Ouachita River	Unit RF4a	080401010206, 080401010301, 080401010205, 080401010104, 080401010302, 080401010102, 080401010204, 080401010201, 080401010103, 080401010202, 080401010203, 080401010101, 080401010105
Red River	AR	Ouachita River	Unit RF4b	080401030507, 080401030604, 080401030605, 080401020905, 080401030601, 080401020904, 080401030705, 080401020705, 080401030701, 080401030702, 080401030802, 080401020704, 080401020906, 080401030809, 080401030902, 080401030903, 080401030305, 080401030901, 080401030302, 080401030508, 080401030807, 080401020901, 080401030303, 080401030906, 080401030905, 080401020902, 080401030304, 080401030703, 080401030704, 080401030602, 080401030606, 080401030907, 080401030603, 080401020806, 080401030908, 080401020804, 080401020802, 080401020801, 080401020903, 80401020108, 080401020103, 080401020102, 080401020104, 080401020101, 080401030904, 080401020805, 080401020803, 080401030407, 080401020605, 080401030406, 080401020505, 080401030503, 080401030805, 080401030405, 080401020701. 080401030801, 080401020506, 80401030501, 080401020502, 080401020601, 080401030803, 080401030804, 080401020604, 080401030402, 080401020504, 080401020501, 080401030403, 080401030401, 080401020503, 080401020109, 080401020106, 080401020105, 080401020107, 080401030404, 080401030502, 080401020406, 080401030505, 080401030806, 080401020602, 080401030301, 080401030504, 080401030201, 080401030202, 080401030506, 080401030107, 080401030808, 080401020607, 080401020702, 080401020703, 080401020606, 080401020603, 080401030203

River Basin	State	Stream	Study Area	HUC 12 Number
Red River	AR	Saline River	Unit RF5	080402040503, 080402040501, 080402040205, 080402040204, 080402040502, 080402030501, 080402040403, 080402040303, 080402040202, 080402040504, 080402040402, 080402040304, 080402030101, 080402030806, 080402040406, 080402040305, 080402030405, 080402030504, 080402030603, 080402040401, 080402040306, 080402030804, 080402040101, 080402030805, 080402030808, 080402030901, 080402030403, 080402040405, 080402040203, 080402030902, 080402030807, 080402040506, 080402040104, 080402040505, 080402040201, 080402030502, 080402030406, 080402030803, 080402030305, 080402030103, 080402040302, 080402040301, 080402030903, 080402040102, 080402040103, 080402030503, 080402030303, 080402030702, 080402030302, 080402030202, 080402040404, 080402030703, 080402030402, 080402030604, 080402040206, 080402030801, 080402030301, 080402030102, 080402030304, 80402030401, 080402030201, 080402030701, 080402030203, 080402030404, 080402030802, 080402030602, 080402030601, 080402030704
Red River	AR, OK	Little River	Unit RF6	111401070402, 111401090101, 111401080308, 111401070210, 111401070309, 111401070208, 111401070207, 111401080307, 111401070206, 111401070404, 111401070408, 111401070307, 111401070204, 111401070209, 111401070403, 111401070407, 111401070205, 111401070409, 111401090302, 111401070406, 111401090301, 111401090304, 111401070201, 111401070203, 111401090103, 111401090501, 111401090105, 111401090106, 111401090108, 111401070401, 111401090503, 111401070308, 111401070202, 111401090303, 111401070405, 111401090602, 111401090107, 111401090603, 111401090601, 111401090104, 111401090102, 111401090502
Tennessee River	AL, MS	Bear Creek	Unit RF16	060300060207, 060300060204, 060300060301, 060300060106, 060300060302, 060300060304, 060300060103, 060300060105, 060300060104, 060300060206
Tennessee River	AL	Paint Rock River	Unit RF18	060300020104, 060300020103, 060300020204, 060300020102, 060300020105, 060300020201, 060300020203, 060300020202, 060300020101, 060300020107, 060300020106

River Basin	State	Stream	Study Area	HUC 12 Number
Tennessee River	TN	Duck River	Unit RF19	060400020603, 060400030507, 060400020501, 060400030102, 060400030302, 060400020305, 060400030506, 060400030501, 060400020602, 060400020703, 060400020601, 060400030303, 060400030402, 060400030704, 060400030301, 060400020502, 060400030101, 060400020707, 060400030902, 060400030203, 060400020702, 060400020705, 060400030502, 060400030503, 060400030202, 060400030504, 060400030401, 060400030201, 060400030103, 060400030104, 060400020401, 060400030602, 060400030702, 060400030901, 060400030903, 060400030904, 060400020304, 060400030701, 060400030703, 060400020301, 060400020302, 060400020105, 060400020202, 060400020201, 060400030601, 060400020704, 060400020203, 060400030505, 060400030705, 060400030508, 060400030509, 060400030403, 060400020404, 060400020701, 060400020403, 060400020303, 060400020307, 060400020306, 060400020402, 060400020706
Tennessee River	TN	Tennessee River	Unit RF20a	060400010201, 060400010203, 060400010504, 060400010501, 060400010502, 060400010503, 060400010202
Verdigris River	KS	Fall and Verdigris Rivers	Unit NM6	110701010402, 110701010501, 110701020302, 110701010408, 110701010407, 110701010401, 110701010404, 110701010405, 110701010406, 110701040307, 110701010502, 110701010403, 110701020305, 110701010503, 110701020306, 110701020303, 110701030101, 110701020304, 110701010504, 110701020301, 110701030102
White River	AR	Middle Fork Little Red River	Unit RF7	110100140403, 110100140405, 10100140302, 110100140401, 110100140304, 110100140305, 110100140301, 110100140402, 110100140404, 110100140303
White River	AR	White River	Unit RF8a	110100130403, 110100130303, 110100040704, 110100130103, 110100130602, 110100130603, 110100130102, 110100130101, 110100130203, 110100130301, 110100130503, 110100130502, 110100130404, 110100130601, 110100040703, 110100040706, 110100040702, 110100040705, 110100130202, 110100130402, 110100130302, 110100130401, 110100130104, 110100130501, 110100130201

River Basin	State	Stream	Study Area	HUC 12 Number
White River	AR	White River	Unit RF8b	080203020401, 080203020204, 080203020106, 080203020104, 080203020203, 080203020205, 080203020506, 080203020201, 080203020505, 080203020207, 080203020103, 080203020202, 080203020305, 080203020502, 080203020105, 080203010103, 080203020306, 080203020304, 080203020303, 080203020206, 080203020101, 080203020503, 080203010502, 080203020708, 080203020806, 080203010504, 080203010404, 080203020706, 080203020802, 080203020805, 080203020707, 080203020302, 080203020501, 080203020801, 080203010503, 080203010106, 080203020702, 080203010303, 080203020803, 080203030509, 080203030510, 080203010406, 080203010403, 080203020701, 080203020807, 080203010304, 080203020404, 080203030501, 080203020606, 080203020603, 080203020403, 080203020602, 080203020507, 080203010301, 080203010201, 080203010102, 080203010104, 080203010101, 080203020604, 080203030504, 080203030503, 080203020406, 080203020601, 080203020405, 080203010204, 080203010203, 080203020605, 080203010307, 080203020705, 080203010505, 080203010105, 080203010202, 080203020402, 080203020607, 080203010302, 080203020301, 080203030507, 080203010401, 080203010402, 80203010501, 080203020209, 080203030502, 080203020208, 080203030506, 080203020704, 080203010305, 080203020102, 080203010405, 080203020808, 080203010506, 080203020407, 080203010205, 080203020703, 080203020804, 080203030505, 080203010306

River Basin	State	Stream	Study Area	HUC 12 Number
White River	AR	Black River	Unit RF9	110100070604, 110100080603, 110100080402, 110100070702, 110100110105, 110100110203, 110100110103, 110100110202, 110100080602, 110100080604, 110100070701, 110100080403, 110100080205, 110100110101, 110100110207, 110100080404, 110100070101, 110100080109, 110100070103, 110100080101, 110100070202, 110100080108, 110100070603, 110100070305, 110100080401, 110100110208, 110100070304, 110100070201, 110100070301, 110100070303, 110100070302, 110100070901, 110100110102, 110100080505, 110100070406, 110100080501, 110100070402, 110100070506, 110100080208, 110100080307, 110100080204, 110100070505, 110100080304, 110100080104, 110100080203, 110100080212, 110100080506, 110100070405, 110100080209, 110100080107, 110100080211, 110100080305, 110100090206, 110100080308, 110100080201, 110100070601, 110100080306, 110100070605, 110100070504, 110100080504, 110100080105, 110100080503, 110100080502, 110100070407, 110100080311, 110100080310, 110100070403, 110100080601, 110100110406, 110100080202, 110100080507, 110100070602, 110100080210, 110100080303, 110100080103, 110100090301, 110100070102, 110100090207, 110100090203, 110100070501, 110100070104, 110100080301, 110100080302, 110100080102, 110100080110, 110100090306, 110100070404, 110100070502, 110100080112, 110100090205, 110100080206, 110100080207, 110100080309, 110100090305, 110100070306, 110100070503, 110100090304, 110100090303, 110100090302, 110100070401, 110100080111, 110100080106, 110100070906, 110100080610, 110100110302, 110100080901, 110100070907, 110100070804, 110100090101, 110100080704, 110100110304, 110100070903, 110100070905, 110100110303, 110100110206, 110100110201, 110100080607, 110100080702, 110100110107, 110100110301, 110100110106, 110100080703, 110100070805, 110100071004, 110100110305, 110100110307, 110100080803, 110100110404, 110100071001, 110100090106, 110100080804, 110100090105, 110100080609, 110100090102, 110100110306, 110100110405, 110100090107, 110100071003, 110100080806, 110100080801, 110100080802, 110100071005, 110100080902, 110100080608, 110100080904, 110100110104, 110100110205, 110100080605, 110100080606, 110100080805, 110100090204, 110100090104, 110100070802, 110100110108, 110100070703, 110100071002, 110100090103, 110100070904, 110100110401, 110100090202, 110100110204, 110100070801, 110100080701, 110100110209, 110100110407, 110100070902, 110100080903, 110100070803, 110100110210, 110100110403, 110100090201, 110100110402, 110100080611

River Basin	State	Stream	Study Area	HUC 12 Number
White River	AR	Spring River, South Fork Spring River	Unit RF10/RF11	110100100101, 10100100503, 110100100303, 110100100307, 110100100402, 110100100403, 110100100207, 110100100205, 110100100306, 110100100507, 110100100501, 110100100103, 110100100206, 110100100204, 110100100301, 110100100305, 110100100203, 110100100401, 110100100102, 110100100308, 110100100201, 110100100504, 110100100506, 110100100505, 110100100304, 110100100202, 110100100502, 110100100302
White River	AR	Strawberry River	Unit RF12	110100120203, 110100120104, 110100120402, 110100120103, 110100120405, 110100120403, 110100120504, 110100120501, 110100120102, 110100120502, 110100120307, 110100120304, 110100120101, 110100120207, 110100120306, 110100120401, 110100120206, 110100120305, 110100120303, 110100120302, 110100120205, 110100120204, 110100120301, 110100120202, 110100120404, 110100120503, 110100120201
White River	AR	Buffalo River	Unit RF13	110100050103, 110100050508, 110100050101, 110100050501, 110100050302, 110100050204, 110100050403, 110100050306, 110100050206, 110100050205, 110100050201, 110100050502, 110100050504, 110100050402, 110100050307, 110100050407, 110100050309, 110100050503, 110100050408, 110100050207, 110100050104, 110100050406, 110100050409, 110100050507, 110100050303, 110100050405, 110100050304, 110100050202, 110100050404, 110100050102, 110100050505, 110100050305, 110100050401, 110100050506, 110100050301, 110100050308, 110100050203

APPENDIX 3

SOCIOECONOMIC DATA

2012 Land Ownership Percentages for the Study Areas by River Basin

2006 Land Use Percentages for the Study Areas by River Basin

Communities and Their Populations nearest Each Proposed Critical Habitat Unit

2012 Land ownership percentages for the study areas by river basin

River Basin and Study Area	Acreage	Private[1]	Federal[2]	State[2]	Local[2]	Joint[2,3]	Private Conservation[1,2]
Arkansas River							
NM3/NM4/NM5/RF1	4,574,691	98.82%	0.01%	1.13%	-	-	0.03%
NM7/RF3	1,450,337	98.24%	0.86%	0.89%	-	-	0.01%
RF2	1,743,488	94.89%	1.43%	0.92%	0.21%	-	2.55%
Study Areas Subtotal	1,380,865	97.41%	0.76%	0.98%	0.06%	-	0.79%
Cumberland River							
RF21	203,023	99.97%	-	-	-	-	0.03%
RF31	454,096	99.98%	-	0.02%	-	-	-
Study Areas Subtotal	657,118	99.98%	-	0.01%	-	-	0.01%
Illinois River							
NM1	846,198	94.52%	3.62%	0.16%	-	-	1.70%
Lower Great Lakes							
RF30	69,786	97.57%	-	0.26%	-	-	2.16%
Lower Mississippi River							
RF14	702,197	84.05%	12.42%	3.53%	-	-	0.00%
RF15	569,009	100.00%	-	-	-	-	-
RF17	1,985,453	99.68%	0.29%	0.03%	-	-	-
Study Areas Subtotal	3,256,659	96.36%	2.86%	0.78%	-	-	0.00%
Neosho River							
NM2	621,310	97.86%	0.69%	1.46%	-	-	0.00%
NM8	911,625	98.58%	0.02%	0.05%	-	-	1.34%
Study Areas Subtotal	1,532,935	98.29%	0.29%	0.62%	-	-	0.80%
Ohio River							
RF21	498,041	91.53%	2.15%	6.00%	-	-	0.31%
RF22	825,590	98.26%	1.69%	0.02%	-	-	0.02%
RF23/RF25	632,348	94.45%	1.51%	3.85%	0.11%	-	0.08%
RF24	1,564,934	78.44%	15.28%	6.04%	0.21%	-	0.03%
RF26	986,898	98.99%	-	0.95%	0.02%	-	0.04%
RF27	707,849	98.05%	-	1.39%	0.55%	-	0.01%
RF28	104,687	99.98%	-	-	-	-	0.02%
RF29	180,720	99.64%	-	0.05%	0.29%	-	0.03%
RF32	158,523	93.28%	0.65%	6.01%	-	-	0.06%

River Basin and Study Area	Acreage	Private[1]	Federal[2]	State[2]	Local[2]	Joint[2,3]	Private Conservation[1,2]
Study Areas Subtotal	5,659,590	91.80%	4.85%	3.14%	0.15%	-	0.06%
Red River							
RF4a	290,089	52.02%	47.97%%	0.01%	-	-	-
RF4b	2,030,552	97.82%	0.02%	2.12%	-	-	0.03%
RF5	1,828,492	96.33%	0.19%	3.36%	-	-	0.13%
RF6	1,041,593	89.41%	4.34%	0.61%	-	5.64%	-
Study Areas Subtotal	5,190,727	93.05%	3.62%	2.14%	-	1.13%	0.06%
Tennessee River							
RF16	290,332	92.85%	1.50%	5.52%	-	-	0.13%
RF18	278,581	93.69%	0.07%	5.02%	-	0.26%	0.96%
RF19	1,452,197	97.66%	0.31%	1.84%	-	0.18%	0.01%
RF20a	200,829	97.06%	2.56%	0.38%	-	-	-
RF20b	449,254	95.59%	3.89%	0.27%	-	0.18%	0.06%
Study Areas Subtotal	2,671,194	96.33%	1.18%	2.20%	-	0.16%	0.13%
Verdigris River							
NM6	552,434	99.31%	0.00%	0.69%	-	-	-
White River							
RF7	214,596	99.92%	0.08%	-	-	-	-
RF8a	580,135	97.85%	-	2.15%	-	-	-
RF8b	2,193,765	92.16%	5.41%	2.44%	-	-	-
RF9[4]	4,201,386	76.38%	16.37%	6.93%	-	-	0.20%
RF10 / RF11	777,623	97.79%	-	2.21%	-	-	-
RF12	486,808	98.92%	-	0.89%	-	-	0.20%
RF13	847,958	65.71%	30.14%	4.15%	-	-	-
Study Areas Subtotal	9,302,272	83.98%	11.42%	4.45%	-	-	0.10%
All Study Areas	34,313,604	92.05%	5.01%	2.47%	0.03%	0.18%	0.24%

Source: CBI 2012, http://consbio.org/products/projects/pad-us-cbi-edition

Total of private, Federal, state, local, joint, and private conservation land may not equal 100% due to rounding.

Notes:

[1] Privately owned land that does not belong to a private entity for the express purpose of conservation; whereas private conservation lands are those lands that would be owned by private organizations such as The Nature Conservancy and National Audubon Society for conservation. Conservation programs such as the Conservation Reserve Program, Wildlife Habitat Incentives Program, Environmental Quality Incentives Program, and others may still be practiced on private land.

[2] A dash (-) indicates that no land is listed in the study area as being owned by any Federal, State, local, joint, or private conservation organization. Values of 0.00 percent indicate that land is owned by these entities, yet the amount is less than 0.01 percent of the total study area acreage.

[3] Joint ownership includes land that is owned by joint partnerships between federal and state organizations.

[4] Total acreage includes 4,928.54 acres (0.12 percent of the study area acreage) of land that is listed as owned by unknown entities.

2006 Land use percentages for the study areas by river basin

River Basin and Study Area	Acreage	Agricultural[1]	Barren[2]	Developed[3]	Forested[4]	Grass and Shrub/Scrub[5]	Open Water[6]	Wetland[7]
Arkansas River								
NM3/NM4/NM5/RF1	1,450,083	70.26%	0.29%	8.30%	17.60%	1.05%	0.45%	2.05%
NM7/RF3	1,743,092	71.90%	0.11%	5.80%	7.19%	11.62%	1.34%	2.04%
RF2	1,380,449	20.49%	0.04%	10.94%	25.70%	41.29%	1.50%	0.03%
Study Areas Subtotal	4,573,624	55.87%	0.15%	8.14%	16.08%	17.23%	1.11%	1.44%
Cumberland River								
RF31	453,821	75.51%	0.01%	7.20%	16.79%	0.29%	0.12%	0.08%
Illinois River								
NM1	845,937	44.10%	0.22%	10.53%	40.42%	3.86%	0.27%	0.60%
Lower Great Lakes								
RF30	69,673	67.80%	None listed	6.36%	7.21%	0.81%	1.90%	15.93%
Lower Mississippi River								
RF14	701,987	16.76%	0.19%	4.47%	75.12%	2.11%	0.50%	0.86%
RF15	568,667	81.44%	0.01%	7.12%	0.39%	0.11%	1.98%	8.95%
RF17	1,984,728	25.33%	0.07%	5.77%	44.01%	12.36%	1.00%	11.46%
Study Areas Subtotals	3,255,383	33.28%	0.08%	5.73%	43.10%	8.01%	1.06%	8.74%
Neosho River								
NM2	621,149	40.38%	0.20%	7.41%	49.07%	2.32%	0.18%	0.43%
NM8	911,387	26.04%	0.03%	3.90%	2.98%	65.47%	0.58%	1.01%
Study Areas Subtotals	1,532,536	31.85%	0.10%	5.32%	21.66%	39.87%	0.42%	0.78%
Ohio River								
RF21	700,729	47.32%	0.19%	7.54%	36.48%	0.76%	3.94%	3.76%
RF22	825,308	45.01%	0.04%	6.06%	45.55%	2.85%	0.40%	0.09%
RF23/RF25	632,140	32.86%	0.04%	7.59%	52.85%	2.22%	1.34%	3.09%
RF24	1,564,533	14.60%	0.08%	4.66%	71.55%	5.21%	0.76%	3.13%

River Basin and Study Area	Acreage	Agricultural[1]	Barren[2]	Developed[3]	Forested[4]	Grass and Shrub/Scrub[5]	Open Water[6]	Wetland[7]
Ohio River (cont'd)								
RF26	986,339	79.36%	0.07%	7.16%	9.43%	1.03%	0.94%	2.00%
RF27	707,412	50.45%	0.00%	10.71%	36.81%	0.89%	0.65%	0.48%
RF28	104,582	87.59%	0.03%	6.03%	5.38%	0.65%	0.13%	0.20%
RF29	180,583	90.30%	0.02%	6.46%	2.97%	0.11%	0.05%	0.11%
RF32	158,352	40.23%	0.03%	9.30%	41.64%	2.37%	2.75%	3.67%
Study Areas Subtotal	5,859,977	44.32%	0.07%	6.87%	42.93%	2.48%	1.19%	2.13%
Red River								
RF4a	289,926	18.46%	0.03%	4.40%	73.23%	3.17%	0.40%	0.31%
RF4b	2,030,057	12.03%	0.12%	4.77%	63.87%	8.34%	0.56%	10.32%
RF5	1,827,941	4.97%	0.06%	5.57%	59.71%	10.96%	0.79%	17.94%
RF6	1,041,088	17.53%	0.16%	5.62%	62.19%	10.12%	0.45%	3.92%
Study Areas Subtotal	5,189,012	11.01%	0.10%	5.20%	62.59%	9.33%	0.61%	11.16%
Tennessee River								
RF16	290,0933	16.55%	0.21%	5.21%	56.00%	18.34%	0.74%	2.94%
RF18	278,376	17.13%	0.02%	2.29%	73.82%	4.98%	0.20%	1.57%
RF19	1,451,664	35.30%	0.08%	6.34%	52.79%	4.83%	0.37%	0.28%
RF20a	200,685	28.38%	0.30%	5.34%	39.68%	14.40%	2.33%	9.56%
RF20b	449,117	48.43%	0.09%	8.39%	36.05%	0.92%	1.20%	4.93%
Study Areas Subtotal	2,669,935	33.06%	0.11%	6.07%	51.53%	6.38%	0.68%	2.18%
Verdigris River								
NM6	552,244	55.74%	0.14%	4.85%	12.94%	24.87%	0.60%	0.85%
White River								
RF7	214,461	15.17%	0.06%	3.40%	77.39%	3.45%	0.16%	0.36%
RF8a	580,029	61.45%	0.07%	6.32%	19.39%	0.97%	1.93%	9.86%
RF8b	2,193,155	63.81%	0.06%	4.84%	13.80%	0.36%	2.12%	15.01%

River Basin and Study Area	Acreage	Agricultural[1]	Barren[2]	Developed[3]	Forested[4]	Grass and Shrub/Scrub[5]	Open Water[6]	Wetland[7]
White River (cont'd)								
RF9	4,200,931	25.44%	0.14%	3.90%	65.23%	1.80%	0.51%	2.99%
RF10 / RF11	777,541	29.30%	0.16%	5.15%	62.10%	2.69%	0.40%	0.19%
RF12	486,702	30.64%	0.10%	5.05%	60.47%	3.01%	0.35%	0.38%
RF13	847,610	14.38%	0.06%	3.19%	79.90%	2.18%	0.15%	0.14%
Study Areas Subtotal	9,300,429	36.08%	0.11%	4.36%	51.35%	1.62%	0.92%	5.56%
All Study Areas	34,302,571	36.75%	0.10%	5.93%	43.38%	8.11%	0.89%	4.85%

Source: (USGS 2006, http://seamless.usgs.gov/nlcd.php)

Total of land cover categories may not equal 100% due to rounding.

Notes:

[1] Includes cultivated crops (areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. This class also includes all land being actively tilled) and pasture/hay land (areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle). Crop, pasture, and hay vegetation accounts for more than 20 percent of the total vegetation in these areas.

[2] Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15 percent of total cover in these areas.

[3] Includes developed open spaces (areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.); low intensity development (areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20 to 49 percent of total cover. These areas most commonly include single-family housing units.); medium intensity development (areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50 to 79 percent of the total cover. These areas most commonly include single-family housing units.); and, high intensity development (highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.).

[4] Includes deciduous forests (areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.); evergreen forests (areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.); and, mixed forests (areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.).

[5] Includes grasslands (areas dominated by graminoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.) and shrub/scrub land (areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.).

[6] All areas of open water, generally with less than 25 percent cover, vegetation, or soil.

[7] Includes emergent herbaceous wetlands (areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.) and woody wetlands (areas where forest or shrub land vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.).

Communities and their populations nearest each proposed critical habitat unit (U.S. Census Bureau 2010a, 2010b)

Proposed Critical Habitat Unit	Nearest Community	County	State	Population	Distance Between Critical Habitat Unit and Nearest Community (miles)[1]
NM1	Watts	Adair	OK	324	0.3
NM2	Noel	McDonald	MO	1,832	Adjacent
	Cayuga	Delaware	OK	140	Adjacent
NM3	Joplin	Jasper, Newton	MO	50,150	Adjacent
	Neosho	Newton		11,835	Adjacent
	Granby			2,134	Adjacent
	Galena	Cherokee	KS	3,085	Adjacent
	Lowell			283	Adjacent
NM4	Carthage	Jasper	MO	14,378	Adjacent
NM5	Neck City	Jasper	MO	186	0.2
NM6	Neodesha	Wilson	KS	2,486	Adjacent
	Altoona			414	Adjacent
	Fall River	Greenwood		162	Adjacent
NM7	LeRoy	Coffey	KS	561	Adjacent
	Neosho Falls	Woodson		141	Adjacent
	Iola	Allen		5,704	Adjacent
	Humboldt			1,953	Adjacent
	Chetopa	Labette		1,125	Adjacent
	Oswego			1,829	Adjacent
NM8	Cottonwood Falls	Chase	KS	903	3.0
RF1	Carthage	Jasper	MO	14,378	Adjacent
RF2	Valley Park	Rogers	OK	77	Adjacent
	Catoosa	Rogers, Wagoner		7,151	Adjacent
RF3	Iola	Allen	KS	5,704	Adjacent
	Humboldt			1,953	Adjacent
RF4a	Oden	Montgomery	AR	232	0.2
RF4b	Malvern	Hot Spring	AR	10,318	Adjacent
	Midway	Hot Spring		389	Adjacent
	Caddo Valley	Clark		635	Adjacent
	Arkadelphia			10,714	Adjacent
	Camden	Ouachita		12,183	Adjacent

Proposed Critical Habitat Unit	Nearest Community	County	State	Population	Distance Between Critical Habitat Unit and Nearest Community (miles)[1]
RF5	Benton	Saline	AR	30,681	Adjacent
	Tull	Grant		448	Adjacent
RF6	Idabel	McCurtain	OK	7,010	Adjacent
	Garvin			256	Adjacent
RF7	Shirley	Van Buren	AR	291	Adjacent
RF8a	Batesville	Independence	AR	10,248	Adjacent
	Oil Trough			260	Adjacent
	Newport	Jackson		7,879	Adjacent
	Jackson Port			212	Adjacent
	Augusta	White		2,199	Adjacent
RF8b	Clarendon	Monroe	AR	1,664	Adjacent
	St. Charles	Arkansas		230	Adjacent
RF9	Pocahontas	Randolph	AR	6,608	Adjacent
	Powhatan	Lawrence		72	Adjacent
	Black Rock			662	Adjacent
RF10	Hardy	Sharp	AR	772	Adjacent
	Williford			75	Adjacent
	Ravenden	Lawrence		118	Adjacent
	Imboden			677	Adjacent
RF11	Cherokee Village	Fulton, Sharp	AR	4,671	2.0
RF12	Franklin	Izard	AR	198	Adjacent
RF13	Gilbert	Searcy	AR	28	1.4
RF14	Greenville	Wayne	MO	511	0.4
RF15	Sunflower	Sunflower	MS	1,159	Adjacent
RF16	Golden	Tishomingo	MS	191	0.5
	Red Bay	Franklin	AL	3,158	Adjacent
RF17	Edwards	Hinds	MS	1,034	0.6
RF18	Paint Rock	Jackson	AL	210	Adjacent
	Woodville			746	Adjacent
	New Hope	Madison		2,810	Adjacent
RF19	Columbia	Maury	TN	34,681	Adjacent
	Centerville	Hickman		3,644	Adjacent
RF20a	Crump	Hardin	TN	1,428	Adjacent
	Savannah			6,982	Adjacent

Proposed Critical Habitat Unit	Nearest Community	County	State	Population	Distance Between Critical Habitat Unit and Nearest Community (miles)[1]
RF20b	Paducah	McCracken	KY	25,024	Adjacent
	Calvert City	Marshall		2,566	Adjacent
RF21	Olmstead	Pulaski	IL	333	Adjacent
	Joppa	Massac		360	Adjacent
	Metropolis			6,537	Adjacent
RF22	Greensburg	Green	KY	2,163	Adjacent
	Munfordville	Hart		1,615	Adjacent
RF23	Venango,	Crawford	PA	239	Adjacent
	Saegertown			997	Adjacent
	Cochranton			1,136	Adjacent
	Meadville			13,388	Adjacent
	Cambridge Springs			2,595	Adjacent
	Sugarcreek	Venango		5,294	Adjacent
	Franklin			6,545	Adjacent
	Utica			189	Adjacent
RF24	Franklin	Venango	PA	6,545	Adjacent
	Kennerdell			247	Adjacent
	Emlenton			625	Adjacent
RF25	Cambridge Springs	Crawford	PA	2,595	2.8
RF26	Winamac	Pulaski	IN	2,490	Adjacent
RF27	Warsaw	Coshocton	OH	682	Adjacent
	Nellie			131	Adjacent
RF28	West Jefferson	Madison	OH	4,222	Adjacent
RF29	Bismarck	Vermillion	IL	579	0.4
RF30	Edgerton	Williams	OH	2,012	Adjacent
RF31	Adams	Robertson	TN	633	Adjacent
RF32	Reynolds Heights	Mercer	PA	2,061	Adjacent

Sources: USCB 2011, http://www.census.gov/cgi-bin/geo/shapefiles2011/layers.cgi;
USCB 2010, http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

Note: [1]Distances between unit and nearest community are approximate.

Source:

Conservation Biology Institute (CBI). 2012. Protected Areas Database of the U.S., PAD-US (CBI Edition). December 14, 2012. Available from http://consbio.org/products/projects/pad-us-cbi-edition.

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