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IN REPLY REFER TO:

June 22, 2016

Mr. Randal Looney
Federal Highway Administration
Arkansas Division
700 West Capitol Avenue
Room 3130
Little Rock, Arkansas 72201-3298

Dear Mr. Looney:

This document is the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) based on our review of the proposed plans to widen and update associated intersections and structures on Interstate 30 (I-30) between Sevier Street and U.S. Highway 70 located in Saline County, Arkansas, and its effects on Arkansas Fatmucket (*Lampsilis powellii*). This BO has been prepared in accordance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, (16 U.S.C. 1531 *et seq*.), and its implementing regulations (50 CFR §402). The Service acknowledged by letter on April 19, 2016, the receipt of your April 12, 2016, email requesting initiation of formal section 7 consultation under the Endangered Species Act along with the accompanying biological assessment (BA).

Section 7(a)(2) of the Act requires federal agencies to consult with the Service to ensure any action authorized, funded, or carried out is not likely to jeopardize the continued existence of any federally listed species nor destroy or adversely modify critical habitat. This BO is based on the best available scientific and commercial data including meetings, electronic mail and telephone correspondence with the Federal Highway Administration (FHWA), Arkansas Highway and Transportation Department (AHTD), Service files, pertinent scientific literature, discussions with recognized species authorities, the Recovery Plan for the Arkansas Fatmucket (Service 1992), Arkansas Fatmucket 5-year Review (Service 2013) and other scientific sources. A complete administrative record is on file at the Arkansas Ecological Services Field Office.

Consultation History

Northern Long-eared Bat

The Service has reviewed the project information submitted in the BA and FHWA/AHTD's determination that the proposed action will not result in any prohibited incidental take. This project may affect the Northern Long-eared Bat; however, there are no effects beyond those previously disclosed in the Service's programmatic biological opinion for the final 4(d) rule dated January 5, 2016. Any taking that may occur incidental to this project is not prohibited under the final 4(d) rule (50 CFR §17.40(o)). This project is consistent with the description of the proposed action in the programmatic biological opinion, and the 4(d) rule does not prohibit incidental take of the northern long-eared bat that may occur as a result of this project. Therefore, the programmatic biological opinion satisfies the FHWA/AHTD's responsibilities under ESA section 7(a)(2) relative to the northern long-eared bat for this project.

FHWA/AHTD must report any departures from the plans submitted; results of any surveys conducted; or any dead, injured, or sick northern long-eared bats that are found to this office. If this project is not completed within one year of this letter, you must update your determination and resubmit the required information.

Freshwater Mussels

AHTD staff conducted a freshwater mussel survey to determine presence/absence within the project area (FHWA 2016). Two live Arkansas Fatmucket specimens were located during the initial time constrained survey of the Saline River on October 30, 2014. This discovery prompted the Service to request further quantitative sampling, which took place on June 30, 2015 and July 24, 2015. Survey methodology consisted of marking all mussels with flags to determine bed size and areal dimensions. In total seven Arkansas Fatmucket individuals were encountered, including the two from the initial survey. A relict valve of the federally threatened Rabbitsfoot (*Quadrula cylindrica cylindrica*) was collected during this quantitative sample within the delineated mussel bed. Qualitative dive locations and delineated bed boundaries can be found in Appendix A.

Winged Mapleleaf (*Quadrula fragosa*) occurs in the Saline River downstream of the action area. Pink Mucket (*Lampsilis abrupta*) occurs in the Saline River upstream and downstream of the action area. The Service found a single "fresh dead" Pink Mucket approximately 0.25 km upstream of the project site during a survey in June 2015 (C. Davidson, pers. comm. 2016), but no live Pink Mucket are known to occur within the action area. The Service concurred with FHWA/AHTD's no effect determinations for Winged Mapleleaf and the "may affect, not likely to adversely affect" determination for Rabbitsfoot and Pink Mucket on April 19, 2016.

In an email dated March 7, 2016, the FHWA/AHTD provided their BA and requested to initiate consultation with the Service.

In an email date March 10, 2016 the Service sent a request for additional information and a revision of the original BA.

In an email dated March 29, 2016, the AHTD submitted a revised BA.

Following phone conversations AHTD submitted a revised BA in an email dated April 12, 2016.

In an email dated April 19, 2016, the Service responded with an email accepting the BA and agreeing to enter into formal consultation. The formal consultation began April 19, 2016, the date the Service concurred with FHWA's adverse effect determination.

In an email dated April 25, 2016 the Service provided a draft BO to the AHTD for review and further discussion.

AHTD replied by email on April 26, 2016 receipt of the draft and questions regarding the draft.

On May 20, 2016, AHTD provided an email with comments to the Service on the Draft BO.

The Service issued its final BO on June 22, 2016, concluding formal consultation.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The AHTD plans to widen and update associated intersections and structures on I-30 between Sevier Street and U.S. Highway 70 in Saline County, Arkansas. Currently the interstate consists of two 3.7 m (12 ft.) travel lanes with 1.9 m (6 ft.) interior shoulders and 3.0 m (10 ft.) outer shoulders. Typical section improvements will consist of three 3.7 m (12 ft.) travel lanes with 3.0 m (10 ft.) interior shoulders and 3.7 m (12 ft.) outer shoulders. Interchanges at U.S. Highway 67, U.S. Highway 70, and Sevier Street will be reconstructed to allow easier and safer ingress/egress onto I-30. Illustrations can be found in Appendix A.

The bridges spanning the Saline River and Saline River Relief will be upgraded on location to accommodate three travel lanes each direction. New piers and bents will be constructed and existing ones removed in three stages. Box culverts and associated cross drains throughout the remainder of project length will be retained and extended to accommodate road widening.

ACTION AREA

The action area consists of the river reach proposed for construction extending 30.5 m (100 ft.) upstream and 91.4 m (300 ft.) downstream of the I-30 bridge at the Saline River. Additionally, a 0.5 km (0.3 mi) area surrounding the construction limit is also being assessed to account for noise and smoke associated with project construction. The project location is within the upper Saline River Watershed (HUC 08040203) which consists of 1,715 mi^2 (4,440 km^2). The land use is approximately 77.9% forest, 8.5% herbaceous, 7.1% grassland, 5.6% urban. Much of the grassland occurs within the flood plain of the Saline River. The substrate consists of gravel, sands and fines within the extent of the action area. The specific project area consists of these same substrate types with gravel and sands at center channel, gravels and sands on the inside of the bend; and gravel, sand, and fines along the thalweg and outside bank.

The specific habitat type within the project area is a run. The run is preceded by a low gradient riffle and followed by another low gradient riffle. Immediately upstream of the upper riffle is a small pool of approximately 224 m in length. Additional alternating runs and riffles dominate downstream for approximately 1,352 m.

STATUS OF THE SPECIES/CRITICAL HABITAT

Arkansas Fatmucket (*Lampsilis powellii*)

Arkansas Fatmucket was listed as threatened under the ESA on April 5, 1990 (55 Federal Register 12797). No critical habitat has been designated for Arkansas Fatmucket. The recovery plan for the species was published February 10, 1992 (Service 1992). A five year status review was initiated September 8, 2006 (71 Federal Register 53127) and completed in 2013 (Service 2013). No critical habitat has been designated for Arkansas Fatmucket.

The Arkansas Fatmucket was described as *Unio powelli* by Lea in 1852 from the Saline River, Arkansas (Johnson 1980), and placed in the genus *Lampsilis* by Simpson (1914). Hoeh and Breton (2012) examined mitochondrial DNA (mtDNA) genomic divergences between Arkansas Fatmucket and the closely related Fatmucket (*Lampsilis siliquoidea*). Their findings were consistent with the hypothesis that Arkansas Fatmucket is a valid species currently experiencing mtDNA introgression due to limited interspecific hybridization with Fatmucket.

The Arkansas Fatmucket is a medium size freshwater mussel (occasionally exceeds 4 inches). The shell is elliptical to long obovate with sub-inflated valves. The shell surface is smooth with a shiny olive brown to tawny periostracum and lacks rays. There are tiny pits running down the shell that sometimes appear to be rays (Harris and Gordon 1990) and there is sexual dimorphism in shell shape (Johnson 1980).

<u>Status and distribution</u>

Arkansas Fatmucket is endemic to the Ouachita Mountains region of the Ouachita River basin in Arkansas. The current known range is restricted to the Caddo River from the confluence of Collier Creek (between Norman and Caddo Gap, Arkansas) to Arkansas Highway 84 (near Amity, Arkansas; 24.3 river miles (rm)); Ouachita River from near the confluence of Chances Creek to the confluence of Polk Creek (16.2 rm); Ouachita River from near the confluence of Snake Creek to Hole In The Ground Creek (7.8 rm), Arkansas Highway 379 to U. S. Highway 270 (12.5 rm), and Interstate 30 to Arkansas Highway 222 (15 rm); South Fork Ouachita River from Montgomery County Road 17 to the inundation pool of Lake Ouachita (14.3 rm); Middle Fork Saline River from Arkansas Highway 7 to its confluence with the Alum Fork Saline River (30.2 rm); Alum Fork Saline River from Love Creek to the inundation pool of Lake Winona (5.6 rm), Lake Winona Dam downstream to the Middle Fork Saline River confluence (28.0 rm), and extending upstream approximately 6.0 rm from the North Fork Saline River confluence; North Fork Saline River from Arkansas Highway 9 to Arkansas Highway 5 (21.7 rm); Saline River from its formation downstream to U.S. Highway 270 (43.6 rm). Extant Arkansas Fatmucket populations have been presumably extirpated from approximately 87 rm range-wide since listing, representing a 28 percent reduction in occupied stream reaches (Service 2013; Figures 1 – 3).

Harris *et al.* (2009) summarize the status and distribution of Arkansas Fatmucket. Scott (2004) and Christian et al. (2006) surveyed 30 Arkansas Fatmucket sites from Harris and Gordon (1988) and three additional sites not previously explored. A total of 137 Arkansas Fatmucket specimens were collected from 19 of 33 surveyed sites. Arkansas Fatmucket numbers were significantly reduced across 29 sites compared to the numbers collected by Harris and Gordon (1988). These surveys provided the first statistical documentation of a range wide decline of Arkansas Fatmucket since federal listing in 1990.

Scott (2004) and Christian et al. (2006) focused their survey effort on previously documented Arkansas Fatmucket sites. In 2006 and 2007, the Service and the AGFC conducted a range wide status assessment focused on determining current distribution and abundance. Results from this survey yielded 15 new sites not documented in previous surveys. The Service and AGFC conducted range wide status assessment again in 2014 – 2015. Results indicate widespread declines in abundance and distribution throughout the Saline River headwaters (Alum, Middle, and North Forks; C. Davidson 2016, pers. comm.). Arkansas Fatmucket appears stable at sites where it occurs in the main stem Saline River from near Benton to Tull, Arkansas, (including the action area).

Figure 1 - Distribution of Arkansas Fatmucket

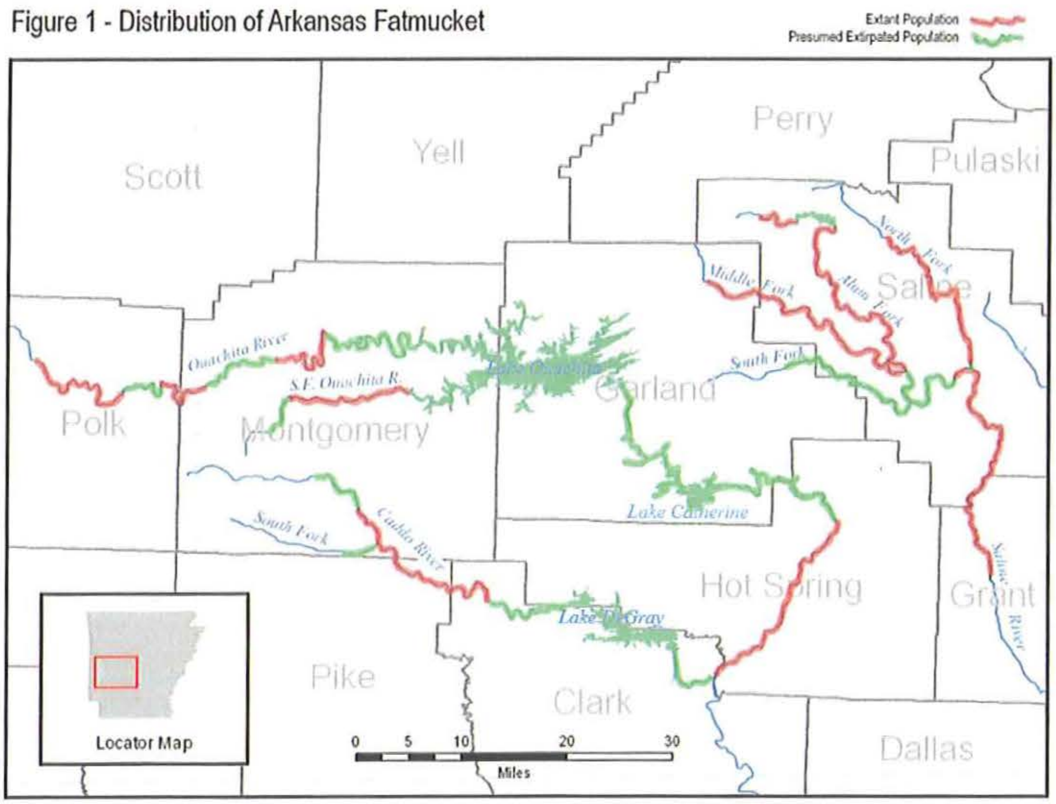


Figure 2 - Live and fresh dead occurrences of Arkansas Fatmucket, 1981-1996

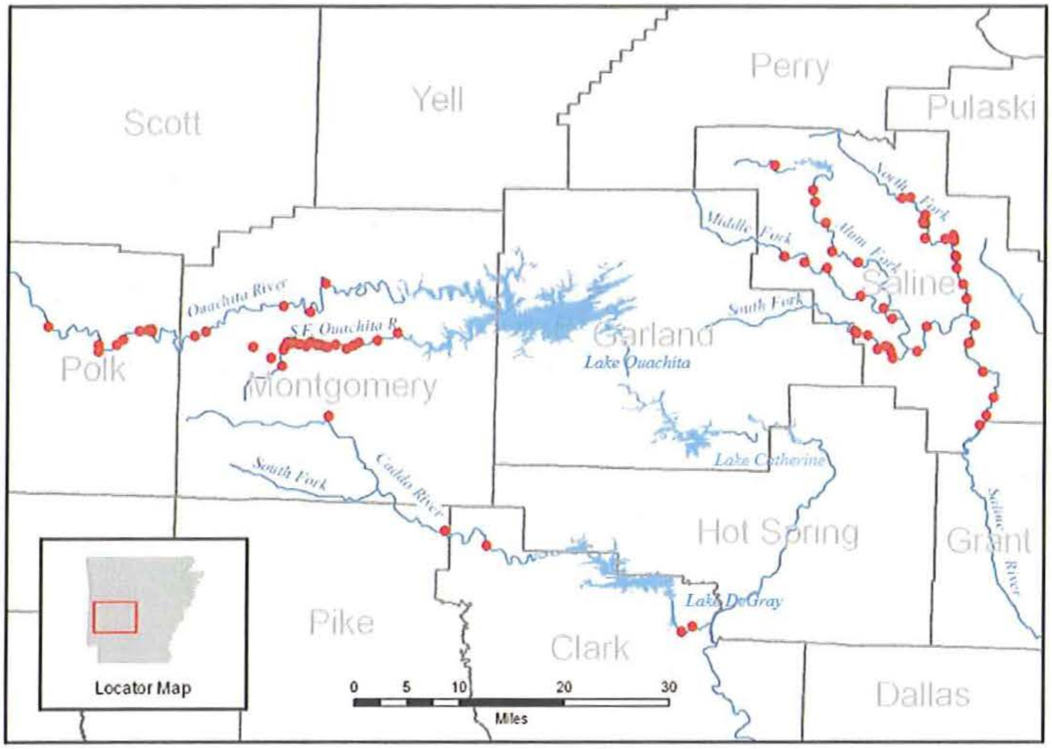
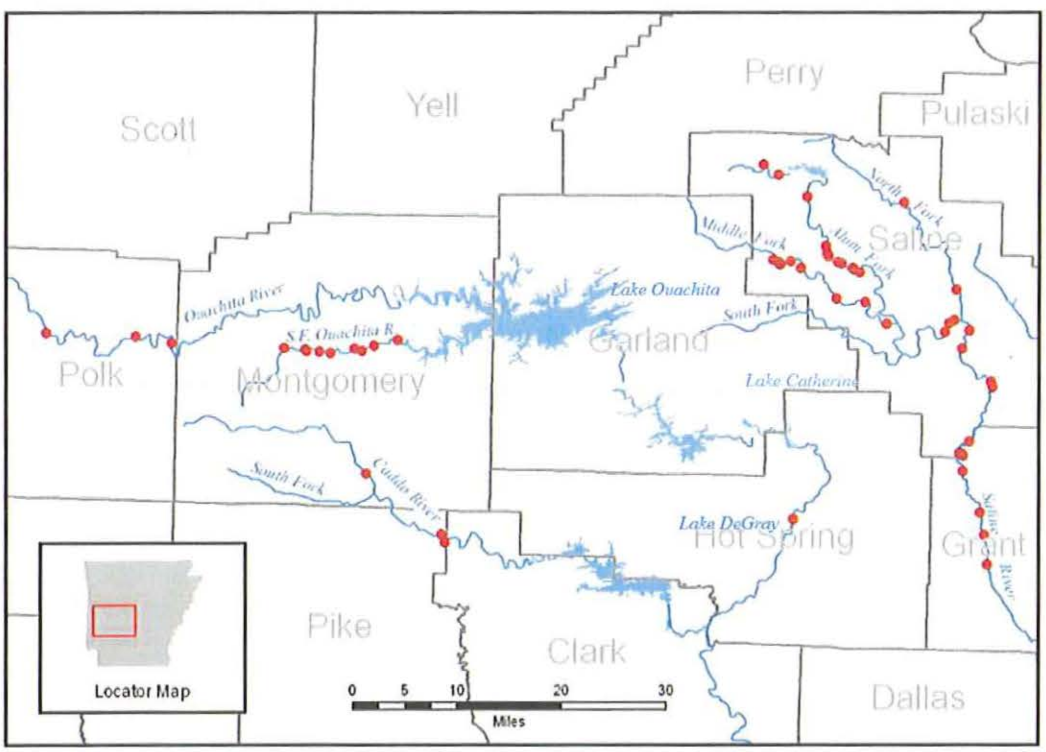


Figure 3 - Live occurrences of Arkansas Fatmucket since 1997



Life history

Biological information specific to this species is sparse, but general information known about other freshwater mussels applies to this taxon. Mussels in streams occur chiefly in "flow refuges" (relatively stable areas that displayed little movement of substrate particles during flood events) (Strayer 1999). Mussel location and density are greatest in areas where shear stress (stream's ability to entrain and transport bed material created by the flow acting on the bed material) is low and sediments remain generally stable during flooding (Layzer and Madison 1995; Strayer 1999; Hastie et al. 2001). These "flow refuges" conceivably allow relatively immobile mussels to remain in the same general location throughout their life span. However, flow refuges are not created equally and other habitat variables are important, but poorly understood (Roberts 2008, pers. comm.).

Food habits – Freshwater mussels siphon water into their shells and across four gills specialized for respiration and food collection. Food items include algae, bacteria, detritus (disintegrated organic debris), and microscopic animals (Strayer et al. 2004). It also has been surmised dissolved organic matter may be a significant source of nutrition (Strayer et al. 2004). Adults are filter feeders and generally orient themselves on or near the substrate surface to take in food and oxygen from the water column. Juveniles typically burrow completely beneath the substrate surface and are pedal (foot) feeders (bringing food particles inside the shell for ingestion that adhere to the foot while it is extended outside the shell) until the structures for filter feeding are more fully developed (Yeager et al. 1994; Gatenby et al. 1996).

Growth and longevity – Growth rates for mussels are highly variable among individual species, but overall, mussels tend to grow relatively rapidly for the first few years (Scruggs 1960; Negus 1966) then slow appreciably (Bruenderman and Neves 1993; Hove and Neves 1994). This reduction in growth rate is correlated to sexual maturity, probably as a result of energy being diverted from growth to gamete production (Baird 2000). No quantitative information on the longevity of Arkansas Fatmucket is available.

Reproductive biology – Sex ratios in mussels generally do not differ significantly from 1:1. Data collected by Scott (2004), Christian et al. (2006) and the Service (2013) indicate similar sex ratios for Arkansas Fatmucket. Age at sexual maturity for the Arkansas Fatmucket is unknown.

Males release sperm into the water column, which are drawn in by females through their siphons during feeding and respiration. Fertilization takes place inside the shell, and success is apparently influenced by mussel density and water flow conditions (Downing et al. 1993). The eggs are retained in the female gills until they develop into mature larvae called glochidia. The glochidia of Arkansas Fatmucket have a parasitic stage during which they must attach to the gills of a fish to transform into a juvenile mussel. Arkansas Fatmucket females release glochidia separately. The duration of the parasitic stage varies by mussel species, water temperature, and perhaps host fish species.

From parasitic glochidia to free-living juveniles – Arkansas Fatmucket glochidia are an obligate parasite on sunfish (*Centrarchidae*), primarily largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*) and spotted bass (*Micropterus punctatus*) (Scott 2004;

Christian et al. 2006). The Arkansas Fatmucket is gravid March through October (Scott 2004; Christian et al. 2006). Glochidia generally spend from two to six weeks parisitizing the host fish, the duration of encystment being dependent on the mussel species and water temperature (Zimmerman and Neves 2002). Newly-metamorphosed juveniles drop off to begin a free-living existence on the stream bottom. Arkansas Fatmucket is generally associated with pools and backwater areas in sand, sand-gravel, sand-cobble, or sand-rock with sufficient flow to periodically remove organic detritus and other debris. It is frequently found adjacent to water willow (*Justicia americana*).

Recovery and Management

The recovery objective of the Arkansas Fatmucket *(Lampsilis powellii)* Recovery Plan is to delist the species (Service 1992). Recovery criteria for achieving the objective include:

1. Viable populations in the Ouachita, South Fork Ouachita, Saline, Alum Fork Saline, North Fork Saline, and Middle Fork Saline Rivers (the recovery plan defines a viable population as a population with the reproductive capability to sustain itself without immigration of individuals from another population),

2. Habitat for these population is fully protected, and

3. Viable population levels are maintained for a period of at least 20 years.

In an effort to protect and restore habitat of the Arkansas Fatmucket in the Ouachita, Caddo, and Saline River headwaters, The Nature Conservancy along with state and federal agencies decided to undertake the development and implementation of a programmatic Safe Harbor Agreement. This agreement facilitates (i.e., provides assurances and incentives) private landowner cooperation, not otherwise provided by the recovery plan, in implementing habitat conservation practices to protect and restore Arkansas Fatmucket populations and habitat. Additionally, the agreement ensures a collaborative approach to restore and conserve habitat in these watersheds, thus minimizing potential conflicting recommendations associated with recovery of the species. Implementation of the Safe Harbor Agreement is expected to begin in the summer of 2016.

Propagation efforts were initiated for the South Fork Ouachita River in 2014 and Saline River headwaters in 2016. Juveniles are being raised at Missouri State University and Kansas City Zoo facilities. No individuals have been released back to wild populations, but augmentation efforts are expected to begin in 2017 – 2018. A sustained propagation and augmentation effort will continue until resource managers determine augmentation/reintroduction is no longer necessary to ensure the long-term survival of Arkansas Fatmucket.

Previous Incidental Take Authorizations

Prior formal consultations involving Arkansas Fatmucket include one BO for section 10(a)(1)(A) permits in the Service's Southeast Region. The amount or extent of take anticipated for Arkansas Fatmucket in this BO includes no more than 5 adult or sub-adult individuals per one hundred handled during authorized recovery actions under section 10(a)(1)(A). It also exempts mortality of glochidia and juveniles of up to 100 percent during temporary retention of gravid adults for propagation efforts.

In 2004, the Service issued a non-jeopardy BO for construction of the Saline County Road 5 bridge crossing the Saline River near Tull, Arkansas. The level of anticipated incidental take exempted included relocation of 20 Arkansas Fatmucket individuals with a maximum of two individuals killed incidental to actions required for relocation. The Service also anticipated delayed mortality associated with translocation and some individuals would not be found in the affected area. This level of take was approximated by the discovery of two Arkansas Fatmucket individuals or ten percent of the number of individuals collected and relocated, whichever was greater.

In 2013, the Service issued a non-jeopardy BO reviewing the effects of the USDA Forest Service – Ouachita National Forest (ONF) proposal regarding designation, operation, and maintenance of the Wolf Pen Gap Trail Complex (WPG). Because of the difficulty in determining a level of take based on the number of Arkansas Fatmucket that likely would be adversely affected, the Service decided that it was appropriate to quantify the level of authorized incidental take using tons of sediment per year. This value was derived from erosion of WPG trails and roads and stream bank erosion in Gap and Board Camp Creeks that would be affected by ONF's proposed action. Therefore, the level of take anticipated in this BO was 1,077 tons of sediment per year from WPG trails and roads and 968.5 tons of sediment per year from stream bank erosion in Gap and Board Camp Creeks over a five year period extending from January, 2014 – January, 2019. The Service will re-evaluate the level of incidental take anticipated beyond January 1, 2019 prior to January 1, 2019. The incidental take statement anticipated the taking of Arkansas Fatmucket only from the actions associated with the proposed action.

In 2015, the Service issued a non-jeopardy BO reviewing the effects of the proposed issuance of a Clean Water Act (CWA) Section 404 permit by the U.S. Army Corps of Engineers (Corps). The permit allowed fill to be placed in the Caddo River (Montgomery County, Arkansas) for the purpose of stream bank rehabilitation. The rehabilitation project was a cooperative effort between private landowners, the Arkansas Game and Fish Commission (AGFC), and the Service's Partners for Fish and Wildlife (Partners) program. The Service anticipated up to three Arkansas Fatmucket individuals may be affected as a result of the proposed action. This was based upon the amount of time spent surveying, the paucity of mussels within the site, the marginal habitat present, and the rarity in general of the Arkansas Fatmucket. The incidental take statement anticipated the taking of Arkansas Fatmucket only from the actions associated with the proposed activity. All Arkansas Fatmucket found within the footprint of the reach (N = 0) were translocated to suitable habitat. Because the activity was itself a conservation action (rehabilitation of an actively eroded streambank), the Service did not recommend additional conservation actions.

ENVIRONMENTAL BASELINE

This section describes the species status and trend information within the action area. It also includes State, tribal, local, and private actions already affecting the species or that will occur contemporaneously with the proposed action, including Federal actions that have completed formal or informal consultation (50 CFR 402.02). The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat, and ecosystem, within the action area. The environmental baseline provides the basis from which to judge the effects of the action.

For recovery permits issued under section 10(a)(1)(A) in the Service's Southeast Region, see Previous Incidental Take Authorizations section. Additionally, the Service completes numerous informal consultations on this species each year.

Status of the species within the action area

Freshwater mussel surveys were conducted by AHTD (FHWA 2016) on October 30, 2014, June 30, 2015, and July 24, 2015 to assess presence absence of species and to delineate bed density. In the 2014 survey, 46 mussels representing 16 species, including two Arkansas Fatmucket, were observed in two time-constrained searches for a total of 120 minutes. (Appendix A, Table 1). Surveys in 2015 focusing on bed delineation resulted in 247 mussels representing 26 species (25 living, 1 relict) were collected within limits of the bed (Appendix A, Table 1). In total, seven live Arkansas Fatmucket were located within the limits of the bed. In addition, the Service found two living and one dead Arkansas Fatmucket approximately 0.20 km upstream of the project site during a survey in June 2015 (C. Davidson, pers. comm. 2016).

This bed begins at the upstream side of the bridge and extends approximately 45 m (148 ft.) along the western bank ranging from 8-10 m (26-33 ft.) in width. The upper end of the bed is located in a pool averaging 1 m (3.3 ft.) deep which transitions into a riffle at the lower end. Water willow (*Justicia americana*) is found along the water's edge and the substrate is characterized by embedded gravel and sand. This 397 m^2 (4,273 ft^2) mussel bed has an average mussel density of 0.62 mussel/m^2 (0.06/ft^2).

The only stable extant Arkansas Fatmucket population occurs in the Saline River. With increased distance between occupied habitat, reduced abundance, and continuing or increasing threats to Arkansas Fatmucket in the Saline River headwaters, populations the Saline River population may start to decline in the next 10 – 20 years (Service 2013).

The majority of the remaining Arkansas Fatmucket populations are generally small and becoming more geographically isolated. The patchy distributional pattern of stream populations in short stream reaches makes them much more susceptible to extirpation due to the low potential for recolonization from other populations. Single catastrophic events, such as toxic chemical spills or other stochastic events, could cause the extirpation of any of these small, isolated Arkansas Fatmucket occurrences. Increasing levels of isolation make natural repopulation of any extirpated population improbable without human intervention. Population isolation also prohibits the natural interchange of genetic material between populations.

Factors affecting species environment within the action area

The Upper Saline watershed is largely composed of forest area (78.6%) with intermixed grassland (9.8%) used for cattle grazing and hay production. Pine-dominated forest increased by

24 percent with a corresponding decrease in the natural mixed woods forest matrix by 22 percent. This change is indicative of increasing timber production activities.

The U.S. Census Department estimated a 1.6% population increase of 23,346 to 23,713 from 2010 to 2014 in the vicinity immediately upstream of the project location. Population increases result in increases in development both directly and cumulatively. Increased development leads to increases in sedimentation runoff, impervious surfaces, and loss of vegetated habitat.

The project location on the Saline River is a popular recreation location for the residents of Saline and surrounding counties. Popular activities in and around the bridge include fishing, swimming, and the use of off-road-vehicles (ORV), which can often be seen driving directly through the river. The area directly downstream of the bridge is shallower and wider leading to easier ORV access than upstream. The frequent disturbance resulting from these recreational activities has left the river downstream from the bridge in a highly degraded condition.

Several new threats have been identified since listing in the upper Saline River watershed (DeClerk et al. 2006). A landscape level analysis of major land use changes within the watershed was assessed for the years between 1986 and 2004 and quantified the changes in the watershed and determined anthropogenic impacts. Results indicated that the largest change (47 percent increase) in landscape classification was the increasing urbanization of the watershed characterized by the expansion of Benton and Hot Springs Village into rural areas. Hot Spring Village, a large gated community, is located in the headwater portion of this watershed. Numerous large impoundments and increased impervious surfaces in Hot Springs Village have altered the natural flow regimes of the Middle Fork and South Fork Saline River. There was an increase in golf course coverage by 231 percent within Hot Springs Village. DeClerk et al. (2006) ranked housing and urban development as the number one threat to the upper Saline River watershed.

There are 19 impoundments located within the upper Saline River watershed. Nine new dams have been constructed in the Middle Fork Saline River watershed in conjunction with development of Hot Springs Village (the largest gated community in the world). The expansion of water withdrawals, diversions, and impoundments is suspected to be one contributing factor to increases in elevated turbidity level during storm events, soil erosion/sediment instability and hydrologic alteration. Hydrologic alterations are a large contributing factor in geomorphic instability in the four forks of the Saline River. U.S. Geological Survey gaging stations on the Middle Fork Saline River exhibited an increasing trend in the annual number of zero-flow days (1986 – 2004), a trend consistent with increased consumptive water withdrawals within the tributary watersheds (Service 2013).

Changing land uses may lead to altered hydrology and stream geomorphology characteristics and increased pollutant inputs (e.g., sedimentation, nutrients, and other contaminant from storm water runoff). Unrestricted cattle access into streams, water withdrawal for agricultural and recreational purposes (i.e., golf courses), lack of adequate riparian buffers, construction and maintenance of county roads, and non-point source pollution arising from a broad array of activities, particularly rapid urbanization around Benton and Hot Springs Village, continue to increase and degrade suitable habitat for Arkansas Fatmucket in the upper Saline River watershed, including the action area.

Habitat Alteration – Small gravel operations are common within the range of the Arkansas Fatmucket and many streams are impacted by the removal of preferred substrate and by the resulting downstream sedimentation. The Saline River downstream of Benton has been severely impacted by gravel dredging (Harris and Gordon 1988). Additionally, channel modification is common at road crossings, and habitat for this species undoubtedly has been affected by the many road crossings along the forks of the Saline River and within its range.

Sedimentation – Excessive sediments may adversely affect riverine mussel populations requiring clean, stable streams (Ellis 1936; Brim Box and Mossa 1999). Adverse effects resulting from sediments have been noted for many components of aquatic communities. Potential sediment sources within a watershed include natural events and anthropogenic activities that disturb the land surface. Most localities occupied by Arkansas Fatmucket are currently being affected to varying degrees by sedimentation.

Sedimentation has been implicated in the decline of mussel populations nationwide, and remains a threat to mussels in the Saline River (Ellis 1936; Vannote and Minshall 1982; Dennis 1984; Brim Box and Mosa 1999; Fraley and Ahlstedt 2000; Poole and Downing 2004). Specific biological effects include reduced feeding and respiratory efficiency from clogged gills, disrupted metabolic processes, reduced growth rates, limited burrowing activity, physical smothering, and disrupted host fish attraction mechanisms (Ellis 1936; Marking and Bills 1979; Vannote and Minshall 1982; Waters 1995; Hartfield and Hartfield 1996). In addition, mussels may be indirectly affected if high turbidity levels significantly reduce the amount of light available for photosynthesis, and thus, the production of certain food items (Kanehl and Lyons 1992).

Primary effects of excess sediment levels on mussels may be sublethal, with detrimental effects not immediately apparent (Brim Box and Mossa 1999). The physical effects of sediment on mussel habitat appear to be multifold, and include changes in suspended and bed material load; bed sediment composition associated with increased sediment production and runoff in the watershed; channel changes in form, position, and degree of stability; changes in depth or width and depth ratio that affects light penetration and flow regime; actively aggrading (filling) or degrading (scouring) channels; and changes in channel position. These effects to habitat may dislodge, transport downstream, or leave mussels stranded (Vannote and Minshall 1982; Kanehl and Lyons 1992; Brim Box and Mossa 1999). For example, many Arkansas streams (e.g., Saline River) supporting mussels have become increasingly silted in over the past century (EPA 2013), reducing habitat for mussels.

Increased sedimentation and siltation may explain in part why mussel populations are experiencing recruitment failure in some streams. Interstitial spaces in the substrate provide crucial habitat (shelter and nutrient uptake) for juvenile mussel survival. When interstitial spaces are clogged, interstitial flow rates and spaces are reduced (Brim Box and Mossa 1999), and this decreases habitat for juvenile mussels. Furthermore, sediment may act as a vector for delivering contaminants, such as nutrients and pesticides, to streams, and juvenile mussels may ingest contaminants adsorbed to silt particles during normal feeding activities. Arkansas Fatmucket reproductive strategies depend on clear water (enables fish hosts to see mussel lures) during critical reproductive periods.

Agricultural activities also are responsible, in part, for sediment affecting rivers in the United States (Waters 1995). Grazing may reduce infiltration rates, decrease filtering capacity of pollutants (thereby increasing sedimentation run-off), and trampling and eventual elimination of woody vegetation reduces bank resistance to erosion and contributes to increased water temperatures (Armour et al., 1991; Trimble and Mendel, 1995; Brim Box and Mossa, 1999; Henley et al., 2000).

Erosion from silvicultural activities accounts for six percent of national sediment pollution (Henley et al., 2000). Sedimentation effects are more the result of logging roads than from the actual harvesting of timber (Waters, 1995; Brim Box and Mossa, 1999). Annual run-off and/or peak flow volumes increase with timber harvests, particularly during the wet season (Allan 1995). This is partially due to the construction of logging roads, and vegetation removal tends to compact soils, reduce infiltration rates, and increase soil erosion. Increased flows and improper harvesting within streamside management zones may result in stream channel changes (Brim Box and Mossa, 1999) that may ultimately affect mussel beds.

Chemical Contaminants – Chemical contaminants are ubiquitous in the environment and are considered a major threat in the decline of mussel species (Richter et al. 1997; Strayer et al. 2004; Wang et al. 2007; Cope et al. 2008). Chemicals enter the environment through point and nonpoint discharges including spills, industrial and municipal effluents, and residential and agricultural runoff. These sources contribute organic compounds, heavy metals, nutrients, pesticides, and a wide variety of newly emerging contaminants such as pharmaceuticals to the aquatic environment. Arkansas Fatmucket are susceptible to chemical contaminants that degrade water and sediment quality and subsequently may result in adverse effects.

Cope et al. (2008) evaluated the pathways of exposure to environmental pollutants for all four freshwater mollusk life stages (free glochidia, encysted glochidia, juveniles, adults) and found that each life stage has both common and unique characteristics that contribute to observed differences in exposure and sensitivity. Almost nothing is known of the potential mechanisms and consequences of waterborne toxicants on sperm viability. In the female mollusk, the marsupial region of the gill is thought to be physiologically isolated from respiratory functions, and this isolation may provide some level of protection from contaminant interference with a female's ability to achieve fertilization or brood glochidia (Cope et al. 2008). A major exception to this assertion is with chemicals that act directly on the neuroendocrine pathways controlling reproduction (see discussion below). Nutritional and ionic exchange is possible between a brooding female and her glochidia, providing a route for chemicals (accumulated or waterborne) to disrupt biochemical and physiological pathways (such as maternal calcium transport for construction of the glochidial shell). Glochidia can be exposed to waterborne contaminants for up to 36 hours until encystment occurs; between 2 and 36 hours, and then from fish host tissue burdens (for example, atrazine), that last from weeks to months and could affect transformation success of glochidia into juveniles (Ingersoll et al. 2007).

Juvenile mussels typically remain burrowed beneath the sediment surface for 2 to 4 years. Residence beneath the sediment surface necessitates deposit (pedal) feeding and a reliance on interstitial water for dissolved oxygen (Watters 2007, p. 56). The relative importance of exposure of juvenile mussels to contaminants in overlying surface water, interstitial water, whole sediment, or food has not been adequately assessed. Exposure to contaminants from each of these routes varies with certain periods and environmental conditions (Cope et al. 2008).

The primary routes of exposure to contaminants for adult mussels are surface water, sediment, interstitial (pore) water, and diet; adults can be exposed when either partially or completely burrowed in the substrate (Cope et al. 2008). Adult mussels have the ability to detect toxicants in the water and close their valves to avoid exposure (Van Hassel and Farris 2007). Adult mussel toxicity and relative sensitivity (exposure and uptake of toxicants) may be reduced at high rather than at low toxicant concentrations because uptake is affected by the prolonged or periodic toxicant avoidance responses (when the avoidance behavior of keeping their valves closed can no longer be sustained for physiological reasons (respiration and ability to feed) (Cope et al. 2008). Toxicity results based on low–level exposure of adults are similar to estimates for glochidia and juveniles for some toxicants (for example, copper). The duration of any toxicant avoidance response by an adult mussel is likely to vary due to several variables, such as species, age, shell thickness and gape, properties of the toxicant, and water temperature. There is a lack of information on toxicant response(s) for Arkansas Fatmucket, but results of tests using glochidia and juveniles may be valuable for protecting adults (Cope et al. 2008).

Agriculture, timber harvest, and lawn management practices utilize nutrients and pesticides. These are two broad categories of chemical contaminants that have the potential to adversely affect mussel species. Nutrients, such as nitrogen and phosphorus, primarily occur in runoff from livestock farms, feedlots, heavily fertilized row crops and pastures (Peterjohn and Correll 1984), post timber management activities, and urban and suburban runoff, including leaking septic tanks, and residential lawns.

Studies have shown that excessive nitrogen concentrations can be lethal to the adult freshwater pearl mussel (*Margaritifera margaritifera*) and reduce the life span and size of other mussel species (Bauer 1988; Bauer 1992). Nutrient enrichment can result in an increase in primary productivity, and the associated algae respiration depletes dissolved oxygen levels. This may be particularly detrimental to juvenile mussels that inhabit the interstitial spaces in the substrate where lower dissolved oxygen concentrations are more likely than on the sediment surface where adults tend to live (Sparks and Strayer 1998).

Population Fragmentation and Isolation – Population fragmentation and isolation prohibit the natural interchange of genetic material between populations. Populations of Arkansas Fatmucket in the Saline River are small and geographically isolated, and, thus, are susceptible to genetic drift, inbreeding depression, and stochastic changes to the environment. Inbreeding depression can result in early mortality, decreased fertility, smaller body size, loss of vigor, reduced fitness, and various chromosome abnormalities (Smith 1990). Although changes in the environment may cause populations to fluctuate naturally, small and low-density populations are more likely to fluctuate below a minimum viable population size (the minimum or threshold number of individuals needed in a population to persist in a viable state for a given interval) (Shaffer 1981;

Shaffer and Samson 1985; Gilpin and Soulé 1986). Furthermore, this level of isolation makes natural repopulation of any extirpated population unlikely without human intervention. Population isolation prohibits the natural interchange of genetic material between populations, and small population size reduces the reservoir of genetic diversity within populations, which can lead to inbreeding depression (Avise and Hambrick 1996).

The likelihood is high Arkansas Fatmucket populations in the Saline River are approaching or may already be below the effective population size (EPS– the number of individuals in a population who contribute offspring to the next generation), based on restricted distribution and populations only represented by a few individuals, and achieving the EPS is necessary for a population to adapt to environmental change and maintain long-term viability. Isolated populations eventually are extirpated when population size drops below the EPS or threshold level of sustainability (Soulé 1980). Evidence of recruitment in these populations is scant, making recruitment reduction or outright failure suspect. These populations may be experiencing the bottleneck effect of not attaining the EPS. Without genetic interchange, small, isolated populations could be slowly expiring, a phenomenon termed the extinction debt (Tilman *et al.* 1994, pp. 65–66). Even given the absence of existing or new anthropogenic threats, disjunct populations may be lost as a result of current below-threshold effective population size. Additionally, evidence indicates that general habitat degradation continues to decrease habitat patch size, further contributing to the decline of these mussel populations.

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on the species and/or critical habitat and its interrelated and interdependent activities. While analyzing direct and indirect effects of the proposed action, the Service considered the following factors:

1. <u>Proximity of the action</u> – Known species locations in relation to the action area and proposed action.

2. <u>Distribution</u> –Where the proposed action will occur and the likely effects of the activities.

3. <u>Timing</u> –The likely effects in relation to sensitive periods of the species' life cycle.

4. <u>Nature of the effects</u> –How the effects of the action may be manifested in elements of the species' life cycle, population size or variability, or distribution, and how individual animals may be affected.

5. <u>Duration</u> –Whether the effects are short-term, long-term, or permanent.

6. <u>Disturbance frequency</u> –How the proposed action will be implemented in terms of the number of events per unit of time.

7. <u>Disturbance intensity</u> – The effect of the disturbance on a population or species.

8. Disturbance severity – How long we expect the adverse effects to persist and how long it would take a population to recover.

Proximity of the action: FWHA (2016) states the project is located in Saline County, Arkansas (S10 T2S R15W, S9 T2S R15W, S16 T2S R15W, S17 T2S R15W, S20 T2S R15W, S19 T2S R15W, and S24 T2S R16W – Haskell Quad) from the city limits of Benton west to the interchange at U.S. Highway 70. This 8.6 km (5.36 mi) section of I-30 is located on the border of the Ouachita Mountain and South Central Plain ecoregions characterized by moderate urbanization and mixed pine and hardwood forest (Woods et al. 2004). The project is entirely within the Upper Saline watershed (HUC 08040203), vicinity maps can be found in Appendix A.

Arkansas Fatmucket individuals were found at the upstream side of the bridge extending approximately 45 m (148 ft.) upstream along the western bank ranging from 8 – 10 m (26 – 33 ft.) in width. The upper end of the bed is located in a pool averaging 1 m (3.3 ft.) deep which transitions into a riffle at the lower end before terminating under the I-30 bridge.

Distribution: The aquatic action area consists of the river reach proposed for construction extending 30.5 m (100 ft.) upstream and 91.4 m (300 ft.) downstream of the I-30 bridge at the Saline River. Additionally, a 0.5 km (0.3 mi) area surrounding the construction limit is also being assessed to account for noise and smoke associated with project construction.

The clearing and grubbing of trees will take place on new right-of-way directly adjacent to the current I-30 corridor. Additionally, interchanges at U.S. Highway 67 and 70 and Sevier Street will be reconstructed requiring tree clearing. A total of 6.2 hectares (15.3 acres) of currently forested area is estimates to be cleared. All measures will be taken to ensure proper sediment and erosion control to prevent runoff into waterways.

Timing: The Arkansas Fatmucket is gravid from March through October (Scott 2004). The project is scheduled to be let to contractors in March 2017. Work orders are typically issued the month following the letting date. Construction is estimated to take 2.5 years, but bridge construction, according to AHTD, typically takes less time. Any juveniles or adults present within the action area will be directly affected. These effects can be minimized through relocation and avoiding relocation during the brooding period. Any portion of the life cycle could be affected by temporary increases in sedimentation or turbidity.

There are several possible mechanisms for sediment effects on mussels. We expect detrimental effects could occur during all life stages (glochidia to adult), including sensitive periods such as brooding and the temporary parasitic larval stage. Detrimental effects are expected to result in harm and/or harassment due to degradation of water quality and/or habitat that may cause mortality of glochidia, juveniles, and adults, primarily as a result of increased suspended sediment loading, sedimentation (deposited sediment), and other habitat related effects.

Exposure of host fish to suspended sediment reduces attachment and metamorphosis success of glochidia (Beussink 2007). The increased radius of the gill tips, where a large proportion of glochidia normally attach, caused by fusion, clubbing, and loss of lamellae may provide a less suitable geometry for glochidia to grasp, thus reducing attachment success. Fish coughing induced by sediment may dislodge loosely attached glochidia before encapsulation. In addition to reduced attachment success, the proportion of glochidia successfully transformed is reduced following host exposure to suspended sediment. A likely mechanism involves the relationship between the keratocyte migration and encapsulation. Excessive sediments also can expose juvenile mussels to entrainment or predation and be detrimental to survival of juvenile mussels (Hartfield and Hartfield 1996). Detrimental effects of suspended sediment on mussel reproduction are most likely if high sediment loads coincide with mussel reproductive events.

Nature of the effects: It is likely the proposed action could have a variety of effects on Arkansas Fatmucket individuals and populations. Specific biological effects associated with sediment include, but may not be limited to:

1. Reduced feeding and respiratory efficiency from clogged gills.
2. Disrupted metabolic processes.
3. Reduced growth rates.
4. Limited burrowing activity.
5. Physical smothering.
6. Vector for delivering contaminants such as nutrients and pesticides.
7. Decrease food production due to reduced light availability for photosynthesis.
8. Affects sight-feeding fish that serve as host for mussels to complete their life cycle.
9. Gill trauma and the variety of associated physiological effects (e.g., hyperplasia and hypertrophy of gill cells and tissue, inflammatory responses including mucus secretion, increased hematocrit, erosion, branchial leasions and fusion of gill surfaces, and susceptibility to infection).
10. Reduced attachment and metamorphosis success of glochidia.
11. Detrimental effects not immediately apparent.

Specific physical effects associated with sediment include, but may not be limited to:

1. Altered suspended and bed material loads.
2. Clogged interstitial habitats.
3. Reduced interstitial flow rates and dissolved oxygen levels.
4. Changed channels in form, position, and degree of stability.

5. Altered depth or width/depth ratio that affects light penetration and flow regime.

6. Reduced channel capacity exacerbating downstream bank erosion.

7. Aggraded (filling) or degraded (scouring) channels.

8. Changed channel position that dewater habitats formerly inhabited by mussels/fish.

It is important to note that most of these negative effects will be temporary in nature and that the proposed stabilization of the actively eroding streambank will beneficially reduce many of these same issues that are currently occurring year round.

Duration: It has been estimated that this project will take 2.5 years to complete. All disturbed areas will be permanently seeded following construction activities. All areas must meet coverage requirements outlined in the National Pollutant Discharge Elimination System permit.

Disturbance frequency: The proposed activity will result in multiple short-term disturbance events associated with each phase of construction. Once the project area has been stabilized during each phase there should be no further disturbance episodes related to this project (outside of natural disturbances associated with flooding).

Three stages of work roads will be required for the widening of the Saline River Bridge. Each stage will require work roads within the channel of the Saline River. The project is designed to replace the bridge with a modern structure and should decrease routine maintenance activities to the infrastructure. Maintenance activities such as mowing, herbicide application, etc. are not expected to change.

Disturbance intensity: Sedimentation from runoff and bank de-stabilization will occur, but should be minimal with application of proposed erosion controls and BMPs in accordance with the AHTD Construction Stormwater Program. This program has developed various BMPs, guidelines, and specifications for minimizing storm water effects. These documents include the Arkansas 2003 Standard Specification for Highway Construction (Specifications), the Stormwater Pollution and Prevention Plan (SWPPP), and the 2014 Statewide Storm Water Management Program (SWMP). The proposed work involves widening within the existing right-of-way with minimal new right-of- way acquisition for the majority of the project. Improved interchanges will require new right-of-way for construction. Within new right-of-way, trees will be mechanically cleared, piled, and burned on site. After vegetation is removed, heavy machinery will excavate and dispose of material at an approved waste area. Clearing, grubbing, or any other disturbance of vegetation on stream banks shall be limited to the minimum necessary for the completion of the project.

Some direct effects within the footprint of the project will be permanent such as the placement of rip-rap for stabilization and pier construction and replacement. The intensity will be lessened outside the footprint. There will be direct effects from temporary stages of work associated with work roads, geomorphic alteration, and bank destabilization. Over the long-term the site will be stabilized, temporary fills will be removed and banks will be re-vegetated and stabilized so that there should be no lasting sedimentation in the immediate area.

Stage 1 will consist of two work roads in the center of the existing bridge. One work road will come from the east and one from the west for a total of 7,597.4 m^3 (9,937 yd^3) below the plane of ordinary high water. All materials from the first stage shall be removed prior to second stage activities.

Stage two work roads will be constructed mainly at the downstream end of the east bound bridge. There will be two straight main roads extending from the east and west with 13 crossing roads (five on the west road and eight on the east). Each road will be located approximately 7 m (23.0 ft) downstream from the eastern bridge. A distance of 30 m (98.4 ft) will be maintained between the two work roads to accommodate low flow conditions similar to stage one. A total of 17,507.5 m^3 (22,899 yd^3) will be placed below ordinary high water mark. All material from the second stage work roads will be removed prior to the construction of this stage.

The final stage of work roads will be constructed at the upstream end of the bridge project associated with the west bound structure. Two main work roads will be constructed during this phase. The eastern main work road will be parallel to the west bound travel lane, approximately 7 m upstream. Eight work roads will be constructed to allow for access under the bridge. A portion of the work roads slope will be placed in the channel beyond the water's edge. The main western work road also will parallel the western bound bridge and have four associated roads to allow for access under the bridge. In total, 14,269.7 m^3 (18,664 yd^3) will be placed during this final stage which will be removed before project completion.

Temporary culverts to sufficiently maintain low stream flows and assist the passage of aquatic life will also be provided. Following bridge construction a layer of rip-rap will be placed between the bridge ends and the bridge piers located within the channel to prevent scour.

Disturbance severity: Temporary effects to water quality are common during highway construction activities. These effects can be lessened with the proper implementation and maintenance of BMPs for erosion control. Efforts (BMPs) will be implemented to reduce and limit adverse effects to water quality.

The habitat present at the site currently is marginal and supports few listed mussels. The negative effects of the proposed action will be limited in scope and mostly temporary and are not expected to affect Arkansas Fatmucket at the population level. It is possible that a few individuals may be affected. However, the area should be stabilized within a short period following implementation of erosion controls and application of the BMPs.

Analyses for effects of the action

Beneficial Effects

Beneficial effects are those effects of an action that are wholly positive, without any adverse effect, on a listed species or designated critical habitat. The Service has determined that there are no wholly beneficial effects associated with the proposed action.

Direct effects

Direct effects are the direct or immediate effects of the agency action on the species or its habitat. Direct effects include the effects of any interrelated or interdependent actions. Interrelated actions are part of the proposed action and depend on the proposed action for justification. Interdependent actions are those actions that have no independent utility apart from the action under consultation. Future federal actions that are not a direct effect of the action under consideration are not considered in this BO. The proposed action occurs alongside and in the Saline River. The stream reach is occupied by the Arkansas Fatmucket and AHTD surveys detected 7 individuals within the action area.

The proposed action will directly affect Arkansas Fatmucket, their host fish, and their habitats in the Saline River. Direct effects of the proposed action to Arkansas Fatmucket include harassment, harm, and potential mortality from bridge construction (e.g., bridge pilings, placement of temporary work roads and culverts, the demolition/removal of the existing structures and placement of rip rap within previously occupied habitats for work pads and scour prevention). These activities could result in mortality or injury of any mussels that are not transferred out of the action area during the translocation effort.

Direct effects of mussel translocation include harm, harassment and possible mortality due to the stress of being handled, processed, and relocated. These effects can result in premature release of sperm or aborted glochidia negatively affecting reproductive success. A trained malacologist that holds an active Section 10(a)(1)(A) permit from the Service will accomplish the relocation work, which will minimize some of these effects.

During placement of work roads, rip rap could accidently fall within the confines of the bed directly smashing mussels. Additionally, heavy machinery could be driven through the water during the placement of work roads causing direct mortality of mussels. While direct mortality due to smashing could result from either the construction or removal of work roads, placement of rip rap in the channel will likely alter the flow regime causing either sediment accumulation or scouring change. During all phases of this estimated 2.5 year project, impairments to water quality, and altered flow will affect the mussel community located within the delineated bed.

The project is designed to replace the bridge with a modern structure and should decrease routine maintenance activities to the infrastructure. Maintenance activities such as mowing, herbicide application, etc. are not expected to change.

Indirect effects

Indirect effects are caused by or result from the proposed action, are later in time and reasonably certain to occur. Any long-term indirect effects should be minor and beneficial as a result of reductions in sedimentation associated with the actively eroding streambank. Increases in sedimentation and turbidity should be restricted to areas near the construction site and will be temporary in nature. However, these temporary changes could result the following effects.

Habitat Degradation – Adverse effects may degrade the quality of habitat in the action area. Suspended and bed sediment loading and sedimentation may lead to a loss in the availability and quality of habitat in the Saline River. Arkansas Fatmucket may be indirectly affected by temporary habitat degradation and/or loss through alteration to stream geomorphology characteristics, and may be indirectly affected by this until conditions stabilize and become suitable for recolonization.

Three piers will be placed within the wetted width of the channel while six will be removed. The change in placement of these piers will alter hydrologic and geomorphologic characteristics within the channel. Additionally, work roads that are constructed and removed will likely leave a different flow regime after construction. Placement of rip rap to reduce scour and stabilize banks may reduce habitat availability. These structures and stabilizing features will likely alter existing flow patterns that could interfere with species of freshwater organisms including mussels.

Water and Sediment Quality Degradation – Petroleum products from improperly maintained construction equipment and storage areas can make their way into receiving streams if preventative measures are not properly followed. Staging areas will be sited to minimize the potential for such contamination. Special provisions will be included in the contract to limit quantities and locations of storage tanks.

Temporary effects to water quality from increased siltation and turbidity increases due to erosion, bed destabilization, and hydrologic alteration are common during highway construction activities. These effects can be lessened with the proper implementation of BMPs for erosion control. All efforts to reduce and limit adverse effects to water quality will be implemented.

The clearing and grubbing of trees will take place on new right-of-way directly adjacent to the current I-30 corridor. Additionally, interchanges at U.S. Highways 67 and 70 and Sevier Street will be reconstructed requiring tree clearing. A total of 6.2 hectares (15.3 acres) of currently forested area is estimates to be cleared. All measures will be taken to ensure proper sediment and erosion control to prevent run off into waterways.

Food Availability, Reproduction, and Metabolic Processes – Arkansas Fatmucket may be indirectly affected by limitation or reduction in available food, harassment during brooding or to infected host fish, or disruption of metabolic processes.

Construction related activities have the potential to disrupt the reproductive cycle of the mussel in a variety of ways. Vibrations, which are common during construction, have stimulated mussels to artificially release glochidia in lab settings. Also temporary effects to water quality may affect host fish (largemouth and spotted bass) by causing avoidance of the area, limiting visibility of the mussel's lure, or decreasing available food forage. Both vibrations and sedimentation are common during construction activities. Any disturbances that may reduce the number of fish within the action area have the potential to reduce mussel/host interactions.

Land Use Effects – This area has been utilized for recreation and will likely continue to be used in the future. Changes to channel depth may increase off road vehicle use of currently unused areas. Highway infrastructure improvements have been associated with increases in residential, commercial, and industrial development. Those types of development would likely lead to increased amounts of non-point source pollution which impair water quality.

Global Climate Change – Our analyses under the ESA include consideration of ongoing and projected changes in climate. The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Mussels can be placed into thermal guilds, thermally sensitive and thermally tolerant species, according to their response to warm summer water temperatures greater than 35 °C (95 °F) (Spooner and Vaughn 2008). Although we do not have physiological data on Arkansas Fatmucket, a closely related species, *Lampsilis cardium*, is thermally sensitive (Spooner and Vaughn 2008). Data for the Kiamichi River in Oklahoma suggests that, over a 17 year period as water and air temperatures have increased, mussel beds once dominated by thermally sensitive species are now dominated by thermally tolerant species (Galbraith et al. 2010; Spooner and Vaughn 2008). As temperature increases due to climate change, these mussels may experience population declines as warmer rivers are more suitable for thermally tolerant species.

The proposed action is likely to result (directly and/or indirectly) in the emission of greenhouse gases. While it is likely the observed increase in global average temperatures is due to the observed increase in human-induced greenhouse gas concentrations, the best scientific data available today does not allow us to draw a causal connection between specific greenhouse gas emissions and effects posed to the Arkansas Fatmucket, nor is there sufficient data to establish that such effects are reasonably certain to occur.

Summary of Indirect Effects – The life history traits and habitat requirements of the Arkansas Fatmucket, and other freshwater mussels in general, make them extremely susceptible to environmental change. Unlike other aquatic organisms (e.g., aquatic insects and fish), mussels have limited refugia from stream disturbances (e.g., sedimentation). The synergistic (interaction of two or more components) effects of threats are often complex in aquatic environments, making it difficult to predict changes in mussel and fish host(s) distribution, abundance, and habitat availability that may result from these effects. While these stressors may act in isolation, it is more probable that many stressors are acting simultaneously (or in combination) (Galbraith *et al.* 2010).

CUMULATIVE EFFECTS

Cumulative effects include the combined effects of any non-Federal action (e.g., future State, local, or private actions) reasonably certain to occur within the action area covered in this BO. Future Federal actions unrelated to the proposed action are not considered in this section because they require separate consultation under section 7 of the Act. In particular, many of the large-scale activities that could occur in the action area, such as highway development, storm water permits, U.S. Army Corps of Engineers' 404 permits, would have a federal nexus that require an independent consultation under section 7 of the Act.

Numerous land use activities that affect the Arkansas Fatmucket and that likely occur within the action area include: timber harvest, recreational use, and development associated with road, residential, industrial and agricultural development and related activities. These private actions are likely to occur within the action area, but the Service is unaware of any quantifiable information relating to the extent of private timber harvests and recreational use within the action area. Similarly, the Service does not have any information on the amount of residential, industrial, or agricultural development that has or will occur within the action area. The Service is unable to make any determinations or conduct any meaningful analysis of how these effects with no quantifiable information may or may not adversely and/or beneficially affect this species. We can say it is possible these activities, when they occur, may have cumulative effects on this species and its habitats in certain situations. In stating this, however, we can only speculate as to the extent or severity of those effects, if any.

Cumulative pressure on existing populations of Arkansas Fatmucket can be caused by silviculture activities and other forest conversion activities (e.g., urbanization of the watershed) related to agriculture. Legal and illegal gravel mining activities will likely continue within the watershed and may even increase with further urban development and need for resources. Deleterious influences from improperly maintained poultry, swine, and cattle operations may also affect water quality, riparian, and aquatic habitats in the Saline River.

CONCLUSION

After reviewing the current status of Arkansas Fatmucket, the environmental baseline for the action area, effects of the proposed action, and cumulative effects of the proposed action, it is the Service's BO that the proposed action is not likely to jeopardize the continued existence of Arkansas Fatmucket. No critical habitat has been designated for Arkansas Fatmucket.

Because of our analysis, we do not believe the proposed action "would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of Arkansas Fatmucket by reducing the reproduction, numbers, or distribution of Arkansas Fatmucket (50 CFR 402)." In fact, we believe that neither survival nor recovery will be reduced appreciably for reasons summarized later in this section.

For the proposed action to "reduce appreciably" numbers of Arkansas Fatmucket, the proposed action would have to impede or stop the process by which this species's ecosystem is restored, and/or threats to this species is removed, so that self-sustaining and self-regulating populations can be supported as persistent members of native biotic communities (Service and NMFS 1998, pages 4-35). We do not believe the proposed action impedes or stops the recovery process for the Arkansas Fatmucket because:

1. We are reasonably certain the proposed action will result in incidental take of some individuals but the proposed action is not a significant threat to the species as a whole and, therefore, does not rise to the level of jeopardy.

2. No component of the proposed action is expected to result in harm, harassment, or mortality at a level that would appreciably reduce the reproduction, numbers, or distribution of Arkansas Fatmucket.

3. The adverse effects to Arkansas Fatmucket associated with the proposed action will have minor effects on this species. Additionally, as a result of the proposed action, these adverse effects will be minimized through Reasonable and Prudent Measures (RPMs) and Terms and Conditions that implement those RPMs.

4. The primary threats to the Arkansas Fatmucket recovery are destruction and alteration of habitat at inhabited sites and at the watershed level (holistic effects on aquatic ecosystems). The proposed action directly affects only a very small number of individuals at the inhabited mussel bed immediately adjacent to the site. Furthermore, we are reasonably certain the watershed will not be degraded to the point at which it cannot sustain the species by this action directly, indirectly, or as a result of associated cumulative actions.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which included, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out of an otherwise lawful activity. Under terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the FHWA/AHTD so they become binding conditions of any grant, contract, or permit issued to an applicant, contractor, or permittee, as proper, for the exemption in section 7(o)(2) to apply. The Service has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the FHWA/AHTD (1) fails to assume and implement the terms and conditions or (2) fails to require contractors or other parties conducting work on behalf of the FHWA/AHTD to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms added to the permit, contract, or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the effect of incidental take, the FHWA/AHTD must monitor and report the progress of the action and its effects to the Service as specified in the Incidental Take Statement.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

Take will likely occur to mussels in the action area when the bridge replacement work begins, as mussels in the action area that cannot be located during translocation efforts may not survive. It is possible that these mussels could be harmed, harassed or killed as a result of increased sedimentation and turbidity, dislodgement, or crushing from bridge construction activities. We do not anticipate complete survival of translocated Arkansas Fatmucket, as translocation is highly stressful to mussels. The Service anticipates no more than 12 Arkansas Fatmucket will be taken incidental to actions required during construction and/or relocation of these mussels. This level of take is approximated by densities of Arkansas Fatmucket in beds located immediately upstream of the project site. In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the Arkansas Fatmucket. Therefore, the level of take anticipated in the BO is 12 individuals. The incidental take statement anticipates the taking of Arkansas Fatmucket only from the actions associated with the proposed activity.

In order to be exempt from the prohibitions of section 9 of the Act, the FHWA/AHTD must ensure that permittees implement the action as proposed. If the FHWA/AHTD wishes to modify the action including conservation measures, we suggest the FHWA/AHTD contact the Service for further recommendations and/or for reinitiation of this consultation.

EFFECT OF THE TAKE

In this BO, the Service determined this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize effects of incidental take of Arkansas Fatmucket:

1. FHWA/AHTD will implement the proposed action as described above in this BO.

2. FHWA/AHTD will relocate all Arkansas Fatmucket found within the action area.

3. FHWA/AHTD will provide funds to support two years of Arkansas Fatmucket propagation in the headwaters of the Saline River.

4. FHWA/AHTD will ensure erosion control BMPs are properly installed and maintained to minimize sediment effects.

5. FHWA/AHTD will install and maintain stable river crossings and approaches to minimize sediment effects.

6. FHWA/AHTD will stabilize stream banks within and immediately adjacent to I-30 right-of-way (within action area) to minimize sediment and channel geomorphology effects.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, the FHWA/AHTD must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline reporting/monitoring requirements. These terms and conditions are non-discretionary.

This Term and Condition is associated with Reasonable and Prudent Measure 1.

1. FHWA/AHTD will fully implement the proposed action and in accordance with the terms and conditions that implement RPMs 2 – 6.

These Terms and Conditions are associated with Reasonable and Prudent Measure 2.

1. A qualified malacologist acceptable to the Service will oversee mussel relocation activities.

2. All Arkansas Fatmucket individuals encountered within the action area will be tagged and relocated to a Service and AGFC designated site between the Lyle Park and I-30 boat accesses.

3. Arkansas Fatmucket will not be relocated during brooding periods.

4. Mussels will be kept moist and cool during transport. Mussels will be transported in containers of aerated, river water provided water temperature and quality can be adequately monitored and controlled. Container water temperatures must be within 5° F of the point of capture.

5. Once Arkansas Fatmucket individuals are removed from the river, transportation to and relocation at a suitable site shall occur within 24 hours.

6. All dead or moribund Arkansas Fatmucket that contain soft tissue will be preserved according to standard museum practices and in a manner that preserves genetic material (not frozen or 70% alcohol). Any losses will be reported within 72 hours to Lindsey Lewis at the U.S. Fish and Wildlife Service Office, 110 South Amity Road, Conway,

Arkansas, 72032, (501) 513-4481.

These Terms and Conditions are associated with Reasonable and Prudent Measure 3.

1. FHWA/AHTD will provide two years of funding to a Service approved propagation facility to support Arkansas Fatmucket propagation efforts in the Saline River headwaters.

2. FHWA/AHTD will provide funds to a Service approved propagation facility prior to termination of the AGFC's existing contract for Arkansas Fatmucket propagation in the Saline River headwaters.

These Terms and Conditions are associated with Reasonable and Prudent Measure 4.

1. FHWA/AHTD will ensure strict adherence and enforcement of erosion control BMPs during construction and until bare erodible soils are 95 percent revegetated. BMPs will be implemented and maintained in accordance with AHTD's Specifications, SWPPP and/or SWMP unless otherwise noted below.

2. FHWA/AHTD will not implement new construction activities if the soil disturbance cannot be stabilized (i.e., installation of temporary and/or permanent BMPs) before rainfall is likely to occur.

3. FHWA/AHTD will install temporary BMPs during project delays or stops to minimize sediment delivery to the Saline River in accordance with the . AHTD's Specifications, SWPPP and/or SWMP.

This Term and Condition is associated with Reasonable and Prudent Measure 5.

1. FHWA/AHTD will strive for zero sediment discharge during installation of stream crossing structures in accordance with the AHTD's Specifications, SWPPP and/or SWMP unless otherwise noted below.

This Term and Condition is associated with Reasonable and Prudent Measure 6.

1. FHWA/AHTD will strive to stabilize stream banks within and immediately adjacent to the I-30 right-of-way (within action area) to minimize sediment and channel geomorphology in accordance with the AHTD's Specifications, SWPPP and SWMP unless otherwise noted below.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the effect of incidental take that might otherwise result from the proposed action. The Service believes that no more than 12 Arkansas Fatmucket will be incidentally taken. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring re-initiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to use their authorities to further the purpose of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse impacts of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service encourages FHWA/AHTD to develop a programmatic section 7(a)(1) mussel conservation plan for future highway construction and maintenance activities.

REINITIATION NOTICE

This concludes formal consultation regarding the FHWA/AHTD proposed action and its effects on the Arkansas Fatmucket. As provided in 50 CFR Sec 402.16, reinitiation of formal consultation is required where discretionary FWHA/AHTD involvement or control over the action has been retained (or is authorized by law) and if:

1. The amount or extent of taking specified in the incidental take statement is exceeded;
2. New information reveals effects of FHWA's action that may affect listed species or critical habitat in a manner or to an extent not previously considered ;
3. FHWA's action is subsequently modified in a manner that was not considered in the BO ; or
4. A new species is listed or critical habitat is designated that may be affected by the action.
5. Should the incidental take level be reached, project work will cease immediately pending reinitiation.

The Service appreciates this opportunity to work with the FHWA and the AHTD in fulfilling our mutual responsibilities under the ESA. Please contact Lindsey Lewis of this office at 501-513-4489 or Lindsey_Lewis@fws.gov, if you have any questions or require additional information.

Sincerely,

Melvin Tobin
Field Supervisor

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cc: Randal Looney, Federal Highway Administration
Johnny Mclean, United States Army Corps of Engineers
Mark Hathcote, Arkansas Department of Environmental Quality
Kendall Moles, Arkansas Game and Fish Commission
Jennifer Sheehan, Arkansas Game and Fish Commission
Cindy Osborne, Arkansas Natural Heritage Commission
John Turner, Arkansas Natural Resources Conservation Commission
Wanda Boyd, United States Environmental Protection Agency

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