



ECONOMIC ANALYSIS OF CRITICAL
HABITAT DESIGNATION FOR NEOSHO
MUCKET AND RABBITSFOOT

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LIST OF ACRONYMS AND ABBREVIATIONS

Act or ESA	Endangered Species Act
ADEQ	Arkansas Department of Environmental Quality
ARRA	American Recovery and Reinvestment Act
BMPs	best management practices
BO	Biological Opinion
CCAAs	Candidate Conservation Agreements with Assurances
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
DOI	U.S. Department of the Interior
ECOS	Environmental Conservation Online System
EIA	Energy Information Administration
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
GID	U.S. Census Government Integrated Directory
HCP	Habitat Conservation Plan
HUC	Hydrologic Unit Code
HUD	Department of Housing and Urban Development
IEc	Industrial Economics, Incorporated
IN DOT	Indiana Department of Transportation
JOF	Johnsonville Fossil Plant
KDHE	Kansas Department of Health and Environment
KWO	Kansas Water Office
LPN	listing priority number
LRMP	Land and Resource Management Plans
MDEQ	Mississippi Department of Environmental Quality
NAICS	North American Industry Classification System
NEPA	National Environmental Policy Act

NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
ODEQ	Oklahoma Department of Environmental Quality
OHV	off-highway vehicle
OMB	U.S. Office of Management and Budget
OSMRE	Office of Surface Mining Reclamation and Enforcement
PBFs	physical and biological features
RFA	Regulatory Flexibility Act
RMA	Risk Management Association
ROW	right-of-way
SBREFA	Small Business Regulatory Enforcement Fairness Act
Service	U.S. Fish and Wildlife Service
SHAs	Safe Harbor Agreements
SMCRA	Surface Mining Control and Reclamation Act of 1977
TAILS	Tracking and Integrated Logging System
TDEC	Tennessee Department of Environment and Conservation
TMDL	Total Maximum Daily Load
TVA	Tennessee Valley Authority
UMRA	Unfunded Mandates Reform Act
USFS	Forest Service
WHIP	Wildlife Habitat Incentive Program

EXECUTIVE SUMMARY

1. The purpose of this report is to evaluate the potential economic impacts associated with the designation of critical habitat for two mussel species – Neosho mucket (*Lampsilis rafinesqueana*) and rabbitsfoot (*Quadrula cylindrica cylindrica*) (hereafter, “mussels”). This report was prepared by Industrial Economics, Incorporated (IEc), under contract to the U.S. Fish and Wildlife Service (Service).

OVERVIEW OF THE PROPOSED CRITICAL HABITAT AND STUDY AREA

2. On October 16, 2012, the Service published a Proposed Rule to list Neosho mucket as an endangered species and rabbitsfoot as a threatened species, and to designate critical habitat for both species, under the Endangered Species Act (hereafter, “ESA” or “Act”).¹ The proposed critical habitat designation includes 43 units totaling approximately 2,139 river miles.² Proposed critical habitat for Neosho mucket consists of eight units totaling approximately 484 river miles in four states (Arkansas, Kansas, Missouri, and Oklahoma). Proposed critical habitat for rabbitsfoot consists of 35 units totaling approximately 1,655 river miles in 12 states (Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Missouri, Mississippi, Ohio, Oklahoma, Pennsylvania, and Tennessee). As described in the Proposed Rule, all 43 units are occupied by at least one of the species and four units are occupied by both species.
3. Areas proposed as critical habitat for Neosho mucket and rabbitsfoot include the river channels within the ordinary high-water line.³ In addition, the Service has defined a broader “study area” for each proposed critical habitat unit where activities have the potential to affect the mussels and their proposed critical habitat.⁴ These areas are based on either fourth level (8-digit) Hydrologic Unit Code (HUC) watersheds or groups of sixth level (12-digit) HUC watersheds. Exhibit ES-1 depicts the proposed critical habitat and corresponding study area for Neosho mucket and rabbitsfoot.⁵

¹ 77 FR 63440.

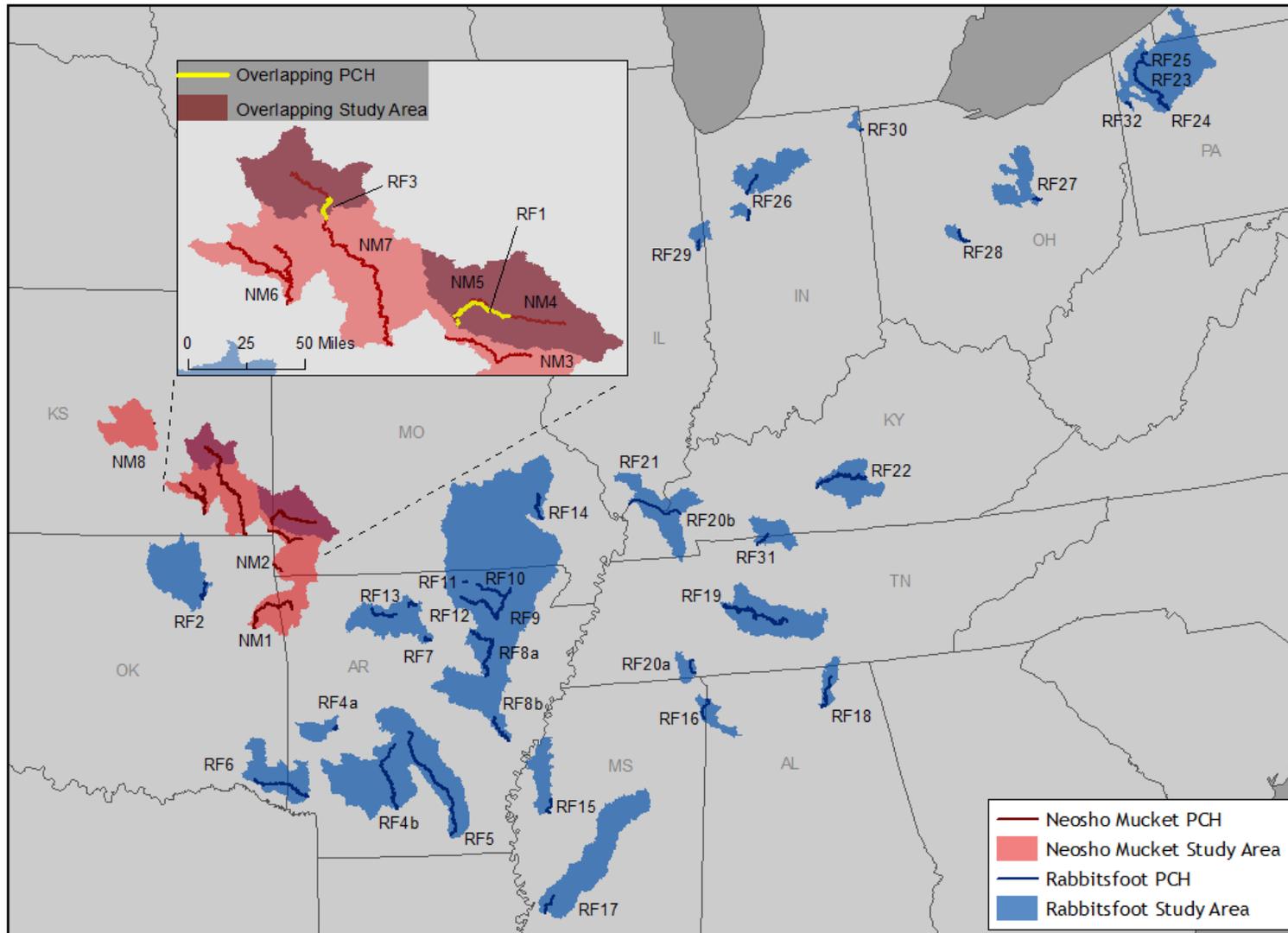
² *Ibid.*

³ *Ibid.*

⁴ Personal communication with the Service’s Arkansas Field Office on October 31, 2012.

⁵ Note that the following proposed critical habitat units (and their corresponding study areas) overlap: Unit NM4 and Unit RF1, and Unit NM7 and Unit RF3.

EXHIBIT ES-1. OVERVIEW OF NEOSHO MCKET AND RABBITSFOOT PROPOSED CRITICAL HABITAT AND STUDY AREA



Source:
 1. U.S. Fish and Wildlife Service, Arkansas Field Office
 2. Environmental Systems Research Institute, Inc. (ESRI), Redlands, California, USA

0 20 40 80 120 160 Miles



4. Exhibit ES-2 presents ownership of the riparian areas adjacent to the proposed critical habitat.⁶ The majority of the proposed river stretches are surrounded by privately owned lands (over 85 percent, including tribal jurisdictional areas).

EXHIBIT ES-2. LANDOWNERSHIP OF RIPARIAN AREAS ADJACENT TO PROPOSED CRITICAL HABITAT (RIVER MILES)

SPECIES	STATE (LOCATION)	FEDERAL	STATE/ LOCAL	PRIVATE	TRIBAL ¹	TOTAL
Neosho mucket	AR, KS, MO, OK	18.3	6.1	459.7	64.0	484.1
Rabbitsfoot	AL, AR, IL, IN, KS, KY, MO, MS OH, OK, PA, TN	203.9	85.7	1,365.6	54.0	1,655.0
GRAND TOTAL		222.2 (10.4%)	91.8 (4.3%)	1,825.3 (85.3%)	118.0 (5.5%)	2,139.1
<p>Notes: Totals may not sum due to rounding. Represents ownership of riparian lands adjacent to proposed critical habitat river areas.</p> <p>1. Tribal Jurisdictional Area only, does not represent riparian land ownership by any Tribe; for purposes of this analysis the area is considered a subset of private lands.</p> <p>Source: 2012 Proposed Listing and Critical Habitat Rule, 77 FR 63477-63478.</p>						

OVERVIEW OF ECONOMIC ACTIVITIES

5. This analysis considers economic impacts of conservation efforts for the two mussels and their proposed critical habitat associated with the following activities: (1) water flow management; (2) water quality management; (3) timber management, agriculture, and grazing; (4) mining; (5) oil and gas development; (6) transportation and utilities; (7) development and recreation; and (8) other activities (such as animal and biological control, prescribed burns, land clearing, habitat or shoreline restoration, among others). The analysis estimates economic impacts to these activities from 2013 (expected year of the final designation of critical habitat) to 2032 (20 years from the expected critical habitat designation). Forecast impacts are organized into two categories according to "without critical habitat" and "with critical habitat" scenarios. The "without critical habitat" scenario represents the baseline for the analysis, considering protections afforded the two mussels absent critical habitat; for example, under Federal listing and other Federal, State, and local regulations. The "with critical habitat" scenario describes the incremental impacts expected to result from the designation of critical habitat for the species. That is, the reported incremental conservation efforts and associated economic impacts are those expected to occur specifically because of the critical habitat designation. This information on incremental impacts is intended to assist the Secretary of the U.S. Department of the Interior (DOI) in determining whether benefits of excluding particular areas from the designation outweigh benefits of including those areas in the designation.⁷

⁶ Note that the landownership information presented in Exhibit ES-2 is for the riparian areas adjacent to proposed critical habitat and not for the larger study areas shown in Exhibit ES-1.

⁷ 16 U.S.C. § 1533(b)(2).

SUMMARY OF KEY FINDINGS

- Exhibit ES-3 presents the estimated incremental impacts of the designation over the next 20 years. We estimate these costs annually over an analysis period of 20 years beginning in 2013, which we then calculate on a present value basis.⁸ Depending on the discount rate applied, we estimate that these costs will range from \$4.4 million to \$5.9 million over 20 years, or from \$290,000 to \$390,000 on an annualized basis.⁹

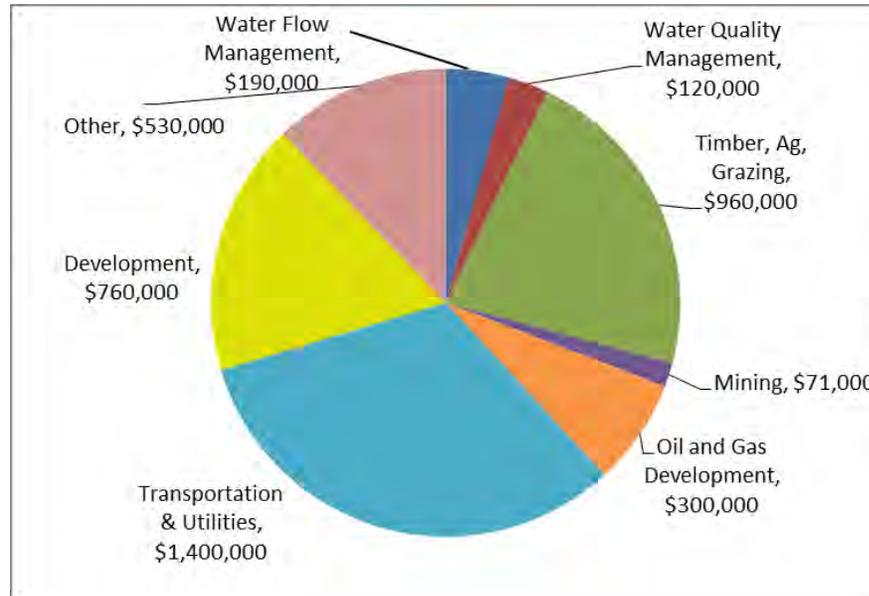
EXHIBIT ES-3. SUMMARY OF INCREMENTAL IMPACTS (2013-2032, 2012\$)

DISCOUNT RATE ASSUMPTION	PRESENT VALUE	ANNUALIZED
7%	\$4,400,000	\$290,000
3%	\$5,900,000	\$390,000

Notes: The level of effort per consultation represents approximate averages based on the best available cost information. The cost estimates in this report are accordingly rounded to two significant digits to reflect this imprecision. The cost estimates may therefore not sum to the total costs reported due to rounding.

- The distribution of projected incremental costs for each activity is provided in Exhibit ES-4. As highlighted in the exhibit, activities related to transportation and utilities are likely to be subject to the greatest incremental impacts at \$1,400,000 over the next 20 years.

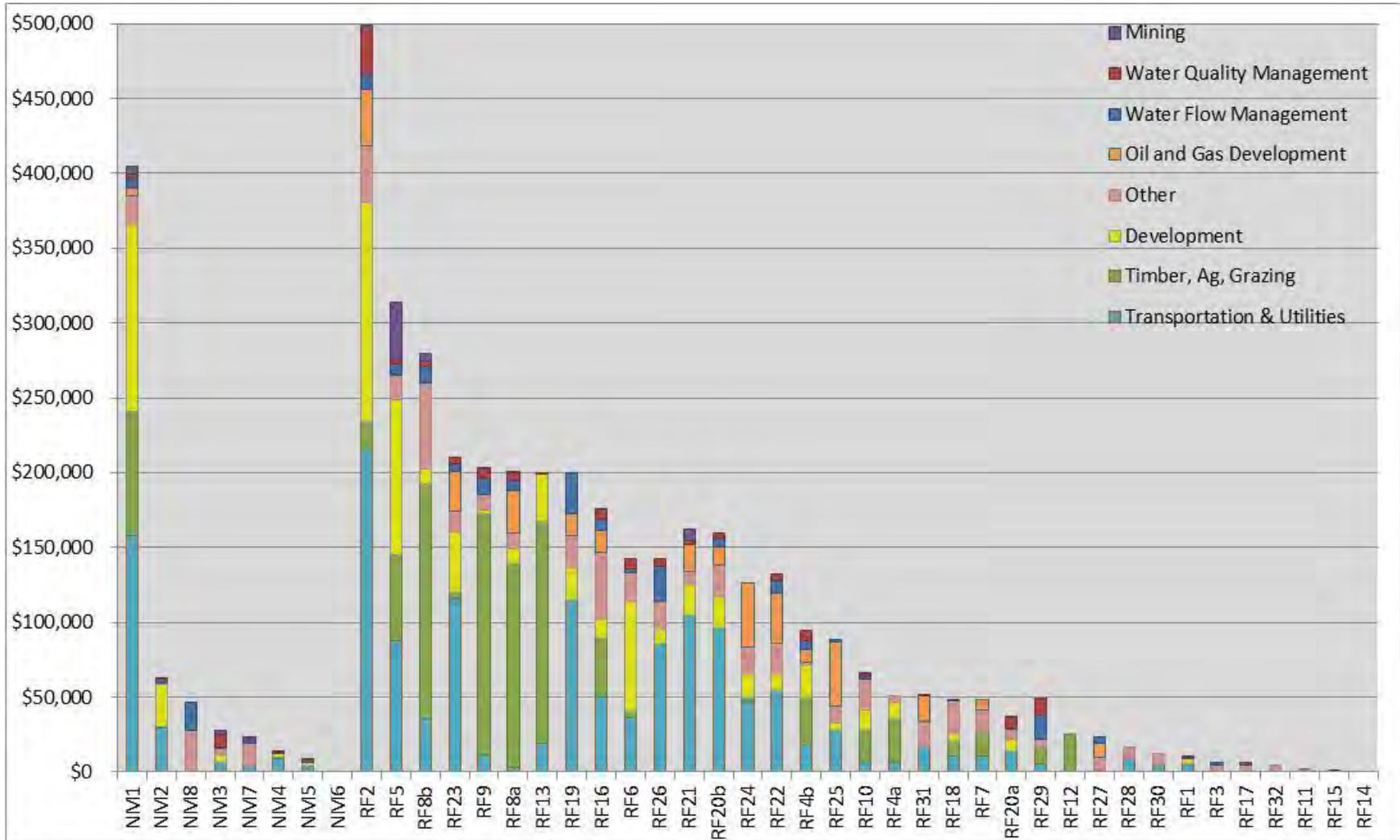
EXHIBIT ES-4. ESTIMATED INCREMENTAL IMPACTS BY ECONOMIC ACTIVITY (2013-2032, 2012\$, SEVEN PERCENT DISCOUNT RATE)



⁸ For this cost analysis, we assume a base year (Year 1) of 2013 for present value calculations using costs estimated in 2012 dollars.

⁹ To calculate present value and annualized impacts, guidance provided by U.S. Office of Management and Budget (OMB) specifies the use of a real annual discount rate of seven percent. In addition, OMB recommends conducting a sensitivity analysis using other discount rates, such as three percent. Accordingly, all cost figures presented in Chapter 3 this analysis describe present value cost impacts assuming a seven percent discount rate. Appendix B reports forecast impacts assuming a discount rate of three percent to highlight the sensitivity of results to the discount rate assumption. Appendix C presents undiscounted impacts by economic activity.

EXHIBIT ES-5. TOTAL INCREMENTAL IMPACT BY ACTIVITY AND PROPOSED CRITICAL HABITAT UNIT (2013-2032, 2012\$, SEVEN PERCENT DISCOUNT RATE)



Note: Graph represents unrounded cost estimates.

8. Exhibit ES-5 provides a visual depiction of the estimated incremental impacts of the proposed designation over the next 20 years by proposed critical habitat unit and activity. Overall, proposed critical habitat Units NM1 (Illinois River) and RF2 (Verdigris River) are expected to generate the largest incremental impacts due to a relatively larger number of future section 7 consultations related to development, transportation and utilities in these units. In addition, section 7 consultations are expected to occur in Units NM1 and RF2 in all of the activity categories over the next 20 years. Note that future incremental impacts are forecast for all but two proposed critical habitat units (NM6 and RF14), where we forecast no future consultations.
9. Exhibit ES-6 ranks the proposed critical habitat units by total estimated incremental impacts and cost per river mile. As shown in the exhibit, when considering the estimated incremental impacts to each proposed critical habitat unit in terms of cost per river mile, Unit NM8 (Cottonwood River) is expected to generate relatively larger impacts than the other units proposed for Neosho mucket. Unit NM8 is also the smallest proposed critical habitat unit in terms of river miles, and yet its study area is comparable in size to other units; as a result, the cost per river mile is larger.

EXHIBIT ES-6. PROPOSED CRITICAL HABITAT UNIT RANKING BY TOTAL IMPACT AND IMPACT PER RIVER MILE (2012\$, SEVEN PERCENT DISCOUNT RATE)

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	RIVER MILES	UNIT TOTAL (20-YEAR, PV 7%) ^{2,3}	COST PER RIVER MILE	RANK BY UNIT TOTAL	RANK BY COST PER RIVER MILES
NM1	Illinois River	AR, OK	90.8	\$400,000	\$4,500	1	3
NM2	Elk River	AR, MO	12.6	\$63,000	\$5,000	2	2
NM8	Cottonwood River	KS	1.6	\$47,000	\$29,000	3	1
NM3	Shoal Creek	KS, MO	47.1	\$28,000	\$590	4	5
NM7	Neosho River	KS	151.9	\$23,000	\$150	5	7
NM4	Spring River	KS, MO	63.6	\$14,000	\$210	6	6
NM5	North Fork Spring River	KS, MO	10.2	\$8,000	\$780	7	4
NM6	Fall & Verdigris Rivers	KS	106.3	\$0	\$0	8	8
RF2	Verdigris River	OK	28.3	\$500,000	\$18,000	1	1
RF5	Saline River	AR	179.7	\$310,000	\$1,700	2	18
RF8b	White River	AR	42.8	\$280,000	\$6,500	3	4
RF23	French Creek	PA	74.8	\$210,000	\$2,800	4	13
RF9	Black River	AR, MO	57.3	\$200,000	\$3,500	5	8
RF8a	White River	AR	117.0	\$200,000	\$1,700	6	19
RF19	Duck River	TN	146.2	\$200,000	\$1,400	7	23
RF13	Buffalo River	AR	70.6	\$200,000	\$2,800	8	12
RF16	Bear Creek	AL, MS	30.9	\$180,000	\$5,700	9	5
RF21	Ohio River	IL, KY	28.5	\$160,000	\$5,700	10	6
RF20b	Tennessee River	KY	22.1	\$160,000	\$7,200	11	2
RF6	Little River	AR, OK	86.8	\$140,000	\$1,600	12	22
RF26	Tippecanoe River	IN	47.0	\$140,000	\$3,000	13	11
RF22	Green River	KY	109.1	\$130,000	\$1,200	14	24
RF24	Allegheny River	PA	35.6	\$130,000	\$3,500	15	9

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	RIVER MILES	UNIT TOTAL (20-YEAR, PV 7%) ^{2,3}	COST PER RIVER MILE	RANK BY UNIT TOTAL	RANK BY COST PER RIVER MILES
RF4b	Ouachita River	AR	98.1	\$94,000	\$960	16	25
RF25	Muddy Creek	PA	12.5	\$89,000	\$7,100	17	3
RF10	Spring River	AR, MO	39.0	\$66,000	\$1,700	18	20
RF31	Red River	KY, TN	31.2	\$52,000	\$1,700	19	21
RF4a	Ouachita River	AR	13.6	\$51,000	\$3,700	20	7
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	17.7	\$49,000	\$2,800	21	14
RF18	Paint Rock River	AL	50.3	\$48,000	\$950	22	26
RF7	Middle Fork Little Red River	AR	15.4	\$48,000	\$3,100	23	10
RF20a	Tennessee River	TN	16.6	\$37,000	\$2,200	24	16
RF12	Strawberry River	AR	76.9	\$25,000	\$330	25	30
RF27	Walhonding River	OH	10.9	\$24,000	\$2,200	26	17
RF28	Little Darby Creek	OH	20.7	\$17,000	\$810	27	27
RF30	Fish Creek	IN, OH	4.8	\$12,000	\$2,600	28	15
RF1	Spring River	KS, MO	35.1	\$9,800	\$280	29	31
RF3	Neosho River	KS	16.5	\$6,400	\$390	30	29
RF17	Big Black River	MS	26.9	\$6,000	\$220	31	33
RF32	Shenango River	PA	10.1	\$4,500	\$440	32	28
RF11	South Fork Spring River	AR, MO	10.2	\$2,300	\$230	33	32
RF15	Big Sunflower River	MS	32.0	\$1,500	\$47	34	34
RF14	St. Francis River	MO	40.0	\$0	\$0	35	35
TOTAL			2,139.1	\$4,400,000	\$140,000	--	--

Notes:

1. The State(s) listed for each proposed critical habitat unit contain(s) the proposed critical habitat unit and corresponding study area. In some cases, small portions of study areas fall into other States. However, in these instances, no section 7 consultations are forecast to occur in these other States; therefore, these States are not included in this list.
2. Proposed critical habitat unit RF1 overlaps with a portion of proposed critical habitat unit NM4, as both species are present in the same stretch of the Spring River. Likewise, proposed critical habitat unit RF3 overlaps unit NM7, as both species are present in the same stretch of the Neosho River. In cases where a consultation was forecast in the overlapping portion of the study areas for these units, costs associated with the consultation were apportioned evenly across the units.
3. The level of effort per consultation represents approximate averages based on the best available cost information. The cost estimates in this report are accordingly rounded to two significant digits to reflect this imprecision. The unit cost estimates therefore may not sum to the total costs reported due to rounding.

10. A key conclusion of the incremental analysis is that we do not expect critical habitat designation to generate additional requests for project modification in any of the proposed critical habitat units. According to the Service, 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.”¹⁰

11. Because every proposed critical habitat unit is occupied by at least one mussel species, we do not anticipate that critical habitat designation will generate additional requests for project modification in any of the units. As such, incremental economic impacts of the designation presented in Exhibits ES-3 through ES-6 are limited to additional administrative costs to the Service, Federal agencies and third parties of considering critical habitat as part of the forecast section 7 consultations.
12. With respect to potential benefits of the designation, the primary goal of critical habitat designation for the two mussels is to support their long-term conservation. Theoretically, conservation and recovery of the species may result in benefits, including use benefits (wildlife-viewing), non-use benefits (existence values), and ancillary ecosystem service benefits (e.g., public safety benefits of reduced wildfire risks). As described above, however, the potential economic impacts of designating critical habitat for these species are limited to minor administrative costs associated with section 7 consultation. Changes in land management or management of the designated waterways as a result of the designation of critical habitat are unlikely. Thus, in this instance, critical habitat designation will likely add minimal conservation benefits to those already provided by baseline conservation efforts. However, Chapter 5 of this report qualitatively discusses the potential benefits associated with conservation efforts resulting from the baseline protections discussed in Chapter 4.
13. Lastly, Appendix A of this report includes an analysis of the distributional impacts of the proposed critical habitat designation on small entities. The only costs expected to be borne by third parties as a result of the Proposed Rule are portions of the total cost of each section 7 consultation action (formal, informal, or technical assistances). Appendix A describes the number and types of small entities taking part in each of the eight activities which may be affected by the designation of critical habitat. This analysis concludes 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 cost incurred by each entity being affected is approximately \$420, which constitutes less than 0.03 percent of annual revenue for any industries involved in the affected activity types.
14. Appendix A also concludes that, in accordance with Executive Orders 13211 and 13132, as well as Title II of UMRA, the Proposed Rule is unlikely to have any effect on 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.

¹⁰ U.S. Fish and Wildlife Service to Industrial Economics, Inc. August 17, 2012. “Incremental Effects Memorandum for the Economic Analysis of the Proposed Rule to Designate Critical habitat for Neosho Mucket and Rabbitsfoot.” See Appendix D.

KEY UNCERTAINTIES

15. The economic costs presented in Exhibit ES-3 are based on a series of assumptions that may affect the impact estimates. Exhibit ES-7 presents key assumptions applied in this analysis and information on the extent to which they may lead to under- or over-estimates of the potential incremental impacts of the proposed critical habitat designation.

EXHIBIT ES-7. KEY SOURCES OF UNCERTAINTY ASSOCIATED WITH THE ESTIMATED INCREMENTAL IMPACTS OF CRITICAL HABITAT DESIGNATION FOR THE TWO MUSSELS

ASSUMPTION/ SOURCE OF UNCERTAINTY	DIRECTION OF POTENTIAL BIAS	LIKELY SIGNIFICANCE WITH RESPECT TO ESTIMATED IMPACTS
<p>We predict future section 7 consultation activity based, in part, on historical consultation data provided by the Service, and also on conversations with the Service’s field office representatives who conduct section 7 consultations within the study area for the analysis. We assume that the information we received is complete and accurate and that no other projects will occur during the timeframe of the analysis.</p>	<p>May result in an overestimate or an underestimate of costs.</p>	<p>Unknown. We attempt to verify that the level of past consultation activity is a reasonable predictor of future activity by evaluating population growth projects and other economic projections. To the extent that these projections understate or overstate future economic activity, our analysis may underestimate or overestimate future consultation costs.</p> <p>Note that in Chapter 3, we provide an analysis demonstrating the sensitivity of our results to this assumption using data on trends in economic growth.</p>
<p>Because the mussels are aquatic species, actions taken to avoid jeopardizing the species are likely to be coincident to actions taken to avoid adversely modifying critical habitat. Thus, according to the Service, incremental conservation efforts, while possible, are unlikely. Therefore, we assume that the incremental costs of this designation are limited to minor administrative costs associated with future section 7 consultations.</p>	<p>May result in an underestimate of costs.</p>	<p>Unknown. We rely on the Service as the best authority on the likely outcome of future section 7 consultations. If this assumption is incorrect, and the Service recommends conservation efforts in future consultations solely to protect critical habitat, incremental costs estimated in this analysis are understated.</p>
<p>We assume impacts related to regulatory uncertainty or stigma are unlikely.</p>	<p>May result in an underestimate of costs.</p>	<p>Probably minor. The study area analyzed in this report includes the watersheds surrounding proposed critical habitat. As a result, there may be a perception of increased Federal oversight on private lands.</p>

CHAPTER 1 | INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

16. This chapter provides an overview of the proposed critical habitat for the two mussel species – Neosho mucket (*Lampsilis rafinesqueana*) and rabbitsfoot (*Quadrula cylindrica cylindrica*) (hereafter, “mussels”). It includes a summary of past legal actions that relate to the current proposal, a description of the area proposed for designation, and a discussion of threats to proposed critical habitat. The information contained in this chapter provides context for the analysis. All official definitions and proposed critical habitat boundaries are provided in the Proposed Rule.¹¹

1.1.1 PREVIOUS FEDERAL ACTIONS

17. On October 16, 2012, the Service published a Proposed Rule to list Neosho mucket as an endangered species and rabbitsfoot as a threatened species, and to designate critical habitat for both species, under the Endangered Species Act (hereafter, “ESA” or “Act”).¹²
18. Neosho mucket was first identified as a candidate for protection under the Act on May 22, 1984, and was assigned a status Category 2 designation.¹³ However, after the category 2 list was eliminated in 1996, Neosho mucket was no longer considered a candidate species.¹⁴ Neosho mucket was identified as a candidate species again on October 30, 2001 and was assigned a listing priority number (LPN) of 5, which was retained in the Notices of Review on June 13, 2002; May 4, 2004; May 11, 2005; September 12, 2006; December 6, 2007; and December 8, 2008.¹⁵ The LPN was elevated to 2 in Notice of Review dated November 10, 2010 to reflect the change from non-imminent to imminent threats of high magnitude.¹⁶
19. Rabbitsfoot was first identified as a candidate for protection under the Act on November 15, 1994, and was also assigned a status Category 2 designation. However, rabbitsfoot was no longer considered a candidate species after the Category 2 list was eliminated in 1996.¹⁷ On November 9, 2009, rabbitsfoot was identified as a candidate species again, with an LPN of 9, which was retained in the Notice of Review on November 10, 2010.¹⁸

¹¹ 77 FR 63440.

¹² 77 FR 63440.

¹³ 49 FR 21664.

¹⁴ 61 FR 7596.

¹⁵ 66 FR 54808; 67 FR 40657; 69 FR 24876; 70 FR 24870; 71 FR 53756; 72 FR 69034; 73 FR 75156.

¹⁶ 75 FR 69222.

¹⁷ 61 FR 7596.

¹⁸ 74 FR 57804; 75 FR 69222.

1.1.2 PROPOSED CRITICAL HABITAT DESIGNATION

20. The Service proposes to designate a total of 43 units encompassing approximately 2,139 river miles.¹⁹ Proposed critical habitat for Neosho mucket consists of eight units totaling approximately 484 river miles in four States (Arkansas, Kansas, Missouri, and Oklahoma). Proposed critical habitat for rabbitsfoot consists of 35 units totaling approximately 1,655 river miles in 12 States (Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Missouri, Mississippi, Ohio, Oklahoma, Pennsylvania, and Tennessee). As described in the Proposed Rule, all of the 43 units are occupied by at least one of the mussels and four units are occupied by both Neosho mucket and rabbitsfoot.
21. Proposed critical habitat Units RF16 (Bear Creek) and RF19 (Duck River) are currently designated under the Act as critical habitat for oyster mussel (*Epioblasma capsaeformis*) and Cumberlandian combshell (*Epioblasma brevidens*).²⁰ In addition, the majority of proposed critical habitat Unit RF7 (Middle Fork Little Red River) is currently designated as critical habitat for yellowcheek darter (*Etheostoma moorei*). Lastly, five critical habitat units proposed for 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 for Neosho mucket alone in Shoal Creek. The State-level protections are similar to those provided under the Act.²¹
22. Areas proposed as critical habitat for Neosho mucket and rabbitsfoot include the river channels within the ordinary high-water line.²² In addition, the Service has defined a broader “study area” for each proposed critical habitat unit where activities have the potential to affect the mussels and their proposed critical habitat.²³ These areas are based on either fourth level (8-digit) Hydrologic Unit Code (HUC) watersheds or groups of sixth level (12-digit) HUC watersheds. Exhibit 1-1 depicts the proposed critical habitat units and corresponding study areas for Neosho mucket and rabbitsfoot.²⁴

¹⁹ *Ibid.*

²⁰ According to the Proposed Rule, the existing critical habitat for the oyster mussel and Cumberlandian combshell completely overlaps proposed critical habitat unit RF16 (Bear Creek), but the exact unit descriptions differ due to mapping refinement since the earlier designation.

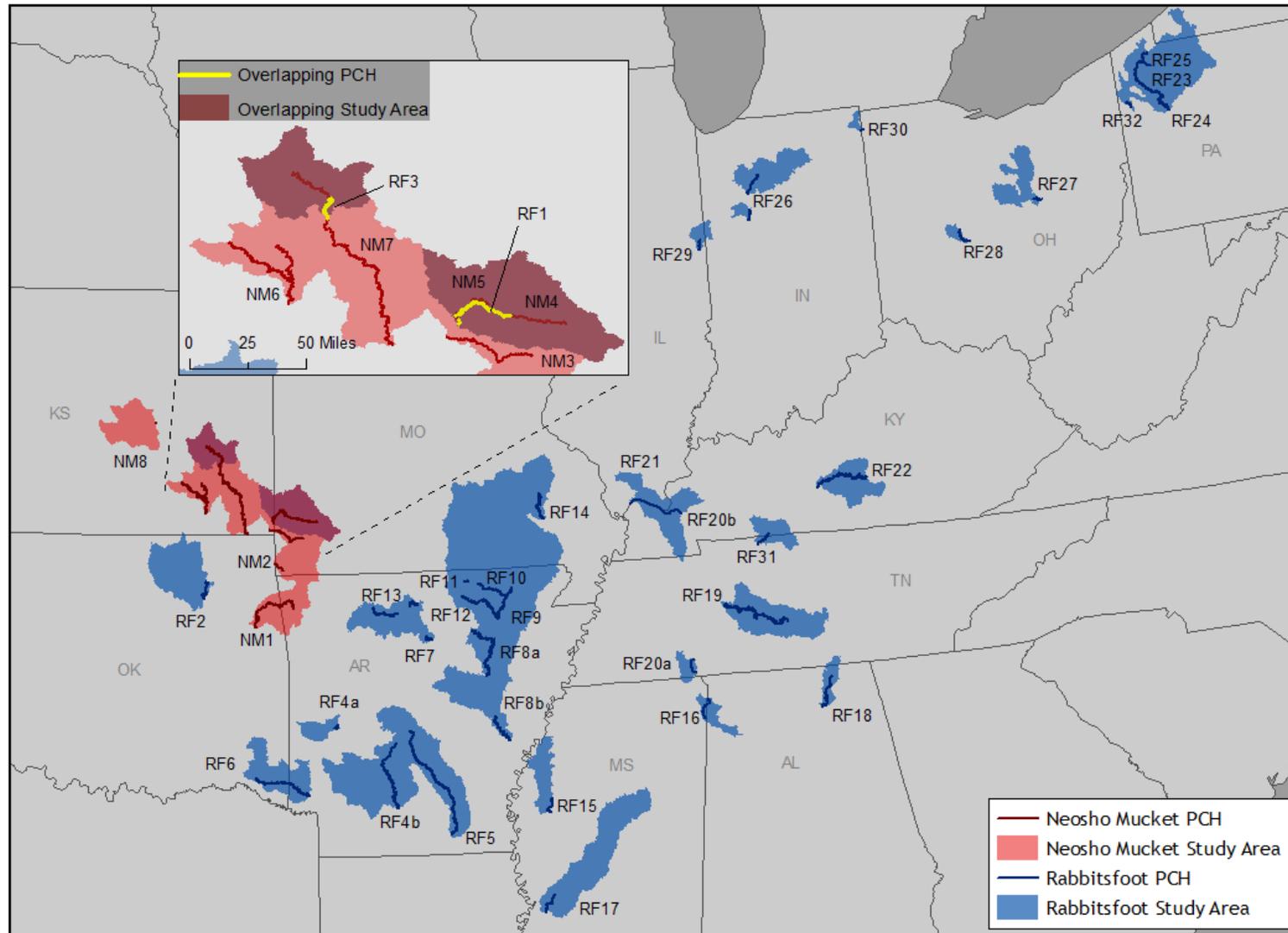
²¹ KSA 32-959

²² 77 FR 63440.

²³ Personal communication with the Service’s Arkansas Field Office on October 31, 2012.

²⁴ Note that the following proposed critical habitat units (and their corresponding study areas) overlap: Unit NM4 and Unit RF1, and Unit NM7 and Unit RF3.

EXHIBIT 1-1. OVERVIEW OF NEOSHO MUCKET AND RABBITSFOOT PROPOSED CRITICAL HABITAT AND STUDY AREA



Source:
 1. U.S. Fish and Wildlife Service, Arkansas Field Office
 2. Environmental Systems Research Institute, Inc. (ESRI), Redlands, California, USA

0 20 40 80 120 160
 Miles

IEc
 INDUSTRIAL ECONOMICS, INCORPORATED

23. Exhibit 1-2 presents land ownership of the riparian areas adjacent to the proposed critical habitat.²⁵ The majority of the proposed river segments are adjacent to privately owned lands (over 85 percent, including tribal jurisdictional areas).

EXHIBIT 1-2. LANDOWNERSHIP OF RIPARIAN AREAS ADJACENT TO PROPOSED CRITICAL HABITAT (RIVER MILES)

UNIT	RIVER	STATE (LOCATION)	FEDERAL	STATE/ LOCAL	PRIVATE	TRIBAL ¹	TOTAL
Neosho mucket Proposed Critical Habitat							
NM1	Illinois River	AR, OK	18.3	1.4	71.1	64.0	90.8
NM2	Elk River	MO, OK	0.0	0.0	12.6	0.0	12.6
NM3	Shoal Creek	KS, MO	0.0	0.0	47.1	0.0	47.1
NM4	Spring River	KS, MO	0.0	0.9	62.7	0.0	63.6
NM5	North Fork Spring River	MO	0.0	0.0	10.2	0.0	10.2
NM6	Fall & Verdigris Rivers	KS	0.0	0.0	106.3	0.0	106.3
NM7	Neosho River	KS	0.0	3.8	148.1	0.0	151.9
NM8	Cottonwood River	KS	0.0	0.0	1.6	0.0	1.6
NEOSHO MUCKET TOTAL			18.3	6.1	459.7	64.0	484.1
Rabbitsfoot Proposed Critical Habitat							
RF1	Spring River	MO, KS	0.0	0.9	34.2	0.0	35.1
RF2	Verdigris River	OK	2.5	0.0	25.8	25.8	28.3
RF3	Neosho River	KS	0.0	0.0	16.5	0.0	16.5
RF4a	Ouachita River	AR	2.4	0.0	11.2	0.0	13.6
RF4b	Ouachita River	AR	0.0	0.0	98.1	0.0	98.1
RF5	Saline River	AR	0.0	13.9	165.8	0.0	179.7
RF6	Little River	OK, AR	39.7	0.0	47.1	25.7	86.8
RF7	Middle Fork Little Red River	AR	0.0	0.0	15.4	0.0	15.4
RF8a	White River	AR	0.0	6.7	110.3	0.0	117.0
RF8b	White River	AR	36.0	0.0	6.8	0.0	42.8
RF9	Black River	AR	0.0	6.3	51.0	0.0	57.3
RF10	Spring River	AR	0.0	0.7	38.3	0.0	39.0
RF11	South Fork Spring River	AR	0.0	0.0	10.2	0.0	10.2
RF12	Strawberry River	AR	0.0	0.0	76.9	0.0	76.9
RF13	Buffalo River	AR	70.6	0.0	0.0	0.0	70.6
RF14	St. Francis River	MO	15.7	0.6	23.7	0.0	40.0
RF15	Big Sunflower River	MS	0.0	0.0	32.0	0.0	32.0
RF16	Bear Creek	MS	7.4	3.8	19.7	0.0	30.9
RF17	Big Black River	MS	0.0	0.0	26.9	0.0	26.9
RF18	Paint Rock River	AL	0.3	0.0	50.0	0.0	50.3
RF19	Duck River	TN	0.0	25.2	121.0	0.0	146.2
RF20a	Tennessee River	TN	1.6	0.0	15.0	0.0	16.6
RF20b	Tennessee River	KY	1.5	0.4	20.2	0.0	22.1
RF21	Ohio River	KY, IL	0.0	8.0	20.5	0.0	28.5
RF22	Green River	KY	10.6	0.0	98.5	0.0	109.1
RF23	French Creek	PA	0.0	2.2	72.6	0.0	74.8

²⁵ Note that the landownership information presented in Exhibit 1-2 is for the riparian areas adjacent to proposed critical habitat and not for the larger study areas shown in Exhibit 1-1.

UNIT	RIVER	STATE (LOCATION)	FEDERAL	STATE/ LOCAL	PRIVATE	TRIBAL ¹	TOTAL
RF24	Allegheny River	PA	0.0	6.2	29.4	0.0	35.6
RF25	Muddy Creek	PA	10.1	0.0	2.4	0.0	12.5
RF26	Tippecanoe River	IN	0.0	1.3	45.7	0.0	47.0
RF27	Walhonding River	OH	0.0	3.1	7.8	0.0	10.9
RF28	Little Darby Creek	OH	0.0	5.4	15.3	0.0	20.7
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL	0.0	0.0	17.7	0.0	17.7
RF30	Fish Creek	OH	0.0	1.0	3.8	0.0	4.8
RF31	Red River	KY, TN	0.0	0.0	31.2	0.0	31.2
RF32	Shenango River	PA	5.5	0.0	4.6	0.0	10.1
RABBITSFOOT TOTAL			203.9	85.7	1,365.6	54.0	1,655.0
GRAND TOTAL			222.2 (10.4%)	91.8 (4.3%)	1,824.5 (85.3%)	118.0 (5.5%)	2,139.1
<p>Notes: Totals may not sum due to rounding. Represents ownership of riparian lands adjacent to proposed critical habitat river areas.</p> <p>¹ Tribal Jurisdictional Area only, does not represent riparian land ownership by any Tribe; for purposes of this analysis the area is considered a subset of private lands.</p> <p>Source: 2012 Proposed Listing and Critical Habitat Rule, 77 FR 63477-63478.</p>							

1.2 ECONOMIC ACTIVITIES CONSIDERED IN THIS ANALYSIS

24. Review of the Proposed Rule and consultation history identified the following economic activities as potential threats to the mussels, their fish hosts, and their habitat within the boundaries of proposed critical habitat. We therefore focus this analysis of potential impacts of two mussels conservation efforts on these activities.

- (1) **Water Flow Management.** Dams, diversions, and groundwater pumping have the potential to degrade water quality through sedimentation; alter stream hydrology, geomorphology, and flow levels; decrease habitat heterogeneity; block upstream and downstream movement of mussels and fish; and destroy habitat through direct and/or indirect in-stream disturbance of substrate.²⁶ In addition, commercial navigation activities, including channel dredging and snag removal, alter stream hydrology and geomorphology, and degrade water and habitat quality. Disposal of dredged material into proposed critical habitat can alter or destroy substrate through direct and/or indirect in-stream disturbance.
- (2) **Water Quality Management.** Activities that would significantly alter the water chemistry or quality (e.g., temperature, pH, contaminants, conductivity, and excess nutrients) include spills, industrial and municipal effluents, and residential and agricultural runoff. These activities may release chemical, biological, or heated effluents to rivers that can alter water conditions beyond the tolerances of the mussels, their fish hosts, or both, resulting in direct or cumulative adverse impacts to the species and their aquatic habitat.

²⁶ 77 FR 63440.

- (3) **Timber Management, Agriculture, and Grazing.** These activities have the potential to significantly degrade water quality through introduction of pesticides, fertilizers, and other chemicals to the water via runoff, and are also associated with direct and/or indirect in-stream disturbance and sedimentation.
- (4) **Mining.** Mining activities have the potential to degrade water quality through siltation and contamination and may alter hydrology and contaminate habitat through direct and/or indirect in-stream disturbance.
- (5) **Oil and Gas Development.** Resource extraction activities degrade water quality through siltation and contamination and alter stream banks and bottoms through direct and/or indirect in-stream disturbance.
- (6) **Transportation (roads, highways, bridges) and Utilities.** 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. Construction of roads, highways, pipelines, and related facilities also contributes to degradation of water quality through increased runoff of contaminated stormwater.
- (7) **Development and Recreation.** Commercial and residential development and recreational activities may cause riparian habitat and vegetation loss and siltation. Development- and recreation-related activities may include in-stream construction of moorings, piles, docks, and related structures.
- (8) **Other.** Other activities frequently occurring in-stream or on river banks with the potential to result in adverse impacts to habitat, such as animal and biological control, prescribed burns, land clearing, bank stabilization, habitat or shoreline restoration.

1.3 ORGANIZATION OF THE REPORT

25. The remainder of this report is organized as follows:

- **Chapter 2** – Framework for the Analysis
- **Chapter 3** – Incremental Impacts of Critical Habitat Designation for the Neosho Mucket and Rabbitsfoot Mussels
- **Chapter 4** – Baseline Conservation for the Neosho Mucket and Rabbitsfoot Mussels within Proposed Critical Habitat
- **Chapter 5** – Potential Economic Benefits
- **Appendix A** – Additional Statutory Requirements
- **Appendix B** – Sensitivity of Results to Discount Rate Assumption
- **Appendix C** – Undiscounted Impacts by Economic Activity
- **Appendix D** – Information from the U.S. Fish and Wildlife Service Regarding Potential Changes in Conservation for the Neosho Mucket and Rabbitsfoot Mussels Following Designation of Critical Habitat
- **Appendix E** – Overview of Regional Demographics

CHAPTER 2 | FRAMEWORK FOR THE ANALYSIS

26. The purpose of this analysis is to estimate the economic impact of actions taken to protect the two mussels and their habitat. This analysis examines the impacts of restricting or modifying specific land uses or activities for the benefit of the species and their habitat within the proposed critical habitat area. This analysis employs "without critical habitat" and "with critical habitat" scenarios. The "without critical habitat" scenario represents the baseline for the analysis, considering protections afforded the mussels absent critical habitat designation; for example, under Federal listing and other Federal, State, and local regulations. The "with critical habitat" scenario describes the incremental impacts associated specifically with the designation of critical habitat for the species. The incremental conservation efforts and associated impacts are those not expected to occur absent the designation of critical habitat for the mussels. The analysis discusses baseline and incremental impacts likely to occur after the proposed critical habitat is finalized.
27. According to section 4(b)(2) of the ESA, the Service must consider economic impacts, impacts to national security, and other relevant impacts of designating any particular area as critical habitat. An area may be excluded from designation as critical habitat if the benefits of exclusion (i.e., the impacts that would be avoided if an area were excluded from the designation) outweigh the benefits of designation so long as exclusion of the area will not result in extinction of the species. **The purpose of the economic analysis is to provide information to assist the Secretary of the DOI in determining whether the benefits of excluding particular areas from the designation outweigh the benefits of including those areas in the designation.**²⁷ In addition, this information allows the Service to address the requirements of Executive Orders 12866 (as affirmed and supplemented by Executive Order 13563), 12630, and 13211; the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA); and the Unfunded Mandates Reform Act (UMRA).²⁸
28. This chapter describes the framework for this analysis. It first describes the case law that led to the selection of the framework applied in this report. Next, the chapter describes in economic terms the general categories of economic effects that are the focus of the impact analysis, including a discussion of efficiency and distributional effects. This chapter then defines the analytic framework used to measure these impacts in the context

²⁷ 16 U.S.C. § 1533(b)(2).

²⁸ Executive Order 12866, Regulatory Planning and Review, September 30, 1993; Executive Order 13563, Improving Regulation and Regulatory Review, January 18, 2011; Executive Order 12630, Governmental Actions and Interference with Constitutionally Protected Property Rights, March 15, 1988; Executive Order 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use, May 18, 2001; 5. U.S.C. §§ 601 *et seq*; Pub Law No. 104-121; and 2 U.S.C. § 1501, *et seq*.

of critical habitat regulation and the consideration of benefits. It concludes with a description of the information sources relied upon in the analysis and notes on the presentation of the results.

2.1 BACKGROUND

29. The U.S. Office of Management and Budget's (OMB) guidelines for conducting economic analyses of regulations direct Federal agencies to measure the costs of a regulatory action against a baseline, which it defines as the "best assessment of the way the world would look absent the proposed action."²⁹ In other words, the baseline includes the existing regulatory and socio-economic burden imposed on landowners, managers, or other resource users potentially affected by the designation of critical habitat. Impacts that are incremental to that baseline (i.e., occurring over and above existing constraints) are attributable to the proposed regulation. Significant debate has occurred regarding whether assessing the impacts of the Service's proposed regulations using this baseline approach is appropriate in the context of critical habitat designations.

30. In 2001, the U.S. Tenth Circuit Court of Appeals instructed the Service to conduct a full analysis of all economic impacts of proposed critical habitat, regardless of whether those impacts are attributable co-extensively to other causes.³⁰ Specifically, the court stated,

The statutory language is plain in requiring some kind of consideration of economic impact in the CHD [critical habitat designation] phase. Although 50 C.F.R. 402.02 is not at issue here, the regulation's definition of the jeopardy standard as fully encompassing the adverse modification standard renders any purported economic analysis done utilizing the baseline approach virtually meaningless. We are compelled by the canons of statutory interpretation to give some effect to the congressional directive that economic impacts be considered at the time of critical habitat designation. . . . Because economic analysis done using the FWS's [Fish and Wildlife Service's] baseline model is rendered essentially without meaning by 50 C.F.R. § 402.02, we conclude Congress intended that the FWS conduct a full analysis of all of the economic impacts of a critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes. Thus, we hold the baseline approach to economic analysis is not in accord with the language or intent of the ESA [Endangered Species Act].³¹

31. Since that decision, however, courts in other cases have held that an incremental analysis of impacts stemming solely from the critical habitat rulemaking is proper.³² For example,

²⁹ OMB, "Circular A-4," September 17, 2003, available at <http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf>.

³⁰ *New Mexico Cattle Growers Assn v. United States Fish and Wildlife Service*, 248 F.3d 1277 (10th Cir. 2001).

³¹ *Ibid.*

³² *Cape Hatteras Access Preservation Alliance v. Department of Interior*, 344 F. Supp. 2d 108 (D.D.C. 2004); *Center for Biological Diversity v. United States Bureau of Land Management*, 422 F.Supp.2d 1115 (N.D. Cal. 2006).

in the March 2006 ruling that the August 2004 critical habitat rule for the Peirson's milk-vetch was arbitrary and capricious, the United States District Court for the Northern District of California stated,

The Court is not persuaded by the reasoning of *New Mexico Cattle Growers*, and instead agrees with the reasoning and holding of *Cape Hatteras Access Preservation Alliance v. U.S. Dep't of the Interior*, 344 F. Supp 2d 108 (D.D.C. 2004). That case also involved a challenge to the Service's baseline approach and the court held that the baseline approach was both consistent with the language and purpose of the ESA and that it was a reasonable method for assessing the actual costs of a particular critical habitat designation *Id* at 130. 'To find the true cost of a designation, the world with the designation must be compared to the world without it.'³³

32. More recently, in 2010, the U.S. Ninth Circuit Court of Appeals came to similar conclusions during its review of critical habitat designations for the Mexican spotted owl and 15 vernal pool species.³⁴
33. In order to address the divergent opinions of the courts and provide the most complete information to decision-makers, this economic analysis will employ "without critical habitat" and "with critical habitat" scenarios:
 - The "**without critical habitat**" scenario represents the **baseline** for the analysis, considering protections already afforded the mussels. The baseline for this analysis is the state of regulation absent designation of critical habitat. In the baseline, the two mussels receive protection under the Act, as well as under other Federal, State and local laws and conservation plans. The baseline includes sections 7, 9, and 10 of the Act to the extent they are expected to apply absent the designation of critical habitat for the species. The analysis qualitatively describes how baseline conservation efforts for the two mussels may be implemented across the proposed designation, and, where possible, provides examples of the potential magnitude of costs of these baseline conservation efforts (Chapter 4).
 - The "**with critical habitat**" scenario describes and monetizes the **incremental** impacts due specifically to designation of critical habitat for the species. Incremental conservation efforts and associated impacts are those that are expected to occur as a result of critical habitat designation. This report focuses on the incremental analysis (Chapter 3).
34. Incremental effects of critical habitat designation are determined using the Service's December 9, 2004 interim guidance on "Application of the 'Destruction or Adverse Modification' Standard Under Section 7(a)(2) of the Endangered Species Act" and information from the Service regarding what potential consultations and conservation

³³ *Center for Biological Diversity v. United States Bureau of Land Management*, 422 F.Supp.2d 1115 (N.D. Cal. 2006).

³⁴ *Home Builders Association of Northern California v. United States Fish and Wildlife Service*, 616 F.3d 983 (9th Cir. 2010), cert. denied, 179 L. Ed 2d 301, 2011 U.S. Lexis 1392, 79 U.S.L.W. 3475 (2011); *Arizona Cattle Growers v. Salazar*, 606 F. 3d 1160 (9th Cir. 2010), cert. denied, 179 L. Ed. 2d 300, 2011 U.S. Lexis 1362, 79 U.S.L.W. 3475 (2011).

efforts may be recommended as a result of critical habitat designation over and above those associated with the listing.³⁵ Specifically, in *Gifford Pinchot Task Force v. United States Fish and Wildlife Service*, the Ninth Circuit invalidated the Service's regulation defining destruction or adverse modification of critical habitat, and the Service no longer relies on this regulatory definition when analyzing whether an action is likely to destroy or adversely modify critical habitat.³⁶ Under the Act, the Service determines destruction or adverse modification on the basis of whether, with implementation of the proposed Federal action, the affected critical habitat would remain functional to serve its intended conservation role for the species.

35. A detailed description of the methodology used to define baseline and incremental impacts is provided in Section 2.3.

2.2 CATEGORIES OF POTENTIAL ECONOMIC EFFECTS OF SPECIES CONSERVATION

36. This economic analysis considers the economic efficiency and distributional effects that may result from efforts to protect the mussels and their habitat (hereinafter referred to collectively as "two mussels conservation efforts"). Economic efficiency effects generally reflect "opportunity costs" associated with the commitment of resources required to accomplish species and habitat conservation. For example, if the set of activities that may take place on a parcel of land is limited as a result of the designation or the presence of the species, and thus the market value of the land is reduced, this reduction in value represents one measure of opportunity cost or change in economic efficiency. Similarly, the costs incurred by a Federal action agency to consult with the Service under section 7 represent opportunity costs of two mussels conservation efforts.
37. This analysis also addresses the distribution of impacts associated with the designation, including an assessment of any local or regional impacts of habitat conservation and the potential effects of conservation efforts on small entities and the energy industry. This information may be used by decision-makers to assess whether the effects of species conservation efforts unduly burden a particular group or economic sector. For example, while conservation efforts may have a small impact relative to the national economy, individuals employed in a particular sector of the regional economy may experience relatively greater impacts. The differences between economic efficiency effects and distributional effects, as well as their application in this analysis, are discussed in greater detail below.

2.2.1 EFFICIENCY EFFECTS

38. At the guidance of OMB and in compliance with Executive Order 12866 "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to understand how society, as a whole, will be affected by a regulatory action. In the context of regulations that protect the two mussels' habitat, these efficiency effects

³⁵ Director, U.S. Fish and Wildlife Service, Memorandum to Regional Directors and Manager of the California-Nevada Operations Office, Subject: Application of the "Destruction or Adverse Modification" Standard under Section 7(a)(2) of the Endangered Species Act, dated December 9, 2004.

³⁶ *Gifford Pinchot Task Force v. United States Fish and Wildlife Service*, No. 03-35279 (9th Cir. 2004).

represent the opportunity cost of resources used or benefits foregone by society as a result of the regulations. Economists generally characterize opportunity costs in terms of changes in producer and consumer surpluses in affected markets.³⁷

39. In some instances, compliance costs may provide a reasonable approximation for the efficiency effects associated with a regulatory action. For example, a Federal land manager may enter into a consultation with the Service to ensure that a particular activity will not adversely modify critical habitat. The effort required for consultation is an economic opportunity cost because the landowner or manager's time and effort would have been spent in an alternative activity had the parcel not been included in the designation. When compliance activity is not expected to significantly affect markets—that is, not result in a shift in the quantity of a good or service provided at a given price, or in the quantity of a good or service demanded given a change in price—the measurement of compliance costs can provide a reasonable estimate of the change in economic efficiency.
40. Where habitat protection measures are expected to significantly impact a market, it may be necessary to estimate changes in producer and consumer surpluses. For example, protection measures that reduce or preclude development of large areas of land may shift the price and quantity of housing supplied in a region. In this case, changes in economic efficiency (i.e., social welfare) can be measured by considering changes in producer and consumer surplus in the market.
41. This analysis begins by measuring impacts associated with conservation efforts undertaken to protect the mussels and their habitat. As noted above, in some cases, compliance costs can provide a reasonable estimate of changes in economic efficiency. However, if the cost of conservation efforts is expected to significantly impact markets, the analysis will consider potential changes in consumer and/or producer surplus in affected markets. In the case of the two mussels, conservation efforts are not anticipated to significantly affect markets; therefore, this report focuses solely on compliance costs.

2.2.2 DISTRIBUTIONAL AND REGIONAL ECONOMIC EFFECTS

42. Measurements of changes in economic efficiency focus on the net impact of conservation efforts, without consideration of how certain economic sectors or groups of people are affected. Thus, a discussion of efficiency effects alone may miss important distributional considerations. OMB encourages Federal agencies to consider distributional effects separately from efficiency effects.³⁸ This analysis considers several types of distributional effects, including impacts on small entities; impacts on energy supply, distribution, and use; and regional economic impacts. It is important to note that these are fundamentally

³⁷ For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see: Gramlich, Edward M., *A Guide to Benefit-Cost Analysis* (2nd Ed.), Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. Environmental Protection Agency, *Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, September 2000, available at <http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html>.

³⁸ U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at <http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf>.

different measures of economic impact than efficiency effects, and thus cannot be added to or compared with estimates of changes in economic efficiency.

Impacts on Small Entities, Governments, and Energy Supply, Distribution, and Use

43. This analysis considers how small entities, including small businesses, organizations, and governments, as defined by the RFA, might be affected by future species conservation efforts.³⁹ It also assesses the potential for impacts to State, local and Tribal governments and the private sector as required by Title II of UMRA.⁴⁰ In addition, in response to Executive Order 13211 "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," this analysis considers the future impacts of conservation efforts on the energy industry and its customers.⁴¹

Regional Economic Effects

44. Regional economic impact analysis can provide an assessment of the potential localized effects of conservation efforts. Specifically, regional economic impact analysis produces a quantitative estimate of the potential magnitude of the initial change in the regional economy resulting from a regulatory action. Regional economic impacts are commonly measured using regional input/output models. These models rely on multipliers that represent the relationship between a change in one sector of the economy (e.g., expenditures by recreators) and the effect of that change on economic output, income, or employment in other local industries (e.g., suppliers of goods and services to recreators). These economic data provide a quantitative estimate of the magnitude of employment and revenue shifts in the local economy.
45. The use of regional input/output models in an analysis of the impacts of species and habitat conservation efforts can overstate the long-term impacts of a regulatory change. Most importantly, these models provide a static view of a region's economy. That is, they measure the initial impact of a regulatory change on an economy but do not consider long-term adjustments that the economy will make in response to this change. For example, these models estimate the number of jobs lost as a result of a regulatory change, but do not consider re-employment of these individuals over time or other adaptive responses by impacted businesses. In addition, flow of goods and services across regional boundaries defined in the model may change as a result of the regulation, compensating for a potential decrease in economic activity within the region.
46. Despite these and other limitations, in certain circumstances regional economic impact analyses may provide useful information about the scale and scope of localized impacts. It is important to remember that measures of regional economic effects generally reflect shifts in resource use rather than efficiency losses. Thus, these types of distributional effects are reported separately from efficiency effects (i.e., not summed). In addition, measures of regional economic impact cannot be compared with estimates of efficiency

³⁹ 5 U.S.C. §§ 601 *et seq.*

⁴⁰ 2 U.S.C. § 1531 *et seq.*

⁴¹ Executive Order 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use, May 18, 2001.

effects, but should be considered as distinct measures of impact. Given the limited nature of incremental impacts likely to result from this designation (see Chapter 3), measurable regional impacts are not anticipated.

2.3 ANALYTIC FRAMEWORK AND SCOPE OF THE ANALYSIS

47. This analysis: 1) identifies those economic activities most likely to threaten the mussels and their habitat; 2) describes the baseline regulation protection for the species; and 3) monetizes the incremental economic impacts to avoid adverse modification of the proposed critical habitat area. This section provides a description of the methodology used to separately identify baseline protections from the incremental impacts stemming from the proposed designation of critical habitat for the mussels. This evaluation of impacts in a "with critical habitat designation" versus a "without critical habitat designation" framework effectively measures the net change in economic activity associated with the proposed rulemaking.

2.3.1 IDENTIFYING BASELINE IMPACTS

48. The baseline for this analysis is the existing state of regulation prior to the designation of critical habitat, including the listing of the species under the Act, and other Federal, State and local laws and guidelines. This "without critical habitat designation" scenario also considers a wide range of additional factors beyond compliance costs of regulations that provide protection to the species. As recommended by OMB, the baseline incorporates, as appropriate, trends in market conditions, implementation of other regulations and policies by the Service and other government entities, and trends in other factors that have the potential to affect economic costs and benefits, such as the rate of regional economic growth in potentially affected industries.
49. Baseline protections include sections 7, 9, and 10 of the Act, and economic impacts resulting from these protections to the extent that they are expected to occur absent designation of critical habitat for the species. This analysis describes these baseline regulations and, where possible, provides examples of the potential magnitude of the costs of these baseline protections. The primary focus, however, is not on baseline costs, since these will not be affected by the proposed regulation. Instead, the focus of this analysis is on monetizing the incremental impacts forecast to result from the proposed critical habitat designation.
- Section 7 of the Act, absent critical habitat designation, requires Federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species. Consultations under the jeopardy standard result in administrative costs, as well as impacts of conservation efforts resulting from consideration of this standard. For context, Exhibit 2-1 provides the estimated costs to address jeopardy in a section 7 consultation.
 - Section 9 defines the actions that are prohibited by the Act. In particular, it prohibits "take" of endangered wildlife, where "take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in

any such conduct."⁴² Economic impacts associated with section 9 manifest themselves in sections 7 and 10.

- Under section 10(a)(1)(B) of the Act, a non-Federal entity (e.g., a landowner or local government) may develop a Habitat Conservation Plan (HCP) for a listed animal species in order to meet the conditions for issuance of an incidental take permit in connection with a land or water use activity or project.⁴³ The requirements posed by the HCP may have economic impacts associated with the goal of ensuring that effects of incidental take are adequately avoided or minimized. Development and implementation of HCPs is considered a baseline protection for the species and habitat unless the HCP is determined to be precipitated by the designation of critical habitat, or the designation influences stipulated conservation efforts under HCPs.

Enforcement actions taken in response to violations of the Act are not included in this analysis.

50. The protection of listed species and habitat is not limited to the Act. Other Federal agencies, as well as State and local governments, may also seek to protect the natural resources under their jurisdiction. If compliance with the Clean Water Act or State environmental quality laws, for example, protects habitat for the species, such protective efforts are considered to be baseline protections and costs associated with these efforts are categorized accordingly. Of note, however, such efforts may not be considered baseline in the case that they would not have been triggered absent the designation of critical habitat. In these cases, they are considered incremental impacts and are discussed below.

2.3.2 IDENTIFYING INCREMENTAL IMPACTS

51. This analysis quantifies the potential incremental impacts of this rulemaking. The focus of the incremental analysis is to determine the impacts on land uses and activities resulting from designation of critical habitat that are above and beyond those impacts resulting from existing required or voluntary conservation efforts undertaken due to other Federal, State, and local regulations or guidelines.
52. When critical habitat is designated, section 7 requires Federal agencies to ensure that their actions will not result in the destruction or adverse modification of critical habitat (in addition to considering whether the actions are likely to jeopardize the continued existence of the species). The added administrative costs of considering critical habitat in section 7 consultation and the additional impacts of implementing conservation efforts (i.e., reasonable and prudent alternatives in the case of an adverse modification finding) resulting from the protection of critical habitat are the direct compliance costs of designating critical habitat. These costs are not in the baseline and are considered incremental impacts of the rulemaking.

⁴² 16 U.S.C. § 1532.

⁴³ U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," August 6, 2002, accessed at <http://endangered.fws.gov/hcp/>.

Direct Impacts

53. The direct, incremental impacts of critical habitat designation stem from the consideration of the potential for destruction or adverse modification of critical habitat during section 7 consultations. The two categories of direct, incremental impacts of critical habitat designation are: 1) the administrative costs of conducting section 7 consultation; and 2) implementation of any conservation efforts requested by the Service through section 7 consultation to avoid potential destruction or adverse modification of critical habitat.
54. Section 7(a)(2) of the Act requires Federal agencies to consult with the Service whenever activities that they undertake, authorize, permit, or fund may affect a listed species or designated critical habitat. In some cases, consultations will involve the Service and another Federal agency only, such as the U.S. Army Corps of Engineers (the Corps). Often, they will also include a third party involved in projects that involve a permitted entity, such as the recipient of a Clean Water Act (CWA) section 404 permit.
55. During a consultation, the Service, Action agency, and entity applying for Federal funding or permitting (if applicable) communicate in an effort to minimize potential adverse effects to the species and/or proposed critical habitat. Communication between these parties may occur via written letters, phone calls, in-person meetings, or any combination of these. The duration and complexity of these interactions depends on a number of variables, including the type of consultation, the species, the activity of concern, and the potential effects to the species and designated critical habitat associated with the proposed activity, the Federal agency, and whether there is a private applicant involved.
56. Section 7 consultations with the Service may be either informal or formal. *Informal consultations* consist of discussions between the Service, Action agency, and applicant concerning an action that may affect a listed species or its designated critical habitat, and are designed to identify and resolve potential concerns at an early stage in the planning process. By contrast, a *formal consultation* is required if the Action agency determines that its proposed action may or will adversely affect the listed species or designated critical habitat in ways that cannot be resolved through informal consultation. The formal consultation process results in the Service's determination in its Biological Opinion (BO) of whether the action is likely to jeopardize a species or adversely modify critical habitat and recommendations to minimize those impacts. Regardless of the type of consultation or proposed project, section 7 consultations can require substantial administrative effort on the part of all participants.

Administrative Section 7 Consultation Costs

57. As described above, parties involved in section 7 consultations include the Service, a Federal action agency, and in some cases, a third-party applicant. While consultations are required for activities that involve a Federal nexus and may affect a species regardless of whether critical habitat is designated, the designation may increase the effort for consultations if the project or activity in question may affect critical habitat. Administrative efforts for consultation may therefore result in baseline and incremental impacts.

58. In general, three different scenarios associated with the designation of critical habitat may trigger incremental administrative consultation costs:
1. **Additional effort to address adverse modification in a new consultation** - New consultations taking place after critical habitat designation may require additional effort to address critical habitat issues above and beyond the listing issues. In this case, only the additional administrative effort required to consider critical habitat is considered an incremental impact of the designation.
 2. **Re-initiation of consultation to address adverse modification** - Consultations that have already been completed on a project or activity may require re-initiation to address critical habitat. In this case, costs of re-initiating the consultation, including all associated administrative and project modification costs, are considered incremental impacts of the designation.
 3. **Incremental consultation resulting entirely from critical habitat designation** - Critical habitat designation may trigger additional consultations that may not occur absent the designation (e.g., for an activity for which adverse modification may be an issue, while jeopardy is not, or consultations resulting from the new information about the potential presence of the species provided by the designation). Such consultations, for example, may be triggered in critical habitat areas that are not occupied by the species. All associated administrative and project modification costs of incremental consultations are considered incremental impacts of the designation.
59. The administrative costs of these consultations vary depending on the specifics of each project. One way to address this variability is to show a range of possible costs of consultation, as it may not be possible to predict the precise outcome of each future consultation in terms of level of effort. Review of consultation records and discussions with Service field offices resulted in a range of estimated administrative costs of consultation. For simplicity, the average of the range of costs in each category is applied in this analysis.
60. Exhibit 2-1 provides the incremental administrative consultation costs applied in this analysis. To estimate the fractions of the total administrative consultation costs that are baseline and incremental, the following assumptions are applied.
- The greatest effort will be associated with consultations that consider jeopardy and adverse modification. Depending on whether the consultation is precipitated by the listing or critical habitat designation, part or all of the costs, respectively, will be attributed to the proposed rule.
 - Efficiencies exist when considering jeopardy and adverse modification at the same time (e.g., in staff time saved for project review and report writing), and therefore incremental administrative costs of considering adverse modification in consultations precipitated by the listing result in the least incremental effort, roughly 10 percent of the cost of the entire consultation.⁴⁴ The remaining 90

⁴⁴ *Ibid.*

percent of the costs are attributed to consideration of the jeopardy standard in the baseline scenario. This latter amount also represents the cost of a consultation that only considers adverse modification (e.g., an incremental consultation for activities in unoccupied critical habitat) and is attributed wholly to critical habitat.

- Incremental costs of the re-initiation of a previously completed consultation because of the critical habitat designation are assumed to be approximately half the cost of a consultation considering both jeopardy and adverse modification. This assumes that re-initiations are less time-consuming as the groundwork for the project has already been considered in terms of its effect on the species. However, because the previously completed effort must be re-opened, they are more costly than simply adding consideration of critical habitat to a consultation already underway.

Section 7 Conservation Efforts Impacts

61. Section 7 consultation considering critical habitat may also result in additional conservation efforts recommended specifically to address potential destruction or adverse modification of critical habitat. For future consultations considering jeopardy and adverse modification, and for re-initiations of past consultations to consider critical habitat, the economic impacts of conservation efforts undertaken to avoid adverse modification are considered incremental impacts of critical habitat designation. For consultations forecast to occur specifically due to the designation, impacts of all associated conservation efforts are assumed to be incremental impacts of the designation. This is summarized below.
1. **Additional effort to address adverse modification in a new consultation** - Only conservation efforts above and beyond what would be requested to avoid or minimize jeopardy are considered incremental.
 2. **Re-initiation of consultation to address adverse modification** - Only conservation efforts above and beyond what was requested to avoid or minimize jeopardy are considered incremental.
 3. **Incremental consultation resulting entirely from critical habitat designation** - Impacts of all conservation efforts are considered incremental.

EXHIBIT 2-1. ADMINISTRATIVE CONSULTATION COSTS (2012 \$)

BASELINE ADMINISTRATIVE COSTS OF CONSULTATION					
CONSULTATION TYPE	SERVICE	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT	TOTAL COSTS
CONSULTATION CONSIDERING JEOPARDY (DOES NOT INCLUDE CONSIDERATION OF ADVERSE MODIFICATION)					
Technical Assistance	\$430	n/a	\$790	n/a	\$1,200
Informal	\$1,800	\$2,300	\$1,500	\$1,500	\$7,100
Formal	\$4,100	\$4,700	\$2,600	\$3,600	\$15,000
Programmatic	\$12,000	\$10,000	n/a	\$4,200	\$27,000
INCREMENTAL ADMINISTRATIVE COSTS OF CONSULTATION					
CONSULTATION TYPE	SERVICE	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT	TOTAL COSTS
NEW CONSULTATION RESULTING ENTIRELY FROM CRITICAL HABITAT DESIGNATION (TOTAL COST OF A CONSULTATION CONSIDERING BOTH JEOPARDY AND ADVERSE MODIFICATION)					
Technical Assistance	\$570	n/a	\$1,100	n/a	\$1,600
Informal	\$2,500	\$3,100	\$2,100	\$2,000	\$9,500
Formal	\$5,500	\$6,200	\$3,500	\$4,800	\$20,000
Programmatic	\$17,000	\$14,000	n/a	\$5,600	\$36,000
RE-INITIATION OF CONSULTATION TO ADDRESS ADVERSE MODIFICATION					
Technical Assistance	\$290	n/a	\$530	n/a	\$810
Informal	\$1,200	\$1,600	\$1,000	\$1,000	\$4,800
Formal	\$2,800	\$3,100	\$1,800	\$2,400	\$10,000
Programmatic	\$8,300	\$6,900	n/a	\$2,800	\$18,000
ADDITIONAL EFFORT TO ADDRESS ADVERSE MODIFICATION IN A NEW CONSULTATION					
Technical Assistance	\$140	n/a	\$260	n/a	\$410
Informal	\$610	\$780	\$510	\$500	\$2,400
Formal	\$1,400	\$1,600	\$880	\$1,200	\$5,000
Programmatic	\$4,200	\$3,500	n/a	\$1,400	\$9,000
Source: IEC analysis of full administrative costs is based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2011, and a review of consultation records from several Service field offices across the country conducted in 2002. Notes: 1. Estimates are rounded to two significant digits and may not sum due to rounding. 2. Estimates reflect average hourly time required by staff.					

Indirect Impacts

62. The designation of critical habitat may, under certain circumstances, affect actions that do not have a Federal nexus and thus are not subject to the provisions of section 7 under the Act. Indirect impacts are those unintended changes in economic behavior that may occur outside of the Act, through other Federal, State, or local actions, and that are caused by the designation of critical habitat. This section identifies common types of indirect

impacts that may be associated with the designation of critical habitat. Importantly, these types of impacts are not always considered incremental. In the case that these types of conservation efforts and economic effects are expected to occur regardless of critical habitat designation, they are appropriately considered baseline impacts in this analysis.

Habitat Conservation Plans

63. Under section 10 of the Act, landowners seeking an incidental take permit must develop an HCP to counterbalance the potential harmful effects that an otherwise lawful activity may have on a species. As such, the purpose of the habitat conservation planning process is to ensure that the effects of incidental take are adequately avoided, minimized, and, if unavoidable, mitigated. Thus, HCPs are developed to ensure compliance with section 9 of the Act and to meet the requirements of section 10 of the Act. We are unaware of any efforts to develop HCPs for Neosho mucket or rabbitsfoot.

Other State and Local Laws

64. Under certain circumstances, critical habitat designation may provide new information to a community about the sensitive ecological nature of a geographic region, potentially triggering additional economic impacts under other State or local laws. In cases where these impacts would not have been triggered absent critical habitat designation, they are considered indirect, incremental impacts of the designation. According to conversations with the Service's field office representatives in the States containing proposed critical habitat, indirect effects of critical habitat resulting from State and local laws are unlikely.⁴⁵
65. In Kansas, the *Kansas Nongame and Endangered Species Conservation Act of 1975* places the responsibility for identifying and undertaking appropriate conservation efforts for listed species directly upon the Department of Wildlife, Parks and Tourism through statutes and regulations.⁴⁶ Regulations require the department to issue special action permits for activities that affect species listed as threatened and endangered in Kansas. Department personnel conduct environmental reviews of these proposed activities, and if necessary issue action permits with special conditions that help offset negative effects to listed species and their critical habitat. Neosho mucket and rabbitsfoot are listed as endangered by the State, and permits are therefore already required for activities that may affect the species. The designation of critical habitat is not expected to change the State's implementation of this Act.⁴⁷

⁴⁵ Personal communications with the Service's Kansas, Missouri, and Mississippi Field Offices on November 26, 2012; with Alabama, Arkansas, Kentucky, and Pennsylvania Field Offices on November 28, 2012; with Indiana Field Office on November 30, 2012; with Tennessee Field Office on December 3, 2012; with Oklahoma Field Office on December 10, 2012; and with Illinois Field Office on December 13, 2012.

⁴⁶ Kansas Department of Wildlife, Parks, and Tourism. Threatened and Endangered Wildlife Website. Accessed at <http://www.kdwpt.state.ks.us/news/Services/Threatened-and-Endangered-Wildlife> on December 6, 2012.

⁴⁷ Personal communication with Eric Johnson, KS Department of Wildlife, Parks and Tourism, on December 7, 2012.

Additional Indirect Impacts

66. In addition to the indirect effects of compliance with other laws or triggered by the designation, project proponents, land managers and landowners may face additional indirect impacts, including the following:
- **Time Delays** - Both public and private entities may experience incremental time delays for projects and other activities due to requirements associated with the need to reinitiate the section 7 consultation process and/or compliance with other laws triggered by the designation. To the extent that delays result from the designation, they are considered indirect, incremental impacts of the designation.
 - **Regulatory Uncertainty** - The Service conducts each section 7 consultation on a case-by-case basis and issues a biological opinion on formal consultations based on species-specific and site-specific information. As a result, government agencies and affiliated private parties who consult with the Service under section 7 may face uncertainty concerning whether conservation efforts will be recommended by the Service and the nature of these modifications. This uncertainty may diminish as consultations are completed and additional information becomes available on the effects of critical habitat on specific activities. Where information suggests that this type of regulatory uncertainty stemming from the designation may affect a project or economic behavior, associated impacts are considered indirect, incremental impacts of the designation.
 - **Stigma** - In some cases, the public may perceive that critical habitat designation may result in limitations on private property uses above and beyond those associated with anticipated conservation efforts and regulatory uncertainty described above. 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. As the public becomes aware of the true regulatory burden imposed by critical habitat, the impact of the designation on property markets may decrease. To the extent that potential stigma effects on markets are probable and identifiable, these impacts are considered indirect, incremental impacts of the designation.
67. Indirect impacts may also result from critical habitat providing new information regarding where project proponents should consult on potential impacts to the species or habitat. According to representatives from the Service's field offices that oversee section 7 consultations in the study area, no indirect impacts are expected to result from critical habitat designation for the two mussels.⁴⁸

⁴⁸ Personal communications with the Service's Kansas, Missouri, and Mississippi Field Offices on November 26, 2012; with Alabama, Arkansas, Kentucky, and Pennsylvania Field Offices on November 28, 2012; with Indiana Field Office on November 30, 2012; with Tennessee Field Office on December 3, 2012; with Oklahoma Field Office on December 10, 2012; and with Illinois Field Office on December 13, 2012.

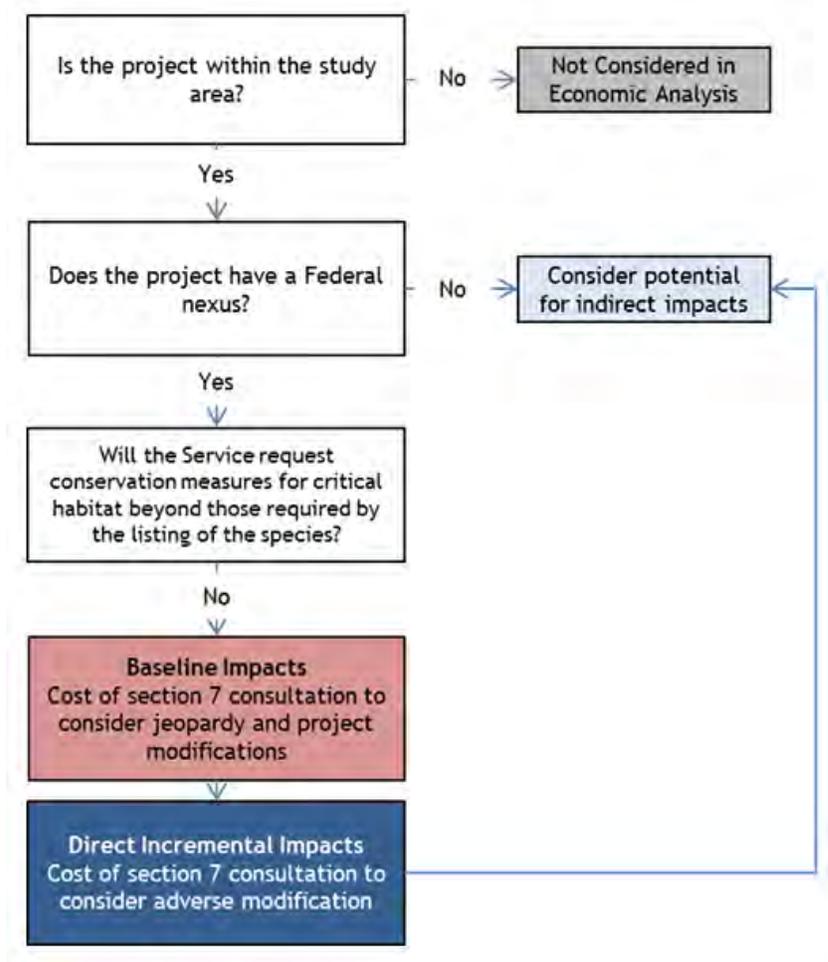
Approach to Identifying Incremental Impacts

68. To inform the economic analysis, the Service has provided a memorandum describing its expected approach to conservation for the mussels following critical habitat designation.⁴⁹ Specifically, this memorandum provides information on how the Service intends to address projects that might lead to adverse modification of critical habitat as distinct from projects that pose jeopardy to the species. The Service's memorandum is provided in Appendix D.
69. Based on the Service's memorandum, we expect that incremental conservation efforts associated with the proposed critical habitat designation are unlikely to be recommended. Specifically, the Service states in its memorandum:
- For occupied habitat, proposed actions that would adversely affect the physical and biological features (PBFs) in the designated critical habitat would usually also result in sufficient harm or harassment as to constitute jeopardy to the species... As such, project modifications that minimize effects to Neosho mucket and rabbitsfoot also would minimize effects to the PBFs associated with critical habitat. Accordingly, in occupied critical habitat it would be rare that an analysis would identify a difference between measures needed to avoid the destruction or adverse modification of critical habitat and measures needed to avoid jeopardizing the species. Absent reasonably foreseeable economic impacts that are distinctly attributable to the critical habitat portion of the analysis, 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. Therefore, we do not expect significant incremental effects in regard to developing and implementing conservation actions in currently occupied habitat for Neosho mucket and rabbitsfoot, although we acknowledge that this could occur.⁵⁰
70. While both mussel species do not occur in each of the 43 units, every unit is occupied by at least one mussel species. Consequently, we do not anticipate that critical habitat designation will generate additional requests for conservation efforts in any proposed critical habitat unit. As such, incremental economic impacts of the designation will likely be limited to additional administrative costs to the Service, Federal agencies and third parties of considering critical habitat as part of section 7 consultation.
71. Exhibit 2-2 summarizes the decision framework employed in this analysis.

⁴⁹ U.S. Fish and Wildlife Service to Industrial Economics, Inc. August 17, 2012. "Incremental Effects Memorandum for the Economic Analysis of the Proposed Rule to Designate Critical habitat for Neosho Mucket and Rabbitsfoot." See Appendix D.

⁵⁰ U.S. Fish and Wildlife Service to Industrial Economics, Inc. August 17, 2012. "Incremental Effects Memorandum for the Economic Analysis of the Proposed Rule to Designate Critical habitat for Neosho Mucket and Rabbitsfoot." See Appendix D.

EXHIBIT 2-2. DECISION FRAMEWORK FLOW CHART FOR TWO MUSSELS



2.3.3 BENEFITS

72. Under Executive Order 12866, OMB directs Federal agencies to provide an assessment of both the social costs and benefits of proposed regulatory actions.⁵¹ OMB’s Circular A-4 distinguishes two types of economic benefits: *direct benefits* and *ancillary benefits*. Ancillary benefits are defined as favorable impacts of a rulemaking that are typically unrelated, or secondary, to the statutory purpose of the rulemaking.⁵²
73. In the context of critical habitat, the primary purpose of the rulemaking (i.e., the direct benefit) is the potential to enhance conservation of the species. The published economics literature has documented that social welfare benefits can result from the conservation and recovery of endangered and threatened species. In its guidance for implementing Executive Order 12866, OMB acknowledges that it may not be feasible to monetize, or even quantify, the benefits of environmental regulations due to either an absence of

⁵¹ Executive Order 12866, Regulatory Planning and Review, September 30, 1993.

⁵² U.S. Office of Management and Budget, “Circular A-4,” September 17, 2003, available at <http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf>

defensible, relevant studies or a lack of resources on the implementing agency's part to conduct new research.⁵³ *Rather than rely on economic measures, the Service believes that the direct benefits of the proposed rule are best expressed in biological terms that can be weighed against the expected cost impacts of the rulemaking.*

74. Critical habitat designation may also generate ancillary benefits. Critical habitat aids in the conservation of species specifically by protecting the primary constituent elements on which the species depends. To this end, critical habitat designation can result in maintenance of particular environmental conditions that may generate other social benefits aside from the preservation of the species. That is, management actions undertaken to conserve a species or habitat may have coincident, positive social welfare implications, such as increased recreational opportunities in a region. While they are not the primary purpose of critical habitat, these ancillary benefits may result in gains in employment, output, or income that may offset the direct, negative impacts to a region's economy resulting from actions to conserve a species or its habitat. The potential ancillary benefits of critical habitat designation are described qualitatively in a separate chapter at the end of this report.

2.3.4 GEOGRAPHIC SCOPE OF THE ANALYSIS

75. Economic impacts of conservation for the two mussels are considered across the entire study area, as defined in Chapter 1. Results are presented for each proposed critical habitat unit.

2.3.5 ANALYTIC TIME FRAME

76. Ideally, the time frame of this analysis would be based on the expected time period over which the critical habitat regulation is expected to be in place. Specifically, the analysis would forecast impacts of implementing this rule through species recovery (i.e., when the rule is no longer required). Recent guidance from OMB indicates that "if a regulation has no predetermined sunset provision, the agency will need to choose the endpoint of its analysis on the basis of a judgment about the foreseeable future."⁵⁴ The "foreseeable future" for this analysis includes, but is not limited to, activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. Forecasted impacts will be based on the planning periods for potentially affected projects and will look out over a 20-year time horizon. OMB supports this time frame stating that "for most agencies, a standard time period of analysis is ten to 20 years, and rarely exceeds 50 years."⁵⁵ Therefore, this analysis considers economic impacts to activities over a 20-year period from 2013 (expected year of final critical habitat designation) through 2032.

⁵³ *Ibid.*

⁵⁴ The U.S. Office of Management and Budget, February 7, 2011. "Regulatory Impact Analysis: Frequently Asked Questions (FAQs)." Accessed on May 3, 2011 by http://www.whitehouse.gov/sites/default/files/omb/circulars/a004/a-4_FAQ.pdf.

⁵⁵ *Ibid.*

2.4 INFORMATION SOURCES

77. The primary sources of information for this report are communications with, and data provided by, personnel from the Service. In particular, the Incremental Effects Memorandum provided by the Service (see Appendix D), the Service's section 7 consultation record, and follow-on communication with representatives from the field offices that oversee section 7 consultations for the study area. This analysis also relies upon data from the U.S. Census, Energy Information Administration, and regional population forecasts. A complete list of references is provided at the end of this document.

2.5 PRESENTATION OF RESULTS

78. Impacts are described in present value and annualized terms applying discount rates of seven percent throughout the body of the report. Additionally, Appendix B provides the present and annualized value of impacts in each unit applying a three percent discount rate for comparison with values calculated at seven percent.⁵⁶ Appendix C presents undiscounted annual impact values by activity and subunit. Present value and annualized impacts are calculated according to the methods described in Exhibit 2-3 below.

⁵⁶ The U.S. Office of Management and Budget (OMB) directs Federal agencies to report results using discount rates of three and seven percent (see OMB, Circular A-4, 2003).

EXHIBIT 2-3. CALCULATING PRESENT VALUE AND ANNUALIZED IMPACTS

This analysis compares economic impacts incurred in different time periods in present value terms. The present value represents the value of a payment or stream of payments in common dollar terms. That is, it is the sum of a series of past or future cash flows expressed in today's dollars. Translation of economic impacts of past or future costs to present value terms requires the following: a) past or projected future costs of critical habitat designation; and b) the specific years in which these impacts have been or are expected to be incurred. With these data, the present value of the past or future stream of impacts (PV_c) from year t to T is measured in 2012 dollars according to the following standard formula:^a

$$PV_c = \sum_t^T \frac{C_t}{(1+r)^{t-2013}}$$

C_t = cost of two mussels critical habitat conservation efforts in year t

r = discount rate^b

Impacts for each activity are also expressed as annualized values. Annualized values are calculated to provide comparison of impacts across activities with varying forecast periods (T). For this analysis, activities employ a forecast period of 20 years, 2013 through 2032. Annualized future impacts (APV_c) are calculated by the following standard formula:

$$APV_c = PV_c \left[\frac{r}{1 - (1+r)^{-N}} \right]$$

N = number of years in the forecast period (in this analysis, 20 years)

^a To derive the present value of future impacts to development activities, t is 2013 and T is 2032.

^b To discount and annualize costs, guidance provided by the OMB specifies the use of a real rate of seven percent. In addition, OMB recommends sensitivity analysis using other discount rates such as three percent, which some economists believe better reflects the social rate of time preference. (U.S. Office of Management and Budget, Circular A-4, September 17, 2003 and U.S. Office of Management and Budget, "Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations; Notice," 68 *Federal Register* 5492, February 3, 2003.)

CHAPTER 3 | INCREMENTAL IMPACTS OF CRITICAL HABITAT DESIGNATION FOR THE NEOSHO MUCKET AND RABBITSFOOT MUSSELS

79. This chapter evaluates the potential incremental economic impacts of critical habitat designation for the two mussels. Section 3.1 summarizes the results of the incremental analysis and Section 3.2 describes the methodology used in the incremental analysis to forecast future section 7 activity within the study area. Section 3.3 presents the results of the incremental analysis by activity. In Section 3.4, we provide a sensitivity analysis that assesses the sensitivity of our results to the assumption that historical consultation rates, which are the predominant basis of the forecast provided by the Service, are predictive of future rates. Lastly, Section 3.5 describes the key assumptions in the analysis and the extent to which they may lead to under- or over-estimates of incremental impacts.

3.1 SUMMARY OF RESULTS

80. As described in Chapter 1 of this analysis, we assess the potential for critical habitat designation for the mussels to affect activities in the following major categories: (1) water flow management; (2) water quality management; (3) timber management, agriculture, and grazing; (4) mining; (5) oil and gas development; (6) transportation and utilities; (7) development and recreation; (8) other activities (such as animal and biological control, prescribed burns, land clearing, habitat or shoreline restoration, among others).

81. The key conclusion of the incremental analysis is that we do not expect critical habitat designation to generate additional requests for conservation efforts in any of the proposed critical habitat units. Every proposed critical habitat unit is occupied by at least one of the two mussel species. As described in Chapter 2, the Service's incremental effects memorandum (see Appendix D) 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."⁵⁷

82. Accordingly, incremental economic impacts of the designation will likely be limited to additional administrative costs to the Service, Federal agencies and third parties of considering critical habitat as part of the forecast section 7 consultations. This chapter presents our forecast section 7 consultation activity and the associated incremental costs of these consultations. Chapter 4 explores potential baseline costs associated with

⁵⁷ U.S. Fish and Wildlife Service to Industrial Economics, Inc. August 17, 2012. "Incremental Effects Memorandum for the Economic Analysis of the Proposed Rule to Designate Critical habitat for Neosho Mucket and Rabbitsfoot." See Appendix D.

conservation efforts recommended by the Service during these forecast section 7 consultations.

83. Exhibit 3-1 presents the total estimated incremental impacts associated with two mussel consultations by proposed critical habitat unit. We estimate these costs annually over an analysis period of 20 years beginning in 2013, which we then calculate on a present value basis.⁵⁸ Overall, proposed critical habitat Units RF2 (Verdigris River) and NM1 (Illinois River) are expected to generate the greatest amount of incremental impacts, due to the fact that section 7 consultations are expected to occur in this unit in all of the above activity categories over the next 20 years. Note that future incremental impacts are forecast for all but two proposed critical habitat units (NM6 and RF14), where we forecast no future consultations.

EXHIBIT 3-1. INCREMENTAL IMPACTS ASSOCIATED WITH FORECAST CONSULTATIONS FOR EACH PROPOSED CRITICAL HABITAT UNIT BY ACTIVITY TYPE (2012\$, SEVEN PERCENT DISCOUNT RATE)

PROPOSED CRITICAL HABITAT UNIT(S)	UNIT NAME	STATE(S) ¹	20-YEAR IMPACTS (2013-2032) ^{2, 3}	
			PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	\$400,000	\$26,000
NM2	Elk River	AR, MO	\$63,000	\$4,100
NM3	Shoal Creek	KS, MO	\$28,000	\$1,800
NM4	Spring River	KS, MO	\$14,000	\$890
NM5	North Fork Spring River	KS, MO	\$8,000	\$520
NM6	Fall and Verdigris Rivers	KS	\$0	\$0
NM7	Neosho River	KS	\$23,000	\$1,500
NM8	Cottonwood River	KS	\$47,000	\$3,000
RF1	Spring River	KS, MO	\$9,800	\$640
RF2	Verdigris River	OK	\$500,000	\$33,000
RF3	Neosho River	KS	\$6,400	\$420
RF4a	Ouachita River	AR	\$51,000	\$3,300
RF4b	Ouachita River	AR	\$94,000	\$6,100
RF5	Saline River	AR	\$310,000	\$20,000
RF6	Little River	AR, OK	\$140,000	\$9,300
RF7	Middle Fork Little Red River	AR	\$48,000	\$3,100
RF8a	White River	AR	\$200,000	\$13,000
RF8b	White River	AR	\$280,000	\$18,000
RF9	Black River	AR, MO	\$200,000	\$13,000
RF10	Spring River	AR, MO	\$66,000	\$4,300
RF11	South Fork Spring River	AR, MO	\$2,300	\$150
RF12	Strawberry River	AR	\$25,000	\$1,700
RF13	Buffalo River	AR	\$200,000	\$13,000
RF14	St. Francis River	MO	\$0	\$0
RF15	Big Sunflower River	MS	\$1,500	\$98

⁵⁸ For this cost analysis, we assume a base year (Year 0) of 2013 for present value calculations using costs estimated in 2012 dollars.

PROPOSED CRITICAL HABITAT UNIT(S)	UNIT NAME	STATE(S) ¹	20-YEAR IMPACTS (2013-2032) ^{2, 3}	
			PRESENT VALUE	ANNUALIZED
RF16	Bear Creek	AL, MS	\$180,000	\$12,000
RF17	Big Black River	MS	\$6,000	\$390
RF18	Paint Rock River	AL	\$48,000	\$3,100
RF19	Duck River	TN	\$200,000	\$13,000
RF20a	Tennessee River	TN	\$37,000	\$2,400
RF20b	Tennessee River	KY	\$160,000	\$10,000
RF21	Ohio River	IL, KY	\$160,000	\$11,000
RF22	Green River	KY	\$130,000	\$8,600
RF23	French Creek	PA	\$210,000	\$14,000
RF24	Allegheny River	PA	\$130,000	\$8,200
RF25	Muddy Creek	PA	\$89,000	\$5,800
RF26	Tippecanoe River	IN	\$140,000	\$9,300
RF27	Walhonding River	OH	\$24,000	\$1,500
RF28	Little Darby Creek	OH	\$17,000	\$1,100
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	\$49,000	\$3,200
RF30	Fish Creek	IN, OH	\$12,000	\$800
RF31	Red River	KY, TN	\$52,000	\$3,400
RF32	Shenango River	PA	\$4,500	\$290
TOTAL			\$4,400,000	\$290,000

Notes:

1. The State(s) listed for each proposed critical habitat unit contain(s) the proposed critical habitat unit and corresponding study area. In some cases, small portions of study areas fall into other States. However, in these instances, no section 7 consultations are forecast to occur in these other States; therefore, these States are not included in this list.
2. Proposed critical habitat unit RF1 overlaps with a portion of proposed critical habitat unit NM4, as both species are present in the same stretch of the Spring River. Likewise, proposed critical habitat unit RF3 overlaps unit NM7, as both species are present in the same stretch of the Neosho River. In cases where a consultation was forecast in the overlapping portion of the study areas for these units, costs associated with the consultation were apportioned evenly across the units.
3. The level of effort per consultation represents approximate averages based on the best available cost information. The cost estimates in this report are accordingly rounded to two significant digits to reflect this imprecision. The unit cost estimates therefore may not sum to the total costs reported due to rounding.

3.2 SECTION 7 CONSULTATION FORECAST METHODOLOGY

84. To identify the incremental impacts of the designation for each economic activity, we first reviewed past section 7 consultation rates within areas proposed for critical habitat designation. Consultation history data were provided by the Service's Environmental Conservation Online System (ECOS).⁵⁹ The data included consultations for fish and mussel species that had been entered into the Service's Tracking and Integrated Logging System (TAILS) database since 2007 by the Service's twelve field offices that have

⁵⁹ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

jurisdiction over the areas proposed for critical habitat designation.⁶⁰ The data included only those consultations that had been entered into TAILS with geospatial information (e.g., latitude and longitude), allowing us to import the data into GIS and identify those consultations that occurred within the study area for each proposed critical habitat unit. We then compiled a database that summarized, by proposed critical habitat unit, the past consultations by activity and consultation type (formal, informal, and technical assistance).

85. Next, we contacted representatives from each of the Service's twelve field offices that have jurisdiction within the study area in Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, and Tennessee.⁶¹ We provided each representative with the summary of past consultations for the proposed critical habitat units in their respective State. Our main goals in contacting the representatives were to a) ensure that the data were accurate and complete, and b) to determine if the representatives had any additional information that would allow us to better project future section 7 activity within the study area over the next 20 years.
86. During the interviews with the field office representatives, we learned of several reasons why the TAILS data provided by ECOS may not be accurate and complete. First, some of the Service's field offices have used the TAILS database more consistently or for a longer period of time than others. Secondly, TAILS data provided by ECOS included only consultations that had been entered into TAILS with geospatial information and excluded consultations without spatial information. Lastly, some field offices do not expect that all consultations occurring within the study areas for the proposed critical habitat units will include the two mussels. This is due to the fact that some of the study areas are quite large and so projects may occur within the study area, but at such a distance from the proposed critical habitat unit that it would not impact the mussels or their habitat. In all of these cases, field office representatives provided additional data or information that allowed us to more accurately summarize the consultation history for each proposed critical habitat unit.
87. As part of our interviews, we asked the field office representatives whether or not they expect historical rates of consultation to change over the next 20 years. In response, some field offices provided us with information that allowed us to adjust historical rates of consultation going forward to better reflect anticipated changes in the levels of activities occurring within the study area. For example, a recent informal consultation with Natural Resources Conservation Service (NRCS) in Arkansas identified many practices that are implemented by landowners participating in Farm Bill programs that should be consulted on with the Service. Because these practices have not been consulted on previously, they are not reflected in the consultation history for Arkansas. Therefore, the Arkansas Field Office provided us with a per-unit estimate of future consultations on NRCS Farm Bill

⁶⁰ 2007 is the year when TAILS was implemented by the Service.

⁶¹ A small area of the watershed that defines the study area for proposed critical habitat Unit RF24 (Allegheny River) overlaps with New York State. However, according to the New York Field Office, all section 7 consultations for this Unit would fall under the jurisdiction of the Pennsylvania Field Office. (Personal communication with Service's New York Field Office on October 2, 2012).

programs over the next 20 years. For more detailed information on this consultation, please refer to Section 4.3.3 of Chapter 4.

88. Notably, representatives in the Service's Arkansas and Oklahoma Field Offices indicated that they anticipate that the future rate of consultations on development and transportation-related activities will change from the historical rate reflected in the TAILS data due to future growth of cities located in or around the study areas for proposed critical habitat units. Specifically, in Arkansas, the Little Rock Metropolitan Area overlaps with the study area for proposed critical habitat Unit RF5 (Saline River). The Arkansas Field Office representative anticipates that the suburbs will continue to grow over the next 20 years, and as a result he recommended that we conservatively estimate a doubling of the rate of future consultations related to transportation and development activities for this unit.⁶²
89. Likewise, in Oklahoma, the Tulsa Metropolitan Area overlaps with the study area for proposed critical habitat Unit RF2 (Verdigris River). The Oklahoma Field Office representative anticipates that the suburbs of Tulsa will continue expanding within the study area for Unit RF2 over the next 20 years, and he recommended that we conservatively estimate a 50 percent increase in future consultations related to transportation and development for this unit.
90. According to their population projections, Tulsa anticipates a 31 percent increase in population between 2010 and 2035, and the Little Rock Metropolitan Area forecasts an increase of 24.9 percent between 2010 and 2030.^{63,64} Although these levels of anticipated growth are more modest than the increases provided by the Service, absent additional information on the geographic distribution of growth in these urban areas or on the specific relationship between growth and level of consultation activity, we conservatively adopt the higher increases forecast by the Service.
91. Other field office representatives did not anticipate changes in historical consultation rates. This conclusion may reflect the fact that the study area on whole is highly rural. Exhibit 3-2 shows the breakdown of population per square mile across census blocks that intersect the study area. Areas with population densities of less than 50 people per square mile make up over 86 percent of the study area, and only approximately 1.6 percent of the study area surpasses 500 people per square mile. The pattern of population density across census tracts that intersect the study area is displayed spatially in Exhibit 3-3. Additional detail on basic population statistics for the counties overlapping the study areas for the proposed critical habitat is provided in Appendix E.

⁶² Personal communication with the Service's Arkansas Field Office on November 28, 2012.

⁶³ Incog. Population Projections: The methodology for projecting and allocating, 2005 to 2035. Accessed on December 11, 2012 from <http://www.incog.org/Transportation/demographics.htm>. 2010 estimates from U.S. Census. 2012. Population Estimates: County Intercensal Estimates (2000-2010). Accessed on December 12, 2012 from <http://www.census.gov/popest/data/intercensal/county/county2010.html>.

⁶⁴ Metroplan. 2004. Population Projections for Little Rock-NLR-Conway MSA to 2030. Accessed on December 11, 2012 from <http://www.metroplan.org/index.php?fuseaction=p0007.&mod=64>.

EXHIBIT 3-2. BREAKDOWN OF POPULATION DENSITY ACROSS THE STUDY AREA

POPULATION PER SQUARE MILE	AREA WITHIN CENSUS BLOCKS OVERLAPPING THE STUDY AREA (SQUARE MILES)	PERCENTAGE OF AREA WITHIN CENSUS BLOCKS OVERLAPPING THE STUDY AREA
0 to 5	23,294	38.7%
5 to 20	17,782	29.5%
20 to 50	10,819	18.0%
25 to 100	4,489	7.5%
100 to 500	2,874	4.8%
500 to 2,000	650	1.1%
2,000 to 10,000	295	0.49%
>10,000	11	0.02%
TOTAL	60,214	100%
Source: U.S. Census Bureau (2010), 2010 TIGER/Line Shapefile: 2010 Census Population & Housing Unit Counts - Blocks. Retrieved December 18, 2012 at http://www.census.gov/geo/maps-data/data/tiger-data.html . Note: Totals may not sum due to rounding.		

92. Also of note, some of the field offices provided information about how they expect the historical rates of consultation on resource extraction activities to change in the future. Specifically, the Arkansas Field Office representative recommended that we double the historical rate of mining-related consultations going forward for proposed critical habitat Unit RF5 (Saline River) due to the presence of lignite resources in the watershed that may be mined if it becomes economically feasible to do so.⁶⁵ Similarly, the Oklahoma Field Office representative recommended that we double the historical rate of oil and gas-related consultations going forward in proposed critical habitat unit RF2 (Verdigris River).⁶⁶ While many of the shallow resources have been depleted in this area, technological advancements in the oil and gas industry may make it economically feasible for companies to return for further extraction.⁶⁷ Lastly, the Ohio Field Office anticipated that the rate of historical oil and gas-related consultations in proposed critical habitat Unit RF27 (Walhonding River) may double in the next 20 years due to increasing resource exploration in the watershed.⁶⁸
93. We recognize that a key source of uncertainty in the analysis is whether historical consultation rates, which are the predominant basis of the forecast provided by the Service, are predictive of future rates. Therefore, we test the sensitivity of our results to this assumption in a separate sensitivity analysis. The results of this analysis are presented in Section 3.4 of this chapter.

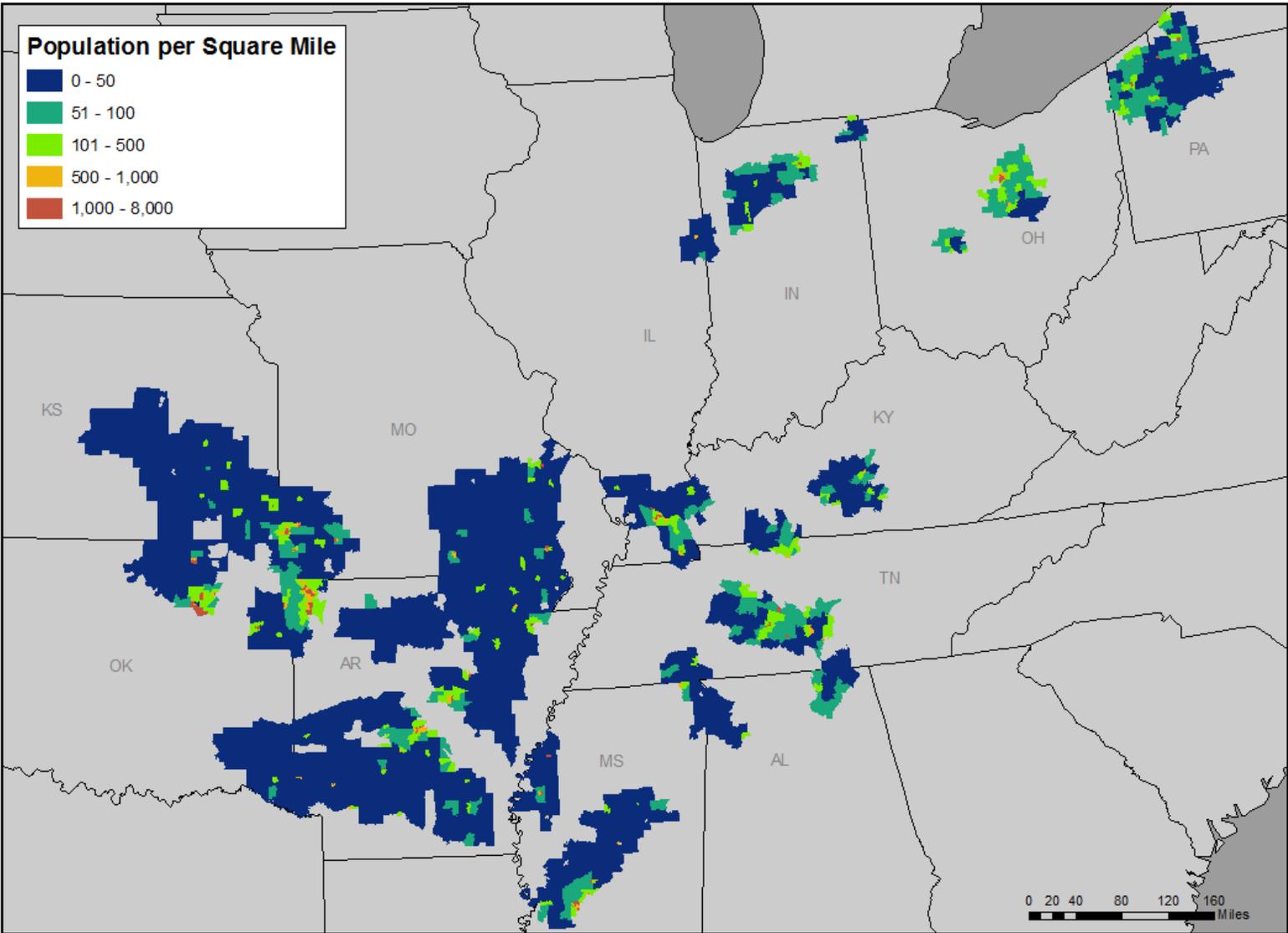
⁶⁵ Personal communication with the Service's Arkansas Field Office on November 28, 2012.

⁶⁶ Personal communication with the Service's Oklahoma Field Office on December 10, 2012.

⁶⁷ *Ibid.*

⁶⁸ Personal communication with the Service's Ohio Field Office on December 12, 2012.

EXHIBIT 3-3. POPULATION PER SQUARE MILE IN CENSUS TRACTS OVERLAPPING STUDY AREA



Source:
1. U.S. Fish and Wildlife Service, Arkansas Field Office
2. U.S. Census Bureau. (2010). 2010 Tiger/Line Shapefiles: Census Tracts. Retrieved December 18, 2012, from <http://www.census.gov/cgi-bin/geo/s/shapefiles2010/layrs.cgi>.

3.3 DETAILED RESULTS BY ACTIVITY

94. In this section, we present the forecast section 7 consultations for each activity by consultation type (formal, informal, and technical assistance), along with the estimated incremental impacts associated with the consultations over the next 20 years. These costs represent the estimated additional administrative costs to the Service, Federal agencies and third parties of considering critical habitat as part of the forecast section 7 consultations. In addition, for each activity, we present background information, including the nature of the threat to the two mussels and the Federal nexus that requires parties to consult with the Service under section 7 of the Act.

3.3.1 WATER FLOW MANAGEMENT

95. Dams, diversions, and groundwater pumping have the potential to degrade water quality through sedimentation; alter stream hydrology, geomorphology, and flow levels; decrease habitat heterogeneity; block upstream and downstream movement of mussels and fish; and destroy habitat through direct and/or indirect in-stream disturbance of substrate.⁶⁹ In addition, commercial navigation activities, including channel dredging and snag removal, alter stream hydrology and geomorphology, and degrade water and habitat quality. Disposal of dredged material into proposed critical habitat can alter or destroy substrate through direct and/or indirect in-stream disturbance.
96. Under section 404 of the CWA, any operation involving dredge or fill of the waters of the United States is required to receive a permit issued by the Corps.⁷⁰ In addition, Section 10 of the Rivers and Harbors Act regulates the construction of any structure in or over any navigable water of the United States, as well as the excavating from or depositing of material in such waters and the accomplishment of any other work affecting the course, location, condition, or capacity of such waters.⁷¹ Under Section 10, these projects require approval from the Corps and are subject to Corps permitting requirements. These broad permitting requirements serves as the main Federal nexus for water flow management activities that may threaten the two mussels.
97. In addition, the Service may also consult with the Tennessee Valley Authority (TVA), EPA, or with State environmental departments on water flow management activities. Lastly, the Service may consult with the Federal Energy Regulatory Commission (FERC), which issues licenses for hydropower projects. According to the Corps' National Inventory of Dams, five FERC-regulated hydroelectric dams are located in the study area for proposed critical habitat Units RF4b (Ouachita River), RF8a (White River), RF9 (Black River), RF24 (Allegheny River) and RF26 (Tippecanoe River). However, according to the Service, future consultations with FERC are not expected to occur as a result of critical habitat designation.^{72,73} The Service does not expect to recommend additional conservation efforts for the dams to protect against adverse modification of

⁶⁹ 77 FR 63440.

⁷⁰ 16 U.S.C. § 1344

⁷¹ 33 U.S.C. § 403

⁷² Personal communication with the Service's Pennsylvania Field Office on December 6, 2012.

⁷³ Personal communication with the Service's Arkansas Field Office on December 7, 2012.

critical habitat (i.e., above and beyond what would be required to protect against jeopardy of the species).^{74,75} In addition, Broken Bow Lake, a reservoir managed by the Corps and located within the study area for proposed critical habitat Unit RF6 (Little River), has been documented to affect the mussel community in the Little River.⁷⁶ However, while future consultations on relicensing the dam will likely consider impacts to the rabbitsfoot and its critical habitat, the Service does not expect to recommend additional conservation efforts for the dam to protect against adverse modification of critical habitat (i.e., above and beyond what would be required to protect against jeopardy of the species).⁷⁷

98. As shown in Exhibit 3-4, future section 7 consultations concerning water flow management activities are expected to occur in 28 proposed critical habitat units located in all 12 States containing proposed critical habitat (Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky Missouri, Mississippi, Ohio, Oklahoma, Pennsylvania, and Tennessee).⁷⁸ Overall, Unit RF19 (Duck River) is expected to generate the greatest amount of incremental impacts to future water flow management activities over the next 20 years.^{79,80} According to the Service's Tennessee Field Office, water flow management activities may be relatively high in this unit due to activities at Normandy Dam, which is located on the Duck River and operated by TVA.⁸¹ Normandy Reservoir supplies water to the City of Columbia and surrounding areas, and there is increasing pressure from local organizations to increase the water supply. The Tennessee Field Office believes that this may lead to changes in how TVA manages releases from the dam, and anticipates consulting with TVA on this work in the future.⁸²

⁷⁴ Personal communication with the Service's Pennsylvania Field Office on December 6, 2012.

⁷⁵ Personal communication with the Service's Arkansas Field Office on December 7, 2012.

⁷⁶ Personal communication with the Service's Arkansas Field Office on November 27, 2012.

⁷⁷ Personal communication with the Service's Oklahoma Field Office on December 10, 2012.

⁷⁸ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

⁷⁹ *Ibid.*

⁸⁰ Personal communication with the Service's Tennessee Field Office on December 3, 2012.

⁸¹ Personal communication with the Service's Tennessee Field Office on December 12, 2012.

⁸² *Ibid.*

**EXHIBIT 3-4. FORECAST SECTION 7 CONSULTATIONS FOR WATER FLOW MANAGEMENT AND
INCREMENTAL IMPACTS BY UNIT (2012\$, SEVEN PERCENT DISCOUNT RATE)**

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	NUMBER OF FORECAST SECTION 7 CONSULTATIONS			20-YEAR IMPACTS (2013-2032) ²	
			FORMAL	INFORMAL	TECHNICAL ASSISTANCE	PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	0.0	3.3	10.0	\$6,800	\$440
NM2	Elk River	AR, MO	0.0	0.0	10.0	\$2,300	\$150
NM3	Shoal Creek	KS, MO	0.0	0.5	0.0	\$610	\$40
NM4	Spring River	KS, MO	0.3	0.0	0.0	\$940	\$62
NM5	North Fork Spring River	KS, MO	0.3	0.0	0.0	\$940	\$62
NM7	Neosho River	KS	0.5	0.5	0.0	\$1,900	\$120
NM8	Cottonwood River	KS	3.6	6.4	0.0	\$19,000	\$1,200
RF1	Spring River	KS, MO	0.3	0.0	0.0	\$940	\$62
RF2	Verdigris River	OK	0.0	8.0	2.0	\$11,000	\$730
RF3	Neosho River	KS	0.5	0.0	0.0	\$1,400	\$92
RF4b	Ouachita River	AR	0.0	3.3	6.7	\$6,000	\$390
RF5	Saline River	AR	0.0	3.3	10.0	\$6,800	\$440
RF6	Little River	AR, OK	0.0	2.0	0.0	\$2,700	\$180
RF8a	White River	AR	0.0	3.3	10.0	\$6,800	\$440
RF8b	White River	AR	1.0	0.0	26.7	\$11,000	\$730
RF9	Black River	AR, MO	0.0	6.7	6.7	\$11,000	\$690
RF10	Spring River	AR, MO	0.0	0.0	6.7	\$1,500	\$100
RF16	Bear Creek	AL, MS	0.0	3.3	16.7	\$8,300	\$540
RF18	Paint Rock River	AL	0.0	0.0	3.3	\$770	\$50
RF19	Duck River	TN	6.0	5.0	6.7	\$27,000	\$1,800
RF20a	Tennessee River	TN	0.0	0.0	3.3	\$770	\$50
RF20b	Tennessee River	KY	1.0	2.0	0.0	\$5,500	\$360
RF22	Green River	KY	2.0	2.0	0.0	\$8,400	\$550
RF23	French Creek	PA	0.0	3.3	0.0	\$4,500	\$290
RF25	Muddy Creek	PA	0.0	1.7	0.0	\$2,200	\$150
RF26	Tippecanoe River	IN	0.0	16.7	3.3	\$23,000	\$1,500
RF27	Walhonding River	OH	0.0	3.3	0.0	\$4,500	\$290
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	4.0	4.0	0.0	\$17,000	\$1,100
TOTAL			19.6	78.6	122.0	\$190,000	\$13,000

Notes:

1. The State(s) listed for each proposed critical habitat unit contain(s) the proposed critical habitat unit and corresponding study area. In some cases, small portions of study areas fall into other States. However, in these instances, no section 7 consultations are forecast to occur in these other States; therefore, these States are not included in this list.
2. The level of effort per consultation represents approximate averages based on the best available cost information. The cost estimates in this report are accordingly rounded to two significant digits to reflect this imprecision. The unit cost estimates therefore may not sum to the total costs reported due to rounding.

3.3.2 WATER QUALITY MANAGEMENT

99. Water quality management activities are those that would significantly alter the water chemistry or quality (e.g., temperature, pH, contaminants, conductivity, and excess nutrients) and include spills, industrial and municipal effluents, and residential and agricultural runoff. These activities may release chemical, biological, or heated effluents to rivers that can alter water conditions beyond the tolerances of the mussels, their fish hosts, or both, resulting in direct or cumulative adverse impacts to the species and their aquatic habitat.
100. While water quality management activities likely occur throughout the study area for the proposed critical habitat designation, there are fewer section 7 consultations for this activity compared to others due to the lack of Federal nexus. The majority of past water quality management-related consultations within the study area have occurred with State departments to which EPA has delegated the authority to issue National Pollutant Discharge Elimination System (NPDES) permits (including Arkansas Department of Environmental Quality (ADEQ), Tennessee Department of Environment and Conservation (TDEC), Oklahoma Department of Environmental Quality (ODEQ), and Mississippi Department of Environmental Quality (MDEQ), among others).⁸³ All of the States containing proposed critical habitat for the two mussels have approved State NPDES permit programs.⁸⁴ While Section 7 of the Act does not apply to NPDES-authorized States for issuance of NPDES permits, a number of States have adopted procedures to evaluate listed species and their critical habitat consistent with Federal procedures.⁸⁵ For example, in Arkansas NPDES permit applicants are required 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.^{86,87}
101. As shown in Exhibit 3-5, future section 7 consultations concerning water quality management activities are expected to occur in the study area for 24 proposed critical habitat units located in 11 States (Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, Oklahoma, Pennsylvania, and Tennessee). Overall, proposed critical habitat unit RF2 (Verdigris River) is expected to generate the greatest amount of incremental impacts to future water quality management activities. Specifically, the Service expects to conduct informal section 7 consultations relatively frequently in this unit with ODEQ on the issuance of stormwater permits.⁸⁸ Permit activity is expected to be relatively high in proposed critical habitat Unit RF2 because the

⁸³ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

⁸⁴ 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> on December 7, 2012. As noted, 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 CAFOs and certain other discharges from agriculture.

⁸⁵ U.S. Environmental Protection Agency. NPDES Frequently Asked Questions. Accessed at http://cfpub.epa.gov/npdes/allfaqs.cfm?program_id=0 on December 7, 2012.

⁸⁶ Personal communication with the Service's Arkansas Field Office on December 7, 2012.

⁸⁷ Personal communication with Arkansas Department of Environmental Quality, Water Division, Permits Branch on December 10, 2012.

⁸⁸ Personal communication with the Service's Oklahoma Field Office on December 10, 2012.

study area for the unit overlaps with the Tulsa Metropolitan Area, which is the second-largest city in Oklahoma.⁸⁹

EXHIBIT 3-5. FORECAST SECTION 7 CONSULTATIONS FOR WATER QUALITY MANAGEMENT AND INCREMENTAL IMPACTS BY UNIT (2012\$, SEVEN PERCENT DISCOUNT RATE)

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	NUMBER OF FORECAST SECTION 7 CONSULTATIONS			20-YEAR IMPACTS (2013-2032) ²	
			FORMAL	INFORMAL	TECHNICAL ASSISTANCE	PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	0.0	0.0	13.3	\$3,100	\$200
NM2	Elk River	AR, MO	0.0	0.0	6.7	\$1,500	\$100
NM3	Shoal Creek	KS, MO	0.0	6.7	0.0	\$9,000	\$590
NM4	Spring River	KS, MO	0.0	0.0	1.1	\$260	\$17
NM5	North Fork Spring River	KS, MO	0.0	0.0	1.1	\$260	\$17
RF1	Spring River	KS, MO	0.0	0.0	1.1	\$260	\$17
RF2	Verdigris River	OK	0.0	22.0	6.0	\$31,000	\$2,000
RF4b	Ouachita River	AR	0.0	0.0	26.7	\$6,100	\$400
RF5	Saline River	AR	0.0	0.0	13.3	\$3,100	\$200
RF6	Little River	AR, OK	0.0	4.0	3.3	\$6,100	\$400
RF8a	White River	AR	0.0	0.0	20.0	\$4,600	\$300
RF8b	White River	AR	0.0	0.0	16.7	\$3,800	\$250
RF9	Black River	AR, MO	0.0	0.0	26.7	\$6,100	\$400
RF10	Spring River	AR, MO	0.0	0.0	6.7	\$1,500	\$100
RF13	Buffalo River	AR	0.0	0.0	3.3	\$770	\$50
RF16	Bear Creek	AL, MS	0.0	3.3	3.3	\$5,300	\$340
RF20a	Tennessee River	TN	1.7	1.7	0.0	\$7,000	\$450
RF20b	Tennessee River	KY	0.0	3.0	0.0	\$4,000	\$260
RF21	Ohio River	IL, KY	0.0	2.0	0.0	\$2,700	\$180
RF22	Green River	KY	0.0	3.0	0.0	\$4,000	\$260
RF23	French Creek	PA	0.0	3.3	0.0	\$4,500	\$290
RF26	Tippecanoe River	IN	0.0	3.3	0.0	\$4,500	\$290
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	0.0	8.0	0.0	\$11,000	\$700
RF31	Red River	KY, TN	0.0	1.0	0.0	\$1,300	\$88
TOTAL			1.7	61.3	149.3	\$120,000	\$7,900

Notes:

1. The State(s) listed for each proposed critical habitat unit contain(s) the proposed critical habitat unit and corresponding study area. In some cases, small portions of study areas fall into other States. However, in these instances, no section 7 consultations are forecast to occur in these other States; therefore, these States are not included in this list.
2. The level of effort per consultation represents approximate averages based on the best available cost information. The cost estimates in this report are accordingly rounded to two significant digits to reflect this imprecision. The unit cost estimates therefore may not sum to the total costs reported due to rounding.

⁸⁹ Personal communication with the Service's Oklahoma Field Office on December 10, 2012.

3.3.3 TIMBER, AGRICULTURE, AND GRAZING

102. Timber, agriculture, and grazing activities have the potential to significantly degrade water quality through introduction of pesticides, fertilizers, and other chemicals to the water via runoff, and are also associated with direct and/or indirect in-stream disturbance and sedimentation.
103. Although timber, agriculture, and grazing operations on private lands are not normally federally-regulated or permitted activities, the possibility exists for these operations to require Federal permits or receive Federal funding. When undertaken within or adjacent to waters of the U.S., these operations could potentially require section 404 permitting from the Corps. Silviculture, agriculture, and grazing projects may also receive Federal funding through NRCS programs, such as the Environmental Quality Incentive Program (EQIP), Wildlife Habitat Incentive Program (WHIP), and Working Lands for Wildlife. In these cases, the activities are subject to section 7 consultation regarding potential effects on listed species and habitats.
104. As shown in Exhibit 3-6, future section 7 consultations concerning timber, agriculture, and grazing activities are expected to occur in the study area for 23 proposed critical habitat units located in eight States (Alabama, Arkansas, Illinois, Kansas, Mississippi, Missouri, Oklahoma, and Pennsylvania). Overall, proposed critical habitat Units RF8b (White River) and RF9 (Black River) are expected to generate the greatest amount of incremental impacts to future timber, agriculture, and grazing activities over the next 20 years. This is due to new NRCS Farm Bill program work that the Service's Arkansas Field Office anticipates occurring over the next 20 years.⁹⁰ The outcome of the Arkansas Field Office's consultation with NRCS is discussed in greater detail in Chapter 4 of this report.
105. According to the Service, the reason NRCS is not expected to consult at as high a rate in other States is because NRCS has not initiated section 7 consultation on their Farm Bill programs and associated practices in many of the other States containing proposed critical habitat.⁹¹ To the extent that future NRCS consultations with the States leads to an increased rate of section 7 consultation on Farm Bill programs, this analysis may underestimate the incremental impacts to these activities of critical habitat designation. This uncertainty is discussed further in section 3.5 of this chapter.

⁹⁰ Personal communication with the Service's Arkansas Field Office on November 28, 2012.

⁹¹ Personal communication with the Service's Arkansas Field Office on December 18, 2012.

**EXHIBIT 3-6. FORECAST SECTION 7 CONSULTATIONS FOR TIMBER, AGRICULTURE AND GRAZING
AND INCREMENTAL IMPACTS BY UNIT (2012\$, SEVEN PERCENT DISCOUNT RATE)**

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	NUMBER OF FORECAST SECTION 7 CONSULTATIONS			20-YEAR IMPACTS (2013-2032) ²	
			FORMAL	INFORMAL	TECHNICAL ASSISTANCE	PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	0.0	55.3	40.0	\$84,000	\$5,500
NM2	Elk River	AR, MO	0.0	0.0	3.3	\$770	\$50
NM3	Shoal Creek	KS, MO	0.0	0.3	0.0	\$340	\$22
NM4	Spring River	KS, MO	0.0	0.3	0.0	\$340	\$22
NM5	North Fork Spring River	KS, MO	0.0	0.3	0.0	\$340	\$22
RF1	Spring River	KS, MO	0.0	0.3	0.0	\$340	\$22
RF2	Verdigris River	OK	4.0	6.0	0.0	\$19,000	\$1,300
RF4a	Ouachita River	AR	0.0	20.0	6.7	\$28,000	\$1,900
RF4b	Ouachita River	AR	0.0	20.0	23.3	\$32,000	\$2,100
RF5	Saline River	AR	0.0	40.0	16.7	\$58,000	\$3,800
RF6	Little River	AR, OK	0.0	0.0	20.0	\$4,600	\$300
RF7	Middle Fork Little Red River	AR	0.0	12.0	0.0	\$16,000	\$1,100
RF8a	White River	AR	0.0	100.0	6.7	\$140,000	\$8,900
RF8b	White River	AR	0.0	116.7	0.0	\$160,000	\$10,000
RF9	Black River	AR, MO	0.0	120.0	0.0	\$160,000	\$11,000
RF10	Spring River	AR, MO	0.0	15.0	0.0	\$20,000	\$1,300
RF12	Strawberry River	AR	0.0	18.3	3.3	\$25,000	\$1,700
RF13	Buffalo River	AR	0.0	110.0	0.0	\$150,000	\$9,700
RF16	Bear Creek	AL, MS	0.0	26.7	13.3	\$39,000	\$2,500
RF18	Paint Rock River	AL	0.0	6.7	3.3	\$9,700	\$640
RF23	French Creek	PA	0.0	3.3	0.0	\$4,500	\$290
RF24	Allegheny River	PA	0.0	1.7	0.0	\$2,200	\$150
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	0.0	8.0	0.0	\$11,000	\$700
TOTAL			4.0	680.7	136.7	\$960,000	\$63,000

Notes:

1. The State(s) listed for each proposed critical habitat unit contain(s) the proposed critical habitat unit and corresponding study area. In some cases, small portions of study areas fall into other States. However, in these instances, no section 7 consultations are forecast to occur in these other States; therefore, these States are not included in this list.
2. The level of effort per consultation represents approximate averages based on the best available cost information. The cost estimates in this report are accordingly rounded to two significant digits to reflect this imprecision. The unit cost estimates therefore may not sum to the total costs reported due to rounding.

3.3.4 MINING

106. Mining activities have the potential to degrade water quality through siltation and contamination and may alter hydrology and contaminate habitat through direct and/or indirect in-stream disturbance.
107. In general, mining activities across the study area are regulated by State environmental departments. States issuing non-coal mining permits (such as sand and gravel) under State programs (that do not receive Federal funding) are not required to consult with the Service under section 7 of the Act, but it is sometimes the case that a non-coal mining activity will lead to a consultation with the Service if there are endangered species present in the proposed mining area.⁹² States issuing coal mining permits generally have been delegated the primary responsibility to regulate surface coal mining on lands within their jurisdiction by the Office of Surface Mining Reclamation and Enforcement (OSMRE), with OSMRE performing an oversight role.⁹³ Although some State programs may receive funding assistance from OSMRE, monetary allotments to States for mining was deemed not to be a major Federal action within the meaning of Section 102(2)(C) of NEPA, and therefore does not require section 7 consultation.⁹⁴ In Tennessee, however, OSMRE has operated a Federal regulatory program as the primary regulator under Surface Mining Control and Reclamation Act of 1977 (SMCRA) since October 1984 when the State repealed its surface mining law.⁹⁵
108. In addition, the Service consulted with OSMRE in 1996 on the continuation and approval of surface coal mining and reclamation operations under State and Federal regulatory programs adopted pursuant to SMCRA.^{96,97} The Service issued a BO which concluded that surface coal mining and reclamation operations conducted in accordance with the provisions of SMCRA and the terms and conditions of the BO are “unlikely to jeopardize the continued existence of any threatened, endangered, or proposed species or result in adverse modification of designated or proposed critical habitats.”⁹⁸ In sum, due to the fact that most mining programs are State-run and due to the findings of the BO, there are few cases where mining activities lead to section 7 consultation with the Service.

⁹² Personal communication with Arkansas Department of Environmental Quality, Surface Mining and Reclamation Division, Non-Coal Program, on December 7, 2012.

⁹³ Office of Surface Mining Reclamation and Enforcement. OSM’s Major Programs Website. Accessed at <http://www.osmre.gov/programs/programs.shtm> on December 7, 2012.

⁹⁴ Office of Surface Mining Reclamation and Enforcement. “Department of the Interior, Departmental Manual, Series: Environmental Quality Programs, Part 516: National Environmental Policy Act of 1969, Chapter 13: Managing the NEPA Process—Office of Surface Mining.” Effective Date: 5/17/04.

⁹⁵ Office of Surface Mining Reclamation and Enforcement. 2011. *Appalachian Region: Tennessee*. Accessed on February 10, 2012 at <http://www.osmre.gov/aboutus/Aboutus.shtm>.

⁹⁶ Memorandum of Understanding among the U.S. Army Corps of Engineers, the U.S. Office of Surface Mining, the U.S. Environmental Protection Agency, and the U.S. Fish and Wildlife Service for the purpose of providing concurrent and coordinated review and processing of surface coal mining applications proposing placement of dredged and/or fill material in waters of the United States.

⁹⁷ Endangered Species Act - section 7 Consultation - Biological Opinion and Conference Report - Surface Coal Mining Regulatory Programs Under the Surface Mining Control and Reclamation Act of 1977, P.L. 95-87 (SMCRA or the Act). September 24, 1996.

⁹⁸ Memorandum from Assistance Director - Ecological Services, Formal Section 7 Biological Opinion and Conference Report on Surface Coal Mining and Reclamation Operations Under the Surface Mining Control and Reclamation Act of 1977.

109. As displayed in Exhibit 3-7, future section 7 consultations concerning mining activities are expected to occur in the study area for 14 proposed critical habitat units located in eight States (Alabama, Arkansas, Kansas, Kentucky, Mississippi, Missouri, Oklahoma, and Tennessee). Consultations concerning sand and gravel mining are expected to occur in the study area for eight proposed critical habitat units: NM1, NM3, NM7, RF8a, RF8b, RF9, RF10, RF20a, and RF21.⁹⁹ Mining-related activities are also expected to occur in Oklahoma (Unit RF2), these activities are expected to be limited to reclamation projects on abandoned mining sites.¹⁰⁰

EXHIBIT 3-7. FORECAST SECTION 7 CONSULTATIONS FOR MINING AND INCREMENTAL IMPACTS BY UNIT (2012\$, SEVEN PERCENT DISCOUNT RATE)

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	NUMBER OF FORECAST SECTION 7 CONSULTATIONS			20-YEAR IMPACTS (2013-2032) ²	
			FORMAL	INFORMAL	TECHNICAL ASSISTANCE	PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	0.0	3.3	3.3	\$5,300	\$340
NM3	Shoal Creek	KS, MO	0.5	0.9	0.0	\$2,500	\$160
NM7	Neosho River	KS	0.5	0.9	0.0	\$2,500	\$160
RF2	Verdigris River	OK	0.0	2.0	0.0	\$2,700	\$180
RF5	Saline River	AR	0.0	26.7	6.7	\$37,000	\$2,400
RF8a	White River	AR	0.0	0.0	6.7	\$1,500	\$100
RF8b	White River	AR	0.0	3.3	0.0	\$4,500	\$290
RF9	Black River	AR, MO	0.0	0.0	3.3	\$770	\$50
RF10	Spring River	AR, MO	0.0	0.0	3.3	\$770	\$50
RF15	Big Sunflower River	MS	0.0	1.1	0.0	\$1,500	\$98
RF16	Bear Creek	AL, MS	0.0	1.1	0.0	\$1,500	\$98
RF17	Big Black River	MS	0.0	1.1	0.0	\$1,500	\$98
RF20a	Tennessee River	TN	0.0	0.0	3.3	\$770	\$50
RF21	Ohio River	IL, KY	1.0	4.0	0.0	\$8,200	\$540
TOTAL			1.9	44.5	26.7	\$71,000	\$4,700

Notes:

1. The State(s) listed for each proposed critical habitat unit contain(s) the proposed critical habitat unit and corresponding study area. In some cases, small portions of study areas fall into other States. However, in these instances, no section 7 consultations are forecast to occur in these other States; therefore, these States are not included in this list.

2. The level of effort per consultation represents approximate averages based on the best available cost information. The cost estimates in this report are accordingly rounded to two significant digits to reflect this imprecision. The unit cost estimates therefore may not sum to the total costs reported due to rounding.

⁹⁹ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

¹⁰⁰ Personal communication with the Service's Oklahoma Field Office on December 10, 2012.

110. Coal mining activities have occurred in the past in the study area for proposed critical habitat Unit RF5 (Saline River).¹⁰¹ According to the Service's Arkansas Field Office, the historical rate of consultation on coal mining in this area may increase significantly over the next 20 years due to the presence of untapped lignite resources in the watershed.¹⁰² Therefore, our analysis conservatively estimates that the historical rate of coal mining consultations in Unit RF5 will double going forward for the 20 year timeframe of the analysis. Lastly, there is potential for future lignite mining in the proposed critical habitat units in Mississippi (Units RF15, RF16, and RF17) due to the fact that there are untapped resources in the study area, and because in 2012 the Service conducted an informal consultation with OSMRE regarding mining enforcement policy.¹⁰³ Due to uncertainty surrounding if and when future mining and associated section 7 consultations with the Service may occur, we conservatively estimate that the historical rate of consultation on this activity will remain the same in the future across the three units in Mississippi.
111. Overall, most informal and technical assistance consultations associated with mining are expected to occur in proposed critical habitat unit RF5 (Saline River). This unit is also expected to generate the greatest amount of incremental impacts to future mining activities over the next 20 years, due to the fact that there are untapped lignite resources in the Saline River watershed that may be mined in the future if it becomes economically feasible to do so.¹⁰⁴ However due to uncertainty surrounding if and when this may occur, the analysis may overestimate future impacts to mining in this unit.

3.3.5 OIL AND GAS

112. Resource extraction activities degrade water quality through siltation and contamination and alter stream banks and bottoms through direct and/or indirect in-stream disturbance.
113. Oil and gas activities are generally regulated at the State level, and although it is not required under section 7 of the Act, some State agencies do consult with the Service when permitting oil and gas projects.¹⁰⁵ In addition to being permitted at the State level, oil and gas activities are also regulated by FERC, which provides the main Federal nexus for these activities within the study area.
114. As shown in Exhibit 3-8, future section 7 consultations concerning oil and gas are expected to occur in the study area for 16 proposed critical habitat units located in nine States (Alabama, Arkansas, Illinois, Kentucky, Mississippi, Ohio, Oklahoma, Pennsylvania, and Tennessee).

¹⁰¹ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

¹⁰² Personal communication with the Service's Arkansas Field Office on November 28, 2012.

¹⁰³ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

¹⁰⁴ Personal communication with the Service's Arkansas Field Office on November 28, 2012.

¹⁰⁵ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

EXHIBIT 3-8. FORECAST SECTION 7 CONSULTATIONS FOR OIL AND GAS AND INCREMENTAL IMPACTS BY UNIT (2012\$, SEVEN PERCENT DISCOUNT RATE)

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	NUMBER OF FORECAST SECTION 7 CONSULTATIONS			20-YEAR IMPACTS (2013-2032) ²	
			FORMAL	INFORMAL	TECHNICAL ASSISTANCE	PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	0.0	3.3	0.0	\$4,500	\$290
RF2	Verdigris River	OK	0.0	28.0	4.0	\$39,000	\$2,500
RF4b	Ouachita River	AR	0.0	6.7	0.0	\$9,000	\$590
RF5	Saline River	AR	0.0	0.0	6.7	\$1,500	\$100
RF7	Middle Fork Little Red River	AR	0.0	0.0	26.7	\$6,100	\$400
RF8a	White River	AR	0.0	13.3	46.7	\$29,000	\$1,900
RF16	Bear Creek	AL, MS	0.0	10.0	3.3	\$14,000	\$930
RF19	Duck River	TN	3.3	3.3	0.0	\$14,000	\$910
RF20b	Tennessee River	KY	3.0	3.0	0.0	\$13,000	\$820
RF21	Ohio River	IL, KY	3.0	7.0	0.0	\$18,000	\$1,200
RF22	Green River	KY	8.0	8.0	0.0	\$33,000	\$2,200
RF23	French Creek	PA	0.0	20.0	0.0	\$27,000	\$1,800
RF24	Allegheny River	PA	0.0	31.7	0.0	\$43,000	\$2,800
RF25	Muddy Creek	PA	0.0	31.7	0.0	\$43,000	\$2,800
RF27	Walhonding River	OH	0.0	6.7	0.0	\$9,000	\$590
RF31	Red River	KY, TN	2.0	8.0	0.0	\$16,000	\$1,100
TOTAL			19.3	180.7	87.3	\$320,000	\$21,000

Notes:

1. The State(s) listed for each proposed critical habitat unit contain(s) the proposed critical habitat unit and corresponding study area. In some cases, small portions of study areas fall into other States. However, in these instances, no section 7 consultations are forecast to occur in these other States; therefore, these States are not included in this list.

2. The level of effort per consultation represents approximate averages based on the best available cost information. The cost estimates in this report are accordingly rounded to two significant digits to reflect this imprecision. The unit cost estimates therefore may not sum to the total costs reported due to rounding.

115. Proposed critical habitat Units RF2 (Verdigris River), RF24 (Allegheny River) and RF25 (Muddy Creek) are expected to generate the greatest impacts to future oil and gas activity over the next 20 years. Oil and gas reserves in the study area for proposed critical habitat unit RF2 are relatively shallow, resulting in a great deal of early production from these reserves in the past.¹⁰⁶ However, due to technological advancements in the oil and gas industry, further extraction is now economically feasible and, as a result, the Service's

¹⁰⁶ Personal communication with the Service's Oklahoma Field Office on December 10, 2012.

Oklahoma Field Office expects a relatively high rate of oil and gas consultation activity in the next 20 years.¹⁰⁷

116. The study area for proposed critical habitat Units RF24 and RF25 is located within the Marcellus Shale and Utica Shale in Pennsylvania, hence the higher level of oil and gas activity compared with other proposed critical habitat units across the study area. While our analysis projects future oil and gas activity based on historical consultations, the Service's Pennsylvania Field Office notes that this type of activity may increase in the future in proposed critical habitat Units RF24 and RF25, as well as in proposed critical habitat Units RF23 (French Creek) and RF32 (Shenango River), which are located in the same area, if gas prices increase in the future.¹⁰⁸ Therefore, in the case that the rate of oil and gas activity does increase in these units in the future, our analysis may underestimate the incremental impacts to these activities of critical habitat designation. This uncertainty is discussed further in section 3.5 of this chapter.

3.3.6 TRANSPORTATION AND UTILITIES

117. 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. Construction of roads, highways, pipelines, and related facilities also contributes to degradation of water quality through increased runoff of contaminated stormwater.
118. Transportation and utility activities occur throughout the study area. These activities are regulated both at the State level, by environmental and transportation departments, and at the Federal level, by the Corps, Federal Aviation Administration (FAA), Federal Communications Commission (FCC), Federal Highway Administration (FHWA), Federal Emergency Management Agency (FEMA), and Department of Housing and Urban Development (HUD), among others. Both State agencies and Federal agencies, including all of those listed above, have consulted with the Service in the past under section 7 of the Act.¹⁰⁹
119. As shown in Exhibit 3-9, future section 7 consultations concerning transportation and utilities are expected to occur in the study area for 35 proposed critical habitat units in all 12 of the States containing proposed critical habitat. This activity is expected to occur in more units across the study area for the proposed designation than any other activity.

¹⁰⁷ *Ibid.*

¹⁰⁸ Personal communication with the Service's Pennsylvania Field Office on November 29, 2012.

¹⁰⁹ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

**EXHIBIT 3-9. FORECAST SECTION 7 CONSULTATIONS FOR TRANSPORTATION AND UTILITIES AND
INCREMENTAL IMPACTS BY UNIT (2012\$, SEVEN PERCENT DISCOUNT RATE)**

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	NUMBER OF FORECAST SECTION 7 CONSULTATIONS			20-YEAR IMPACTS (2013-2032) ²	
			FORMAL	INFORMAL	TECHNICAL ASSISTANCE	PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	2.0	90.0	115.3	\$160,000	\$10,000
NM2	Elk River	AR, MO	0.0	16.7	30.0	\$29,000	\$1,900
NM3	Shoal Creek	KS, MO	0.0	4.6	1.3	\$6,400	\$420
NM4	Spring River	KS, MO	2.0	2.4	1.3	\$9,100	\$590
NM5	North Fork Spring River	KS, MO	0.0	2.4	1.3	\$3,400	\$220
NM7	Neosho River	KS	0.9	0.9	0.0	\$3,800	\$250
RF1	Spring River	KS, MO	0.5	2.9	0.0	\$5,200	\$340
RF2	Verdigris River	OK	0.0	156.0	27.0	\$220,000	\$14,000
RF4a	Ouachita River	AR	0.0	3.3	10.0	\$6,800	\$440
RF4b	Ouachita River	AR	0.0	6.7	40.0	\$18,000	\$1,200
RF5	Saline River	AR	0.0	40.0	146.7	\$88,000	\$5,700
RF6	Little River	AR, OK	1.0	23.3	8.7	\$36,000	\$2,400
RF7	Middle Fork Little Red River	AR	0.0	6.7	6.7	\$11,000	\$690
RF8a	White River	AR	0.0	0.0	13.3	\$3,100	\$200
RF8b	White River	AR	0.0	23.3	16.7	\$35,000	\$2,300
RF9	Black River	AR, MO	0.0	6.7	10.0	\$11,000	\$740
RF10	Spring River	AR, MO	0.0	3.3	13.3	\$7,500	\$490
RF11	South Fork Spring River	AR, MO	0.0	0.0	10.0	\$2,300	\$150
RF13	Buffalo River	AR	1.0	10.0	3.3	\$19,000	\$1,300
RF16	Bear Creek	AL, MS	0.0	33.3	23.3	\$50,000	\$3,300
RF18	Paint Rock River	AL	0.0	6.7	6.7	\$11,000	\$690
RF19	Duck River	TN	27.7	23.3	13.3	\$120,000	\$7,500
RF20a	Tennessee River	TN	3.3	3.3	0.0	\$14,000	\$910
RF20b	Tennessee River	KY	23.0	23.0	0.0	\$96,000	\$6,300
RF21	Ohio River	IL, KY	16.0	44.0	0.0	\$100,000	\$6,800
RF22	Green River	KY	13.0	13.0	0.0	\$54,000	\$3,500
RF23	French Creek	PA	10.0	63.3	10.0	\$120,000	\$7,600
RF24	Allegheny River	PA	3.3	28.3	0.0	\$48,000	\$3,100
RF25	Muddy Creek	PA	3.3	13.3	3.3	\$28,000	\$1,800
RF26	Tippecanoe River	IN	0.0	63.3	3.3	\$86,000	\$5,600
RF27	Walhonding River	OH	0.0	0.0	6.7	\$1,500	\$100
RF28	Little Darby Creek	OH	0.0	6.7	0.0	\$9,000	\$590
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	0.0	4.0	0.0	\$5,400	\$350
RF30	Fish Creek	IN, OH	0.0	3.3	0.0	\$4,500	\$290
RF31	Red River	KY, TN	2.0	8.0	0.0	\$16,000	\$1,100
TOTAL			109.0	736.2	521.7	\$1,400,000	\$93,000

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	NUMBER OF FORECAST SECTION 7 CONSULTATIONS			20-YEAR IMPACTS (2013-2032) ²	
			FORMAL	INFORMAL	TECHNICAL ASSISTANCE	PRESENT VALUE	ANNUALIZED
<p>Notes:</p> <p>1. The State(s) listed for each proposed critical habitat unit contain(s) the proposed critical habitat unit and corresponding study area. In some cases, small portions of study areas fall into other States. However, in these instances, no section 7 consultations are forecast to occur in these other States; therefore, these States are not included in this list.</p> <p>2. The level of effort per consultation represents approximate averages based on the best available cost information. The cost estimates in this report are accordingly rounded to two significant digits to reflect this imprecision. The unit cost estimates therefore may not sum to the total costs reported due to rounding.</p>							

120. Overall, proposed critical habitat Units NM1 (Illinois River) and RF2 (Verdigris River) are expected to generate the greatest amount of incremental impacts to future transportation and utility activities over the next 20 years. The study area for proposed critical habitat unit RF2 overlaps with the Tulsa Metropolitan Area. According to the Service’s Oklahoma Field Office, the suburbs of Tulsa are expected to continue expanding within the study area for Unit RF2 over the next 20 years, resulting in an increased rate of consultation on transportation and utility activities.¹¹⁰ The study area for proposed critical habitat Unit NM1 overlaps with the Fayetteville-Springdale-Rogers Metropolitan Area, which is the second largest metropolitan area in Arkansas.

3.3.7 DEVELOPMENT AND RECREATION

121. Commercial and residential development and recreational activities may cause riparian habitat and vegetation loss, siltation, and degradation that could adversely affect proposed critical habitat. These activities include in-stream construction of moorings, piles, docks, and related structures.
122. Any development activities in the study area involving dredging operations and/or the "discharge of dredged materials" into waters of the U.S. would be subject to regulation under section 404 of the CWA. Such development projects would likely require a section 404 permit from the Corps, which would lead to consultation with the Service regarding effects on the proposed critical habitat. In addition, development projects and recreational activities are often regulated at the State level. According to the consultation history, a number of State environmental departments have consulted with the Service under section 7 of the Act on development activities.¹¹¹ In addition, FEMA and HUD may be involved in development activities either through funding or permitting, and this Federal nexus would lead to section 7 consultation with the Service.
123. As shown in Exhibit 3-10, future section 7 consultations concerning development and recreation are expected to occur in the study area for 29 proposed critical habitat units

¹¹⁰ Personal communication with the Service’s Oklahoma Field Office on December 10, 2012.

¹¹¹ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

located in ten States (Alabama, Arkansas, Kansas, Kentucky, Indiana, Mississippi, Missouri, Oklahoma, Pennsylvania, and Tennessee).

EXHIBIT 3-10. FORECAST SECTION 7 CONSULTATIONS FOR DEVELOPMENT AND RECREATION AND INCREMENTAL IMPACTS BY UNIT (2012\$, SEVEN PERCENT DISCOUNT RATE)

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	NUMBER OF FORECAST SECTION 7 CONSULTATIONS			20-YEAR IMPACTS (2013-2032) ²	
			FORMAL	INFORMAL	TECHNICAL ASSISTANCE	PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	0.0	78.7	82.7	\$120,000	\$8,100
NM2	Elk River	AR, MO	0.0	16.7	26.7	\$29,000	\$1,900
NM3	Shoal Creek	KS, MO	0.0	3.3	0.0	\$4,500	\$290
NM4	Spring River	KS, MO	0.0	2.2	0.0	\$3,000	\$200
NM5	North Fork Spring River	KS, MO	0.0	2.2	0.0	\$3,000	\$200
RF1	Spring River	KS, MO	0.0	2.2	0.0	\$3,000	\$200
RF2	Verdigris River	OK	0.0	108.0	6.0	\$150,000	\$9,600
RF4a	Ouachita River	AR	1.0	3.3	6.7	\$11,000	\$720
RF4b	Ouachita River	AR	0.0	10.0	33.3	\$21,000	\$1,400
RF5	Saline River	AR	0.0	60.0	100.0	\$100,000	\$6,800
RF6	Little River	AR, OK	0.0	54.0	3.3	\$73,000	\$4,800
RF7	Middle Fork Little Red River	AR	0.0	0.0	3.3	\$770	\$50
RF8a	White River	AR	0.0	3.3	26.7	\$11,000	\$690
RF8b	White River	AR	0.0	3.3	23.3	\$9,800	\$640
RF9	Black River	AR, MO	0.0	0.0	10.0	\$2,300	\$150
RF10	Spring River	AR, MO	0.0	10.0	0.0	\$13,000	\$880
RF13	Buffalo River	AR	0.0	23.3	0.0	\$31,000	\$2,000
RF16	Bear Creek	AL, MS	0.0	6.7	20.0	\$14,000	\$890
RF18	Paint Rock River	AL	0.0	0.0	20.0	\$4,600	\$300
RF19	Duck River	TN	5.0	5.0	3.3	\$22,000	\$1,400
RF20a	Tennessee River	TN	1.7	1.7	3.3	\$7,700	\$500
RF20b	Tennessee River	KY	5.0	5.0	0.0	\$21,000	\$1,400
RF21	Ohio River	IL, KY	5.0	5.0	0.0	\$21,000	\$1,400
RF22	Green River	KY	2.0	4.0	0.0	\$11,000	\$720
RF23	French Creek	PA	0.0	30.0	0.0	\$40,000	\$2,600
RF24	Allegheny River	PA	0.0	11.7	0.0	\$16,000	\$1,000
RF25	Muddy Creek	PA	0.0	3.3	0.0	\$4,500	\$290
RF26	Tippecanoe River	IN	0.0	6.7	3.3	\$9,700	\$640
RF31	Red River	KY, TN	0.0	1.0	0.0	\$1,300	\$88
TOTAL			19.7	460.7	372.0	\$760,000	\$50,000

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	NUMBER OF FORECAST SECTION 7 CONSULTATIONS			20-YEAR IMPACTS (2013-2032) ²	
			FORMAL	INFORMAL	TECHNICAL ASSISTANCE	PRESENT VALUE	ANNUALIZED

Notes:

1. The State(s) listed for each proposed critical habitat unit contain(s) the proposed critical habitat unit and corresponding study area. In some cases, small portions of study areas fall into other States. However, in these instances, no section 7 consultations are forecast to occur in these other States; therefore, these States are not included in this list.
2. The level of effort per consultation represents approximate averages based on the best available cost information. The cost estimates in this report are accordingly rounded to two significant digits to reflect this imprecision. The unit cost estimates therefore may not sum to the total costs reported due to rounding.

124. Proposed critical habitat Units RF2 (Verdigris River), RF5 (Saline River) and NM1 (Illinois River) are expected to generate the greatest amount of incremental impacts to future development and recreation activities over the next 20 years. The study area for proposed critical habitat Unit RF2 overlaps with the Tulsa Metropolitan Area (see paragraph 105 above), and the Service’s Oklahoma Field Office expects a relatively high level of future development-related section 7 activity due to the expansion of the city’s suburbs within the study area.¹¹² Likewise, the study area for proposed critical habitat Unit RF5 encompasses the southwestern limits of the Little Rock Metropolitan Area, and according to the Service’s Arkansas Field Office, section 7 activity on this development is expected to increase in the future due to growth of the metropolitan area.¹¹³ In addition, as stated above, the study area for proposed critical habitat Unit NM1 encompasses the Fayetteville-Springdale-Rogers Metropolitan Area.
125. Of note, the Service’s Arkansas Field Office anticipates that in 2013 there will be a formal consultation with the Forest Service (USFS) on off-highway vehicle (OHV) use in proposed critical habitat Unit RF4a (Ouachita River), however the outcome of the consultation is uncertain at this time as the project is still undergoing National Environmental Policy Act (NEPA) review.¹¹⁴ The Service does not expect to recommend additional conservation efforts for the project to protect against adverse modification of critical habitat (i.e., above and beyond what would be required to protect against jeopardy of the species).¹¹⁵

3.3.8 OTHER ACTIVITIES

126. Other activities frequently occur on river banks that have the potential to result in adverse impacts to habitat, including animal and biological control, prescribed burns, land clearing, bank stabilization, habitat or shoreline restoration, among others. According to

¹¹² Personal communication with the Service’s Oklahoma Field Office on December 10, 2012.

¹¹³ Personal communication with the Service’s Arkansas Field Office on November 28, 2012.

¹¹⁴ Personal communication with the Service’s Arkansas Field Office on November 28, 2012.

¹¹⁵ Personal communication with the Service’s Arkansas Field Office on October 5, 2012.

the consultation history, the Service has consulted with a variety of agencies on these activities, including State environmental and transportation departments, USFS, the National Park Service (NPS), USDA, TVA, FEMA, and EPA. Many of the historical consultations on these activities have occurred with the Corps due to bank stabilization work.¹¹⁶

127. As shown in Exhibit 3-11, future section 7 consultations concerning these other activities, primarily bank stabilization and land management plans, are expected to occur in the study area for 34 proposed critical habitat units in all 12 of the States containing proposed critical habitat. Proposed critical habitat Units RF8b (White River) is expected to generate the greatest amount of incremental impacts to future development and recreation activities over the next 20 years, mainly as a result of land management activities.

EXHIBIT 3-11. FORECAST SECTION 7 CONSULTATIONS FOR OTHER ACTIVITIES AND INCREMENTAL IMPACTS BY UNIT (2012\$, SEVEN PERCENT DISCOUNT RATE)

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	NUMBER OF FORECAST SECTION 7 CONSULTATIONS			20-YEAR IMPACTS (2013-2032) ²	
			FORMAL	INFORMAL	TECHNICAL ASSISTANCE	PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	0.0	11.3	16.7	\$19,000	\$1,200
NM2	Elk River	AR, MO	0.0	0.0	3.3	\$770	\$50
NM3	Shoal Creek	KS, MO	0.0	3.3	0.0	\$4,500	\$290
NM7	Neosho River	KS	2.7	5.5	0.0	\$15,000	\$980
NM8	Cottonwood River	KS	5.5	9.1	0.0	\$28,000	\$1,800
RF2	Verdigris River	OK	0.0	28.0	4.0	\$39,000	\$2,500
RF3	Neosho River	KS	0.9	1.8	0.0	\$5,000	\$330
RF4a	Ouachita River	AR	0.0	3.3	0.0	\$4,500	\$290
RF4b	Ouachita River	AR	0.0	0.0	6.7	\$1,500	\$100
RF5	Saline River	AR	0.0	10.0	10.0	\$16,000	\$1,000
RF6	Little River	AR, OK	2.0	10.0	0.0	\$19,000	\$1,200
RF7	Middle Fork Little Red River	AR	4.3	0.0	0.0	\$14,000	\$940
RF8a	White River	AR	0.0	6.7	3.3	\$9,700	\$640
RF8b	White River	AR	0.0	40.0	16.7	\$58,000	\$3,800
RF9	Black River	AR, MO	0.0	6.7	6.7	\$11,000	\$690
RF10	Spring River	AR, MO	0.0	13.3	13.3	\$21,000	\$1,400
RF16	Bear Creek	AL, MS	0.0	30.0	16.7	\$44,000	\$2,900
RF17	Big Black River	MS	0.0	3.3	0.0	\$4,500	\$290
RF18	Paint Rock River	AL	0.0	16.7	0.0	\$22,000	\$1,500
RF19	Duck River	TN	5.0	5.0	3.3	\$22,000	\$1,400
RF20a	Tennessee River	TN	1.7	1.7	0.0	\$7,000	\$450
RF20b	Tennessee River	KY	5.0	5.0	0.0	\$21,000	\$1,400
RF21	Ohio River	IL, KY	1.0	4.0	0.0	\$8,200	\$540
RF22	Green River	KY	5.0	5.0	0.0	\$21,000	\$1,400

¹¹⁶ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	NUMBER OF FORECAST SECTION 7 CONSULTATIONS			20-YEAR IMPACTS (2013-2032) ²	
			FORMAL	INFORMAL	TECHNICAL ASSISTANCE	PRESENT VALUE	ANNUALIZED
RF23	French Creek	PA	0.0	10.0	0.0	\$13,000	\$880
RF24	Allegheny River	PA	0.0	13.3	0.0	\$18,000	\$1,200
RF25	Muddy Creek	PA	0.0	8.3	0.0	\$11,000	\$730
RF26	Tippecanoe River	IN	0.0	13.3	3.3	\$19,000	\$1,200
RF27	Walhonding River	OH	2.2	1.1	3.3	\$8,600	\$560
RF28	Little Darby Creek	OH	2.2	1.1	0.0	\$7,800	\$510
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	0.0	4.0	0.0	\$5,400	\$350
RF30	Fish Creek	IN, OH	2.2	1.1	0.0	\$7,800	\$510
RF31	Red River	KY, TN	2.0	8.0	0.0	\$16,000	\$1,100
RF32	Shenango River	PA	0.0	3.3	0.0	\$4,500	\$290
TOTAL			41.8	283.4	107.3	\$530,000	\$34,000

Notes:

1. The State(s) listed for each proposed critical habitat unit contain(s) the proposed critical habitat unit and corresponding study area. In some cases, small portions of study areas fall into other States. However, in these instances, no section 7 consultations are forecast to occur in these other States; therefore, these States are not included in this list.

2. The level of effort per consultation represents approximate averages based on the best available cost information. The cost estimates in this report are accordingly rounded to two significant digits to reflect this imprecision. The unit cost estimates therefore may not sum to the total costs reported due to rounding.

3.4 SENSITIVITY OF RESULTS TO FORECAST CONSULTATION RATES

128. A key source of uncertainty in the analysis is whether historical consultation rates, which are the predominant basis of the forecast provided by the Service, are predictive of future rates. To test the sensitivity of our results to the assumption, we conduct the following analysis.
129. To evaluate the sensitivity of our results to the future consultation rates provided by the Service field offices, we consider how the incremental impacts presented in Section 3.1 would be affected if the consultation rates followed forecast population and economic trends during the 2013 to 2032 period. Of activities considered in this analysis, population growth patterns have a direct influence on the consultation rates of development, recreation, water management, water quality management, sand and gravel mining, and road and utility construction activities. Oil and gas and coal mining activities,

on the other hand, are more likely to be affected by changes in economic activity, including forecast changes in energy production.

130. In our evaluation of population trends, we considered both forecasts and recent population data. Forecasts from the U.S. Census are not available below the State level, and thus provide a very coarse and potentially inaccurate view of anticipated trends within the much smaller and largely rural study area within each State.^{117,118} Instead, we evaluate recent trends based on changes in population between 2000 and 2010 for all Census blocks overlapping the study area.¹¹⁹ Across the study area, changes over this 10-year period range from a 15 percent decrease (Unit RF15) to a 34 percent increase (Unit NM2), with a median change of 2.8 percent. In our sensitivity analysis, we convert these 10-year changes to annual rates (ranging from -1.6 percent to +3.0 percent), and then, for each study area and relevant activity (see above), we apply these changes cumulatively for each year in the 2013 to 2032 consultation forecast.¹²⁰
131. Energy production forecasts are available at the national level from the Energy Information Administration (EIA) and indicate that the anticipated rates of change vary widely across fuel types.¹²¹ Between 2013 and 2032, oil production is forecast to decline by 7.5 percent, whereas natural gas and coal production are forecast to increase by 27 percent and 12 percent, respectively. In the sensitivity analysis, we conservatively apply the natural gas production forecast to the future rates of oil and gas consultations (2.4 percent annual increase), and the coal production forecast to the consultation rates that involve coal mining (1.1 percent annual increase). In addition, although oil and gas activity is currently not occurring in the study area for Unit RF32, the Pennsylvania Field Office acknowledges that activity may commence given activity in the surrounding units. As such, in our sensitivity analysis, we also apply the area-weighted average annual oil and gas consultation rate from nearby Units RF23, RF24, and RF25 to the study area of Unit RF32.
132. We apply the above rates of change in consultation activity to all units and activities for which the Service has not already provided forecasts; that is, we do not adjust the activity-specific forecasts within the study area of Units RF2, RF5, and RF27 described above. Results of the sensitivity analysis are presented in Exhibit 3-12. The overall effect of incorporating forecast changes in population and energy production into the consultation forecasts is an increase in the net present value (NPV) of total impacts from

¹¹⁷ Personal communication with Stephen Laue (Chicago Region) and Whittona Burrell (Philadelphia Region), Information Services Specialists, U.S. Census Bureau, on December 17, 2012.

¹¹⁸ U.S. Census. 2012. Population Projections: State Population Projections. Accessed on December 12, 2012 from <http://www.census.gov/population/projections/data/state/>.

¹¹⁹ Data is block-level total population data from the 2010 U.S. Census, and the 2000 Census. Spatial analysis conducted using U.S. Census Bureau (2010), 2010 TIGER/Line Shapefile: 2010 Census Population & Housing Unit Counts - Blocks, retrieved December 18 2012 at <http://www.census.gov/geo/maps-data/data/tiger-data.html>, and ESRI U.S. Census Block Centroid Populations, 2000 Census data.

¹²⁰ For example, in Unit NM2, increases applied in 2013 through 2015 would be 3.0 percent, 6.1 percent, and 9.3 percent, where 9.3 percent is 3.0 percent compounded annually for three years.

¹²¹ Energy Information Administration. 2012. Annual Energy Outlook 2013 Early Release Overview. Accessed on December 17, 2012 from http://www.eia.gov/forecasts/aeo/er/early_production.cfm.

\$4.4 million to \$4.7 million. This increase is largely attributable to a rise in transportation and utility costs from \$1.4 million to \$1.5 million, and in development costs from \$760,000 to \$830,000. Similarly, incorporating these forecasts had little effect on the relative rank of impacts across the proposed critical habitat units. In the most extreme case, impacts in Unit RF19 (Duck River) moved from 8th to 4th among rabbitsfoot units.

EXHIBIT 3-12. COMPARISON OF STUDY AND SENSITIVITY NPV RESULTS, 2013-2032

ACTIVITY	STUDY RESULTS	SENSITIVITY RESULTS
Water Flow Management	\$190,000	\$200,000
Water Quality Management	\$120,000	\$130,000
Timber, Ag, Grazing	\$960,000	\$1,000,000
Mining	\$71,000	\$75,000
Oil and Gas Development	\$320,000	\$350,000
Transportation & Utilities	\$1,400,000	\$1,500,000
Development	\$760,000	\$830,000
Other	\$530,000	\$550,000
TOTAL	\$4,400,000	\$4,700,000

3.5 KEY ASSUMPTIONS

133. The economic impacts presented in this chapter are based on a number of assumptions that may affect the estimates. This section presents the key assumptions and the extent to which they may lead to under- or over-estimates of the potential incremental impacts of the proposed critical habitat designation. Exhibit 3-13 presents key assumptions made and the potential bias they introduce in the analysis.

**EXHIBIT 3-13. KEY UNCERTAINTIES ASSOCIATED WITH THE ESTIMATED INCREMENTAL IMPACTS OF
CRITICAL HABITAT DESIGNATION FOR THE TWO MUSSELS**

ASSUMPTION/ SOURCE OF UNCERTAINTY	DIRECTION OF POTENTIAL BIAS	LIKELY SIGNIFICANCE WITH RESPECT TO ESTIMATED IMPACTS
We predict future section 7 consultation activity based, in part, on historical consultation data provided by the Service, and also on conversations with the Service's field office representatives who conduct section 7 consultations within the study area for the analysis. We assume that the information we received is complete and accurate and that no other projects will occur during the timeframe of the analysis.	May result in an overestimate or an underestimate of costs.	Unknown. We attempt to verify that the level of past consultation activity is a reasonable predictor of future activity by evaluating population growth projects and other economic projections. To the extent that these projections understate or overstate future economic activity, our analysis may underestimate or overestimate future consultation costs.
The analysis assumes that mining activity will increase in the future in proposed critical habitat unit RF5 (Saline River) due to untapped lignite resources in the area. However, mining in this area may not occur if it continues to be economically disadvantageous to do so.	May result in an overestimate of costs.	Probably minor. This assumption affects only the estimated administrative consultation costs.
The analysis assumes that oil and gas activity will occur at a rate similar to historical rates over the next 20 years. However, in the proposed critical habitat units located within the Marcellus Shale and Utica Shale, (RF23, RF24, RF25, and RF32), oil and gas activity may increase in the future if gas prices go up.	May result in an underestimate of costs.	Probably minor. This assumption affects only the estimated administrative consultation costs.
Because the mussels are aquatic species, actions taken to avoid jeopardizing the species are likely to be coincident to actions taken to avoid adversely modifying critical habitat. Thus, according to the Service, incremental conservation efforts, while possible, are unlikely. Therefore, we assume that the incremental costs of this designation are limited to minor administrative costs associated with future section 7 consultations.	May result in an underestimate of costs.	Unknown. We rely on the Service as the best authority on the likely outcome of future section 7 consultations. If this assumption is incorrect, and the Service recommends conservation efforts in future consultations solely to protect critical habitat, incremental costs estimated in this analysis are understated.

ASSUMPTION/ SOURCE OF UNCERTAINTY	DIRECTION OF POTENTIAL BIAS	LIKELY SIGNIFICANCE WITH RESPECT TO ESTIMATED IMPACTS
We assume incremental time delays are unlikely.	May result in an underestimate of costs.	Probably minor. Because the Service proposes to list the species simultaneously with the designation of critical habitat, no past section 7 consultations have occurred that must be re-initiated. The minor additional administrative burden estimated on a per consultation basis is unlikely to measurably lengthen the number of weeks necessary to complete the consultation process.
We assume impacts related to regulatory uncertainty or stigma are unlikely.	May result in an underestimate of costs.	Probably minor. The study area analyzed in this report includes the watersheds surrounding proposed critical habitat. As a result, there may be a perception of increased Federal oversight on private lands.

CHAPTER 4 | BASELINE CONSERVATION FOR TWO MUSSELS

134. Chapter 3 of this report presents the incremental impacts of critical habitat designation associated with forecast section 7 consultations for the two mussels over the next 20 years. Chapter 4 provides an overview assessment of typical baseline conservation efforts that the Service may recommend to avoid jeopardy to the species during section 7 consultation. The species and habitat protections described in this chapter result from implementation of the Act, as well as other Federal, State and local regulations and conservation plans. These protections are not generated or affected by critical habitat designation for the mussels.

4.1 SUMMARY OF RESULTS

135. As described in Chapter 3, one of the main conclusions of this economic analysis is that the Service does not expect critical habitat designation to result in additional project modification costs, beyond what would be requested to avoid jeopardy to the species.¹²² As a result, we expect incremental economic impacts of the designation will be limited to additional administrative costs to the Service, Federal agencies and third parties of considering critical habitat as part of the forecast section 7 consultations. The costs described in this Chapter are associated with conservation efforts recommended by the Service during section 7 consultation for the two mussels and are considered baseline impacts that are not attributable to the designation of critical habitat.

136. To assess the scope and scale of baseline conservation efforts recommended to avoid impact to the mussels and their habitat, this analysis provides a summary of commonly recommended conservation efforts for mussel species in the proposed areas, and provides ranges of potential costs for these measures. In order to provide additional context, this chapter also summarizes previous BOs as representative examples of baseline conservation efforts for the two mussels for a variety of project types.

137. In the baseline, each of the consultations forecast in Chapter 3 may incur some suite of the modifications and associated costs presented here. However, the actual cost of avoiding impacts to mussels and their habitat resulting from section 7 consultation requirements and recommendations will vary depending on a variety of factors, including, but not limited to, the location, size, and type of project being proposed, as well as the extent to which mussels occur in the project area. Common conservation efforts include requiring proper implementation of best management practices (BMPs) for informal water quality management (stormwater permitting), timber, agriculture, and grazing projects, which frequently incur no additional cost to a project proponent. More extensive projects may require pre-construction surveying (up to \$100,000 per project),

¹²² US Fish and Wildlife Service, Incremental Effects Memorandum, August 17, 2012. See Appendix D.

relocation efforts (up to \$440/mussel), monitoring (\$18,000 annually per project), and population propagation efforts (\$54,000 per population), where in-stream impacts are unavoidable. In some cases, the need to limit the scope, or to redesign a project to avoid in-stream impacts or time constraints may incur additional costs.

4.2 BASELINE PROTECTIONS

138. The primary protection for the mussels absent the designation of critical habitat is the listing of the species under the Act. In addition, the mussels and their habitat receive protection from other Federal statutes and regulations, including CWA and state regulatory schemes. These baseline protections are described below.

Clean Water Act

139. Section 404 of the CWA requires parties to obtain a permit from the Corps prior to discharging dredge or fill material into “water of the United States.”¹²³ Due to the riverine nature of the two mussels’ habitat, the Corps issues section 404 permits within the areas proposed for critical habitat designation. Activities that may require section 404 permitting include: dredging, channelization, and in-stream mining; impoundments, dams, and diversions; and residential and commercial development. The Corps’ review of projects for the issuance of section 404 permits requires section 7 consultation with the Service to the extent that the project may affect listed species or critical habitat. As part of the section 404 permitting process, the Corps reviews potential effects of the proposed action on plant and animal populations and recommends efforts to avoid adverse effects to these populations in addition to wetlands. In general, conservation efforts include:

- Select sites or manage discharges to ensure that habitat remains suitable for indigenous species;
- Avoid sites having unique habitat or other value, including habitat of threatened or endangered species;
- Utilize habitat development and restoration techniques to minimize adverse impacts and compensate for destroyed habitat;
- Time discharge to avoid biologically critical time periods; and
- Avoid destruction of remnant natural sites within areas already affected by development.¹²⁴

140. These conservation efforts would be required by the Corps for section 404 permits regardless of critical habitat designation.¹²⁵ Accordingly, impacts of implementing these conservation efforts are considered baseline impacts. Corps review of projects for the issuance of section 404 permits also requires section 7 consultation with the Service to

¹²³ 16 U.S.C. § 1344.

¹²⁴ 40 CFR Part 230.75.

¹²⁵ *Ibid.*

the extent that the project may affect listed species or critical habitat.¹²⁶ Section 2.3.2 of Chapter 2 of this report discusses why additional conservation efforts are not expected due to the proposed critical habitat designation.

Rivers and Harbors Act

141. Section 10 of the Rivers and Harbors Act regulates the construction of any structure in or over any navigable water of the United States, as well as the excavating from or depositing of material in such waters and the accomplishment of any other work affecting the course, location, condition, or capacity of such waters.¹²⁷ Under Section 10, these projects require approval from the Corps and are subject permit requirements.

Safe Harbor Agreements (SHAs) and Candidate Conservation Agreement with Assurances (CCAAs)

142. Safe Harbor Agreements (SHAs) and Candidate Conservation Agreements with Assurances (CCAAs) are voluntary conservation agreements between the Service and one or more public or private parties, by which the Service provides an Enhancement and Survival Permit under section 10(a)(1)(A) of the Act. The Neosho mucket and rabbitsfoot are not currently covered species under any SHAs or CCAAs. However, another mussel—the endangered speckled pocketbook (*Lampsilis streckeri*)—and an endangered fish—the yellowcheek darter (*Etheostoma moorei*)—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.¹²⁸ No additional conservation efforts would be required beyond those already recommended for speckled pocketbook and yellowcheek darter.¹²⁹ The SHA and CCAA, finalized in 2007, cover lands voluntarily enrolled by landowners within the entire range of speckled pocketbook and yellowcheek darter. Conservation benefits include:

- Control of livestock access through fencing and alternative water sources;
- Protection, enhancement, or restoration of nearby terrestrial habitat through stream buffer establishment and maintenance, habitat easements, erosion control measures, and forgoing of certain land use practices;
- Protection, enhancement, or restoration of aquatic habitat through stream easements, stream de-channelization, installation of in-stream habitat features, stream bank stabilization, and road crossing stabilization; and
- Species reintroduction.¹³⁰

¹²⁶ In a public comment submitted by the Corps, the agency outlines categories of potential baseline costs they expect may result from the listing of the species. For additional information, see public comment submitted by Tyler Bintrim, U.S. Army Corps of Engineers, on December 14, 2012, Docket Document No. FWS-R4-ES-2012-0031-0006.

¹²⁷ 33 U.S.C. §403

¹²⁸ Personal communication with the Service's Arkansas Field Office on November 29, 2012.

¹²⁹ *Ibid.*

¹³⁰ U.S. Fish and Wildlife Service to Industrial Economics, Inc. October 27, 2011. Programmatic Safe Harbor Agreement and Programmatic Candidate Conservation Agreement with Assurances for the Speckled Pocketbook and Yellowcheek Darter in the Upper Little Red River Watershed, AR.

143. To date, multiple landowners have enrolled 12,195 acres (4,935 ha) in the SHA and CCAA programs since its inception in mid-2007, and 10 more landowners with approximately 50,000 acres (20,234 ha) have pending draft agreements.¹³¹ Lands enrolled in these conservation programs include areas within proposed critical habitat Unit RF7, as well as riparian and upland areas that are outside of the proposed critical habitat boundary. Where the study area for Unit RF7 overlaps with lands enrolled in these conservation programs, the agreement provides baseline protection for the rabbitsfoot. However, in the case that landowners participate in the SHA and CCAA specifically because of critical habitat designation, costs of implementing the SHA and CCAA would be considered indirect incremental impacts of the designation. The total number of landowners that may participate in the SHA and CCAA and their reasons for participating are uncertain. For the purposes of this analysis, we therefore do not make assumptions regarding participation in the SHA and CCAA in the future.
144. In addition, the Service is currently reviewing two other programmatic SHAs and CCAAs in Arkansas.¹³² One of these agreements would provide baseline protection to the rabbitsfoot in the upper Ouachita and Saline Rivers, including areas within proposed critical habitat Units RF4a, RF4b, and RF5 as well as adjacent riparian and upland areas that are outside of the proposed critical habitat boundaries. This agreement includes the Service, NRCS, Arkansas Game and Fish Commission (AGFC), and The Nature Conservancy.¹³³ The second agreement would benefit the Neosho mucket and rabbitsfoot indirectly. This agreement, a programmatic SHA and CCAA covering the karst region of northwest and north central Arkansas (Neosho mucket proposed critical habitat Units NM1 and rabbitsfoot proposed critical habitat Units RF7, RF10, RF11, and RF12), may also include riparian and upland areas that are outside of the proposed critical habitat boundary. The parties involved in this agreement include the Service, AGFC, and The Nature Conservancy.¹³⁴ Management activities associated with this agreement that could ameliorate threats to the mussels include, but are not limited to, use of BMPs designed to reduce 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; applying BMPs to and making more sustainable trails for off-road vehicle use; and reduction of other watershed and floodplain disturbances that release sediments, pollutants, or nutrients into the water.

Land and Resource Management Plans (LRMPs)

145. The following two national forests in Arkansas have LRMPs that include specific measures for the protection of listed species: the Ozark National Forest and the Ouachita National Forest. The study areas for proposed critical habitat Units NM1 and RF13 overlap with the Ozark National Forest, and the study area for proposed critical habitat

¹³¹ Personal communication with the Service's Arkansas Field Office on November 29, 2012.

¹³² Personal communication with the Service's Arkansas Field Office on November 29, 2012.

¹³³ Personal communication with the Service's Arkansas Field Office on December 18, 2012.

¹³⁴ *Ibid.*

Units RF4a and RF5 overlap with the Ouachita National Forest. Both LRMPs were revised in 2005 and include provisions for the monitoring and evaluation of threatened and endangered species and for the conservation of habitats for federally listed species, with the goal of moving the species toward recovery and de-listing.^{135, 136}

Other State Laws

146. Under the authority of the CWA, State environmental agencies set, maintain, and enforce water quality standards in the states containing proposed critical habitat for the mussels. State water quality standards are reviewed by EPA to ensure that they comply with national minimum protections under the CWA. To ensure that all State water quality standards sufficiently protect federally listed species and critical habitat, EPA consults with the Service whenever a State promulgates a water quality rule. EPA and the Service also enter consultation on a triennial basis to review all State water quality standards to ensure they are protective of listed species and critical habitat. Such consultation may result in administrative costs related to addressing two mussels' critical habitat in consultation. Estimated incremental impacts associated with future section 7 activity concerning water quality are discussed in greater detail in Chapter 3 of this report.
147. Under section 303(d) of the CWA, States are required to develop lists of impaired waters. According to the Proposed Rule, numerous stream segments within the proposed critical habitat designation are listed as impaired waters under section 303(d) of the CWA or have numerous tributaries in their watersheds also listed as impaired.¹³⁷ When a water body is listed as impaired, the State must complete a plan to address the issue causing the impairment; this plan is called a Total Maximum Daily Load (TMDL). Therefore, numerous stream segments within the proposed critical habitat designation are provided baseline protections under the CWA.

4.3 BASELINE IMPACTS ANALYSIS

148. In order to assess the potential scope and scale of baseline impacts associated with conservation efforts recommended in section 7 consultation for the two mussels, we first reviewed the consultation history for the two mussels and for other listed mussel species in the areas of the proposed designation, along with any BOs from past section 7 consultations.¹³⁸ For each of the eight categories of economic activities determined to pose the greatest threats to the species and their habitat, we assembled the following information:

- An overview of the types of conservation efforts that the Service may recommend to avoid jeopardy to the species as a result of section 7 consultation.

¹³⁵ U.S. Department of Agriculture. 2005. Proposed Revised Land and Resource Management Plan: Ozark-St. Francis National Forests. Forest Service, Southern Region. MANAGEMENT BULLETIN R8-MB-123A.

¹³⁶ U.S. Department of Agriculture. 2005. Revised Land and Resource Management Plan: Ouachita National Forest. Forest Service, Southern Region. Available at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsm9_039609.pdf, accessed on December 3, 2012.

¹³⁷ 77 FR 63440.

¹³⁸ Some Field Offices began consulting on impacts to the two mussels when they were proposed for Federal listing.

- Where possible, a case study that quantifies the baseline impacts associated with implementing conservation efforts during a past project.

149. Many of the conservation efforts recommended by the Service for one activity are common across many of the other anticipated activities.¹³⁹ Exhibit 4-1 presents a table with commonly recommended conservation efforts for mussel species for each of the activities assessed in this analysis.

EXHIBIT 4-1. COMMON CONSERVATION EFFORTS FOR MUSSEL SPECIES

ACTIVITY	CONSERVATION EFFORTS							
	MUSSEL SURVEYS	MUSSEL RELOCATION	MONITORING & REPORTING	MUSSEL PROPAGATION & POP. AUGMENTATION	BMPs, EROSION & SEDIMENTATION CONTROLS	TIMING RESTRICTION*	LIMIT SCOPE, IN-STREAM WORK**	OTHER**
Water Flow Management	X	X	X		X		X	X
Water Quality Management					X			
Timber, Agriculture and Grazing					X			
Mining (in-stream e.g., sand, gravel)	X		X				X	
Oil and Gas Development	X						X	X
Transportation & Utilities	X	X	X	X	X	X	X	X
Development and Recreation	X		X		X		X	X
Other (Bank Stabilization)	X	X			X	X		

Notes:
 * Activity either disallowed during spawning period, or construction period limited to one year to minimize disturbance.
 ** Detail provided in report text.

Sources:

1. U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.
2. Personal communication with the Service's Arkansas Field Office on December 7, 2012.
3. U.S. Fish and Wildlife Service, Tennessee Ecological Services Field Office, Biological Opinion for Johnsonville Fossil Plant (JOF) Ash Disposal Area No. 2 (Johnsonville Island), February 1, 2010.
4. U.S. Fish and Wildlife Service, Tennessee Ecological Services Field Office, Biological Opinion for Occidental Chemical Corporation's Proposed Modifications to an Existing Barge Terminal and Construction of an Outfall Structure in Humphrey's County, Tennessee, October 22, 2012.

150. Exhibit 4-2 presents information on the potential cost of the conservation efforts outlined above. Where available, we provide a range of cost estimates; however, our sources are not necessarily a representative sample of potential projects, and actual impacts could be higher or lower than what is presented here.

¹³⁹ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

EXHIBIT 4-2. RANGES OF COSTS OF COMMON CONSERVATION EFFORTS FOR MUSSEL SPECIES

CONSERVATION EFFORTS	BASELINE IMPACTS			SOURCE(S)
	LOW	HIGH	AVERAGE	
Mussel surveys (per project)	\$8,000	\$180,000	\$54,000	1, 2, 4, 5, 7, 8
Mussel relocation (per project)*	\$19,000	\$160,000	\$67,000	9, 10, 3
Monitoring and reporting (per effort)	\$6,200	\$480,000	\$39,000	1, 2, 3, 4, 5, 7, 10
Mussel propagation and population augmentation (per project)	\$5,600	\$54,000	\$30,000	1, 10
BMPs for erosion and sedimentation controls (per project)	None**	\$97,000	\$46,000	4, 6, 7, 10
Timing restrictions (per project)	None***	\$360,000	\$120,000	4, 6, 7
Limiting project scope, or in-stream work (per project)	None***	\$220,000	\$74,000	4, 6, 7
Other	Project-specific, See examples below.			
<p>Notes:</p> <ul style="list-style-type: none"> • Average impacts for surveys, and monitoring and reporting take into account more than the low and high estimates presented here. • Costs were inflated to 2012 dollars where appropriate using the Bureau of Economic Analysis GDP Price Index, BEA National Income and Product Accounts (NIPA) Table 1.1.4. • *Mussel relocation cost is driven by the number of mussels relocated. Per-mussel costs can range from \$14 to \$440 per mussel (1, 3). • **In many cases, BMPs are required regardless of presence or absence of sensitive or threatened or endangered species or habitat; however, where states or agencies do not have BMPs in place for an activity, or if they are not sufficient, project modification costs may be incurred. • ***Can frequently be incorporated into project design at little to no additive cost. <p>Sources:</p> <ol style="list-style-type: none"> 1. U.S. Army Corps of Engineers, St. Paul District, Definite Project Report and Environmental Assessment for Relocation Plan for the Endangered Higgins' Eye Pearlymussel (<i>Lampsilis higginsii</i>), July 2002. 2. TVA Johnsonville Fossil Plant, personal communication with Tennessee Valley Authority on December 6, 2012. 3. Cope and Waller, "Evaluation of Freshwater Mussel Relocation as a Conservation and Management Strategy," 1995, Regulated Rivers: Research & Management, 147-155. 4. Upper Neosho River Basin Stream and Riparian Restoration, personal communication with Susan Metzger, December 7, 2012. 5. FHWA Resource Center Environment Team, "The Environmental Quarterly", Spring 2011. 6. Personal communication with INDOT, December 11, 2012. 7. Personal communication with Michael Tyrell, TRC Solutions, January 16, 2013. 8. Personal communication with Dave Day, American StructurePoint, Inc., January 18, 2013. 9. Personal communication with Judy Reed, Fulton County Assessor, January 17, 2013. 10. Personal communication with Randal Looney, Environmental Coordinator, FHWA AR Division Office, January 3, 2013. 				

151. Although Exhibits 4-1 and 4-2 provide information that can be used to better understand mussel conservation as it relates to the activities expected to be affected by this designation, individual project impacts vary widely depending on a variety of factors,

including size, location, scope, and mussel presence in the specific project area. In addition to changes in the number and scope of the common conservation efforts, projects may require specific modifications, different from or in addition to those above. We indicate where additional modifications are likely in the rightmost columns of Exhibit 4-1. Specific examples of instances where the scope of a project was limited, or in-stream work was avoided include: (1) right-of-way (ROW) adjustments during pipeline construction; (2) limiting the number of activity sites for sand and gravel mining; (3) limit project scope to areas of active sedimentation in dredging; and (4) avoiding in-stream piers when constructing bridges.¹⁴⁰ Examples where “other,” project-specific conservation efforts were required or recommended by the Service to avoid impacts to mussels include:

- **Dredging:** Cease operations if mussels are found in dredge disposal; use upland disposal sites; and release captured specimens and mark for future studies.
- **Dam Operations:** Implement alterations to allowable flow.
- **OHV Recreation:** Close or relocate trails; follow seasonal use guidelines; implement wet weather management; and limit numbers of users per season.
- **Bridge Construction:** Implement zebra mussel control measures (e.g., monitoring) (only suggested in Indiana on the Tippecanoe River).
- **Oil and Gas Pipeline:** Develop a contingency plan for potential frac-out, the uncontrolled release of drilling mud.

152. The following sections present case study examples of projects of each activity type and related conservation efforts, where data were available.

4.3.1 WATER FLOW MANAGEMENT

153. Based on information provided by the Service and on the consultation history, conservation efforts typically recommended to avoid jeopardy to mussel species in water flow management activities include conducting surveys; relocating mussels; monitoring and reporting; limiting the scope of work or re-siting the activity; and ceasing operations if mussels are found in dredge disposal sites.^{141,142}

154. In the past, the majority of section 7 consultations on water flow management in the study area have occurred in Arkansas.¹⁴³ The following case study was selected as a representative example of a water flow management project in the study area of Arkansas, for which typical conservation efforts were recommended.¹⁴⁴

¹⁴⁰ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS reports from Field Offices, received September 28 and October 9, 2012.

¹⁴¹ U.S. Fish and Wildlife Service, Biological Opinion for Maintenance Dredging in the White River, Arkansas, March 1, 2002.

¹⁴² U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

¹⁴³ *Ibid.*

¹⁴⁴ Personal communication with Service’s Arkansas Field Office on November 28, 2012.

Case Study: Maintenance Dredging in the White River, Arkansas¹⁴⁵

155. In Arkansas, the Corps' Memphis District has, in the past, consulted with the Service regarding potential impacts of maintenance dredging in the White River, Arkansas on the endangered pink mucket mussel (*Lampsilis abrupta*), fat pocketbook mussel (*Potamilus capax*), and scaleshell mussel (*Leptodea leptodon*), as well as other endangered species, in accordance with section 7 of the Act. Specifically, the Corps has consulted on hydraulic dredging of the authorized navigation channel to maintain a five-foot deep by 125-foot wide channel from river mile 9.8 to Augusta (eight feet deep at Clarendon gage reading of 12 or greater), and a 4.5-foot deep by 100-foot wide channel from Augusta to Newport (river mile 254).
156. On March 1, 2002, the Service issued a BO on this activity, which concluded that the activity was not likely to affect the fat pocketbook mussel, and not likely to jeopardize the continued existence of the pink mucket mussel or scaleshell mussel. This BO was amended in 2008 due to new information gained from subsequent mussel surveys in the White River and from implementation of Reasonable and Prudent Measures.¹⁴⁶ The amended BO concludes that with implementation of the following reasonable and prudent measures (unchanged from the 2002 BO), dredging in the White River was not likely to jeopardize the continued existence of the pink mucket or scaleshell mussels:
- a) Conduct mussel surveys prior to dredging if an area has not been previously dredged or has not been dredged for the previous five years;
 - b) If the dredging operation will or has encroached on a mussel bed, it may be necessary to relocate mussels;
 - c) If mussels are found in dredge disposal site, cease dredging operations and contact the Service so that a determination can be made as to how to proceed; and
 - d) Conduct periodic mussel surveys to assess long term impacts of ongoing maintenance dredging.
157. Although the Corps' Memphis District was unable to provide cost information for the conservation efforts implemented during the project, Exhibit 4-2 provides information on potential costs for two of the above conservation efforts (conducting mussel surveys and relocating mussels). As presented in the exhibit, the costs of conducting mussel surveys may range from \$8,000 to \$180,000 (\$54,000 on average), and costs of relocating mussels may range from \$19,000 to \$160,000 per project (\$67,000 on average). As stated above, while these costs are informative, individual project impacts vary widely depending on a variety of factors. Therefore, individual water flow management projects occurring in the future may incur greater or lesser costs for conservation efforts than those presented here.

¹⁴⁵ U.S. Fish and Wildlife Service, Biological Opinion for Maintenance Dredging in the White River, Arkansas, March 1, 2002.

¹⁴⁶ U.S. Fish and Wildlife Service, Amendment to Biological Opinion on the Effects of Maintenance Dredging on the White River, Arkansas, July 31, 2008.

4.3.2 WATER QUALITY MANAGEMENT

158. According to the consultation history and conversations with the Service's field office representatives, the majority of forecast water quality management consultations are anticipated to be NPDES permit reviews in Arkansas and Oklahoma.^{147,148,149} According to the Service's Arkansas Field Office, the majority of these consultations are technical assistances, and the conservation efforts are limited to implementing BMPs and erosion control measures, which are already required under Federal law and therefore not attributable to mussel conservation.^{150,151} Therefore, we do not quantify these baseline impacts. However, according to the Service's Oklahoma Field Office, if the activity being permitted is taking place in an area where listed mussels are present, it may require that more stringent conservation efforts be implemented in addition to installing and maintaining BMPs.¹⁵² Additional conservation efforts may include the following:
- a) Perform mussel surveys;
 - b) Limit in-stream disturbance and stabilize the disturbed area as quickly as possible; and
 - c) Potentially relocate mussels.¹⁵³
159. Information on costs associated with implementing the above measures during past water quality management activities in Oklahoma was unavailable. However, Exhibit 4-2 provides information on potential costs associated with conducting mussel surveys (\$54,000 on average, per project) and relocating mussels (\$67,000 on average, per project). The other potential conservation efforts—limiting in-stream disturbance and stabilizing the area as quickly as possible—vary by project but can frequently be incorporated into project design at little to no additional cost.¹⁵⁴

4.3.3 TIMBER MANAGEMENT, AGRICULTURE, AND GRAZING

160. According to the consultation history and conversations with the Service's field office representatives, the majority of future timber management, agriculture, and grazing activities are expected to occur in Arkansas as a result of new Farm Bill program work.^{155,156} In May 2012, the Service's Arkansas Field Office completed an informal programmatic consultation with NRCS on conservation practices that are implemented on private lands owned by farmers and ranchers participating in the NRCS Farm Bill

¹⁴⁷ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

¹⁴⁸ Personal communication with the Service's Arkansas Field Office on December 7, 2012.

¹⁴⁹ Personal communication with the Service's Oklahoma Field Office on December 10, 2012.

¹⁵⁰ Personal communication with the Service's Arkansas Field Office on December 7, 2012.

¹⁵¹ 40 CFR § 122.34

¹⁵² Personal communication with the Service's Oklahoma Field Office on December 10, 2012.

¹⁵³ *Ibid.*

¹⁵⁴ Upper Neosho River Basin Stream and Riparian Restoration, personal communication with Susan Metzger, KWO, December 7, 2012; Personal communication with INDOT, December 11, 2012.

¹⁵⁵ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

¹⁵⁶ Personal communication with the Service's Arkansas Field Office on November 28, 2012.

programs.^{157,158} During the consultation, the Service determined which conservation practices will have no effect on listed species, and which may have an effect and therefore will require consultation with the Service. The outcome of the consultation was that over 50 practices—ranging from brush management and channel stabilization to nutrient management and riparian buffers—may affect listed species, and will require a separate consultation between the NRCS and Service.¹⁵⁹ The Service identified a variety of conservation efforts corresponding to these practices that may be recommended to minimize take of listed species, but actual recommendations will depend on the specific nature of the project. Specific conservation recommendations identified by the Service include:

- a) Apply a minimum 180-foot buffer along streams, delineated recharge zones, and karst features; and
- b) Use methods to prevent soil erosion and runoff.

161. According to NRCS' Arkansas State Office, consultations with the Service on Farm Bill activities occurring on the lands within the Arkansas study area have happened very infrequently and the Service rarely recommended that landowners implement conservation efforts beyond those required by NRCS.¹⁶⁰ However, as a result of the recent consultation described above, NRCS expects that consultations with the Service on Farm Bill activities in the Arkansas study area will increase significantly in the future (see Chapter 3 for specific consultation forecasts for the proposed critical habitat units in Arkansas). Due to the fact that many of the specific practices identified as having the potential to affect listed species were previously not consulted on with the Service, information is not available on the costs associated with conservation efforts undertaken during past projects in Arkansas.¹⁶¹ Because there has not yet been a consultation with a landowner under this new system, cost data for conservation efforts undertaken as part of Farm Bill program participation are unavailable.¹⁶²

4.3.4 MINING

162. Although a small number of consultations have occurred on mining in the past, none of these resulted in implementation of mining-related conservation efforts. The majority of historical mining consultations has occurred in Arkansas and, according to the Arkansas Field Office, these consultations have occurred in response to ADEQ stormwater permitting requirements.¹⁶³ In mining-related consultations, as indicated in Exhibit 4-1, the Service has typically recommended that the project implement BMPs and erosion and sedimentation controls. According to the Arkansas Field Office, these measures are

¹⁵⁷ *Ibid.*

¹⁵⁸ U.S. Fish and Wildlife Service, Arkansas Field Office, Programmatic Consultation for the Effects of Farm Bill Practices on Federally Listed Species in Arkansas, April 2012.

¹⁵⁹ U.S. Fish and Wildlife Service, Arkansas Field Office, Programmatic Consultation for the Effects of Farm Bill Practices on Federally Listed Species in Arkansas, April 2012.

¹⁶⁰ Personal communication with NRCS Arkansas State Office on December 11, 2012.

¹⁶¹ *Ibid.*

¹⁶² *Ibid.*

¹⁶³ Personal communication with the Service's Arkansas Field Office on November 30, 2012.

already required under the terms of the ADEQ stormwater permits, and are not implemented as a result of the presence of listed species.^{164,165} Therefore, if future mining consultations in Arkansas continue to result in the Service recommending only that the project implement BMPs and erosion and sedimentation controls, we do not expect conservation efforts recommended for mining activities in Arkansas to result in baseline impacts. However, there is a possibility that, for future mining projects involving in-stream work, the Service may require additional conservation efforts, including but not limited to mussel surveying and relocation.¹⁶⁶ Information on costs associated with implementing these measures during past mining activities in Arkansas was unavailable. However, Exhibit 4-2 provides information on potential costs associated with conducting mussel surveys (\$54,000 on average, per project) and relocating mussels (\$67,000 on average, per project).

4.3.5 OIL AND GAS¹⁶⁷

163. Based on the consultation history, conservation efforts typically recommended to avoid jeopardy to mussel species in oil and gas development activities include conducting surveys; limiting the scope of work or re-siting the activity; and, potentially additional, project-specific requirements such as developing a frac-out contingency plan.¹⁶⁸
164. In the past, section 7 consultations on oil and gas development projects in the study area have occurred in Alabama, Arkansas, Illinois, Kentucky, Mississippi, Ohio, Oklahoma, Pennsylvania, and Tennessee, with the majority occurring in Pennsylvania.¹⁶⁹ The following case study was selected as an example of an oil and gas pipeline development project with stream crossings that affected mussel species. Though this case study gives a sense of the activity type and impacts, it is likely larger in scope than many of the projects expected to occur in the areas being proposed for designation. The majority of expected future consultations on the two mussels are expected to be informal.¹⁷⁰

Case Study: Natural Gas Pipeline Construction, Virginia¹⁷¹

165. In 2005, the Service formally consulted on impacts to seven federally-listed endangered mussel species from a proposed natural gas pipeline construction project in Virginia. In that consultation, five mussel species were considered likely to be adversely affected by the proposed action (little-wing pearly mussel, purple bean and its critical habitat, rough rabbitsfoot and its critical habitat, shiny pigtoe, and tan riffleshell). The proposed Jewell Ridge Lateral Project consisted of constructing a 32-mile long, 20-inch diameter natural

¹⁶⁴ Personal communication with the Service's Arkansas Field Office on December 4, 2012.

¹⁶⁵ Personal communication with Service's Arkansas Field Office on December 4, 2012.

¹⁶⁶ Personal communication with the Service's Arkansas Field Office on December 4, 2012.

¹⁶⁷ This case study does not occur in the proposed study area, but, due to a lack of relevant consultation history, was chosen because it represents a relevant activity type, and likely affects similar mussel species. It is important to note, however, that this project may be larger in scale than what may be considered a "typical" oil and gas pipeline project.

¹⁶⁸ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS reports from Field Offices, received September 28 and October 9, 2012.

¹⁶⁹ *Ibid.*

¹⁷⁰ Personal communication with Service's Arkansas Field Office on November 28, 2012.

¹⁷¹ U.S. Fish and Wildlife Service, Virginia Field Office, Biological Opinion on the Jewell Ridge Gas Pipeline, April 17, 2006.

gas pipeline. The pipeline had a 100-ft. wide temporary construction ROW, and a permanent 50-ft. wide access ROW.

166. Pipeline construction crossed streams with federally-listed species in four locations (Indian Creek, Clinch River, Little River, and North Fork Holston River). On the Clinch River, Little River, and North Fork Holston River, the pipeline was constructed using a dry crossing, and stream flow was conveyed around the work area using sand bag dams, pumps, piping, and similar methods. The crossing area was excavated with blasting then backfilled after the pipeline was placed, and river flow was restored after a 24- to 72-hour construction period. On the Indian River (where critical habitat is designated for purple bean and rough rabbitsfoot), a boring method was used to place pipeline. Routine maintenance is expected at the pipeline crossings once every three years.
167. The Service determined that this project would not jeopardize continued existence of the five species of mussels. The following terms and conditions were established by the Service to avoid incidental take of the listed species:
- a) Conduct all in-stream and soil-disturbing work between June 1 and August 15 to minimize impacts to mussel reproduction and ensure revegetation before winter. Boring under Indian Creek will also be subject to this time restriction.
 - b) Conduct a mussel survey within one month prior to the start of construction in the area 50 ft. upstream and 200 ft. downstream of the pipeline crossing. Relocate all mussels and report results of the survey and relocation to the Service and the state's Fish and Game office.
 - c) In Indian Creek, monitor the construction area in the year of construction. Water turbidity is monitored using real-time turbidity monitors. If erosion control measures are found to be failing, operations must cease and improved erosion control methods will be applied to all construction crossings. Monitoring data will be reported to the Service. Revegetation efforts and macro invertebrate populations are also monitored and reported to the Service.
 - d) Erosion and sedimentation controls are implemented and monitored in accordance with state BMPs handbook.
 - e) Three full-time inspectors are employed for watersheds with endangered species to monitor implementation of terms and conditions of the Incidental Take Statement.
 - f) One full-time inspector is employed for watersheds with endangered species to report any noncompliance to FERC and to the Service, with special attention to events of sediment release.
 - g) Fuel, oil, lubricants, etc., are stored in a secure location at least 100 ft. from water bodies.
 - h) When withdrawing water for pipeline testing, must leave minimum amount necessary to reduce adverse effects to listed species. No withdrawals may be made during drought, and test water may not be discharged to a water body.
 - i) Use of herbicides and pesticides in ROW is prohibited.

- j) Must allow access to Service in ROW for monitoring.
- k) Dead mussel specimens found in the project area must be preserved and reported to the Service.

168. The recommended conservation efforts are summarized in Exhibit 4-4 below. However, since this is a project of relatively larger scale than most projects in the consultation history, it is likely only a subset, or portion, of these project costs would be applicable to future projects.

EXHIBIT 4-4. BASELINE IMPACTS ASSOCIATED WITH MUSSEL CONSERVATION ON THE JEWELL PIPELINE LATERAL PROJECT

CONSERVATION EFFORTS	BASELINE IMPACTS (2012\$)
Construction date restrictions	\$360,000*
Mussel surveys on 12 streams	\$180,000
Monitoring and reporting of water turbidity, erosion control, revegetation success, and macro invertebrates, pre- and post-construction	\$480,000
Implement erosion and sedimentation BMPs	\$97,000
Compliance inspectors (three total, full-time during construction)	\$220,000
Water withdrawal guidelines/restrictions	No measurable cost impact
Sources: U.S. Fish and Wildlife Service, Virginia Field Office, Biological Opinion on the Jewell Ridge Gas Pipeline, April 17, 2006; Personal communication with Michael Tyrell, TRC Solutions, January 16, 2013.	
Notes: It is important to note that this project may be larger in scale than what may be considered a “typical” oil and gas pipeline project, and therefore costs are likely larger than what may be expected in future consultations. *Based on interruption of normal construction installation methods; Contractor estimate to move equipment and reschedule work flow.	

4.3.6 TRANSPORTATION AND UTILITIES

169. Based on the consultation history, conservation efforts recommended to avoid jeopardy to mussel species in transportation and utility activities include conducting surveys; relocating mussels; monitoring potential effects to mussels and reporting to the Service; propagating mussels and augmenting mussel population; implementing BMPs, erosion and sedimentation controls; restricting timing of activities; limiting the scope of work or re-siting the activity; and, potentially additional, project-specific requirements such as implementing zebra mussel control measures.¹⁷²

¹⁷² U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS reports from Field Offices, received September 28 and October 9, 2012.

170. In the past, section 7 consultations on transportation and utility projects in the study area have occurred in all 12 States in the study area.¹⁷³ The following case study was selected as an example of a transportation and utilities project where streambank disturbance had the potential to impact a listed mussel species.
- Case Study: Bridge Replacement on Tippecanoe River in Indiana*¹⁷⁴
171. In 2004, the FHWA consulted the Service on impacts to the clubshell mussel (*Pleurobema clava*) resulting from the replacement of Leiters Ford Bridge over the Tippecanoe River in Fulton County, Indiana on impacts to clubshell mussel, a federally-listed endangered species. The proposed project consisted of stream bank disturbance due to road construction and maintenance, two piers in the river, and removal of the existing bridge.
172. The Service determined that the proposed action was not likely to jeopardize the continued existence of the clubshell, and recommended the following reasonable and prudent measures to minimize incidental take to the mussel:
- a) Employ a qualified malacologist approved by FWS to oversee relocation and monitoring, and to prepare reports.
 - b) Survey for and relocate clubshell specimens out of project area, and provide an inventory of relocated mussels to FWS.
 - c) Establish a monitoring program to evaluate endangered species survival, survival of non-listed species if any are relocated, adequacy of handling techniques, and recolonization of the action area.
 - d) Design the project to minimize physical impacts on the mussel habitat, including constructing the piers, cofferdams, and bridge from the river banks and/or the existing bridge, avoiding temporary bridge or causeway construction, and implementing measures that limit sedimentation and introduction of construction of debris into the river.
 - e) Limit clearing of woody riparian vegetation and other actions which would reduce stream bank stability to the minimum necessary for bridge construction, and revegetate the disturbed stream banks wherever possible with native tree and other species.
 - f) Ensure that all equipment used in construction and relocation is free of zebra mussel adults and veligers before it enters the Tippecanoe River, and has been appropriately disinfected and inspected.
173. The recommended conservation efforts are summarized in Exhibit 4-5 below.

¹⁷³ *Ibid.*

¹⁷⁴ U.S. Fish and Wildlife Service, Region 3, Biological Opinion for Replacement of Fulton County Bridge #2 over Tippecanoe River, Leiters Ford, Fulton County, Indiana, January 12, 2004.

EXHIBIT 4-5. BASELINE IMPACTS ASSOCIATED WITH MUSSEL CONSERVATION FOR THE LEITERS FORD BRIDGE CONSTRUCTION, FULTON COUNTY, IN

CONSERVATION EFFORTS	BASELINE IMPACTS (2012\$)
Mussel surveys	\$12,000
Mussel relocation	\$19,000
Minimizing project impacts, and implementing measures for preventing debris from entering river	\$0*
Monitoring for species survival and recolonization	Data Unavailable
Employ a qualified malacologist for monitoring, etc.	
Limiting clearing of woody riparian vegetation, and revegetate where necessary	
Ensure equipment is free of zebra mussel adults and veligers before entering the Tippecanoe River	
Sources: U.S. Fish and Wildlife Service, Region 3, Biological Opinion for Replacement of Fulton County Bridge #2 over Tippecanoe River, Leiters Ford, Fulton County, Indiana, January 12, 2004; Personal communication with Laura Hilden and Nathan Saxe, IN DOT, December 11, 2012; Personal communication with Dave Day, American StructurePoint, Inc., January 18, 2013; Personal communication with Judy Reed, Fulton County Assessor, January 17, 2013.	
Notes: *Able to incorporate into project design at little or no additional cost.	

4.3.7 DEVELOPMENT AND RECREATION

174. Based on information provided by the Service and on the consultation history, conservation efforts typically recommended for development and recreation activities include conducting surveys; monitoring and reporting; implementing BMPs, erosion and sedimentation controls; and limiting in-stream work, among other, project-specific recommendations.¹⁷⁵

175. While we are not aware of any formal development-related consultations that have occurred within the study area for the two mussels in the recent past, the Service's Tennessee Field Office provided us with the case study presented below, which involves the type of work typical of commercial and industrial activities throughout the study area.¹⁷⁶

Case Study: Johnsonville Fossil Plant (JOF) Activities¹⁷⁷

176. In 2010, the TVA consulted with the Service on an activity at the Johnsonville Fossil Plant (JOF) Ash Disposal Area No. 2 (Johnsonville Island) within the Kentucky

¹⁷⁵ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

¹⁷⁶ Personal communication with the Service's Tennessee Ecological Services Field Office on December 3, 2012.

¹⁷⁷ U.S. Fish and Wildlife Service, Tennessee Ecological Services Field Office, Biological Opinion for Johnsonville Fossil Plant (JOF) Ash Disposal Area No. 2 (Johnsonville Island), February 1, 2010.

Reservoir impoundment in Humphrey’s County, Tennessee. The proposed project is one of many activities that the TVA has undertaken for the JOF, but the only one that has resulted in a formal consultation with the Service.¹⁷⁸ The purpose of the project was to enhance the slope stability of the northeast dike of the JOF so as not to affect stability of the structure. The activity would include the construction of a rock toe buttress along the boat harbor, which would provide additional stabilizing weight at the dike tow and stabilize the steep bank above the water’s edge against erosion.

177. The Service determined that the project would not likely jeopardize the continued existence of the pink mucket, an endangered mussel species. This area is also proposed for designation as rabbitsfoot critical habitat. The Service recommended the following reasonable and prudent measures to avoid incidental take of the pink mucket:
- a) Adaptive management: Identify ways to minimize harm during project construction and implementation of operations and maintenance activities.
 - b) Monitor the level of take associated with the proposed dike stabilization project and evaluate ways to minimize take by studying the distribution and abundance of the mussels in the action area.
 - c) Implement sediment control and minimize impacts to water quality in the action area.
178. According to TVA, they routinely implement sediment control measures and minimize impacts to water quality as part of their projects, and therefore these costs are not attributable to mussel conservation.¹⁷⁹ The only quantifiable costs incurred by TVA as a result of the above recommendations from the Service was the cost of conducting surveys of mussels prior to the beginning of the project, and the costs of monitoring mussel populations after the project. Exhibit 4-6 presents these conservation efforts along with the corresponding cost estimates, provided by TVA.¹⁸⁰

EXHIBIT 4-6. BASELINE IMPACTS ASSOCIATED WITH MUSSEL CONSERVATION FOR THE JOHNSONVILLE FOSSIL PLAN, HUMPHREY’S COUNTY, TN

CONSERVATION EFFORTS	BASELINE IMPACTS (2012\$)
Pre-project mussel survey and report	\$10,000
Mussel monitoring	\$13,000/year
Sources: Personal communication with Tennessee Valley Authority on December 6, 2012.	

¹⁷⁸ Personal communication with Tennessee Valley Authority on December 6, 2012.

¹⁷⁹ Personal communication with Tennessee Valley Authority on December 6, 2012.

¹⁸⁰ Personal communication with Tennessee Valley Authority on December 6, 2012.

4.3.8 OTHER ACTIVITIES

179. Other activities frequently occur on river banks that have the potential to result in adverse impacts to habitat, including animal and biological control, prescribed burns, land clearing, bank stabilization, habitat or shoreline restoration, among others. Bank stabilization and restoration activities have historically been common activities throughout the study area.¹⁸¹ The two case studies presented below demonstrate how the Service may recommend similar conservation efforts for both of these types of activities.

Case Study A: Chase County, KS Bank Stabilization and Riparian Restoration¹⁸²

180. In 2011, the Corps consulted with the Service on the issuance of a CWA section 10 permit for proposed bank stabilization and riparian restoration activity on the Cottonwood River. The project proposed to redirect the main flowing channel of the river to avoid continued erosion of a bridge abutment, consisting of installing riprap, reshaping the channel, and placing a vegetative buffer.

Case Study B: Upper Neosho River Basin Stream and Riparian Restoration¹⁸³

181. In 2011, the EPA consulted with the Service on a project to be undertaken by the Kansas Department of Health and Environment (KDHE) and the Kansas Water Office (KWO), funded with American Recovery and Reinvestment Act (ARRA) money to stabilize and revegetate 3.5 miles of eroding streambank, including 12 “hotspots” along an 8.3-mile stretch of the Neosho River to reduce sediment transport to the John Redmond Reservoir.
182. The Service determined for each of these projects was that it would not likely jeopardize the continued existence of the species, and recommended the following reasonable and prudent measures to avoid incidental take of the Neosho madtom, a federally-listed fish species occurring in areas proposed as rabbitsfoot critical habitat:
- a) Limit in-stream construction, excavation, or vehicle operations activities to specified project areas.
 - b) No temporary or permanent filling shall take place.
 - c) No activity shall take place during the reproduction period.
 - d) Minimize ground and channel disturbance during construction, including ramp building and channel reshaping.
 - e) Apply best management practices to avoid sedimentation from runoff from denuded construction sites.
 - f) Seeding and/or mulching shall occur within all stream runoff areas as soon as site conditions allow, following the end of excavation activities.

¹⁸¹ U.S. Fish and Wildlife Service to Industrial Economics, Inc. TAILS report from ECOS. November 9, 2012.

¹⁸² U.S. Fish and Wildlife Service, Kansas Ecological Services Field Office, Biological Opinion for Chase County Bank Stabilization and Riparian Restoration Project, 2011.

¹⁸³ U.S. Fish and Wildlife Service, Kansas Ecological Services Field Office, Biological Opinion for Upper Neosho River Basin Stream and Riparian Restoration Project, January 26, 2010.

183. In the case of bank stabilization for areas on the Neosho River, the Service also recommended population and habitat monitoring, including pre- and post-construction surveys and reporting biennially for a five-year period.
184. KWO provided information regarding the cost of the following conservation efforts for implementing Case Study B. This project, however, is a relatively large bank stabilization effort, including multiple sites. We expect the majority of future such consultations to be smaller in scope, and therefore only incur a portion of the following costs.

EXHIBIT 4-7. BASELINE IMPACTS ASSOCIATED WITH BANK STABILIZATION AND RESTORATION PROJECTS IN KANSAS

CONSERVATION EFFORTS	BASELINE IMPACTS (2012\$)
Limit project footprint	Able to incorporated without cost into project design
No temporary or permanent filling	
Timing restrictions to avoid reproductive season	
Minimize ground-disturbing impacts	
Apply erosion and sedimentation BMPs	\$42,000
Reseeding and mulching	
Post-construction surveys and monitoring (bank stabilization only)	\$18,000
Pre-construction survey (bank stabilization only)	\$8,000
Monitoring and reporting for species and habitat conditions for a five-year period (bank stabilization only)	estimated \$41,000 total
TOTAL	\$109,000
Sources: U.S. Fish and Wildlife Service, Kansas Ecological Services Field Office, Biological Opinion for Upper Neosho River Basin Stream and Riparian Restoration Project, January 26, 2010; U.S. Fish and Wildlife Service, Kansas Ecological Services Field Office, Biological Opinion for Chase County Bank Stabilization and Riparian Restoration Project, 2011; Personal communication with Susan Metzger, KWO, December 7, 2012.	

CHAPTER 5 | POTENTIAL ECONOMIC BENEFITS

185. The previous chapters of this report estimate the potential economic impacts that may be generated by the designation of critical habitat for the two mussels and provide a qualitative discussion of the economic impacts of listing the species as threatened or endangered. This chapter contemplates potential economic benefits resulting from listing and designation. First, we discuss the potential for conservation benefits resulting from the designation of critical habitat. Then, we focus on the potential benefits of the listing, first introducing economic methods employed to quantify benefits of species conservation, and then discussing the availability of existing literature to support valuation. We conclude with a qualitative description of the potential categories of ancillary benefits that may result from the designation, and identify the units where such benefits may be generated.

KEY ISSUES AND CONCLUSIONS:

- The primary goal of critical habitat designation for the mussels is to support their long-term conservation. Theoretically, conservation and recovery of the species may result in benefits, including use benefits (wildlife-viewing), non-use benefits (existence values), and ancillary ecosystem service benefits (e.g., public safety benefits of reduced wildfire risks).
- As described in Chapter 3, the potential economic impacts of designating critical habitat for these species are limited to minor administrative costs associated with section 7 consultations. Changes in land management or the management of the designated waterways as a result of the designation of critical habitat are unlikely. Thus, in this instance, critical habitat designation will likely add minimal conservation benefits to those already provided by baseline conservation efforts.
- This Chapter also qualitatively discusses the potential benefits associated with conservation efforts resulting from the baseline protections discussed in Chapter 4.

5.1 ESTIMATING INCREMENTAL BENEFITS

186. The primary intended benefit of critical habitat is to support the conservation of threatened and endangered species, such as the two mussels. Thus, attempts to develop monetary estimates of the benefits of this proposed critical habitat designation would focus on the public's willingness to pay to achieve any conservation benefits to the mussels resulting from this designation.
187. Quantification and monetization of species conservation benefits requires two primary pieces of information: (1) data on the incremental change in the probability of the conservation of the two mussels that is expected to result from the designation; and (2) data on the public's willingness to pay for this incremental change. As described in

Chapter 3, the potential economic impacts of designating critical habitat for the species are limited to minor administrative costs associated with section 7 consultations. Changes in land management or the management of the designated waterways as a result of the designation of critical habitat are unlikely. Thus, in this instance, critical habitat designation will likely add minimal conservation benefits to those already provided by baseline conservation efforts.

5.2 ESTIMATING BASELINE BENEFITS

188. Chapter 4 provides case study examples of the types of conservation efforts undertaken to avoid jeopardizing or to minimize take of listed mussel species. In this section, we describe the methods used by economists to value the benefits of such actions, and we discuss the availability of existing studies that are potentially relevant to the mussels. Finally, we provide a qualitative discussion of the categories of ancillary benefits potentially resulting from the implementation of such conservation efforts.

5.2.1 ECONOMIC METHODS USED TO VALUE USE AND NON-USE VALUES OF SPECIES AND HABITAT CONSERVATION

189. The primary intended benefit of listing a species and designating its critical habitat is to ensure the survival and long-term conservation of the species.¹⁸⁴ Various economic benefits, measured in terms of social welfare or regional economic performance, may result from conservation efforts. The benefits can be placed into two broad categories: (1) those associated with the primary goal of species survival and conservation (i.e. direct benefits), and (2) those additional beneficial services that derive from the conservation efforts but are not the purpose of the Act (i.e., ancillary benefits, such as improved habitat for other species).
190. Because the purpose of the Act is to provide for the conservation of endangered and threatened species, the benefits of actions taken under the Act are often measured in terms of the value placed by the public on species preservation (e.g., avoidance of extinction, and/or increase in a species' population). Such social welfare values for a species may reflect both use and non-use values for the species. Use values derive from a direct use for a species, such as commercial harvesting or recreational wildlife-viewing opportunities. Non-use values are not derived from direct use of the species, but instead reflect the utility the public derives from knowledge that a species continues to exist (e.g., existence or bequest values).
191. As a result of actions taken to preserve endangered and threatened species, such as habitat management, various other benefits may accrue to the public. Conservation efforts may result in improved environmental quality, which in turn may have collateral human health or recreational use benefits. In addition, conservation efforts undertaken for the benefit of a threatened or endangered species may enhance shared habitat for other wildlife. Such benefits may result from modifications to projects, or may be collateral to

¹⁸⁴ The term "conservation" means "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary" (16 U.S.C. § 1532).

such actions. For example, the listing may reduce discharges to waterways to improve water quality. This in turn may reduce downstream treatment costs for municipal uses of the water.

192. Economists apply a variety of methodological approaches in estimating both use and non-use values for species and for habitat improvements, including stated preference and revealed preference methods. Stated preference techniques include such tools as the contingent valuation method, conjoint analysis, or contingent ranking methods. In simplest terms, these methods employ survey techniques, asking respondents to state what they would be willing to pay for a resource or for programs designed to protect that resource. A substantial body of literature has developed that describes the application of this technique to the valuation of natural resource assets.
193. More specific to use values for species or habitats, revealed preference techniques examine individuals' behavior in markets in response to changes in environmental or other amenities (i.e., people "reveal" their value by their behavior). For example, travel cost models are frequently applied to value access to recreational opportunities, as well as to value changes in the quality and characteristics of these opportunities. Basic travel cost models are rooted in the idea that the value of a recreational resource can be estimated by analyzing the travel and time costs incurred by individuals visiting the site. Another revealed preference technique is hedonic analysis, which is often employed to determine the effect of site-specific characteristics on property values.

5.2.3 USE AND NON-USE VALUATION STUDIES

194. Numerous published studies estimate individuals' willingness to pay to protect endangered species.¹⁸⁵ The economic values reported in these studies reflect various groupings of benefit categories (including both use and non-use values). For example, these studies assess public willingness to pay for wildlife-viewing opportunities, for the option for seeing or experiencing the species in the future, to assure that the species will exist for future generations, and simply knowing a species exists, among other values. This literature, however, addresses a relatively narrow range of species and circumstances compared to the hundreds of species and habitats that are the focus of the Act.
195. An ideal study for use in valuing the use and non-use values that may derive from the species' listing would be specific to the species, the policy question at hand (survival and recovery of the species), and the relevant population holding such values (e.g., citizens of the relevant states or of the United States as a whole). No such study has been undertaken to date for the Neosho mucket or rabbitsfoot or other mussel species.
196. Absent primary research specific to the policy question (benefits of listing mussel species), resource management decisions can often be informed by applying the results of existing valuation research to a new policy question – a process known to economists as benefit transfer. Benefit transfer involves the application of unit value estimates,

¹⁸⁵ See, for example, the summary in Richardson, L. and J. Loomis. March 2009. The Total Economic Value of Threatened, Endangered, and Rare Species: An Updated Meta-Analysis. *Ecological Economics* 68(5): 1535-1548.

functions, data, and/or models from existing studies to estimate the benefits associated with the resource under consideration.

197. OMB has written guidelines for conducting credible benefit transfers. The important steps in the OMB guidance are: (1) specify the value to be estimated for the rulemaking; and (2) identify appropriate studies to conduct benefits transfer based on the following criteria:

- The selected studies should be based on adequate data, sound and defensible empirical methods and techniques;
- The selected studies should document parameter estimates of the valuation function;
- The study and policy contexts should have similar populations (e.g., demographic characteristics). The market size (e.g., target population) between the study site and the policy site should be similar;
- The good, and the magnitude of change in that good, should be similar in the study and policy contexts;
- The relevant characteristics of the study and policy contexts should be similar;
- The distribution of property rights should be similar so that the analysis uses the same welfare measure (i.e., if the property rights in the study context support the use of willingness-to-accept measures while the rights in the rulemaking context support the use of willingness-to-pay measures, benefits transfer is not appropriate); and
- The availability of substitutes across study and policy contexts should be similar.

198. We undertook a literature review to identify existing research regarding the use and non-use values the public holds for conserving the mussels. Existing information on potential use and non-use values does not support a benefit transfer based analysis associated with mussel populations. Specifically, existing studies focus almost exclusively on large mammal, bird, and fish species, rather than mussel species. Furthermore, the studies of fish species focus on regions of the United States that are dissimilar from the study area (e.g., the Southwest, Pacific northwest, and the Atlantic Coast).

5.3 QUALITATIVE DISCUSSION OF THE ANCILLARY BENEFITS OF LISTING

199. Benefits beyond use and non-use values may also be achieved through a species listing. For example, the public may hold a value for habitat conservation, beyond its willingness to pay for conservation of a specific species. Studies have estimated the public's willingness to pay to preserve wilderness areas, for wildlife management and preservation programs, and for wildlife protection in general. These studies address categories of benefits (e.g., ecosystem integrity) that may be similar to the types of benefits provided by the listing.

200. In general, ancillary benefits could derive from conservation efforts that may be implemented to avoid jeopardizing the species. Based on our analysis in Chapter 3 of

likely consultation activity, such efforts could be undertaken in all but two proposed critical habitat units (NM6 and RF14), where we forecast no future consultations. The categories of related economic benefits include:

- **Improved water quality:** Implementation of BMPs and erosion controls, and the retention of vegetation may reduce sedimentation in wetlands and streams and reduce adverse impacts to downstream water quality. Improved water quality may reduce water treatment costs and have human or ecological health benefits.
- **Aesthetic benefits:** Water quality improvements may result in clearer waterways. Preferences for aesthetic improvements may be measured, for example, through increased willingness-to-pay to visit a habitat region for recreation, increased visitation, or changes in the value of neighboring properties.

201. In addition to these categories of potential benefits, many of the conservation efforts undertaken for the mussels may also result in improvements to ecosystem health that are shared by other, coexisting species (including other endangered or threatened species). The maintenance or enhancement of use and non-use values for these other species, or for biodiversity in general, may also result from these conservation efforts for the mussels.
202. To estimate the change in water quality resulting from the implementation of BMPs and erosion controls and the retention of vegetation, the following types of detailed, on-the-ground data would be required as model inputs: the type and density of vegetative cover; precipitation, temperature, and other weather-related data; topography (e.g., steepness of slope); pre-existing water quality conditions (e.g., the amount of total dissolved solids, pH, temperature); and potentially other hydrologic characteristics (e.g., flow rates, water volume, in-stream structures such as dams).
203. While some of these data are available; some would need to be generated at a relatively fine level of resolution in order to model the types of incremental changes in services likely to result from the designation. Furthermore, once we estimated the change in water quality, we would need to either develop a methodology or use a pre-existing tool and compile data to estimate the value of such changes (e.g., avoided water treatment costs; revealed of stated preference studies of willingness to pay for water quality improvements). Such detailed data collection and analysis to estimate the ancillary benefits of the decision to list the mussels is beyond the scope of this report, which focuses primarily on the incremental effects of critical habitat designation.

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APPENDIX A | ADDITIONAL STATUTORY REQUIREMENTS

204. This appendix addresses the remaining analytical requirements under administrative law and executive order. Section A.1 presents an analysis of impacts to small entities which is conducted pursuant to the Regulatory Flexibility Act, as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 and Executive Order 13272. Section A.2 assesses the effects of the Proposed Rule on State, local, and Tribal governments and the private sector as required by Title II of the Unfunded Mandates Reform Act of 1995. Section A.3 addresses the potential for federalism concerns as required by Executive Order 13132. And Section A.4 considers potential impacts to the energy industry in response to Executive Order 13211, entitled, “Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use.”
205. The analyses in this appendix rely on the estimated incremental impacts resulting from the proposed critical habitat designation. The incremental impacts of the rulemaking are most relevant for these analyses because they reflect costs that may be avoided or reduced based on decisions regarding the composition of the final rule.

A.1 RFA/SBREFA ANALYSIS

206. When a Federal agency proposes regulations, the 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).¹⁸⁶ 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 that a rule will not have significant economic impact on a substantial number of small entities.
207. Three types of small entities are defined in the RFA:
- **Small Business** - Section 601(3) of the RFA defines a small business as having the same meaning as small business concern under section 3 of the Small Business Act. This includes any firm that is independently owned and operated and is not dominant in its field of operation. The Small Business Administration (SBA) has developed size standards to carry out the purposes of the Small Business Act, and those size standards can be found in 13 CFR 121.201. The size standards are matched to North American Industry Classification System (NAICS) industries. The SBA definition of a small business applies to a firm’s parent company and all affiliates as a single entity.

¹⁸⁶ 5 U.S.C. § 601 et seq.

- **Small Governmental Jurisdiction** - Section 601(5) defines small governmental jurisdictions as governments of cities, counties, towns, townships, villages, school districts, or special districts with a population of less than 50,000. Special districts may include those servicing irrigation, ports, parks and recreation, sanitation, drainage, soil and water conservation, road assessment, etc. When counties have populations greater than 50,000, those municipalities of fewer than 50,000 can be identified using population reports. Other types of small government entities are not as easily identified under this standard, as they are not typically classified by population.
 - **Small Organization** - Section 601(4) defines a small organization as any not-for-profit enterprise that is independently owned and operated and not dominant in its field. Small organizations may include private hospitals, educational institutions, irrigation districts, public utilities, agricultural co-ops, etc.
208. The courts have held that the RFA/SBREFA requires Federal agencies to perform a regulatory flexibility analysis of forecast impacts to small entities that are directly regulated. In the case of *Mid-Tex Electric Cooperative, Inc., v. Federal Energy Regulatory Commission (FERC)*, FERC proposed regulations affecting the manner in which generating utilities incorporated construction work in progress in their rates. The generating utilities that expected to be regulated were large businesses; however, their customers -- transmitting utilities such as electric cooperatives -- included numerous small entities. In this case, the court agreed that FERC simply authorized large electric generators to pass these costs through to their transmitting and retail utility customers, and FERC could therefore certify that small entities were not directly impacted within the definition of the RFA.¹⁸⁷
209. Similarly, *American Trucking Associations, Inc. v. Environmental Protection Agency (EPA)* addressed a rulemaking in which EPA established a primary national ambient air quality standard for ozone and particulate matter.¹⁸⁸ The basis of EPA's RFA/SBREFA certification was that this standard did not directly regulate small entities; instead, small entities were indirectly regulated through the implementation of State plans that incorporated the standards. The court found that, while EPA imposed regulation on States, it did not have authority under this rule to impose regulations directly on small entities and therefore small entities were not directly impacted within the definition of the RFA.
210. Following the court decisions described above, this analysis considers only those entities directly regulated by the Proposed Rule. The regulatory mechanism through which critical habitat protections are realized is section 7 of the Act, which requires Federal agencies, in consultation with the Service, to insure that any action authorized, funded, or carried by the Agency is not likely to adversely modify critical habitat. Therefore, under a strict interpretation of the definition of a "directly regulated entity," only Federal action agencies are subject to a regulatory requirement (i.e., to avoid adverse modification) as the result of the designation. Because Federal agencies are not small entities, under this

¹⁸⁷ 773 F. 2d 327 (D.C. Cir. 1985).

¹⁸⁸ 175 F. 3d 1027, 1044 (D.C. Cir. 1999).

interpretation, the Service may certify that the proposed critical habitat rule will not have a significant economic impact on a substantial number of small entities.

211. 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. While these entities are not directly regulated, the Service has requested information regarding the potential number of third parties participating in consultations on an annual basis in order to ensure a robust examination of the effects of this proposed rule. Below, we provide that information. We also provide information to assist the Service in determining whether these entities are likely to be “small,” and whether the number of potentially affected small entities is “substantial.”¹⁸⁹
212. Importantly, the impacts of the 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 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.
213. This analysis first characterizes the industries potentially involved in section 7 consultations (formal, informal, or technical assistances) for each activity type addressed in this analysis. We then estimate the number of small entities that may be subject to consultation on each activity, and estimate the financial magnitude of those impacts on industries undergoing section 7 consultation for each activity type. For this analysis, we define the study area differently from the analysis presented in the main body of this report. The study area for the purposes of this small entity analysis is defined as the 237 counties encompassing the critical habitat study areas defined in Chapter 1, assuming that businesses within this geographic range are likely to feasibly partake in a project needing to consult on potential impacts to mussel critical habitat. This analysis also makes the conservative assumptions that every consultation will have a third party, and that every participating third party will be a small entity.

SUMMARY OF FINDINGS

214. The incremental costs of potential future section 7 consultations are estimated in Chapter 3 of this report for each of the eight types of activity potentially affecting critical habitat (water flow management; water quality management; timber, agriculture, and grazing; mining; oil and gas development; transportation and utilities; development and recreation; and other activities). The costs estimated in this economic analysis consist of the administrative costs associated with conducting section 7 consultations to address potential adverse modification of mussel critical habitat. Therefore, the only costs expected to be borne by third parties are portions of the total cost of each section 7 consultation action (formal, informal, or technical assistances).

¹⁸⁹ The RFA does not provide quantitative thresholds to defining the terms “substantial” and “significant.” In its guidance to Federal agencies on complying with the RFA, SBA provides qualitative descriptions of these terms, leaving the Agencies with discretion to interpret these terms on a case-by-case basis.

215. As shown in Exhibit A-2, below, the proportion of small entities in the study area that may be affected by the designation 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 a year, the average cost incurred by each entity being affected is approximately \$420, which constitutes less than 0.03 percent of annual revenue for any industries involved in each activity (see Exhibit A-2). In some cases, the same industry or type of small entity could be involved in more than one activity type. For example, the “Other Heavy and Civil Engineering Construction” industry could partake in water flow management activities, development activities, and other activities such as bank stabilization projects. If an entity in this industry consulted on three activities in a year, the total cost of approximately \$1,220 would constitute 0.01 percent of annual revenue for this industry specifically.¹⁹⁰
216. Importantly, potential financial impacts to local government agencies and private landowners are not estimated as a proportion of annual revenues due to a lack of data. Local government entities may engage in a number of activities, such as municipal development, NPDES permit reviews, and utility construction. Likewise, private landowners may be third parties in activities that require section 7 consultation with the Service such as on timber or agriculture projects that require 404 permitting. However, of note, for any entity with greater than \$47,000 in annual revenue, the financial burden of undertaking a project requiring consultation on the mussels would constitute less than one percent of annual revenue.

CHARACTERIZATION OF POTENTIALLY AFFECTED THIRD PARTIES

217. This analysis identifies the entities defined by the NAICS codes presented in Exhibit A-1 as potential third party participants in section 7 consultation. Exhibit A-1 also provides the Small Business Administration’s and RFA’s definitions of a small entities. To identify the total number of small entities found within our study area in these NAICS categories, we rely on data obtained from Dun’s Market Identifiers, a privately-compiled database containing basic company data such as annual revenues and number of employees.¹⁹¹ An exception to this was for NAICS 517210 (Wired Communications Providers) for which this database provided no information. Instead, this analysis relies on U.S. Census County Business Patterns data. To identify small local governments, this analysis relies on the U.S. Census Government Integrated Directory (GID).¹⁹²
218. Business and local government data were obtained for each of the 13 states in which entities may be required to consult on potential impacts on mussel habitat. In order to account for the proportion of these entities that may be feasibly affected by the rule, this analysis assumes that small businesses are distributed proportionally to population, and

¹⁹⁰ Average annual revenue for this industry is estimated to be approximately \$8 million. See notes in Exhibit A-2 below for a description of the estimation methodology.

¹⁹¹ Dun and Bradstreet, D&B - Dun’s Market Identifiers, searched via Dialog File 516 on December 16 and 17, 2012; U.S. County Business Patterns, Industry Code Comparison for NAICS 517210, accessed at <http://censtats.census.gov/cgi-bin/cbpnaic/cbpcomp.pl> on December 17, 2012. Of note, this data does not include nonemployer businesses, and is therefore likely an underestimate of the total number of entities, and small entities, in this industry.

¹⁹² U.S. Census Bureau, 2007 Governments Integrated Directory (GID), accessed on December 10, 2012 at http://harvester.census.gov/gid/gid_07/options.html.

applies the proportion of the State’s population that is in the study area counties in that State to the total number of businesses and local governments in the State.¹⁹³ Across the study area, approximately 11 percent of the State populations are located within the 237 affected counties.

219. Exhibit A-1 presents the total number of entities in the study area for each industry, as well as the number and percent that are small. Private landowners are included here as potential third parties for activities such as residential development. Importantly, private landowners who are not using the property for some commercial purpose (e.g., ranching, timber, agriculture) and who hold the property as a private investment are not “entities” as defined by the Small Business Administration.

IMPACTS TO THIRD PARTIES PARTICIPATING IN WATER FLOW MANAGEMENT CONSULTATIONS

220. Across the study area, 1,311 businesses and 4,746 local government entities are engaged in water flow management activities. Of these, approximately 96 percent are below their respective small size standard thresholds, and are therefore considered small. In Chapter 3, we estimate that approximately 220 consultations will occur over the next 20 years related to water flow management projects, for activities such as dams, diversions, levees, and related in-stream and bank construction. On an annual basis, this report projects approximately 11 consultations per year. Some of these consultations will not include one of these entities as a third party, since the activity is undertaken by Federal agencies such as the Corps or TVA. As previously stated, however, this analysis assumes that each consultation involves a small entity as a third party. As such, we assume approximately 0.2 percent of all entities will undergo section 7 consultation each year and incur approximately \$410 in associated costs. This cost represents less than one percent of annual revenue for businesses in these industries. Revenue data was not available for local governments; however, for any entity with greater than \$41,000 in annual revenue, this impact would constitute less than one percent of annual revenue.

¹⁹³ This analysis utilizes 2010 U.S. Census Data for total population in each State and total population in each county.

EXHIBIT A-1 OVERVIEW OF NUMBER OF SMALL ENTITIES POTENTIALLY AFFECTED BY THE PROPOSED DESIGNATION

POTENTIAL THIRD PARTY INDUSTRIES (NAICS)	SBA DEFINITION OF A "SMALL" ENTITY	TOTAL ENTITIES	TOTAL "SMALL" ENTITIES	PERCENT "SMALL" ENTITIES
Water Flow Management				
Lock and Waterway Construction, Dredging ¹ (237990)	\$33.5 million	405	373	92.1%
Water Supply and Irrigation Systems (221310)	\$7.0 million	907	773	85.2%
Local Governments	Pop. Of 50,000	4,746	4,677	98.5%
Water Quality Management				
Various, see discussion below	Various	--	--	--
Local Governments ²	Pop. Of 50,000	4,746	4,677	98.5%
Timber, Agriculture, and Grazing				
Beef Cattle Ranching and Farming (112111)	\$0.75 million	2,121	2,095	98.8%
Dairy Cattle and Milk Production (112120)	\$0.75 million	1,058	1,026	96.9%
Crop Production (111-)	\$0.75 million	22,575	22,196	98.3%
Timber Tract Operations (113110)	\$7.0 million	160	144	89.9%
Loggers (113310)	500 employees	836	828	99.1%
Support Activities for Agriculture and Forestry (115-)	\$7.0 million ³	2,135	1,997	93.5%
Private landowners	n/a	--	--	--
Mining				
Construction Sand and Gravel Mining (212321)	500 employees	152	117	77.0%
Coal mining (212111, 212112)	500 employees	83	41	49.8%
Oil and Gas Development				
Oil and Gas Extraction (211-)	500 employees	549	461	84.0%
Development and Recreation				
Land Subdivision (237210)	\$7.0 million	1,902	1,851	97.3%
New Single-Family Housing Construction (Except For-Sale Builders) (236115)	\$33.5 million	21,019	20,934	99.6%
New Multifamily Housing Construction (Except For-Sale Builders) (236116)	\$33.5 million	1,672	1,650	98.7%
New Housing For-Sale Builders (236117)	\$33.5 million	392	374	95.5%
Residential Remodelers (236118)	\$33.5 million	4,496	4,483	99.7%
Industrial Building Construction (236210)	\$33.5 million	459	437	95.1%
Commercial and Institutional Building Construction (236220)	\$33.5 million	2,728	2,580	94.6%
Other Heavy and Civil Engineering Construction (e.g., Park Area, Open Space, and Trail Construction) (237990)	\$33.5 million	405	373	92.1%

POTENTIAL THIRD PARTY INDUSTRIES (NAICS)	SBA DEFINITION OF A "SMALL" ENTITY	TOTAL ENTITIES	TOTAL "SMALL" ENTITIES	PERCENT "SMALL" ENTITIES
Private landowners	n/a	--	--	--
Local Governments ²	Pop. Of 50,000	4,746	4,677	98.5%
Transportation & Utilities				
Highway, Street, and Bridge Construction (237310)	\$33.5 million	1,353	1,179	87.1%
Water and Sewer Line and Related Structures Construction (including Construction management) (237110)	\$33.5 million	865	715	82.8%
Power and Communication Line and Related Structures Construction (237130)	\$33.5 million	152	122	80.2%
Electric Power Transmission, Control, and Distribution (22112-)	4 million megawatt hours ⁴	129	129	100.0%
Wired Telecommunications Carriers (517110)	1,500 employees	741	710	95.9%
Wireless Telecommunications Carriers (except Satellite) (517210) ⁵	1,500 employees	404	404	100.0%
Local Governments ²	Pop. Of 50,000	4,746	4,677	98.5%
Other				
Other Heavy and Civil Engineering Construction (e.g., Riprap Installation) (237990)	\$33.5 million	405	373	92.1%
Local Governments ²	Pop. Of 50,000	4,746	4,677	98.5%
TOTAL⁶		72,037	70,295	97.6%
Notes:				
1. Dredging and Surface Cleanup Activities are considered small if they have revenue of less than \$20.0 million. To be considered small for purposes of Government procurement, a firm must perform at least 40 percent of the volume dredged with its own equipment or equipment owned by another small dredging concern.				
2. Local Government entities include boroughs, cities, civil townships, counties, metropolitan governments, municipalities, towns, townships, villages, and other districts and agencies such as school districts, fire districts, water and irrigation districts, soil conservation districts, sanitary districts, housing authorities, development districts, among others.				
3. Except Forest Fire Suppression and Fuels Management Services (\$17.5 million)				
4. A firm is small if, including its affiliates, it is primarily engaged in the generation, transmission, and/or distribution of electric energy for sale and its total electric output for the preceding fiscal year did not exceed 4 million megawatt hours.				
5. From County Business Patterns, since D&B data not available for this NAICS code.				
6. This is a total of unique entities (e.g., it does not count local governments separately for each time they appear in the categories above).				
7. Totals may not sum due to rounding, resulting from application of county population proportions to total businesses in each state.				
Sources: Dun and Bradstreet, D&B Dun's Market Identifiers, searched via Dialog File 516 on December 16 and 17, 2012; U.S. County Business Patterns, Industry Code Comparison for NAICS 517210, accessed at http://censtats.census.gov/cgi-bin/cbpnaic/cbpcomp.pl on December 17, 2012; U.S. Census Bureau, 2007 Governments Integrated Directory, accessed on December 10, 2012 at http://harvester.census.gov/gid/gid_07/options.html .				

EXHIBIT A-2. IMPACTS TO SMALL ENTITIES AFFECTED BY PROPOSED DESIGNATION

ACTIVITY	LARGEST NUMBER OF AFFECTED SMALL ENTITIES IN A SINGLE YEAR ¹ [A]	NUMBER OF SMALL ENTITIES IN THE STUDY AREA ² [B]	PERCENTAGE OF SMALL ENTITIES AFFECTED [A]/[B]	ANNUALIZED IMPACTS PER ENTITY ¹ [C]	AVERAGE ANNUAL REVENUES ³ [D]	IMPACT AS A PERCENT OF ANNUAL REVENUE ⁴ [C]/[D]
Water Flow Management	11	5,822	0.2%	\$410	\$5,500,000	0.007%
Water Quality Management	11	4,677	0.2%	\$340	--	--
Timber, Agriculture, and Grazing	41	28,286	0.1%	\$470	\$1,700,000 ⁽⁴⁾	0.028%
Mining	4	158	2.3%	\$430	\$8,900,000	0.005%
Oil and Gas Development	14	461	3.1%	\$460	\$7,900,000	0.006%
Development and Recreation	43	37,359	0.1%	\$410	\$5,900,000	0.007%
Transportation and Utilities	68	7,935	0.9%	\$450	\$8,500,000 ⁽⁵⁾	0.005%
Other	35	5,050	0.7%	\$400	\$8,200,000	0.005%

Sources:

1. See Chapter 3 of this report. Impacts per activity type vary as activities have different numbers of each consultation type (technical assistance, informal, or formal). For example, if an activity generates a higher number of formal consultations as opposed to informal consultations, annualized impact per entity may be larger.
2. See Exhibit A-1, above.
3. Annual revenues are estimated using Risk Management Association (RMA), *Annual Statement Studies: Financial Ratio Benchmarks 2011 to 2012*, 2011. These averages do not include local government revenues, which for some categories, comprises the majority of entities in a category. The following method was used to develop these estimates:
 - (a) Matched affected economic activities to available NAICS codes in RMA data. The following codes are used for affected industries: for Water Flow Management, 237990 (Other Heavy and Civil Engineering Construction), 221310 (Water Supply and Irrigation Systems); For Water Quality Management, no NAICS codes matched this category of economic activity; For Timber, Agriculture and Grazing: 111110 (Soybean Farming), 111140 (Wheat Farming), 111150 (Corn Farming), 111199 (All Other Grain Farming), 111211 (Potato Farming), 111219 (Other Vegetable Farming), 111421 (Nursery and Tree Production), 111920 (Cotton Farming), 111988 (All Other Miscellaneous Crop Farming, 112111 (Beef Cattle Ranching, 112120 (Dairy and Milk Production), 113110 (Timber Tract Operations), 113310 (Logging), 115111 (Cotton Ginning), 115112 (Soil Preparation, Planting, and Cultivating), 115116 (Farm Management Services), 115210 (Support Activities for Animal Production); For Oil and Gas Development: 211111 (Crude Petroleum and Natural Gas Extraction); For Mining: 212111 (Bituminous Coal and Lignite Surface Mining), 212321 (Construction Sand and Gravel Mining); For Transportation and Utilities: 221122 (Electric Power Distribution), 237130 (Power and Communication Line and Related Structures Construction), 237130 (Water and Sewer Line and Related Structures Construction), 237310 (Highway, Street, and Bridge Construction), 517210 (Wired Telecommunications Carriers), 517210 (Wireless Telecommunications Carriers (except Satellite)); For Development and Recreation: 237990 (Other Heavy and Civil Engineering Construction), 236115 (New Single-Family Housing Construction (except For-Sale Builders), 236116 (New Multifamily Housing Construction (except For-Sale Builders), 236117 (New Housing For-Sale Builders), 236118 (Residential Remodelers), 236210 (Industrial

Building Construction), 236220 (Commercial and Institutional Building Construction); For Other activities: 237990 (Other Heavy and Civil Engineering Construction). Where possible, these correspond to the NAICS codes noted in Exhibit A-1.

(b) For each NAICS code, RMA provides the net sales and the number of entities falling within several sales categories: \$0 to \$1 million, \$1 to 3 million, \$3 to \$5 million, \$5 to \$10 million, \$10 to \$25 million, and greater than \$25 million. Based on the number of entities and total net sales falling within each sales category, this analysis developed an estimate of average net sales (revenues) per small entity. Specifically, the analysis averages data for the sales categories at or below the small business threshold for each industry. For example, if the small business threshold is \$7 million, this analysis uses the following sales categories: \$0 to \$1 million, \$1 to 3 million, \$3 to \$5 million, and \$5 to \$10 million. For transportation-related activities (threshold of \$33.5 million), this analysis used sales categories up to \$10 to \$25 million. For industries that have a threshold based on the number of employees, all categories up to \$10 to \$25 million are used.

4. Revenue for crop producing (NAICS 111), cattle ranching (NAICS 112111), and cattle milk production (NAICS 112120) entities is substantially lower, averaging approximately \$500,000.

5. These averages do not include local government revenues, which comprise the majority of entities in this activity.

5. Percentages may not calculate due to rounding.

IMPACTS TO THIRD PARTIES PARTICIPATING IN WATER QUALITY CONSULTATIONS

221. In Chapter 3, we estimate that 212 consultations will occur over the next 20 years related to water quality projects, largely for consultation on state-issued Federal NPDES permits. On an annual basis, this report projects approximately 11 consultations per year, most of which are individual requests for construction site discharges, farm operator discharges, pipe outfalls, and similar activities, though some are for water quality modifications for a municipality. NPDES permit applicants cover a wide range of industries, representing the entire study area economy, and likely constituting multiple thousands of entities across the study area. Due to the large number of potentially affected parties, and the small magnitude of the individual impact of each permit request, it is unlikely this activity will result in significant impacts to a substantial number of small entities. For example, as shown in Exhibit A-2, if all each consultation was conducted by a small government entity, approximately 0.2 percent of small entities would be affected. There are likely a great many more potential consulting parties for this activity. For any entity with greater than \$34,000 in annual revenue, this impact would constitute less than one percent of annual revenue.

IMPACTS TO THIRD PARTIES PARTICIPATING IN TIMBER, AGRICULTURE, AND GRAZING CONSULTATIONS

222. Across the study area, 28,885 businesses and an additional number of private landowners are engaged in timber, agriculture, and grazing activities. Of the 28,885 businesses, approximately 98 percent are below their respective small business thresholds, and are therefore considered small. In Chapter 3, we estimate that approximately 820 consultations will occur over the next 20 years (or 41 annually) related to timber, agriculture, and grazing projects. Activities these entities will consult on may include projects for which these entities receive Federal funding through NRCS, or if an entity's project will require a 404 permit from the Corps. As shown in Exhibit A-2, approximately 0.1 percent of small entities undertaking these activities will be affected each year, incurring approximately \$470 per consultation. As shown in Exhibit A-2, average annual revenue for industries undergoing these activities is approximately \$1.7 million, resulting in an impact of approximately 0.03 percent on annual revenues. Revenue for crop producing, cattle ranching, and cattle milk production entities, however, is substantially lower, averaging approximately \$490,000.¹⁹⁴ For these entities, annual impacts constitute approximately 0.1 percent of revenues.

IMPACTS TO THIRD PARTIES PARTICIPATING IN MINING CONSULTATIONS

223. Across the study area, 235 businesses are engaged in mining activities. Of these, approximately 67 percent are below the small business threshold of having 500 employees, and are therefore considered small. In Chapter 3, we estimate that 73 consultations will occur over the next 20 years related to mining projects. On an annual basis, this report projects approximately four consultations per year. As shown in Exhibit A-2, approximately 2.3 percent of small entities undertaking these activities will be

¹⁹⁴ Includes NAICS codes 111-, 112111, and 112120 that had revenue data available in RMA. See notes in Exhibit A-2 above for a detailed description of the estimation methodology used.

affected each year, incurring approximately \$430 per consultation, accruing to less than one percent of average annual revenues for businesses in these industries.

IMPACTS TO THIRD PARTIES PARTICIPATING IN OIL AND GAS DEVELOPMENT CONSULTATIONS

224. Across the study area, 549 businesses are engaged in oil and gas development activities. Of these, approximately 84 percent are below the small business threshold of having 500 employees, and are therefore considered small. In Chapter 3, we estimate that 287 consultations will occur over the next 20 years related to oil and gas development projects, such as constructing pipelines across proposed stream reaches. On an annual basis, this analysis projects approximately 14 consultations per year. As shown in Exhibit A-2, approximately 3.1 percent of small entities undertaking these activities will be affected each year. It is possible; however, that these energy development projects will be conducted by large companies based outside of the study area, in which case we overstates the proportion of affected small entities. Each of these 14 consultations will incur costs of approximately \$460 per consultation, representing less than one percent of average annual revenues for businesses in this industry.

IMPACTS TO THIRD PARTIES PARTICIPATING IN DEVELOPMENT AND RECREATION CONSULTATIONS

225. Across the study area, 33,071 businesses, 4,746 local government agencies, and a number of private landowners are engaged in, or profit from, residential and related development activities. Of the businesses and government agencies, approximately 99 percent are below their respective small business threshold, and are therefore considered small. In Chapter 3, we estimate that 852 consultations will occur over the next 20 years related to development projects, such as new housing or municipal building construction, trail and park construction, or development of industrial parks. On an annual basis, this analysis projects approximately 43 consultations per year. As shown in Exhibit A-2, approximately 0.1 percent of small entities undertaking these activities will be affected each year. Each of these 43 consultations will incur costs of approximately \$410 per consultation, representing less than one percent of average annual revenues for businesses in these industries. Of note, private landowners who hold their properties as an investment and do not otherwise make commercial use of the land (e.g., through agriculture) are not considered to be “entities” for the purposes of this analysis.

IMPACTS TO THIRD PARTIES PARTICIPATING IN TRANSPORTATION AND UTILITY CONSULTATIONS

226. Across the study area, 3,643 businesses and 4,746 local government agencies are engaged in transportation and utility activities. Of these, approximately 95 percent are below their respective small business threshold, and are therefore considered small. In Chapter 3, we estimate that 1,367 consultations will occur over the next 20 years related to transportation and utility projects, such as bridge replacement, water pipeline installation, and telecommunications infrastructure, such as poles. It is likely that a number of these projects will be undertaken by State Departments of Transportation, which are not considered to be small entities. However, this analysis conservatively assumes that each consultation involves a small entity. On an annual basis, this analysis projects

approximately 68 consultations per year. As shown in Exhibit A-2, approximately 0.9 percent of small entities undertaking these activities will be impacted each year. Each of these 68 consultations will incur costs of approximately \$450 per consultation, representing less than one percent of average annual revenues for businesses in these industries. Revenue data from local government agencies were not available, and therefore the magnitude of impact is not assessed. However, for any entity with greater than \$45,000 in annual revenue, this impact would constitute less than one percent of annual revenue.

IMPACTS TO THIRD PARTIES PARTICIPATING IN OTHER ACTIVITY CONSULTATIONS

227. Across the study area, 405 businesses and 4,746 local government agencies are engaged in other activities resulting in potential adverse modification of mussel habitat. Of these, approximately 98 percent are below their respective small business threshold, and are therefore considered small. In Chapter 3, we estimate that 697 consultations will occur over the next 20 years related to projects such as prescribed burns, land clearing, bank stabilization, habitat or shoreline restoration, and others. It is likely that a number of these projects will be undertaken by State or Federal entities, such as public lands managers, which are not considered to be small entities. However, this analysis conservatively assumes that each consultation involves a small entity. On an annual basis, this analysis projects approximately 35 consultations per year. As shown in Exhibit A-2, approximately 0.7 percent of small entities undertaking these activities will be affected each year. Each of these consultations will incur costs of approximately \$400 per consultation, representing less than one percent of average annual revenues for these small entities. Revenue data from local government agencies were not available, and therefore the magnitude of impact is not assessed. However, for any entity with greater than \$40,000 in annual revenue, this impact would constitute less than one percent of annual revenue.

A.2 UMRA ANALYSIS

228. Title II of UMRA requires agencies to assess the effects of their regulatory actions on State, local, and Tribal governments and the private sector.¹⁹⁵ Under Section 202 of UMRA, the Service must prepare a written statement, including a cost-benefit analysis, for rules that may result in the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector, of \$100 million or more in any one year. If a written statement is needed, Section 205 of UMRA requires the Service to identify and consider a reasonable number of regulatory alternatives. The Service must adopt the least costly, most cost-effective or least burdensome alternative that achieves the objectives of the rule, unless the Secretary publishes an explanation of why that alternative was not adopted. The provisions of Section 205 do not apply when they are inconsistent with applicable law.
229. As stated in the Proposed Rule, “the designation of critical habitat does not impose a legally binding duty on non-Federal Government entities or private parties. Under the

¹⁹⁵ 2 U.S.C. § 1531 et seq.

Act, the only regulatory effect is that Federal agencies must ensure that their actions do not destroy or adversely modify critical habitat under section 7. While non-Federal entities that receive Federal funding, assistance, or permits, or that otherwise require approval or authorization from a Federal agency for an action, maybe indirectly impacted by the designation of critical habitat, the legally binding duty to avoid destruction or adverse modification of critical habitat rests squarely on the Federal agency.”¹⁹⁶ Therefore, this rule does not place an enforceable duty upon State, local, or Tribal governments, or the private sector.

A.3 FEDERALISM IMPLICATIONS

230. Executive Order 13132, entitled “Federalism,” requires the Service to develop an accountable process to ensure “meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications.”¹⁹⁷ “Policies that have federalism implications” are defined in the Executive Order to include regulations that have “substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.”¹⁹⁸ Under Executive Order 13132, the Service may not issue a regulation that has federalism implications, that imposes substantial direct compliance costs, and that is not required by statute, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by State and local governments, or the Service consults with State and local officials early in the process of developing the regulation.
231. This Proposed Rule does not have direct federalism implications. The designation of critical habitat directly affects only the responsibilities of Federal agencies. As a result, the Proposed Rule does not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in the Order.
232. State or local governments may be indirectly affected by the proposed revision if they require Federal funds or formal approval or authorization from a Federal agency as a prerequisite to conducting an action. In these cases, the State or local government agency may participate in the section 7 consultation as a third party. As discussed in Chapter 2, one of the key conclusions of the incremental analysis is that we do not expect critical habitat designation to generate additional requests for project modification in any of the proposed critical habitat units. Incremental economic impacts of the designation will likely be limited to minor additional administrative costs to the Service, Federal agencies and third parties of considering critical habitat as part of the forecast section 7 consultations. Therefore, the proposed critical habitat is also not expected to have substantial indirect impacts on State or local governments.

¹⁹⁶ 77 FR 63488.

¹⁹⁷ 64 FR 43255.

¹⁹⁸ *Ibid.*

A.4 POTENTIAL IMPACTS TO THE ENERGY INDUSTRY

233. Pursuant to Executive Order No. 13211, “Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use,” issued May 18, 2001, Federal agencies must prepare and submit a “Statement of Energy Effects” for all “significant energy actions.” The purpose of this requirement is to ensure that all Federal agencies “appropriately weigh and consider the effects of the Federal Government’s regulations on the supply, distribution, and use of energy.”¹⁹⁹
234. The Office of Management and Budget provides guidance for implementing this Executive Order, outlining nine outcomes that may constitute “a significant adverse effect” when compared with the regulatory action under consideration:
- Reductions in crude oil supply in excess of 10,000 barrels per day (bbls);
 - Reductions in fuel production in excess of 4,000 barrels per day;
 - Reductions in coal production in excess of 5 million tons per year;
 - Reductions in natural gas production in excess of 25 million Mcf (1,000 cubic feet) per year;
 - Reductions in electricity production in excess of 1 billion kilowatts-hours per year or in excess of 500 megawatts of installed capacity;
 - Increases in energy use required by the regulatory action that exceed the thresholds above;
 - Increases in the cost of energy production in excess of one percent;
 - Increases in the cost of energy distribution in excess of one percent; or
 - Other similarly adverse outcomes.²⁰⁰
235. As described in Chapter 3, critical habitat designation for the mussels is anticipated to affect oil and gas activities. The Service does not anticipate consulting with FERC on hydropower operations as a result of the designation. Impacts to oil and gas development are limited to the administrative costs of consultation and therefore reductions in oil and natural gas production are not anticipated. This analysis projects approximately 14 actions each year on oil and gas related activities, totaling approximately \$7,000 per year. The magnitude of these consultation costs is not anticipated to increase the cost of energy production or distribution in the United States in excess of one percent. Thus, none of the nine threshold levels of impact listed above is exceeded.

¹⁹⁹ Memorandum For Heads of Executive Department Agencies, and Independent Regulatory Agencies, Guidance For Implementing E.O. 13211, M-01-27, Office of Management and Budget, July 13, 2001, <http://www.whitehouse.gov/omb/memoranda/m01-27.html>.

²⁰⁰ *Ibid.*

APPENDIX B | SENSITIVITY OF RESULTS TO DISCOUNT RATE

236. This appendix summarizes the incremental impacts of the designation quantified in Chapter 3 of this report. It presents impacts assuming an alternative real discount rate of three percent (the main text of the report assumes a real discount rate of seven percent).²⁰¹ Exhibit B-1 through B-9 summarize potential undiscounted incremental impacts of the designation overall and by activity.

²⁰¹ A more detailed discussion of how to calculate present and annualized values, as well as the relevant discount rates, is provided in Chapter 2 of this report.

EXHIBIT B-1. SUMMARY OF TOTAL INCREMENTAL IMPACTS BY UNIT (2012\$)

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	\$540,000	\$35,000
NM2	Elk River	AR, MO	\$85,000	\$5,600
NM3	Shoal Creek	KS, MO	\$38,000	\$2,500
NM4	Spring River	KS, MO	\$18,000	\$1,200
NM5	North Fork Spring River	KS, MO	\$11,000	\$710
NM6	Fall & Verdigris Rivers	KS	\$0	\$0
NM7	Neosho River	KS	\$31,000	\$2,100
NM8	Cottonwood River	KS	\$63,000	\$4,100
RF1	Spring River	KS, MO	\$13,000	\$860
RF2	Verdigris River	OK	\$680,000	\$45,000
RF3	Neosho River	KS	\$8,700	\$570
RF4a	Ouachita River	AR	\$67,000	\$4,400
RF4b	Ouachita River	AR	\$130,000	\$8,300
RF5	Saline River	AR	\$420,000	\$28,000
RF6	Little River	AR, OK	\$190,000	\$13,000
RF7	Middle Fork Little Red River	AR	\$63,000	\$4,100
RF8a	White River	AR	\$270,000	\$18,000
RF8b	White River	AR	\$380,000	\$25,000
RF9	Black River	AR, MO	\$270,000	\$18,000
RF10	Spring River	AR, MO	\$89,000	\$5,800
RF11	South Fork Spring River	AR, MO	\$3,100	\$200
RF12	Strawberry River	AR	\$34,000	\$2,200
RF13	Buffalo River	AR	\$270,000	\$17,000
RF14	St. Francis River	MO	\$0	\$0
RF15	Big Sunflower River	MS	\$2,000	\$130
RF16	Bear Creek	AL, MS	\$240,000	\$16,000
RF17	Big Black River	MS	\$8,100	\$530
RF18	Paint Rock River	AL	\$65,000	\$4,200
RF19	Duck River	TN	\$270,000	\$17,000
RF20a	Tennessee River	TN	\$50,000	\$3,300
RF20b	Tennessee River	KY	\$220,000	\$14,000
RF21	Ohio River	IL, KY	\$220,000	\$14,000
RF22	Green River	KY	\$180,000	\$12,000
RF23	French Creek	PA	\$280,000	\$19,000
RF24	Allegheny River	PA	\$170,000	\$11,000
RF25	Muddy Creek	PA	\$120,000	\$7,800

PROPOSED CRITICAL HABITAT UNIT	UNIT NAME	STATE(S) ¹	PRESENT VALUE	ANNUALIZED
RF26	Tippecanoe River	IN	\$190,000	\$13,000
RF27	Walhonding River	OH	\$32,000	\$2,100
RF28	Little Darby Creek	OH	\$23,000	\$1,500
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	\$66,000	\$4,300
RF30	Fish Creek	IN, OH	\$17,000	\$1,100
RF31	Red River	KY, TN	\$70,000	\$4,600
RF32	Shenango River	PA	\$6,100	\$400
TOTAL			\$5,900,000	\$390,000
Notes:				
<p>1. The State(s) listed for each proposed critical habitat unit contain(s) the proposed critical habitat unit and corresponding study area. In some cases, small portions of study areas fall into other States. However, in these instances, no section 7 consultations are forecast to occur in these other States; therefore, these States are not included in this list.</p> <p>2. Proposed critical habitat unit RF1 overlaps with a portion of proposed critical habitat unit NM4, as both species are present in the same stretch of the Spring River. Likewise, proposed critical habitat unit RF3 overlaps unit NM7, as both species are present in the same stretch of the Neosho River. In cases where a consultation was present in the overlapping portion of the study areas for these units, costs associated with that consultation were apportioned evenly across those units. However, In order to assess the total impacts to relevant portions of the Spring and Neosho Rivers, costs presented here in those units should be summed.</p> <p>3. The level of effort per consultation represents approximate averages based on the best available cost information. The cost estimates in this report are accordingly rounded to two significant digits to reflect this imprecision. The unit cost estimates therefore may not sum to the total costs reported due to rounding.</p>				

**EXHIBIT B-2. SUMMARY OF INCREMENTAL IMPACTS TO WATER FLOW MANAGEMENT BY UNIT
(2012\$)**

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	\$9,200	\$600
NM2	Elk River	AR, MO	\$3,100	\$200
NM3	Shoal Creek	KS, MO	\$830	\$54
NM4	Spring River	KS, MO	\$1,300	\$83
NM5	North Fork Spring River	KS, MO	\$1,300	\$83
NM6	Fall & Verdigris Rivers	KS	\$0	\$0
NM7	Neosho River	KS	\$2,600	\$170
NM8	Cottonwood River	KS	\$26,000	\$1,700
RF1	Spring River	KS, MO	\$1,300	\$83
RF2	Verdigris River	OK	\$15,000	\$990
RF3	Neosho River	KS	\$1,900	\$130
RF4a	Ouachita River	AR	\$0	\$0
RF4b	Ouachita River	AR	\$8,100	\$530
RF5	Saline River	AR	\$9,200	\$600
RF6	Little River	AR, OK	\$3,600	\$240
RF7	Middle Fork Little Red River	AR	\$0	\$0
RF8a	White River	AR	\$9,200	\$600
RF8b	White River	AR	\$13,000	\$870
RF9	Black River	AR, MO	\$14,000	\$930
RF10	Spring River	AR, MO	\$2,100	\$140
RF11	South Fork Spring River	AR, MO	\$0	\$0
RF12	Strawberry River	AR	\$0	\$0
RF13	Buffalo River	AR	\$0	\$0
RF14	St. Francis River	MO	\$0	\$0
RF15	Big Sunflower River	MS	\$0	\$0
RF16	Bear Creek	AL, MS	\$11,000	\$730
RF17	Big Black River	MS	\$0	\$0
RF18	Paint Rock River	AL	\$1,000	\$68
RF19	Duck River	TN	\$35,000	\$2,300
RF20a	Tennessee River	TN	\$1,000	\$68
RF20b	Tennessee River	KY	\$7,500	\$490
RF21	Ohio River	IL, KY	\$0	\$0
RF22	Green River	KY	\$11,000	\$740
RF23	French Creek	PA	\$6,100	\$400
RF24	Allegheny River	PA	\$0	\$0
RF25	Muddy Creek	PA	\$3,000	\$200

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
RF26	Tippecanoe River	IN	\$31,000	\$2,000
RF27	Walhonding River	OH	\$6,100	\$400
RF28	Little Darby Creek	OH	\$0	\$0
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	\$23,000	\$1,500
RF30	Fish Creek	IN, OH	\$0	\$0
RF31	Red River	KY, TN	\$0	\$0
RF32	Shenango River	PA	\$0	\$0
TOTAL			\$260,000	\$17,000

EXHIBIT B-3. SUMMARY OF INCREMENTAL IMPACTS TO WATER QUALITY MANAGEMENT BY UNIT (2012\$)

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	\$4,100	\$270
NM2	Elk River	AR, MO	\$2,100	\$140
NM3	Shoal Creek	KS, MO	\$12,000	\$790
NM4	Spring River	KS, MO	\$340	\$23
NM5	North Fork Spring River	KS, MO	\$340	\$23
NM6	Fall & Verdigris Rivers	KS	\$0	\$0
NM7	Neosho River	KS	\$0	\$0
NM8	Cottonwood River	KS	\$0	\$0
RF1	Spring River	KS, MO	\$340	\$23
RF2	Verdigris River	OK	\$42,000	\$2,700
RF3	Neosho River	KS	\$0	\$0
RF4a	Ouachita River	AR	\$0	\$0
RF4b	Ouachita River	AR	\$8,300	\$540
RF5	Saline River	AR	\$4,100	\$270
RF6	Little River	AR, OK	\$8,300	\$540
RF7	Middle Fork Little Red River	AR	\$0	\$0
RF8a	White River	AR	\$6,200	\$410
RF8b	White River	AR	\$5,200	\$340
RF9	Black River	AR, MO	\$8,300	\$540
RF10	Spring River	AR, MO	\$2,100	\$140
RF11	South Fork Spring River	AR, MO	\$0	\$0
RF12	Strawberry River	AR	\$0	\$0
RF13	Buffalo River	AR	\$1,000	\$68
RF14	St. Francis River	MO	\$0	\$0

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
RF15	Big Sunflower River	MS	\$0	\$0
RF16	Bear Creek	AL, MS	\$7,100	\$460
RF17	Big Black River	MS	\$0	\$0
RF18	Paint Rock River	AL	\$0	\$0
RF19	Duck River	TN	\$0	\$0
RF20a	Tennessee River	TN	\$9,400	\$610
RF20b	Tennessee River	KY	\$5,500	\$360
RF21	Ohio River	IL, KY	\$3,600	\$240
RF22	Green River	KY	\$5,500	\$360
RF23	French Creek	PA	\$6,100	\$400
RF24	Allegheny River	PA	\$0	\$0
RF25	Muddy Creek	PA	\$0	\$0
RF26	Tippecanoe River	IN	\$6,100	\$400
RF27	Walhonding River	OH	\$0	\$0
RF28	Little Darby Creek	OH	\$0	\$0
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	\$15,000	\$950
RF30	Fish Creek	IN, OH	\$0	\$0
RF31	Red River	KY, TN	\$1,800	\$120
RF32	Shenango River	PA	\$0	\$0
TOTAL			\$160,000	\$11,000

EXHIBIT B-4. SUMMARY OF INCREMENTAL IMPACTS TO TIMBER, AGRICULTURE, AND GRAZING BY UNIT (2012\$)

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	\$110,000	\$7,400
NM2	Elk River	AR, MO	\$1,000	\$68
NM3	Shoal Creek	KS, MO	\$450	\$30
NM4	Spring River	KS, MO	\$450	\$30
NM5	North Fork Spring River	KS, MO	\$450	\$30
NM6	Fall & Verdigris Rivers	KS	\$0	\$0
NM7	Neosho River	KS	\$0	\$0
NM8	Cottonwood River	KS	\$0	\$0
RF1	Spring River	KS, MO	\$450	\$30
RF2	Verdigris River	OK	\$26,000	\$1,700
RF3	Neosho River	KS	\$0	\$0
RF4a	Ouachita River	AR	\$38,000	\$2,500

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
RF4b	Ouachita River	AR	\$44,000	\$2,800
RF5	Saline River	AR	\$78,000	\$5,100
RF6	Little River	AR, OK	\$6,200	\$410
RF7	Middle Fork Little Red River	AR	\$22,000	\$1,400
RF8a	White River	AR	\$180,000	\$12,000
RF8b	White River	AR	\$210,000	\$14,000
RF9	Black River	AR, MO	\$220,000	\$14,000
RF10	Spring River	AR, MO	\$27,000	\$1,800
RF11	South Fork Spring River	AR, MO	\$0	\$0
RF12	Strawberry River	AR	\$34,000	\$2,200
RF13	Buffalo River	AR	\$200,000	\$13,000
RF14	St. Francis River	MO	\$0	\$0
RF15	Big Sunflower River	MS	\$0	\$0
RF16	Bear Creek	AL, MS	\$53,000	\$3,400
RF17	Big Black River	MS	\$0	\$0
RF18	Paint Rock River	AL	\$13,000	\$860
RF19	Duck River	TN	\$0	\$0
RF20a	Tennessee River	TN	\$0	\$0
RF20b	Tennessee River	KY	\$0	\$0
RF21	Ohio River	IL, KY	\$0	\$0
RF22	Green River	KY	\$0	\$0
RF23	French Creek	PA	\$6,100	\$400
RF24	Allegheny River	PA	\$3,000	\$200
RF25	Muddy Creek	PA	\$0	\$0
RF26	Tippecanoe River	IN	\$0	\$0
RF27	Walhonding River	OH	\$0	\$0
RF28	Little Darby Creek	OH	\$0	\$0
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	\$15,000	\$950
RF30	Fish Creek	IN, OH	\$0	\$0
RF31	Red River	KY, TN	\$0	\$0
RF32	Shenango River	PA	\$0	\$0
TOTAL			\$1,300,000	\$85,000

EXHIBIT B-5. SUMMARY OF INCREMENTAL IMPACTS TO MINING BY UNIT (2012\$)

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	\$7,100	\$460
NM2	Elk River	AR, MO	\$0	\$0
NM3	Shoal Creek	KS, MO	\$3,400	\$220
NM4	Spring River	KS, MO	\$0	\$0
NM5	North Fork Spring River	KS, MO	\$0	\$0
NM6	Fall & Verdigris Rivers	KS	\$0	\$0
NM7	Neosho River	KS	\$3,400	\$220
NM8	Cottonwood River	KS	\$0	\$0
RF1	Spring River	KS, MO	\$0	\$0
RF2	Verdigris River	OK	\$3,600	\$240
RF3	Neosho River	KS	\$0	\$0
RF4a	Ouachita River	AR	\$0	\$0
RF4b	Ouachita River	AR	\$0	\$0
RF5	Saline River	AR	\$51,000	\$3,300
RF6	Little River	AR, OK	\$0	\$0
RF7	Middle Fork Little Red River	AR	\$0	\$0
RF8a	White River	AR	\$2,100	\$140
RF8b	White River	AR	\$6,100	\$400
RF9	Black River	AR, MO	\$1,000	\$68
RF10	Spring River	AR, MO	\$1,000	\$68
RF11	South Fork Spring River	AR, MO	\$0	\$0
RF12	Strawberry River	AR	\$0	\$0
RF13	Buffalo River	AR	\$0	\$0
RF14	St. Francis River	MO	\$0	\$0
RF15	Big Sunflower River	MS	\$2,000	\$130
RF16	Bear Creek	AL, MS	\$2,000	\$130
RF17	Big Black River	MS	\$2,000	\$130
RF18	Paint Rock River	AL	\$0	\$0
RF19	Duck River	TN	\$0	\$0
RF20a	Tennessee River	TN	\$1,000	\$68
RF20b	Tennessee River	KY	\$0	\$0
RF21	Ohio River	IL, KY	\$11,000	\$730
RF22	Green River	KY	\$0	\$0
RF23	French Creek	PA	\$0	\$0
RF24	Allegheny River	PA	\$0	\$0
RF25	Muddy Creek	PA	\$0	\$0
RF26	Tippecanoe River	IN	\$0	\$0

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
RF27	Walhonding River	OH	\$0	\$0
RF28	Little Darby Creek	OH	\$0	\$0
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	\$0	\$0
RF30	Fish Creek	IN, OH	\$0	\$0
RF31	Red River	KY, TN	\$0	\$0
RF32	Shenango River	PA	\$0	\$0
TOTAL			\$97,000	\$6,300

EXHIBIT B-6. SUMMARY OF INCREMENTAL IMPACTS TO OIL AND GAS DEVELOPMENT BY UNIT (2012\$)

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	\$6,100	\$400
NM2	Elk River	AR, MO	\$0	\$0
NM3	Shoal Creek	KS, MO	\$0	\$0
NM4	Spring River	KS, MO	\$0	\$0
NM5	North Fork Spring River	KS, MO	\$0	\$0
NM6	Fall & Verdigris Rivers	KS	\$0	\$0
NM7	Neosho River	KS	\$0	\$0
NM8	Cottonwood River	KS	\$0	\$0
RF1	Spring River	KS, MO	\$0	\$0
RF2	Verdigris River	OK	\$52,000	\$3,400
RF3	Neosho River	KS	\$0	\$0
RF4a	Ouachita River	AR	\$0	\$0
RF4b	Ouachita River	AR	\$12,000	\$790
RF5	Saline River	AR	\$2,100	\$140
RF6	Little River	AR, OK	\$0	\$0
RF7	Middle Fork Little Red River	AR	\$8,300	\$540
RF8a	White River	AR	\$39,000	\$2,500
RF8b	White River	AR	\$0	\$0
RF9	Black River	AR, MO	\$0	\$0
RF10	Spring River	AR, MO	\$0	\$0
RF11	South Fork Spring River	AR, MO	\$0	\$0
RF12	Strawberry River	AR	\$0	\$0
RF13	Buffalo River	AR	\$0	\$0
RF14	St. Francis River	MO	\$0	\$0
RF15	Big Sunflower River	MS	\$0	\$0
RF16	Bear Creek	AL, MS	\$19,000	\$1,300

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
RF17	Big Black River	MS	\$0	\$0
RF18	Paint Rock River	AL	\$0	\$0
RF19	Duck River	TN	\$19,000	\$1,200
RF20a	Tennessee River	TN	\$0	\$0
RF20b	Tennessee River	KY	\$17,000	\$1,100
RF21	Ohio River	IL, KY	\$24,000	\$1,600
RF22	Green River	KY	\$45,000	\$3,000
RF23	French Creek	PA	\$36,000	\$2,400
RF24	Allegheny River	PA	\$58,000	\$3,800
RF25	Muddy Creek	PA	\$58,000	\$3,800
RF26	Tippecanoe River	IN	\$0	\$0
RF27	Walhonding River	OH	\$12,000	\$790
RF28	Little Darby Creek	OH	\$0	\$0
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	\$0	\$0
RF30	Fish Creek	IN, OH	\$0	\$0
RF31	Red River	KY, TN	\$22,000	\$1,500
RF32	Shenango River	PA	\$0	\$0
TOTAL			\$430,000	\$28,000

EXHIBIT B-7. SUMMARY OF INCREMENTAL IMPACTS TO TRANSPORTATION AND UTILITIES BY UNIT (2012\$)

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	\$210,000	\$14,000
NM2	Elk River	AR, MO	\$40,000	\$2,600
NM3	Shoal Creek	KS, MO	\$8,700	\$570
NM4	Spring River	KS, MO	\$12,000	\$810
NM5	North Fork Spring River	KS, MO	\$4,700	\$310
NM6	Fall & Verdigris Rivers	KS	\$0	\$0
NM7	Neosho River	KS	\$5,100	\$340
NM8	Cottonwood River	KS	\$0	\$0
RF1	Spring River	KS, MO	\$7,100	\$460
RF2	Verdigris River	OK	\$290,000	\$19,000
RF3	Neosho River	KS	\$0	\$0
RF4a	Ouachita River	AR	\$9,200	\$600
RF4b	Ouachita River	AR	\$25,000	\$1,600
RF5	Saline River	AR	\$120,000	\$7,700
RF6	Little River	AR, OK	\$49,000	\$3,200

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
RF7	Middle Fork Little Red River	AR	\$14,000	\$930
RF8a	White River	AR	\$4,100	\$270
RF8b	White River	AR	\$48,000	\$3,100
RF9	Black River	AR, MO	\$15,000	\$990
RF10	Spring River	AR, MO	\$10,000	\$670
RF11	South Fork Spring River	AR, MO	\$3,100	\$200
RF12	Strawberry River	AR	\$0	\$0
RF13	Buffalo River	AR	\$24,000	\$1,600
RF14	St. Francis River	MO	\$0	\$0
RF15	Big Sunflower River	MS	\$0	\$0
RF16	Bear Creek	AL, MS	\$68,000	\$4,400
RF17	Big Black River	MS	\$0	\$0
RF18	Paint Rock River	AL	\$14,000	\$930
RF19	Duck River	TN	\$150,000	\$10,000
RF20a	Tennessee River	TN	\$19,000	\$1,200
RF20b	Tennessee River	KY	\$130,000	\$8,500
RF21	Ohio River	IL, KY	\$140,000	\$9,200
RF22	Green River	KY	\$73,000	\$4,800
RF23	French Creek	PA	\$160,000	\$10,000
RF24	Allegheny River	PA	\$64,000	\$4,200
RF25	Muddy Creek	PA	\$38,000	\$2,500
RF26	Tippecanoe River	IN	\$120,000	\$7,600
RF27	Walhonding River	OH	\$2,100	\$140
RF28	Little Darby Creek	OH	\$12,000	\$790
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	\$7,300	\$480
RF30	Fish Creek	IN, OH	\$6,100	\$400
RF31	Red River	KY, TN	\$22,000	\$1,500
RF32	Shenango River	PA	\$0	\$0
TOTAL			\$1,900,000	\$130,000

**EXHIBIT B-8. SUMMARY OF INCREMENTAL IMPACTS TO DEVELOPMENT AND RECREATION BY UNIT
(2012\$)**

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	\$170,000	\$11,000
NM2	Elk River	AR, MO	\$39,000	\$2,500
NM3	Shoal Creek	KS, MO	\$6,100	\$400
NM4	Spring River	KS, MO	\$4,000	\$260
NM5	North Fork Spring River	KS, MO	\$4,000	\$260
NM6	Fall & Verdigris Rivers	KS	\$0	\$0
NM7	Neosho River	KS	\$0	\$0
NM8	Cottonwood River	KS	\$0	\$0
RF1	Spring River	KS, MO	\$4,000	\$260
RF2	Verdigris River	OK	\$200,000	\$13,000
RF3	Neosho River	KS	\$0	\$0
RF4a	Ouachita River	AR	\$13,000	\$860
RF4b	Ouachita River	AR	\$29,000	\$1,900
RF5	Saline River	AR	\$140,000	\$9,200
RF6	Little River	AR, OK	\$99,000	\$6,500
RF7	Middle Fork Little Red River	AR	\$1,000	\$68
RF8a	White River	AR	\$14,000	\$940
RF8b	White River	AR	\$13,000	\$870
RF9	Black River	AR, MO	\$3,100	\$200
RF10	Spring River	AR, MO	\$18,000	\$1,200
RF11	South Fork Spring River	AR, MO	\$0	\$0
RF12	Strawberry River	AR	\$0	\$0
RF13	Buffalo River	AR	\$42,000	\$2,800
RF14	St. Francis River	MO	\$0	\$0
RF15	Big Sunflower River	MS	\$0	\$0
RF16	Bear Creek	AL, MS	\$18,000	\$1,200
RF17	Big Black River	MS	\$0	\$0
RF18	Paint Rock River	AL	\$6,200	\$410
RF19	Duck River	TN	\$29,000	\$1,900
RF20a	Tennessee River	TN	\$10,000	\$680
RF20b	Tennessee River	KY	\$28,000	\$1,800
RF21	Ohio River	IL, KY	\$28,000	\$1,800
RF22	Green River	KY	\$15,000	\$980
RF23	French Creek	PA	\$55,000	\$3,600
RF24	Allegheny River	PA	\$21,000	\$1,400
RF25	Muddy Creek	PA	\$6,100	\$400

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
RF26	Tippecanoe River	IN	\$13,000	\$860
RF27	Walhonding River	OH	\$0	\$0
RF28	Little Darby Creek	OH	\$0	\$0
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	\$0	\$0
RF30	Fish Creek	IN, OH	\$0	\$0
RF31	Red River	KY, TN	\$1,800	\$120
RF32	Shenango River	PA	\$0	\$0
TOTAL			\$1,000,000	\$67,000

EXHIBIT B-9. SUMMARY OF INCREMENTAL IMPACTS TO OTHER ACTIVITIES BY UNIT (2012\$)

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
NM1	Illinois River	AR, OK	\$26,000	\$1,700
NM2	Elk River	AR, MO	\$1,000	\$68
NM3	Shoal Creek	KS, MO	\$6,100	\$400
NM4	Spring River	KS, MO	\$0	\$0
NM5	North Fork Spring River	KS, MO	\$0	\$0
NM6	Fall & Verdigris Rivers	KS	\$0	\$0
NM7	Neosho River	KS	\$20,000	\$1,300
NM8	Cottonwood River	KS	\$37,000	\$2,400
RF1	Spring River	KS, MO	\$0	\$0
RF2	Verdigris River	OK	\$52,000	\$3,400
RF3	Neosho River	KS	\$6,800	\$440
RF4a	Ouachita River	AR	\$6,100	\$400
RF4b	Ouachita River	AR	\$2,100	\$140
RF5	Saline River	AR	\$21,000	\$1,400
RF6	Little River	AR, OK	\$26,000	\$1,700
RF7	Middle Fork Little Red River	AR	\$18,000	\$1,200
RF8a	White River	AR	\$13,000	\$860
RF8b	White River	AR	\$78,000	\$5,100
RF9	Black River	AR, MO	\$14,000	\$930
RF10	Spring River	AR, MO	\$28,000	\$1,900
RF11	South Fork Spring River	AR, MO	\$0	\$0
RF12	Strawberry River	AR	\$0	\$0
RF13	Buffalo River	AR	\$0	\$0
RF14	St. Francis River	MO	\$0	\$0
RF15	Big Sunflower River	MS	\$0	\$0

PROPOSED CRITICAL HABITAT UNIT NAME AND LOCATION			PRESENT VALUE	ANNUALIZED
RF16	Bear Creek	AL, MS	\$60,000	\$3,900
RF17	Big Black River	MS	\$6,100	\$400
RF18	Paint Rock River	AL	\$30,000	\$2,000
RF19	Duck River	TN	\$29,000	\$1,900
RF20a	Tennessee River	TN	\$9,400	\$610
RF20b	Tennessee River	KY	\$28,000	\$1,800
RF21	Ohio River	IL, KY	\$11,000	\$730
RF22	Green River	KY	\$28,000	\$1,800
RF23	French Creek	PA	\$18,000	\$1,200
RF24	Allegheny River	PA	\$24,000	\$1,600
RF25	Muddy Creek	PA	\$15,000	\$990
RF26	Tippecanoe River	IN	\$25,000	\$1,700
RF27	Walhonding River	OH	\$12,000	\$760
RF28	Little Darby Creek	OH	\$11,000	\$690
RF29	North Fork Vermilion River and Middle Branch North Fork Vermilion River	IL, IN	\$7,300	\$480
RF30	Fish Creek	IN, OH	\$11,000	\$690
RF31	Red River	KY, TN	\$22,000	\$1,500
RF32	Shenango River	PA	\$6,100	\$400
TOTAL			\$710,000	\$46,000

APPENDIX C | UNDISCOUNTED IMPACTS BY ECONOMIC ACTIVITY

237. This appendix summarizes undiscounted impacts by year for each economic activity. These details are provided in accordance with OMB guidelines for developing benefit and cost estimates. OMB directs the analysis to: “include separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs, and express the estimates in this table in constant, undiscounted dollars.”²⁰² Exhibit C-1 summarizes potential undiscounted incremental impacts of the designation overall and by activity.

²⁰² Office of Management and Budget, Circular A-4, September 17, 2003, p. 18. The reference to “constant” dollars indicates that the effects of general price level inflation (the tendency of all prices to increase over time) should be removed through the use of an inflation adjustment index.

EXHIBIT C-1. SUMMARY OF INCREMENTAL IMPACTS BY YEAR BY ACTIVITY (2012\$)

YEAR	WATER FLOW MANAGEMENT	WATER QUALITY MANAGEMENT	TIMBER, AGRICULTURE, AND GRAZING	MINING	OIL AND GAS DEVELOPMENT	TRANSPORTATION & UTILITIES	DEVELOPMENT & RECREATION	OTHER	TOTAL
2013	\$26,203	\$10,724	\$84,597	\$6,300	\$28,056	\$143,793	\$71,904	\$51,012	\$422,588
2014	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2015	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2016	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2017	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2018	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2019	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2020	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2021	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2022	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2023	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2024	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2025	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2026	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2027	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2028	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2029	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2030	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2031	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
2032	\$16,203	\$10,724	\$84,597	\$6,300	\$28,056	\$124,268	\$66,904	\$46,012	\$383,063
Total	\$334,054	\$214,480	\$1,691,933	\$125,997	\$561,120	\$2,504,887	\$1,343,077	\$925,247	\$7,700,795

APPENDIX D | INFORMATION FROM THE U.S. FISH AND WILDLIFE SERVICE REGARDING POTENTIAL CHANGES IN CONSERVATION FOR TWO MUSSELS FOLLOWING DESIGNATION OF CRITICAL HABITAT



United States Department of the Interior

FISH AND WILDLIFE SERVICE
110 S. Amity Road, Suite 300
Conway, Arkansas 72032
Tel.: 501/513-4470 Fax: 501/513-4480



AR ESFO/SE

August 17, 2012

Memorandum
Email Transmission

To: Industrial Economics, Inc.

From: Jim Boggs, Field Supervisor, Conway, Arkansas Field Office 

Subject: Incremental Effects Memorandum for the Economic Analysis of the Proposed Rule to Designate Critical Habitat for Neosho Mucket and Rabbitsfoot

The purpose of this document is to provide information to serve as a basis for conducting an economic analysis of the proposed critical habitat designation for Neosho mucket and rabbitsfoot mussels.

Section 4(b)(2) of the Endangered Species Act (Act) requires the U.S. Fish and Wildlife Service (Service) to consider the economic, national security, and other impacts of designating critical habitat. The Service may exclude an area from critical habitat if it determines that the benefits of exclusion outweigh the benefits of including the area as critical habitat, unless the exclusion will result in the extinction of the species. To support its weighing of the benefits of excluding versus including an area as critical habitat, the Service prepares an economic analysis for each proposed critical habitat designation, which describes and monetizes, where possible, the economic impacts (costs and benefits) of the proposed designation.

Economic analyses typically measure probable impacts against a baseline, which is normally described as the way the world would look absent the proposed action. This is often referred to as the "incremental effects" approach. The economic analysis should use a baseline regulatory analysis approach and examine the incremental economic impact of the regulatory change being considered.

Most courts have held that the Service only needs to consider the incremental impacts imposed by the critical habitat designation over and above those impacts imposed as a result of listing the species. For example, the Ninth Circuit Court of Appeals reached this conclusion twice within the last few years, and the U.S. Supreme Court declined to hear any further appeal from those rulings. *Arizona Cattle Growers' Assoc. v. Salazar*, 606 F.3d 116, (9th Cir. June 4, 2010) cert. denied, 179 L. Ed. 2d 300, 2011 U.S. LEXIS 1362, 79 U.S.L.W. 3475 (2011); *Home Builders*

maintenance, mining, oil and natural gas development activities, timber harvest and thinning, and flood control; point and nonpoint discharges, including spills, industrial and municipal effluents, and residential and agricultural runoff; commercial navigation, including channel dredging and snag removal; and recreational developments and activities.

When consulting with other agencies under section 7 of the Endangered Species Act in designated critical habitat, the Service conducts independent analyses for jeopardy and adverse modification. According to the Director's Memorandum of December 9, 2004, (*Application of the "Destruction or Adverse Modification" Standard under Section 7(a)(2) of the Endangered Species Act*) the analysis of "destruction or adverse modification of designated critical habitat" considers whether critical habitat would remain functional to serve the intended conservation role for the species. 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 (50 CFR 402.02).

Jeopardy and adverse modification are not equivalent standards; however, the outcome of section 7 consultations under these standards may be similar in some cases. Alterations of occupied habitat that diminish the value of the habitat (e.g., changes to habitat for any of their life stages, decreases or changes to the food base, decreases or changes to host fish abundance necessary for recruitment, increase in pollutants, alteration of flow patterns or amount of flow, or increases in the number of invasive, non-indigenous species with greater than minimal effects on survival) would result in adverse modification if the effect is severe enough to render the habitat incapable of providing its intended conservation function. 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, a jeopardy determination also would result. Because the ability of these species to exist is very closely tied to the quality of their habitats, significant alterations of their occupied habitat may result in jeopardy as well as adverse modification. Therefore, we anticipate that section 7 consultation analyses will likely result in no difference between recommendations to avoid jeopardy or adverse modification in occupied areas of critical habitat. The Service is not proposing to designate any unoccupied habitat for Neosho mucket or rabbitsfoot.

For occupied habitat, proposed actions that would adversely affect the physical and biological features (PBFs) in the designated critical habitat would usually also result in sufficient harm or harassment to constitute jeopardy to the species. For example, proposed activities that would disturb sediment and water quality to such an extent that critical habitat would be adversely modified also would usually result in a jeopardy determination. As such, project modifications that minimize effects to Neosho mucket and rabbitsfoot also would minimize effects to the PBFs associated with critical habitat. Accordingly, in occupied critical habitat it would be rare that an analysis would identify a difference between measures needed to avoid the destruction or adverse modification of critical habitat and measures needed to avoid jeopardizing the species. Absent reasonably foreseeable economic impacts that are distinctly attributable to the critical habitat portion of the analysis, 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 Neosho mucket and rabbitsfoot listing and within the regulatory baseline. Therefore, we do not anticipate significant incremental effects in regard to developing

and implementing conservation actions in currently occupied habitat for Neosho mucket and rabbitsfoot, although we acknowledge that this could occur.

Listed below are activities that may result in such adverse effects to occupied Neosho mucket and rabbitsfoot critical habitat that an affected stream segment would not be sufficiently capable of providing the necessary conditions to support the PBFs. However, we note that the activities listed may be able to be modified by measures which would sufficiently offset the potential adverse effects so that the value of the habitat for its intended conservation function is not appreciably reduced. The occurrence of the actions described below will not always result in adverse modification of critical habitat if the available mitigation can reduce the effects of these actions on the habitat.

1. Actions that would appreciably diminish flows within the active stream channel. Such activities could include, but are not limited to: water diversions, channelization, construction of barriers or impediments within the active river channel, construction of permanent or temporary diversion structures, and groundwater pumping within aquifers associated with the river. These actions could affect water depth, velocity, flow pattern, and connectivity with the floodplain, adversely affecting exchange of nutrients and sediment for maintenance of the mussels' and fish host's habitat, food availability, spawning habitat for native fishes, and the ability of newly transformed mussel juveniles to settle and become established in their habitats.
2. Actions that significantly alter the water chemistry of the active channel. Such activities could include, but are not limited to: release of chemicals, biological pollutants, or other substances into the surface water or connected groundwater at a point source or by dispersed release (nonpoint source); and storage of chemicals and pollutants that can be transmitted via surface water, groundwater, or air into critical habitat. These actions can affect water and sediment chemistry, and, in turn, the physiological processes necessary for normal behavior, growth, and viability of all life stages of the mussels and their fish hosts.
3. Actions that would significantly increase sediment deposition within the stream. Such activities could include, but are not limited to: livestock overgrazing, road construction, off-highway vehicle trail use, construction and maintenance, commercial and urban development, channel alteration, timber harvest, recreational use, or other watershed and floodplain disturbances. These activities could adversely affect physiological processes for normal behavior, growth, reproduction, and viability of all life stages of the mussels and their fish hosts.
4. Actions that result in the introduction, spread, or augmentation of competitive or predateous invasive (nonnative) species in occupied stream segments that are hydrologically connected, even if those segments are occasionally intermittent. Possible actions could include, but are not limited to: introduction of parasites or disease, stocking of nonnative fishes or mollusks, or other related actions. These activities in quantities that have greater than minimal effects on survival of freshwater mussels and their fish hosts can affect growth, reproduction, and survival of Neosho mucket and rabbitsfoot and

their fish hosts.

5. Actions that would significantly alter channel geomorphology. Such activities could include, but are not limited to: channelization, impoundment, road and bridge construction, mining, dredging, and destruction of riparian vegetation. These activities may lead to changes in the lateral dimensions, longitudinal profiles, and sinuosity patterns and the aggradation or degradation of river channels that support a diversity of freshwater mussels 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). These activities also can lead to increased sedimentation and degradation of water and sediment quality to levels beyond the tolerances of Neosho mucket and rabbitsfoot and their fish hosts.
6. Actions that significantly affect the presence and abundance of fish hosts. Such activities could include, but are not limited to, those activities discussed in Numbers 1–5 above. The occurrence of natural fish communities, reflected by fish species richness, relative abundance, and community composition is necessary for recruitment of the Neosho mucket and rabbitsfoot.

These types of activities would require section 7 consultation only in cases where there is Federal involvement (e.g., a project is proposed, funded, or authorized by a Federal agency).

The following discussion describes the existing regulatory circumstances that are anticipated without critical habitat being designated for Neosho mucket and rabbitsfoot. In the baseline scenario, section 7 of the Endangered Species Act requires Federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of the Neosho mucket and rabbitsfoot.

Conservation plans and regulatory mechanisms that provide protection to the species and its habitat without critical habitat designation

1. Five critical habitat units proposed for the Neosho mucket and rabbitsfoot in the Fall, Spring, Neosho, Cottonwood, and Verdigris Rivers and Neosho mucket in Shoal Creek (K.S.A. 32–959) are currently designated by the State of Kansas as critical habitat for both species and are afforded similar State–level protections to those provided under the Endangered Species Act.
2. Two critical habitat units proposed for the Neosho mucket and rabbitsfoot encompassing the Duck River (74 rkm, 46 rmi) in Tennessee, Bear Creek (40 rkm, 25 rmi) in Alabama and Mississippi (50 CFR 17.95(f)) are currently designated under the Endangered Species Act for the oyster mussel (*Epioblasma capsaeformis*) and Cumberlandian combshell (*Epioblasma brevidens*). Two units proposed for the Neosho mucket and rabbitsfoot in the Middle Fork Little Red River (23.2 rkm, 14.5 rmi) in Arkansas are also proposed as critical habitat under the Act for the yellowcheek darter (*Etheostoma moorei*) (76 FR 63360; Table 3). The existing critical habitat for the oyster mussel and Cumberlandian combshell completely overlaps Unit RF16 (Bear Creek) for the rabbitsfoot.

Federal agencies and other project proponents that are likely to consult with the Service under section 7 without critical habitat

Federal agencies and projects that would likely go through the section 7 consultation process if no critical habitat is designated include the following:

1. U.S. Army Corps of Engineers (channel dredging and maintenance, dam projects, bridge projects, stream restoration, and Clean Water Act permitting).
2. U.S. Bureau of Land Management (land resource management plans, mining permits, oil and natural gas permits, and renewable energy development).
3. U.S. Department of Energy (renewable and alternative energy projects).
4. Federal Energy Regulatory Commission (interstate pipeline construction and maintenance, dam relicensing, and hydrokinetics).
5. U.S. Department of Transportation (highway and bridge construction and maintenance).
6. U.S. Fish and Wildlife Service (issuance of section 10 permits for enhancement of survival, habitat conservation plans, and safe harbor agreements; national wildlife refuge planning and Refuge activities; Partners for Fish and Wildlife program projects benefiting these species or other listed species, Wildlife and Sportfish Restoration program sportfish stocking).
7. U.S. Forest Service (aquatic habitat restoration, fire management plans, fire suppression, fuel reduction treatments, forest plans, livestock grazing allotment management plans, mining permits, travel management plans).
8. Environmental Protection Agency (water quality criteria, permitting).
9. Tennessee Valley Authority (flood control, navigation and land management for the Tennessee River system).

All administrative economic effects associated with reinitiating section 7 consultation as a result of a new critical habitat designation would appropriately be considered an incremental effect of the designation. For a new section 7 consultation, the jeopardy analysis and the adverse modification analysis would be analyzed separately. Costs associated with the jeopardy analysis would be in the baseline, and the costs associated with the adverse modification analysis would be attributable to the designation and therefore incremental. In cases where we determine that an adverse modification finding may be likely, we will work with the Federal agency involved to identify reasonable and prudent alternatives that would eliminate or reduce the effects to a point where adverse modification is no longer likely. The resulting project modifications would also appropriately be considered an incremental cost of the critical habitat designation.

Thank you for your continued coordination. If you have any questions, please contact Chris Davidson (501-513-4481 or chris_davidson@fws.gov) or Lorna Patrick (850-769-0552 x229 or lorna_patrick@fws.gov).

APPENDIX E | OVERVIEW OF REGIONAL DEMOGRAPHICS

238. This appendix presents basic population statistics for the counties that contain portions of the proposed critical habitat study areas.

EXHIBIT E-1. AREA AND POPULATION STATISTICS BY COUNTY

STATE	COUNTY	POPULATION (2010)	PERCENTAGE CHANGE IN POPULATION (2000 TO 2010)	AREA (SQ-MI)	POPULATION DENSITY (2010)
Alabama	Colbert	54,428	-1.0%	622.1	87.5
Alabama	Franklin	31,704	1.5%	646.5	49.0
Alabama	Jackson	53,227	-1.3%	1,126.8	47.2
Alabama	Madison	334,811	21.0%	812.7	412.0
Alabama	Marion	30,776	-1.4%	743.6	41.4
Alabama	Marshall	93,019	13.1%	623.2	149.3
Alabama	Winston	24,484	-1.4%	631.9	38.7
Arkansas	Arkansas	19,019	-8.3%	1,033.7	18.4
Arkansas	Ashley	21,853	-9.7%	940.5	23.2
Arkansas	Baxter	41,513	8.1%	586.7	70.8
Arkansas	Benton	221,339	44.3%	883.9	250.4
Arkansas	Boone	36,903	8.7%	601.8	61.3
Arkansas	Bradley	11,508	-8.7%	652.9	17.6
Arkansas	Calhoun	5,368	-6.5%	632.4	8.5
Arkansas	Clark	22,995	-2.3%	882.8	26.0
Arkansas	Clay	16,083	-8.7%	641.4	25.1
Arkansas	Cleburne	25,970	8.0%	591.9	43.9
Arkansas	Cleveland	8,689	1.4%	598.7	14.5
Arkansas	Craighead	96,443	17.4%	712.7	135.3
Arkansas	Crawford	61,948	16.3%	604.2	102.5
Arkansas	Cross	17,870	-8.5%	622.3	28.7
Arkansas	Dallas	8,116	-11.9%	668.1	12.1
Arkansas	Drew	18,509	-1.1%	835.7	22.1
Arkansas	Faulkner	113,237	31.6%	664.1	170.5
Arkansas	Fulton	12,245	5.2%	620.3	19.7
Arkansas	Garland	96,024	9.0%	734.6	130.7
Arkansas	Grant	17,853	8.4%	632.9	28.2
Arkansas	Greene	42,090	12.7%	579.6	72.6
Arkansas	Hempstead	22,609	-4.1%	741.2	30.5
Arkansas	Hot Spring	32,923	8.5%	622.2	52.9
Arkansas	Howard	13,789	-3.6%	595.3	23.2

STATE	COUNTY	POPULATION (2010)	PERCENTAGE CHANGE IN POPULATION (2000 TO 2010)	AREA (SQ-MI)	POPULATION DENSITY (2010)
Arkansas	Independence	36,647	7.1%	771.5	47.5
Arkansas	Izard	13,696	3.4%	584.0	23.5
Arkansas	Jackson	17,997	-2.3%	641.5	28.1
Arkansas	Jefferson	77,435	-8.1%	913.8	84.7
Arkansas	Lawrence	17,415	-2.0%	592.3	29.4
Arkansas	Lincoln	14,134	-2.5%	572.2	24.7
Arkansas	Little River	13,171	-3.4%	564.8	23.3
Arkansas	Lonoke	68,356	29.4%	802.8	85.1
Arkansas	Madison	15,717	10.3%	837.1	18.8
Arkansas	Marion	16,653	3.2%	640.3	26.0
Arkansas	Monroe	8,149	-20.5%	621.3	13.1
Arkansas	Montgomery	9,487	2.6%	800.3	11.9
Arkansas	Nevada	8,997	-9.6%	620.6	14.5
Arkansas	Newton	8,330	-3.2%	823.2	10.1
Arkansas	Ouachita	26,120	-9.3%	739.7	35.3
Arkansas	Perry	10,445	2.3%	560.5	18.6
Arkansas	Pike	11,291	-0.1%	614.1	18.4
Arkansas	Poinsett	24,583	-4.0%	763.6	32.2
Arkansas	Polk	20,662	2.1%	862.5	24.0
Arkansas	Pope	61,754	13.4%	830.8	74.3
Arkansas	Prairie	8,715	-8.6%	675.6	12.9
Arkansas	Pulaski	382,748	5.9%	807.7	473.9
Arkansas	Randolph	17,969	-1.2%	656.0	27.4
Arkansas	St. Francis	28,258	-3.7%	642.5	44.0
Arkansas	Saline	107,118	28.2%	730.5	146.6
Arkansas	Scott	11,233	2.2%	898.1	12.5
Arkansas	Searcy	8,195	-0.8%	668.5	12.3
Arkansas	Sevier	17,058	8.3%	581.3	29.3
Arkansas	Sharp	17,264	0.8%	606.4	28.5
Arkansas	Stone	12,394	7.8%	609.4	20.3
Arkansas	Van Buren	17,295	6.8%	724.3	23.9
Arkansas	Washington	203,065	28.8%	952.4	213.2
Arkansas	White	77,076	14.8%	1,042.1	74.0
Arkansas	Woodruff	7,260	-16.9%	594.0	12.2
Arkansas	Yell	22,185	4.9%	948.9	23.4
Illinois	Iroquois	29,718	-5.2%	1,118.9	26.6
Illinois	Johnson	12,582	-2.3%	348.9	36.1
Illinois	Massac	15,429	1.8%	241.8	63.8
Illinois	Pope	4,470	1.3%	374.3	11.9
Illinois	Pulaski	6,161	-16.2%	203.2	30.3
Illinois	Union	17,808	-2.7%	422.1	42.2
Illinois	Vermilion	81,625	-2.7%	901.3	90.6
Indiana	Benton	8,854	-6.0%	406.5	21.8
Indiana	Carroll	20,155	0.0%	375.0	53.7
Indiana	Cass	38,966	-4.8%	414.8	93.9
Indiana	DeKalb	42,223	4.8%	363.8	116.0

STATE	COUNTY	POPULATION (2010)	PERCENTAGE CHANGE IN POPULATION (2000 TO 2010)	AREA (SQ-MI)	POPULATION DENSITY (2010)
Indiana	Fulton	20,836	1.6%	371.3	56.1
Indiana	Jasper	33,478	11.4%	561.4	59.6
Indiana	Kosciusko	77,358	4.5%	554.4	139.5
Indiana	Marshall	47,051	4.3%	449.7	104.6
Indiana	Miami	36,903	2.3%	377.4	97.8
Indiana	Pulaski	13,402	-2.6%	434.5	30.8
Indiana	Starke	23,363	-0.8%	312.2	74.8
Indiana	Steuben	34,185	2.9%	322.5	106.0
Indiana	Tippecanoe	172,780	16.0%	503.2	343.3
Indiana	Warren	8,508	1.1%	366.4	23.2
Indiana	White	24,643	-2.5%	508.7	48.4
Indiana	Whitley	33,292	8.4%	337.9	98.5
Kansas	Allen	13,371	-7.0%	505.3	26.5
Kansas	Anderson	8,102	-0.1%	583.7	13.9
Kansas	Bourbon	15,173	-1.3%	639.1	23.7
Kansas	Butler	65,880	10.8%	1,446.5	45.5
Kansas	Chase	2,790	-7.9%	777.7	3.6
Kansas	Chautauqua	3,669	-15.8%	644.8	5.7
Kansas	Cherokee	21,603	-4.4%	591.0	36.6
Kansas	Coffey	8,601	-3.0%	654.1	13.1
Kansas	Crawford	39,134	2.3%	595.0	65.8
Kansas	Elk	2,882	-11.6%	650.5	4.4
Kansas	Greenwood	6,689	-12.8%	1,152.6	5.8
Kansas	Harvey	34,684	5.5%	540.7	64.1
Kansas	Labette	21,607	-5.4%	653.1	33.1
Kansas	Lyon	33,690	-6.2%	855.4	39.4
Kansas	McPherson	29,180	-1.3%	900.6	32.4
Kansas	Marion	12,660	-5.2%	953.7	13.3
Kansas	Montgomery	35,471	-2.2%	651.5	54.4
Kansas	Morris	5,923	-3.0%	702.9	8.4
Kansas	Neosho	16,512	-2.9%	577.8	28.6
Kansas	Wilson	9,409	-8.9%	575.1	16.4
Kansas	Woodson	3,309	-12.6%	505.3	6.5
Kentucky	Adair	18,656	8.2%	412.4	45.2
Kentucky	Ballard	8,249	-0.4%	273.7	30.1
Kentucky	Barren	42,173	10.9%	500.0	84.3
Kentucky	Caldwell	12,984	-0.6%	348.1	37.3
Kentucky	Calloway	37,191	8.8%	410.7	90.6
Kentucky	Crittenden	9,315	-0.7%	371.1	25.1
Kentucky	Edmonson	12,161	4.4%	308.0	39.5
Kentucky	Graves	37,121	0.3%	556.8	66.7
Kentucky	Green	11,258	-2.3%	288.8	39.0
Kentucky	Hart	18,199	4.3%	417.8	43.6
Kentucky	Larue	14,193	6.1%	263.6	53.8
Kentucky	Livingston	9,519	-2.9%	342.3	27.8
Kentucky	Logan	26,835	1.0%	557.0	48.2

STATE	COUNTY	POPULATION (2010)	PERCENTAGE CHANGE IN POPULATION (2000 TO 2010)	AREA (SQ-MI)	POPULATION DENSITY (2010)
Kentucky	Lyon	8,314	2.9%	256.5	32.4
Kentucky	McCracken	65,565	0.1%	268.2	244.5
Kentucky	Marion	19,820	8.8%	346.9	57.1
Kentucky	Marshall	31,448	4.4%	340.2	92.4
Kentucky	Metcalfe	10,099	0.6%	291.2	34.7
Kentucky	Russell	17,565	7.7%	282.9	62.1
Kentucky	Simpson	17,327	5.6%	236.5	73.3
Kentucky	Taylor	24,512	6.9%	276.8	88.5
Kentucky	Todd	12,460	4.1%	377.1	33.0
Mississippi	Alcorn	37,057	7.2%	401.4	92.3
Mississippi	Attala	19,564	-0.5%	736.7	26.6
Mississippi	Bolivar	34,145	-16.0%	905.8	37.7
Mississippi	Carroll	10,597	-1.6%	634.6	16.7
Mississippi	Choctaw	8,547	-12.4%	419.9	20.4
Mississippi	Coahoma	26,151	-14.6%	583.2	44.8
Mississippi	Hinds	245,285	-2.2%	877.3	279.6
Mississippi	Holmes	19,198	-11.2%	764.6	25.1
Mississippi	Itawamba	23,401	2.8%	540.4	43.3
Mississippi	Leake	23,805	13.7%	585.5	40.7
Mississippi	Madison	95,203	27.5%	741.8	128.3
Mississippi	Montgomery	10,925	-10.4%	407.9	26.8
Mississippi	Oktibbeha	47,671	11.1%	461.9	103.2
Mississippi	Sunflower	29,450	-14.3%	706.9	41.7
Mississippi	Tishomingo	19,593	2.2%	444.5	44.1
Mississippi	Warren	48,773	-1.8%	618.6	78.9
Mississippi	Webster	10,253	-0.4%	423.2	24.2
Mississippi	Yazoo	28,065	-0.3%	934.3	30.0
Missouri	Barry	35,597	4.7%	791.0	45.0
Missouri	Barton	12,402	-1.1%	596.7	20.8
Missouri	Butler	42,794	4.7%	699.0	61.2
Missouri	Carter	6,265	5.5%	509.0	12.3
Missouri	Christian	77,422	42.6%	563.8	137.3
Missouri	Dade	7,883	-0.5%	506.3	15.6
Missouri	Dent	15,657	4.9%	754.5	20.8
Missouri	Howell	40,400	8.5%	928.4	43.5
Missouri	Iron	10,630	-0.6%	552.1	19.3
Missouri	Jasper	117,404	12.1%	641.3	183.1
Missouri	Lawrence	38,634	9.7%	613.4	63.0
Missouri	McDonald	23,083	6.5%	539.7	42.8
Missouri	Madison	12,226	3.6%	497.6	24.6
Missouri	Newton	58,114	10.4%	626.6	92.7
Missouri	Oregon	10,881	5.2%	791.5	13.7
Missouri	Reynolds	6,696	0.1%	814.4	8.2
Missouri	Ripley	14,100	4.4%	631.6	22.3
Missouri	Ste. Genevieve	18,145	1.7%	506.8	35.8
Missouri	St. Francis	65,359	17.5%	454.7	143.7

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Missouri	Shannon	8,441	1.4%	1,004.0	8.4
Missouri	Stone	32,202	12.4%	510.8	63.0
Missouri	Texas	26,008	13.1%	1,179.2	22.1
Missouri	Washington	25,195	7.9%	762.5	33.0
Missouri	Wayne	13,521	2.0%	774.1	17.5
New York	Cattaraugus	80,317	-4.3%	1,322.5	60.7
New York	Chautauqua	134,905	-3.5%	1,500.2	89.9
Ohio	Ashland	53,139	1.2%	426.8	124.5
Ohio	Champaign	40,097	3.1%	429.8	93.3
Ohio	Clark	138,333	-4.4%	402.5	343.7
Ohio	Coshocton	36,901	0.7%	567.5	65.0
Ohio	Holmes	42,366	8.8%	424.0	99.9
Ohio	Knox	60,921	11.8%	529.6	115.0
Ohio	Madison	43,435	8.0%	466.6	93.1
Ohio	Medina	172,332	14.1%	423.0	407.4
Ohio	Morrow	34,827	10.1%	407.2	85.5
Ohio	Richland	124,475	-3.4%	500.1	248.9
Ohio	Trumbull	210,312	-6.6%	636.6	330.4
Ohio	Union	52,300	27.8%	436.9	119.7
Ohio	Wayne	114,520	2.6%	556.8	205.7
Ohio	Williams	37,642	-3.9%	423.1	89.0
Oklahoma	Adair	22,683	7.8%	577.1	39.3
Oklahoma	Cherokee	46,987	10.5%	776.3	60.5
Oklahoma	Craig	15,029	0.5%	762.8	19.7
Oklahoma	Delaware	41,487	11.9%	792.3	52.4
Oklahoma	Le Flore	50,384	4.7%	1,608.6	31.3
Oklahoma	McCurtain	33,151	-3.6%	1,902.4	17.4
Oklahoma	Nowata	10,536	-0.3%	580.8	18.1
Oklahoma	Osage	47,472	6.8%	2,304.0	20.6
Oklahoma	Ottawa	31,848	-4.1%	484.6	65.7
Oklahoma	Pushmataha	11,572	-0.8%	1,422.9	8.1
Oklahoma	Rogers	86,905	23.0%	711.5	122.1
Oklahoma	Tulsa	603,403	7.1%	587.0	1027.9
Oklahoma	Wagoner	73,085	27.1%	590.7	123.7
Oklahoma	Washington	50,976	4.0%	424.3	120.2
Pennsylvania	Butler	183,862	5.6%	794.7	231.3
Pennsylvania	Clarion	39,988	-4.3%	609.8	65.6
Pennsylvania	Crawford	88,765	-1.8%	1,037.5	85.6
Pennsylvania	Elk	31,946	-9.0%	832.3	38.4
Pennsylvania	Erie	280,566	-0.1%	1,558.2	180.1
Pennsylvania	Forest	7,716	56.0%	430.5	17.9
Pennsylvania	McKean	43,450	-5.4%	984.2	44.1
Pennsylvania	Mercer	116,638	-3.0%	682.6	170.9
Pennsylvania	Venango	54,984	-4.5%	682.8	80.5
Pennsylvania	Warren	41,815	-4.7%	898.6	46.5
Tennessee	Bedford	45,058	19.9%	474.8	94.9

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Tennessee	Cannon	13,801	7.6%	265.7	51.9
Tennessee	Coffee	52,796	10.0%	434.6	121.5
Tennessee	Dickson	49,666	15.1%	491.3	101.1
Tennessee	Franklin	41,052	4.5%	575.7	71.3
Tennessee	Giles	29,485	0.1%	611.2	48.2
Tennessee	Hardin	26,026	1.8%	596.3	43.6
Tennessee	Henry	32,330	3.9%	593.4	54.5
Tennessee	Hickman	24,690	10.7%	612.6	40.3
Tennessee	Humphreys	18,538	3.4%	556.7	33.3
Tennessee	Lawrence	41,869	4.9%	618.0	67.8
Tennessee	Lewis	12,161	7.0%	282.5	43.0
Tennessee	Lincoln	33,361	6.4%	570.7	58.5
Tennessee	McNairy	26,075	5.8%	563.6	46.3
Tennessee	Marshall	30,617	14.4%	376.2	81.4
Tennessee	Maury	80,956	16.5%	615.6	131.5
Tennessee	Montgomery	172,331	27.9%	543.8	316.9
Tennessee	Moore	6,362	10.8%	130.4	48.8
Tennessee	Perry	7,915	3.7%	422.9	18.7
Tennessee	Robertson	66,283	21.8%	476.5	139.1
Tennessee	Rutherford	262,604	44.3%	624.1	420.8
Tennessee	Sumner	160,645	23.1%	543.2	295.7
Tennessee	Williamson	183,182	44.7%	583.8	313.8

Sources: U.S. Census Bureau (2010). 2010 TIGER/Line Shapefiles: Counties. Retrieved December 18, 2012, from <http://www.census.gov/geo/maps-data/data/tiger-data.html>; U.S. Census Bureau (2000), 2000 Census, SF1 Total Population.