APPENDIX I. DESCRIPTION OF CUMULATIVE EFFECTS AND ENVIRONMENTAL BASELINE OF THE TOPEKA SHINER

August 29, 2007

APPENDIX I. DESCRIPTION OF CUMULATIVE EFFECTS AND ENVIRONMENTAL BASELINE OF THE TOPEKA SHINER

Data included in this appendix were obtained from biological opinions prepared by the U.S. FWS. The number of biological opinions currently available is limited, and the action areas considered in the biological opinions is small relative to the action area considered in the current risk assessment. Therefore,

I.1. CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local, private, or other non-federal entity activities on endangered and threatened species and their critical habitat that are reasonably certain to occur in the action area. Future federal actions unrelated to the proposed action are not considered because they are subject to consultation pursuant to section 7 of the ESA. Although there is a lack of definite information on future state, local or private actions which may occur, numerous non-federal actions that could affect listed species are reasonably certain to occur within the action area. These will typically include silviculture, mining, forestry, agriculture, grazing activities, development of commercial confined animal feeding operations, dredging, construction activities such as bridge construction, and urban development. Each of these future activities could contribute to cumulative effects on the Topeka shiner or its critical habitat in the action area.

I.2. ENVIRONMENTAL BASELINE

The environmental baseline is defined as the effects of past and ongoing human induced and natural factors leading to the status of the species, its habitat, and ecosystem, within the action area. The environmental baseline is a snapshot of the Topeka shiner's status at this time. However, baseline condition of each of the shiner's habitat varies across locations and even within each stream/river. Given the large number of habitats and extent of the action area included of this assessment, the discussion of environmental baseline is limited to a general discussion of factors that may affect the Topeka shiner within the action area and was provided by U.S. FWS (2007, personal communication with V. Tabor via email). In addition, some recent biological opinions have been prepared by the U.S. FWS that provide information on environmental baseline of the Topeka shiner. These are summarized in Attachment 1 and 2 of this appendix.

I.2.1. Factors affecting species environment within the action area

The decline and extirpation of the Topeka shiner is primarily attributed to habitat alteration and destruction. This is largely caused by dramatic land use change and channelization. While this species was once abundant and widely distributed throughout the central Great Plains and western tallgrass prairie regions, the Topeka shiner now inhabits less than 10 percent of its original geographic range. The action most likely impacting the species to the greatest degree in the past is sedimentation and

eutrophication resulting from intensive agricultural development. Most populations of Topeka shiners occurring west of the Flint Hills region of Kansas are believed to have been extirpated prior to 1935 (Cross and Moss 1987). Minckley and Cross (1959) report that watersheds with high levels of cultivation and subsequent siltation, and domestic pollution are unsuitable for the species. These streams often cease to flow and become warm and muddy during the summer months. Cross (1970) indicates that some of the areas where depletion of the species has occurred also coincide with areas having poor aquifers. Pflieger (1975) reports that increased siltation as a result of intensive cultivation may have reduced the amount of Topeka shiner habitat in Missouri. Feedlot operations on or near streams are also known to impact prairie fishes due to organic input resulting in eutrophication (Cross and Braasch 1968).

The species was historically known from open pools of small prairie streams with cool, clear water. Many streams of this nature reportedly existed throughout the geographic range of the Topeka shiner "prior to the plowing of the prairie sod" (Cross 1967). These conditions continue to exist in many of the streams in the Flint Hills region of Kansas, including Fort Riley, primarily due to shallow, rocky soils with numerous limestone exposures which prevent cultivation. This is in contrast to the changes in the natural fish faunas and their associated habitats in prairie areas more suitable to intensive rowcrop agriculture, which is characteristic of the vast majority of the natural range of the species (Menzel et al. 1984). Menzel et al. (1984) also note accelerated rates of soil erosion and instream deposition caused by the action of flowing water throughout many modified prairie streams in areas of Iowa encompassed by the former range of the species. Today, outside the Flint Hills region of Kansas, only a few, small isolated areas not severely impacted, or impacted to an extent within the tolerance of the species, continue to exist.

Channelization negatively impacts many aquatic species, including the Topeka shiner, by eliminating and degrading instream habitat types, altering the natural physical characteristics of surface waters, and by changing water quality (Simpson et al. 1982). Menzel (in litt. 1980) reports the extirpation of Topeka shiners from previous collection sites following stream channelization projects in Iowa. During 1994 surveys conducted by the Service across Iowa, most streams were found to have been severely altered. Changes included elimination of pool habitats, instream debris, and woody riparian vegetation. Water velocities were consistently high throughout the channel and deep silt was the dominant substrate. At Iowa sites where Topeka shiners were captured, streams were not as intensively channelized and many natural conditions persisted. Schrank et al. (2001) developed a logistic model that predicted the probability of Topeka shiners being extirpated from previously occupied streams in Kansas. The significant predictor variables in their model, those features which were most likely to lead to extirpation, were number of small impoundments in the watershed, length of pool, and catch per unit effort of largemouth bass.

Habitat fragmentation for a species can increase genetic differentiation between populations and reduce genetic variation within populations. A genetics study using mitochondrial DNA was completed for the Topeka shiner (Michels 2000), with samples taken from different drainages in every state in the occupied range except Nebraska. The study

showed that sufficient genetic similarities exist to identify three major groups of Topeka shiners: 1) Arkansas River drainage (Kansas); 2) Kansas and Lower Missouri River drainages (Kansas and Missouri); and 3) Upper Missouri and Des Moines River drainages (Minnesota, Iowa, and South Dakota). Results indicated that genetic differences occur between individual populations, even in adjacent streams, and that genetic variation is low within many populations. However, the conclusion is that this is primarily due to the species' preference for naturally-isolated or discontinuous habitat, rather than human-caused isolation due to habitat fragmentation. Therefore, while each population may contain some level of genetic uniqueness, each comprises part of one of three larger genetic groupings with shared characteristics.

Sampling effort has been sporadic across the species' range since its listing in 1999, with very little new information available for the states of Iowa, Minnesota, and Nebraska. Sampling across portions of the Kansas distribution does not indicate a significant change in that state's population status. Unpublished data from Missouri sampling over the period 2000-2002 indicates significant declines in the amount of occupied habitat from that previously known. This is in spite of the fact that Missouri has an active management plan being implemented for the conservation of the species (MDC 1999). The only portion of the range which has documented an increased number of occupied sites is in South Dakota, where intensive sampling through 2000 located the species at several sites previously not known to be occupied (Wall et al. 2001). Coupled with less intensive sampling conducted since that report (Shearer 2003), Topeka shiners have been located in at least low numbers at enough sites to comprise the bulk of its previously known historic distribution in South Dakota, information which was lacking at the time the species was listed.

I.2.2. Status of Critical Habitat

Designation of critical habitat must consider the physical and biological features that are essential to conservation of the species. These features, referred to as the primary constituent elements of critical habitat, include, but are not limited to: (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, rearing (or development) of offspring; and (5) habitats protected from disturbance or that are representative of the historic geographical and ecological distributions of the species.

Activities cited in the Federal Register notice which may adversely modify Topeka shiner critical habitat include those which significantly and detrimentally alter the minimum or natural flow regime, the riparian zone characteristics, the channel morphology, or the water chemistry of a proposed stream segment, or which introduce or spread populations of nonnative competitive species. Some specific actions which were cited in the proposal which may adversely affect critical habitat include groundwater pumping, stream impoundment, water diversion, vegetation removal or manipulation, timber harvest, road and bridge construction and maintenance, livestock grazing, off-road vehicle use, powerline or pipeline construction and repair, mining, urban and suburban development, stream channelization, substrate removal, reduction in available floodplain, chemical or biological pollution, nonnative fish stocking, use of live bait fish, aquaculture, construction and operation of canals, and interbasin water transfers.

Many of these activities are continuing within the action area, including intensive row-cropping of runoff areas draining directly into Topeka shiner streams, overgrazing of riparian areas along streams, overwintering of livestock in confined feeding areas along streams, and construction and replacement of bridges and culverts over streams. Mainstem reservoir development, tributary impoundment, and channelization have impacted the species in many areas. Populations located within small tributary streams upstream from both mainstem and tributary impoundments attempt to utilize these water bodies as refuges from drying streams during periods of drought. During this time, the populations are subject to predation by larger predatory fish inhabiting the impounded water bodies. In unaltered systems, fish move downstream during drought to find suitable habitat. Deacon (1961) reports that fishes characteristic of the small and mid-sized tributaries of the Neosho and Marais des Cygnes rivers' watersheds occurred in the mainstems following several years of protracted drought in the mid-1950's. Tributary dams also serve to block migration of fishes upstream following drought, prohibiting recolonization of upstream reaches

Attachment 1: Summary of Biological Opinions prepared by the U.S. FWS on the Topeka Shiner

Description of Federal Action	Citation	Location	Magnitude of Take	Jeopardy Call
Stockpiling of gravel within the channel of Mill Creek and several of its tributaries during commercial gravel excavation	U.S. FWS, 2000	Mill Creek watershed, including all tributaries, in Wabaunsee County, Kansas	< 25 individuals	Not likely to result in jeopardy
Road and bridge maintenance and repair program	U.S. FWS, 2002	Streams and drainage areas of Wildcat, Sevenmile, Wind, Little Arkansas, Threemile, Fourmile, Honey and Forsyth creeks on Fort Riley Military Reservation, Kansas	< 10 individuals annually	Not likely to result in jeopardy
Bridge construction and relocation of streambed.	U.S. FWS, 2003	Clear Fork Creek in Pottawatomie and Marshall counties, Kansas	Unknown but expected	Not likely to result in jeopardy

Attachment 1 References

U.S. FWS. 2000. Biological Opinion. Letter to Department of the Army DES-Conservation Division AFZN-ES-N April 4, 2002

U.S. FWS. 2002. Biological Opinion. Letter to Department of the Army DES-Conservation Division AFZN-ES-N April 4, 2002

U.S. FWS. 2003. Biological Opinion. Letter to Department of the Army DES-Conservation Division AFZN-ES-N April 4, 2002

Attachment 2. Excerpts from Biological Opinions listed in Attachment 1 that describe environmental baseline of the assessed species.

U.S. FWS, 2000
Species: Topeka Shiner
Location: Mill Creek watershed, including all tributaries, in Wabaunsee County, Kansas

The action area considered in this biological opinion is the entire Mill Creek watershed, including all tributaries, in Wabaunsee County, Kansas. This project area represents less than five percent of the occupied range of the species. This opinion assesses the potential impacts resulting from Mr. Hafenstine's gravel excavation, stockpiling, and removal, which could have an impact on in-stream habitat, channel integrity, and water quality through increased runoff and sedimentation, as well as the potential for direct take of Topeka shiners.

Status of the Species

Once abundant and widely distributed throughout the central Great Plains and western tallgrass prairie regions, the Topeka shiner now inhabits less than 10 percent of its original geographic range. The action most likely impacting the species to the greatest degree in the past is sedimentation and eutrophication resulting from intensive agricultural development. Most populations of Topeka shiners occurring west of the Flint Hills region of Kansas are believed to have been extirpated prior to 1935 (Cross and Moss 1987). Minckley and Cross (1959) report that watersheds with high levels of cultivation and subsequent siltation, and domestic pollution are unsuitable for the species. These streams often cease to flow and become warm and muddy during the summer months. Cross (1970) indicates that some of the areas where depletion of the species has occurred also coincide with areas having poor aquifers. Pflieger (1975) reports that increased siltation as a result of intensive cultivation may have reduced the amount of Topeka shiner habitat in Missouri. Feedlot operations on or near streams are also known to impact prairie fishes due to organic input resulting in eutrophication (Cross and Braasch 1968).

The species was historically known from open pools of small prairie streams with cool, clear water. Many streams of this nature reportedly existed throughout the geographic range of the Topeka shiner "prior to the plowing of the prairie sod" (Cross 1967). These conditions continue to exist in many of the streams in the Flint Hills region of Kansas, primarily due to shallow, rocky soils with numerous limestone exposures which prevent cultivation. This is in contrast to the changes in the natural fish faunas and their associated habitats in prairie areas more suitable to intensive rowcrop agriculture, which is characteristic of the vast majority of the natural range

of the species (Menzel et al. 1984). Menzel et al. (1984) also note accelerated rates of soil erosion and instream deposition caused by the action of flowing water throughout many modified prairie streams in Iowa, encompassed by the former range of the species. Today, outside the Flint Hills region of Kansas, only a few, small isolated areas not severely impacted, or impacted to an extent within the tolerance of the species, continue to exist.

Stream channelization also has occurred throughout much of the Topeka shiner's range. Channelization negatively impacts many aquatic species, including the Topeka shiner, by eliminating and degrading instream habitat types, altering the natural physical characteristics of surface waters, and by changing water quality (Simpson et al. 1982). Menzel (in litt. 1980) reports the extirpation of Topeka shiners from previous collection sites following stream channelization projects in Iowa. During 1994 surveys conducted by the Service across this portion of the range, most streams were found to have been severely altered. Changes included elimination of pool habitats, instream debris, and woody riparian vegetation. Water velocities were consistently high throughout the channel and deep silt was the dominant substrate. At Iowa sites where Topeka shiners were captured, streams were not as intensively channelized and many natural conditions persist.

Environmental Baseline

The environmental baseline is an analysis of the collective effects of past and ongoing human and natural factors leading to the current status of the species or its habitat and ecosystem, the effects of the proposed action and the cumulative effects in the action area. This analysis describes the status of the species and factors affecting the environment of the species in the proposed action area during the consultation. The baseline includes state, local, and private actions already affecting the species. Unrelated federal actions that have completed formal or informal consultations also are part of the environmental baseline, as are federal and other actions within the action area that may benefit listed species.

A detailed review of the human activities which have led to the present status of the species was discussed above. Many of these activities are continuing in Kansas, including intensive row-cropping of runoff areas draining directly into Topeka shiner streams, overgrazing of riparian areas along streams, overwintering of livestock in confined feeding areas along streams, and construction and replacement of bridges and culverts over streams.

Mainstem reservoir development, tributary impoundment, and channelization have impacted the species in many areas. Populations located within small tributary streams upstream from both mainstem and tributary impoundments attempt to utilize these water bodies as refuges from drying streams during periods of drought. During this time, the populations are subject to predation by larger predatory fish inhabiting the impounded water bodies. In unaltered systems, fish move downstream during drought to find suitable habitat. Deacon (1961) reports fishes characteristic of the small and mid-sized tributaries of the Neosho and Marais des Cygnes rivers' watersheds occurred in the mainstems following several years of protracted drought in the mid-1950's. Tributary dams also serve to block migration of fishes upstream following drought, prohibiting recolonization of upstream reaches.

Substantial tributary impoundment is occurring throughout the Flint Hills region of Kansas, endangering the viability of Topeka shiner populations at these locales. Numerous tributary impoundments have been completed in or near habitat for the Topeka shiner in the Cottonwood River basin, with many more potentially planned for construction. Presently in the Mill Creek watershed, which contains the largest remaining complex of habitat for the species, 18 dams have been constructed with additional structures planned. However, the Mill Creek watershed district board of directors has entered into a conservation agreement with the Service and Kansas Department of Wildlife and Parks to conserve the species. This conservation agreement allows for continued dam development in portions of the basin without Topeka shiners or where there are less viable populations, and eliminates development in the areas with complex populations. The agreement also requires habitat improvement and enhancement throughout the occupied portion of the basin. However, this agreement can be terminated by any signatory during the included 5-year review. Also, the agreement would be ineffective if not implemented.

During the period when the Topeka shiner was proposed for federal classification as an endangered species, the Service completed one formal conference with the Federal Highway Administration for anticipated impacts to the species. The project was the proposed renovation of Interstate 70 through Riley, Shawnee, and Wabaunsee counties, with several in-stream culvert extensions or constructions. The Service provided the Federal Highway Administration a formal conference opinion in September 1998, indicating our opinion that the proposed activity is not likely to jeopardize the continued existence of the Topeka shiner. Adverse impacts to the shiner or its habitats were addressed through reasonable and prudent measures provided in the opinion. This conference opinion was later accepted by both agencies as the final biological opinion after the species was finally listed as endangered. A number of additional bridge or culvert activities have been assessed since that time, with the same measures employed in each case to arrive at a determination that the actions would not likely adversely affect the species.

Effects of the Action

The possible adverse impact to the Topeka shiner population in the Mill Creek watershed from this proposed action results from habitat impacts and water quality deterioration caused by in-stream gravel excavation activities, elimination of streambank vegetation which filters runoff, degradation of streambank stability, and possible outright taking of individual Topeka shiners.

Cumulative Effects

Cumulative effects include the effects of future state, local or private actions that are reasonably certain to occur in the area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act. There is a lack of definite information on future state, local or private actions which may occur. It is anticipated that once this consultation is completed, additional commercial gravel interests will be identified. If these involve stockpiling, they will likely also be subject to the section 7 process; if not, their potential for impacts will have to evaluated by other means. Interest has been generated in recent years in

the development of commercial confined animal feeding operations in Kansas. These operations would have to meet water quality standards established by the State of Kansas, so it is unknown to what extent they may impact Topeka shiner populations or habitat.

Summary

After reviewing the current status of the Topeka shiner, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the proposed excavation and temporary stockpiling of gravel from Mill Creek and several of its tributaries by Hafenstine Construction Company is not likely to jeopardize the continued existence of the species. Federally-designated critical habitat has not yet been identified for this species; therefore, none will be affected.

U.S. FWS, 2002
Species: Topeka Shiner
Location: Fort Riley Military Reservation, Kansas

The action area considered in this biological opinion includes the streams and drainage areas of Wildcat, Sevenmile, Wind, Little Arkansas, Threemile, Fourmile, Honey and Forsyth creeks on Fort Riley Military Reservation, Kansas. This project area represents less than one percent of the occupied range of the species. This opinion assesses the potential impacts resulting from stream crossing activities, which could have an impact on in-stream habitat, channel integrity, and water quality through increased runoff and sedimentation, as well as the potential for direct take of Topeka shiners during construction and use of hardened, low water crossings.

Status of the Species

Once abundant and widely distributed throughout the central Great Plains and western tallgrass prairie regions, the Topeka shiner now inhabits less than 10 percent of its original geographic range. The action most likely impacting the species to the greatest degree in the past is sedimentation and eutrophication resulting from intensive agricultural development. Most populations of Topeka shiners occurring west of the Flint Hills region of Kansas are believed to have been extirpated prior to 1935 (Cross and Moss 1987). Minckley and Cross (1959) report that watersheds with high levels of cultivation and subsequent siltation, and domestic pollution are unsuitable for the species. These streams often cease to flow and become warm and muddy during the summer months. Cross (1970) indicates that some of the areas where depletion of the species has occurred also coincide with areas having poor aquifers. Pflieger (1975) reports that increased siltation as a result of intensive cultivation may have reduced the amount of Topeka shiner habitat in Missouri. Feedlot operations on or near streams are also known to impact prairie fishes due to organic input resulting in eutrophication (Cross and Braasch 1968).

The species was historically known from open pools of small prairie streams with cool, clear water. Many streams of this nature reportedly existed throughout the geographic range of the Topeka shiner "prior to the plowing of the prairie sod" (Cross 1967). These conditions continue to exist in many of the streams in the Flint Hills region of Kansas, including Fort Riley, primarily due to shallow, rocky soils with numerous limestone exposures which prevent cultivation. This is in contrast to the changes in the natural fish faunas and their associated habitats in prairie areas more suitable to intensive rowcrop agriculture, which is characteristic of the vast majority of the natural range of the species (Menzel et al. 1984). Menzel et al. (1984) also note accelerated rates of soil erosion and instream deposition caused by the action of flowing water throughout many modified prairie streams in areas of Iowa encompassed by the former range of the species. Today, outside the Flint Hills region of Kansas, only a few, small isolated areas not severely impacted, or impacted to an extent within the tolerance of the species, continue to exist.

Stream channelization also has occurred throughout much of the Topeka shiner's range. Channelization negatively impacts many aquatic species, including the Topeka shiner, by eliminating and degrading instream habitat types, altering the natural physical characteristics of surface waters, and by changing water quality (Simpson et al. 1982). Menzel (in litt. 1980) reports the extirpation of Topeka shiners from previous collection sites following stream channelization projects in Iowa. During 1994 surveys conducted by the Service across this portion of the range, most streams were found to have been severely altered. Changes included elimination of pool habitats, instream debris, and woody riparian vegetation. Water velocities were consistently high throughout the channel and deep silt was the dominant substrate. At Iowa sites where Topeka shiners were captured, streams were not as intensively channelized and many natural conditions persist.

Based on the significant declines in populated areas, as well as the serious continued threats to the species, a proposed rule to list the Topeka shiner as endangered with no critical habitat was published in the Federal Register on October 24, 1997 (62 FR 55381). A final rule officially adding the species to the list of endangered species was published in the Federal Register on December 15, 1998 (63 FR 69008), with the listing taking effect January 14, 1999.

Environmental Baseline

The environmental baseline is an analysis of the collective effects of past and ongoing human and natural factors leading to the current status of the species or its habitat and ecosystem, the effects of the proposed action and the cumulative effects in the action area. This analysis describes the status of the species and factors affecting the environment of the species in the proposed action area during the consultation. The baseline includes state, local, and private actions already affecting the species. Unrelated federal actions that have completed formal or informal consultations also are part of the environmental baseline, as are federal and other actions within the action area that may benefit listed species.

A detailed review of the human activities which have led to the present status of the species was discussed above. Many of these activities are continuing in Kansas, including intensive row-cropping of runoff areas draining directly into Topeka shiner streams, overgrazing of riparian

areas along streams, overwintering of livestock in confined feeding areas along streams, and construction and replacement of bridges and culverts over streams.

Mainstem reservoir development, tributary impoundment, and channelization have impacted the species in many areas. Populations located within small tributary streams upstream from both mainstem and tributary impoundments attempt to utilize these water bodies as refuges from drying streams during periods of drought. During this time, the populations are subject to predation by larger predatory fish inhabiting the impounded water bodies. In unaltered systems, fish move downstream during drought to find suitable habitat. Deacon (1961) reports fishes characteristic of the small and mid-sized tributaries of the Neosho and Marais des Cygnes rivers' watersheds occurred in the mainstems following several years of protracted drought in the mid-1950's. Tributary dams also serve to block migration of fishes upstream following drought, prohibiting recolonization of upstream reaches.

Substantial tributary impoundment is occurring throughout the Flint Hills region of Kansas, endangering the viability of Topeka shiner populations at these locales. Numerous tributary impoundments have been completed in or near habitat for the Topeka shiner in the Cottonwood River basin, with many more potentially planned for construction. Presently in the Mill Creek watershed, which contains the largest remaining complex of habitat for the species, 21 dams have been constructed with additional structures planned. However, the Mill Creek watershed district board of directors has entered into a conservation agreement with the Service and Kansas Department of Wildlife and Parks to conserve the species. This conservation agreement allows for continued dam development in portions of the basin without Topeka shiners or where there are less viable populations, and eliminates development in the areas with complex populations. The agreement also requires habitat improvement and enhancement throughout the occupied portion of the basin. However, this agreement can be terminated by any signatory during the included 5-year review. Also, the agreement would be ineffective if not implemented.

During the period when the Topeka shiner was proposed for federal classification as an endangered species, the Service completed one formal conference with the Federal Highway Administration for anticipated impacts to the species. The project was the proposed renovation of Interstate 70 through Riley, Shawnee, and Wabaunsee counties, with several in-stream culvert extensions or constructions. The Service provided the Federal Highway Administration a formal conference opinion in September 1998, indicating our opinion that the proposed activity is not likely to jeopardize the continued existence of the Topeka shiner. Adverse impacts to the shiner or its habitats were addressed through reasonable and prudent measures provided in the opinion. This conference opinion was later accepted by both agencies as the final biological opinion after the species was finally listed as endangered. A number of additional bridge or culvert activities have been assessed since that time, with the same measures employed in each case to arrive at a determination that the actions would not likely adversely affect the species.

In January 1999, the Service provided the Corps of Engineers a biological opinion stating that the proposed construction of two bridges in the Clarks Creek basin in Geary County is not likely to jeopardize the continued existence of the species. Reasonable and prudent measures to avoid incidental take resulting from bridge construction were provided. In December 2000 the Service

provided the Corps of Engineers a biological opinion stating that the proposed excavation and temporary stockpiling of gravel from Mill Creek and several of its tributaries is not likely to jeopardize the continued existence of the species. This no jeopardy opinion was based on a very limited number of sites being allowed for excavation, with monitoring required for a single below-water excavation site allowed.

Effects of the Action

The possible adverse impact to the Topeka shiner population on Fort Riley from this proposed activity results from habitat impacts and water quality deterioration caused by disruption of streambank vegetation which filters runoff during various construction activities, degradation of streambank stability during and immediately following construction activities, increase in sedimentation and turbidity downstream from low water hardened fords both during construction and during subsequent use, and possible outright destruction of individual Topeka shiners or their eggs during construction, use, replacement or removal of fords, culverts or concrete box bridges.

Cumulative Effects

Cumulative effects include the effects of future state, local or private actions that are reasonably certain to occur in the area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act. There is a lack of definite information on future state, local or private actions which may occur. The City of Manhattan and Riley County have periodically explored the potential for development within the Wildcat Creek basin, but we are unaware of any specific proposals at present. Agricultural practices have the potential to adversely affect stream habitat, but there is no significant change anticipated in the typical ongoing practices occurring within the region. Interest has been generated in recent years in the development of commercial confined animal feeding operations in Kansas. These operations would have to meet water quality standards established by the State of Kansas, so it is unknown to what extent they may impact Topeka shiner populations or habitat in this region.

Summary

After reviewing the current status of the Topeka shiner, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the proposed Fort Riley road maintenance and repair program, including maintenance of hardened low water stream crossings, is not likely to jeopardize the continued existence of the species. Federally-designated critical habitat has not yet been proposed for this species; therefore, none will be affected.

U.S. FWS, 2003
Species: Topeka Shiner
Location: Clear Fork Creek in Pottawatomie and Marshall counties, Kansas

Status of the Species

Once abundant and widely distributed throughout the central Great Plains and western tallgrass prairie regions, information at the time of listing showed the Topeka shiner occupied no more than 10 percent of its original geographic range. The action most likely impacting the species to the greatest degree in the past is sedimentation and eutrophication resulting from intensive agricultural development. Most populations of Topeka shiners occurring west of the Flint Hills region of Kansas are believed to have been extirpated prior to 1935 (Cross and Moss 1987). Minckley and Cross (1959) report that watersheds with high levels of cultivation and subsequent siltation, and domestic pollution are unsuitable for the species. These streams often cease to flow and become warm and muddy during the summer months. Cross (1970) indicates that some of the areas where depletion of the species has occurred also coincide with areas having poor aquifers. Pflieger (1975) reports that increased siltation as a result of intensive cultivation may have reduced the amount of Topeka shiner habitat in Missouri. Feedlot operations on or near streams are also known to impact prairie fishes due to organic input resulting in eutrophication (Cross and Braasch 1968).

The species was historically known from open pools of small prairie streams with cool, clear water. Many streams of this nature reportedly existed throughout the geographic range of the Topeka shiner "prior to the plowing of the prairie sod" (Cross 1967). These conditions continue to exist in many of the streams in the Flint Hills region of Kansas, primarily due to shallow, rocky soils with numerous limestone exposures which prevent cultivation. This is in contrast to the changes in the natural fish faunas and their associated habitats in prairie areas more suitable to intensive rowcrop agriculture, which is characteristic of much of the natural range of the

species (Menzel et al. 1984). Menzel et al. (1984) also note accelerated rates of soil erosion and instream deposition caused by the action of flowing water throughout many modified prairie streams in areas of Iowa encompassed by the former range of the species.

Stream channelization and stream impoundment have occurred throughout much of the Topeka shiner's range. Channelization negatively impacts many aquatic species, including the Topeka shiner, by eliminating and degrading instream habitat types, altering the natural physical characteristics of surface waters, and by changing water quality (Simpson et al. 1982). Menzel (in litt. 1980) reports the extirpation of Topeka shiners from previous collection sites following stream channelization projects in Iowa. During 1994 surveys conducted by the Service across Iowa, most streams were found to have been severely altered. Changes included elimination of pool habitats, instream debris, and woody riparian vegetation. Water velocities were consistently high throughout the channel and deep silt was the dominant substrate. At Iowa sites where Topeka shiners were captured, streams were not as intensively channelized and many natural conditions persisted. Schrank et al. (2001) developed a logistic model that predicted the probability of Topeka shiners being extirpated from previously occupied streams in Kansas. The significant predictor variables in their model, those features which were most likely to lead to extirpation, were number of small impoundments in the watershed, length of pool, and catch per unit effort of largemouth bass.

Based on the significant declines in populated areas, as well as the serious continued threats to the species, a proposed rule to list the Topeka shiner as endangered was published in the Federal Register on October 24, 1997 (62 FR 55381). A final rule officially adding the species to the list of endangered species was published in the Federal Register on December 15, 1998 (63 FR 69008), with the listing taking effect January 14, 1999.

Habitat fragmentation for a species can increase genetic differentiation between populations and reduce genetic variation within populations. A genetics study using mitochondrial DNA was completed for the Topeka shiner (Michels 2000), with samples taken from different drainages in every state in the occupied range except Nebraska. The study showed that sufficient genetic similarities exist to identify three major groups of Topeka shiners: 1) Arkansas River drainage (Kansas); 2) Kansas and Lower Missouri River drainages (Kansas and Missouri); and 3) Upper Missouri and Des Moines River drainages (Minnesota, Iowa, and South Dakota). Results indicated that genetic differences occur between individual populations, even in adjacent streams, and that genetic variation is low within many populations. However, the conclusion is that this is primarily due to the species' preference for naturally-isolated or discontinuous habitat, rather than human-caused isolation due to habitat fragmentation. Therefore, while each population may contain some level of genetic uniqueness, each comprises part of one of three larger genetic groupings with shared characteristics.

Sampling effort has been sporadic across the species' range since its listing, with very little new information available for the states of Iowa, Minnesota, and Nebraska. Sampling across portions of the Kansas distribution does not indicate a significant change in that state's population status. Unpublished data from Missouri sampling over the period 2000-2002 indicates significant declines in the amount of occupied habitat from that previously known. This is in spite of the

fact that Missouri has an active management plan being implemented for the conservation of the species (MDC 1999). The only portion of the range which has documented an increased number of occupied sites is in South Dakota, where intensive sampling through 2000 located the species at several sites previously not known to be occupied (Wall et al. 2001). Coupled with less intensive sampling conducted since that report (Shearer 2003), Topeka shiners have been located in at least low numbers at enough sites to comprise the bulk of its previously known historic distribution in South Dakota, information which was lacking at the time the species was listed.

Status of Proposed Critical Habitat

A proposed rule to designate critical habitat for the Topeka shiner throughout its current range was published in the Federal Register on August 21, 2002 (67 FR 54262). Within Kansas, critical habitat has been proposed for the Cottonwood, Kansas, Big Blue, and Smoky Hill River watersheds. Clear Fork Creek occurs within the Big Blue River watershed, which also contains proposed critical habitat on Walnut Creek, in Riley County, and North Elm Creek, in Marshall County. Critical habitat proposed for Clear Fork Creek extends from its confluence with Jim Creek at S17-T5S-R9E in Marshall County, upstream through S18-T6S-R10E in Pottawatomie County. The upstream extent of proposed critical habitat terminates at the proposed action site, creating the likelihood for downstream impacts to the habitat.

Designation of critical habitat must consider the physical and biological features that are essential to conservation of the species. These features, referred to as the primary constituent elements of critical habitat, include, but are not limited to: (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, rearing (or development) of offspring; and (5) habitats protected from disturbance or that are representative of the historic geographical and ecological distributions of the species. The following nine specific primary constituent elements were cited in the proposed rule as comprising Topeka shiner critical habitat.

1. Streams most often with permanent flow, but that can become intermittent during dry periods.

2. Side channel pools and oxbows either seasonally connected to a stream or maintained by groundwater inputs, at a surface elevation equal to or lower than the bank-full discharge stream elevation.

3. Streams and side channel pools with water quality necessary for unimpaired behavior, growth, and viability of all life stages. The water quality components can vary seasonally and include: temperature (1 to 30^{o} Centigrade), total suspended solids (0 to 2000 ppm), conductivity (100 to 800 mhos), dissolved oxygen (4 ppm or greater), pH (7.0 to 9.0), and other chemical characteristics.

4. Living and spawning areas for adult Topeka shiners with pools or runs with water velocities less than 0.5 m/s and depths ranging from 0.1 to 2.0 m.

5. Living areas for juvenile Topeka shiners with water velocities less than 0.5 m/s and depths less than 0.25 m, and moderate amounts of instream aquatic cover, such as woody debris, overhanging terrestrial vegetation, and aquatic plants.

6. Sand, gravel, cobble, and silt substrates with amounts of fine sediment and substrate embeddedness that allows for nest building and maintenance of nests and eggs by native *Lepomis* sunfishes and Topeka shiners as necessary for reproduction, unimpaired behavior, growth, and viability of all life stages.

7. An adequate terrestrial, semiaquatic, and aquatic invertebrate food base that allows for unimpaired growth, reproduction, and survival of all life stages.

8. A hydrologic regime capable of forming, maintaining, or restoring the flow periodicity, channel morphology, fish community composition, off-channel habitats, and habitat components described in the other primary constituent elements.

9. Few or no nonnative predatory or competitive species present.

Activities cited in the Federal Register notice which may adversely modify Topeka shiner critical habitat include those which significantly and detrimentally alter the minimum or natural flow regime, the riparian zone characteristics, the channel morphology, or the water chemistry of a proposed stream segment, or which introduce or spread populations of nonnative competitive species. Some specific actions which were cited in the proposal which may adversely affect critical habitat include groundwater pumping, stream impoundment, water diversion, vegetation removal or manipulation, timber harvest, road and bridge construction and maintenance, livestock grazing, off-road vehicle use, powerline or pipeline construction and repair, mining, urban and suburban development, stream channelization, substrate removal, reduction in available floodplain, chemical or biological pollution, nonnative fish stocking, use of live bait fish, aquaculture, construction and operation of canals, and interbasin water transfers.

Environmental Baseline

The environmental baseline is an analysis of the collective effects of past and ongoing human and natural factors leading to the current status of the species or its habitat and ecosystem, the effects of the proposed action and the cumulative effects in the action area. This analysis describes the status of the species and factors affecting the environment of the species in the proposed action area during the consultation. The baseline includes state, local, and private actions already affecting the species. Unrelated federal actions that have completed formal or informal consultations also are part of the environmental baseline, as are federal and other actions within the action area that may benefit listed species.

A detailed review of the human activities which have led to the present status of the species was discussed above. Many of these activities are ongoing in the Clear Fork Creek watershed, including intensive row-cropping of runoff areas draining directly into the stream. According to NRCS Soil Survey data, an estimated 60% of Marshall County was utilized for cropland or hay

production in 1967, with 34% of Pottawatomie County in such uses in 1981. Kansas Department of Agriculture statistics for 2002 indicate very little change in Marshall County, with a decrease in farmed land to approximately 27% in Pottawatomie County. Aerial photography indicates extensive cropland tillage immediately adjacent to the riparian corridor through portions of the Clear Fork Creek basin. Other activities include grazing of riparian areas along streams, overwintering of livestock in confined feeding areas along streams, and construction and replacement of bridges and culverts over streams. Urban and commercial development can impact the quality of Topeka shiner habitat, but this is not known to currently be a significant problem along Clear Fork Creek.

Substantial tributary impoundment has and is occurring throughout Kansas, endangering the viability of Topeka shiner populations at these locales. Aerial photography reveals that several tributary impoundments have been built in the Clear Fork Creek basin. Populations located within small streams upstream from both mainstem and tributary impoundments attempt to utilize these water bodies as refuges from drying streams during periods of drought. During this time, the populations are subject to predation by larger predatory fish inhabiting the impounded water bodies. In unaltered systems, fish move downstream during drought to find suitable habitat. Deacon (1961) reports fishes characteristic of the small and mid-sized tributaries of the Neosho and Marais des Cygnes rivers' watersheds occurred in the mainstems following several years of protracted drought in the mid-1950's. Dams also serve to block migration of fishes upstream following drought, prohibiting recolonization of upstream reaches, and they contribute to increases in the number of predators within the streams themselves (Schrank et al. 2001).

During the period when the Topeka shiner was proposed for federal classification as an endangered species, the Service completed one formal conference with the Federal Highway Administration for anticipated impacts to the species. The project was the proposed renovation of Interstate 70 through Riley, Shawnee, and Wabaunsee counties, with several in-stream culvert extensions or constructions. The Service provided the Federal Highway Administration a formal conference opinion in September 1998, indicating our opinion that the proposed activity is not likely to jeopardize the continued existence of the Topeka shiner. Adverse impacts to the shiner or its habitats were addressed through reasonable and prudent measures provided in the opinion. This conference opinion was later accepted by both agencies as the final biological opinion after the species was finally listed as endangered. A number of additional bridge or culvert projects have been assessed since that time, with the same measures employed in each case to arrive at a determination that the actions would not likely adversely affect the species.

In January 1999, the Service provided the Corps of Engineers a biological opinion stating that the proposed construction of two bridges in the Clarks Creek basin in Geary County is not likely to jeopardize the continued existence of the species. Reasonable and prudent measures to avoid incidental take resulting from bridge construction were provided. In December 2000 the Service provided the Corps of Engineers a biological opinion stating that the proposed excavation and temporary stockpiling of gravel from Mill Creek and several of its tributaries is not likely to jeopardize the continued existence of the species. This no jeopardy opinion was based on a very limited number of sites being allowed for excavation, with monitoring required for a single below-water excavation site allowed. In April 2002 the Service provided the Department of the

Army a biological opinion stating that a program for developing and maintaining hardened stream crossings on Fort Riley Military Reservation is not likely to jeopardize the species. Reasonable and prudent measures included with this opinion to avoid and minimize incidental take included timing and construction restrictions.

Effects of the Action

The possible adverse impact to the Topeka shiner population in Clear Fork Creek from this proposed activity results from habitat impacts and water quality deterioration caused by the physical elimination of a natural stretch of stream, and replacing it with an artificially created channel, which must connect upstream and downstream habitats. Impacts may include disruption of streambank vegetation which filters runoff during construction activities, degradation of streambank stability during and immediately following construction activities, increased sedimentation and turbidity downstream from the construction site, creation of habitat in the new channel which is incompatible with Topeka shiner occupancy, and possible outright destruction of individual Topeka shiners or their eggs during construction of the new channel and the new bridge and the closing of the existing channel.

The elimination of a portion of the existing channel in favor of a shortened new channel will permanently alter Topeka shiner habitat in Clear Fork Creek. With a shortened channel, streamflow velocities could increase and result in increased bank erosion, altered sediment load carrying capacity, headcutting of the stream bed, or other changes to overall stream stability and function. This could potentially affect all facets of the species' life history, including movement patterns, reproduction, feeding, and sheltering. If work is conducted in the active stream channel during the spawning season, it could disrupt or even preclude spawning for that year. Despite the best engineering design, there is the potential that the newly created stream channel will not function naturally, and could result not only in a section of non-habitat within the overall stream, but could cut off or eliminate potentially suitable habitat upstream.

Since one stated purpose of this action is to facilitate vehicle traffic through the existing intersection, an interrelated action which should be expected to occur is an increase in such traffic. With this increase there will be a corresponding increase in the amount of dust, road substrate material, and even human trash which will likely be introduced into the stream, all of which would contribute to decreased water quality as well as affecting the stream substrate.

The nine primary constituent elements for Topeka shiner proposed critical habitat were described in a previous section of this opinion. The various effects described here for the proposed action could potentially result in adverse impacts to seven of those nine primary constituent elements (3 through 9). Many of the effects will not be known for certain until after the project is completed and the artificial channel is functioning to pass natural streamflow. The possibility exists to render Clear Fork Creek unsuitable for Topeka shiner occupancy, at least from the project site upstream, and, quite possibly, for some distance downstream as well.

Cumulative Effects

Cumulative effects include the effects of future state, local or private actions that are reasonably certain to occur in the area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act. There is a lack of definite information on future state, local or private actions which may occur in the Clear Fork Creek watershed. Agricultural practices have the potential to adversely affect stream habitat, but there is no significant change anticipated in the typical ongoing practices occurring within the two counties. Interest has been generated in recent years in the development of additional and larger commercial confined animal feeding operations in Kansas. These operations would have to meet water quality standards established by the State of Kansas, so it is unknown to what extent they may impact Topeka shiner populations or habitat in this basin or in the state.

Summary

After reviewing the current status of the Topeka shiner, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is apparent that there is potential for this action to result in adverse impacts to the species. However, it is the Service's biological opinion that the proposed relocation of this section of Clear Fork Creek, elimination of two existing bridges, and construction of one new bridge, is not likely to jeopardize the continued existence of the species throughout its six-state range. This is largely due to the fraction of the species' rangewide population which will be impacted by the proposed action.

Federally-designated critical habitat has been proposed for this species, and includes most of Clear Fork Creek in Pottawatomie and Marshall counties, Kansas, including the proposed project location. It is the Service's opinion that this proposed action, although likely detrimental to Topeka shiner habitat, is not likely to destroy or significantly adversely modify the proposed critical habitat in the Big Blue River watershed unit. As with the species itself, the proposed critical habitat to be affected represents less than one percent of the total for the species.

References

Cross, F.B. 1967. Handbook of fishes of Kansas. University of Kansas, Museum of Natural History. Miscellaneous Publication Number 45. 357 pp.

Cross, F.B. 1970. Fishes as indicators of pleistocene and recent environments in the central plains. in Pleistocene and Recent Environments of the Central Great Plains. Special Publication 3, Department of Geology, University of Kansas. pp. 241-257.

Cross, F.B. and M. Braasch. 1968. Qualitative changes in the fish fauna of the upper Neosho River system, 1952-1967. Transactions of the Kansas Academy of Sciences. 71(3): 350-360.

Cross, F.B. and R.E. Moss. 1987. Historic changes in fish communities and aquatic habitats in plains streams of Kansas. in Community and Evolutionary Ecology of North American Stream Fishes, W.J. Matthews and D.C. Heins (ed.). University of Oklahoma Press, Norman. pp. 155-165.

Deacon, J.E. 1961. Fish populations, following a drought in the Neosho and Marais des Cygnes rivers of Kansas. University of Kansas Publications, Museum of Natural History. 13(9): 359-427.

Menzel, B.W., J.B. Barnum and L.M. Antosch. 1984. Ecological alterations of Iowa prairie - agricultural streams. Iowa State Journal of Research. 59(1): 5-30.

Michels, A.M. 2000. Population genetic structure and phylogeography of the endangered Topeka shiner (*Notropis topeka*) and the abundant sand shiner (*Notropis ludibundus*) using mitochondrial DNA sequence. Ph.D. Thesis, University of Kansas, Lawrence, KS. 68 pp.

Minckley, W.L. and F.B. Cross. 1959. Distribution, habitat, and abundance of the Topeka shiner Notropis topeka (Gilbert) in Kansas. American Midland Naturalist. 61(1): 210-217.

Missouri Department of Conservation. 1999. An action plan for the Topeka shiner (*Notropis topeka*) in Missouri. 29 pp.

Pflieger, W.L. 1975. The fishes of Missouri. Missouri Department of Conservation. pp. 343.

Schrank, S.J., C. S. Guy, M. R. Whiles, and B. L. Brock. 2001. Influence of instream and landscape-level factors on the distribution of Topeka shiners *Notropis topeka* in Kansas streams. Copeia 2001:413-421.

Shearer, J.S. 2003. Topeka shiner (*Notropis topeka*) management plan for the state of South Dakota. South Dakota Department of Game, Fish and Parks, Pierre, Wildlife Division Report No. 2003-10, 82 pp.

Simpson, P.W., J.R. Newman, M.A. Keirn, R.M. Matter and P.A. Guthrie. 1982. Manual of stream channelization impacts on fish and wildlife. U.S. Fish and Wildlife Service. Biological Report 82(24): 1-155.

Wall, S.S., Blausey, C.M., Jenks, J.A., and Berry, C.R. 2001. Topeka shiner (*Notropis topeka*) population status and habitat conditions in South Dakota streams. South Dakota State University, Brookings, Final Report for Research Work Order #73.