CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter presents the existing conditions in the project area and the environmental consequences that can be expected from implementing the proposed action, other action alternative, or no action.

3.1 Water Resources

3.1.1 Affected Environment

The project area lies within an elevation range of 3,040 to 4,240 feet. Average annual precipitation is approximately 18 to 20 inches as recorded by APS at the Childs and Irving hydroelectric power plants, respectively. Precipitation varies considerably on a monthly and yearly basis. Generally, precipitation is distributed bimodally over the year, occurring during the winter months as a result of storms originating in the north Pacific Ocean, and during the summer monsoon season as result of convective thunderstorms which form from moisture drawn into the region from the Gulf of Mexico and Gulf of California (Sellers and Hill, 1974).

Hydrology - Fossil Creek is a major perennial tributary to the Verde River, draining southwest off the Mogollon Rim between the major sub-basins of East Verde River to the south and West Clear Creek to the north. Elevations in the watershed range from 7,260 feet along the Rim to 2,550 feet at the Verde River confluence. Rainfall and snowmelt contribute to intermittent streamflow between the upper basin and Fossil Springs. Perennial flow arises from Fossil Springs at an elevation of 4,280 feet, approximately 14.3 miles upstream from the Verde River. There are several small springs above and below the Irving hydroelectric plant that produce minor additional flows. The lower stream and adjacent drainage lie within the Mazatzal Wilderness, an area dominated by remote, steep-canyoned terrain. Virtually the entire Fossil Creek drainage area is on land administered by the Forest Service.

Fossil Springs consists of at least 5 major springs that emerge along a reach of Fossil Creek approximately 900 feet in length (Monroe 2000). This spring outflow contributes a constant base flow of approximately 43 cfs, and is saturated with calcium carbonate and dissolved carbon dioxide. Prior to the stream being diverted for hydropower use in 1908, calcium carbonate deposited from solution in the form of travertine for many miles downstream from the springs, forming large dams, terraces, and associated pools within the active channel. Floods periodically filled the travertine pools with sediment, aggrading the channel and allowing terraces to form at increasingly higher levels (Overby and Neary 1996). Today only relic deposits remain in the stream channel, most having been lost through erosion from floods. However, some active travertine deposition is occurring just below the Irving power house, where flows of approximately 2 to 5 cfs are being returned to the channel. Minckley (1999) described the process of travertine formation and its effects on the stream bed:

"Spring waters sometimes are charged with carbon dioxide (CO_2) derived from decomposition of organic materials in soils and other materials through which they percolate underground. CO_2 combines with water to form weak carbonic acid which, in turn, dissolves relatively insoluble carbonate ($CaCO_3$) rock such as limestone through formation of more-soluble bicarbonates (HCO_3). The gas and dissolved ions are carried by groundwater at concentrations controlled by underground pressure, temperature, and turbulence. When a spring emerges, pressures are reduced, temperature goes up or down depending on season, and agitation increases as water passes over rough bottoms, riffles, and waterfalls. CO_2 is driven out, changing acid-base relationships, and biology comes into play since photosynthesis by various algae and higher plants uses both gaseous CO_2 and that combined in HCO_3 ions. Both these processes promote re-formation of insoluble $CaCO_3$ that precipitates as tufa on channel bottoms and sides, surfaces of plants, and almost anything else, resulting in their "fossilization." Tufa dams are formed where an obstruction across the stream, such as a bedrock outcrop or even a row of water-carried autumn leaves, causes greater local agitation thus greater loss of CO_2 than up- or downstream. The accumulating tufa promotes ever-greater obstruction and turbulence, thus ever more precipitation, until a "dam" is formed."

Return of full instream flows under the proposed FERC decommissioning process would likely augment travertine formation within the 5-mile reach of stream below Fossil Springs (Overby and Neary 1996). The rate and extent of travertine deposition is uncertain due to a number of complex factors that affect formation and degradation (APS 1998), although conditions similar to those that existed prior to 1908 could reemerge.

Storm runoff and snowmelt from surrounding mountains contribute to flows in excess of base flow. Intense but brief and localized monsoonal storms produce large volumes of runoff within the watershed that generate flashy flows and flooding. Significant floods that overflow the low flow channel and transport substantial quantities of sediment occur about every other year (APS 1998). Floods in excess of a 5-year recurrence have high peak flow velocities capable of transporting cobbles, small boulders and considerable debris. Under current watershed conditions, the estimated peak flow of the 100-year flood event is approximately 13,530 cfs (Loomis 1994).

Almost all base flow is currently diverted by the Childs-Irving Hydroelectric Project at the Fossil Springs diversion, 0.3 mile downstream from Fossil Springs. The Irving portion of the hydroelectric project consists of: (1) the 25-foot high concrete Fossil Springs diversion dam, (2) a 3.1-mile long flume and a 0.6-mile long penstock, (3) a single 1,600 kilowatt (kW) generator powerhouse located along the stream 10.6 miles above the Verde River confluence, (4) powerlines, and (5) appurtenant facilities. The diversion dam removes approximately 43 cfs from Fossil Creek, leaving approximately 0.2 cfs of flow in the 3.4 mile stream reach between the dam and the Irving powerhouse.

The Childs segment consists of: (1) a 5-foot high diversion structure on Fossil Creek approximately 350 feet upstream of the Irving powerhouse that diverts flows from the stream when the Irving powerhouse is not operating, (2) a 4.4-mile long conduit that carries discharges from the Irving powerhouse or the stream to a regulating reservoir, Stehr Lake, (3) the 23-acre Stehr Lake, (4) a 1.2-mile long pressure tunnel and a 0.9-mile long penstock connecting the lake, (5) a powerhouse containing three generating units of 5,400 kW capacity, (6) a tailrace that discharges into the Verde River, (7) utility lines, and (8) appurtenant facilities. The Childs powerhouse is located adjacent to the Verde

River 3.4 miles upstream from the confluence with Fossil Creek. Because of travertine formation in the water conduits that limits transmission capacity, an additional 2 to 5 cfs is returned to Fossil Creek below the Irving powerhouse.

Water Quality - The Arizona Department of Environmental Quality (ADEQ) reported in the 1996 Arizona Water Quality Assessment (Clean Water Act Section 305 (b) Assessment) that Fossil Creek is in full support for fish consumption (FC), full body contact (FBC), agricultural livestock watering (Agl), and the aquatic and wildlife warmwater fishery (A&Ww). No significant contaminant concentrations were recorded in water sampling conducted for APS in 1989 and 1990 (Dames & Moore 1990).

The ADEQ 2002 305 (b) Assessment reported Fossil Creek "inconclusive" for all beneficial uses: FC, FBC, Agl, and A&Ww. This resulted from changes in the assessment process that included an increase in the minimum number of water samples needed for adequate data collection. In 1999, the last year water quality monitoring was conducted by ADEQ in Fossil Creek, an insufficient number of samples were collected to meet the new assessment standard for "attaining" surface water quality. ADEQ has added Fossil Creek to its Planning List for additional review due to lack of sampling events.

3.1.2 Environmental Consequences - Water Resources

No Action Alternative

No environmental consequences to water resources would occur under this alternative.

Proposed Wilderness Alternative

Jurisdictional waters of the U.S. were delineated by Reclamation. The delineated acreage represents the portion of the channel up to the ordinary high water mark for which the U.S. Army Corps of Engineers (COE) has regulatory jurisdiction over discharges of dredged and fill material pursuant to Section 404 of the Clean Water Act (see Chapter 5). Based on this delineation, less than 0.1 acre of jurisdictional waters would be affected by the project.

The estimated volume of fill material to be discharged into jurisdictional waters during construction is 49 cubic yards. This material consists of structural concrete, redeposited channel alluvium, and rocks used in the gabion structure. After construction, the barrier would initially trap sediment in a zone of deposition above the barrier. Captured sediment would aggrade (raise) the streambed to the same height as the top of the barrier (approximately 5 feet), and diminish upstream in response to gradient. Sediment deposition would affect about 240 linear feet (0.1 acre) of channel above the barrier (Figure 5a). Few riparian plants would be affected by sediment buildup. Sediment transport associated with flooding and high seasonal flows is expected to fill the ponded area created by the barrier within one monsoon season. Once sediment deposition stabilizes, sediment transport within the stream would be unimpeded by the project.

Hydrology - Current base flow at the site of the proposed barrier is estimated to be about 2 to 5 cfs. This flow continues downstream to the Verde River, with minor losses attributable to seepage and evaporation.

Project-induced long-term hydrologic effects include a minor increase in upstream backwater flooding during high flow events. Sediment deposition would change the channel gradient upstream of the barrier and permanently raise the water surface profile. This effect would be greatest where water overtops the barrier (about a 5-foot change), and disappear altogether approximately 240 feet upstream from the barrier. Immediately after construction, ponding could extend approximately 100 feet upstream of the structure, affecting 0.05 acre. However, sedimentation will displace the impounded water, and the stream will flow over the barrier as a small falls. The elevated water surface elevation at the barrier will have minimal erosive effect on the channel banks, which are armored with bedrock and boulders. Functionally, the structure would mimic a natural rock barrier that existed in the same vicinity and was removed by massive flood flows in 1995 (Roberson et al. 1996), and travertine formations that were historically a prevalent feature in the stream.

Downstream effects would be minor. Boulders and bedrock dominate the channel at and below the proposed barrier location, so bank destabilization and down cutting would not result from the increased energy of water flowing over the drop structure and short-term capture of sediment by the barrier. Channel structure in this segment of stream is primarily a step/pool system. The barrier would increase the height of an existing bedrock step and would create a water drop that is functionally similar to natural falls and boulder complexes that are common in middle and upper reaches of the stream. Little impact to channel form would be expected.

Fossil Creek is a headwater source to the Salt River watershed. There are no private land parcels at or downstream of the barrier within the boundaries of either Tonto or Coconino National Forest. Water rights to flows within Fossil Creek are held by the Salt River Project (SRP). Reclamation would compensate SRP for water losses attributable to construction usage and increased evaporation associated with changes in fluvial morphology at the barrier.[9] In total, Reclamation estimates approximately 29 acre feet of water would be lost over the 100-year life of the project.[10]

Water Quality - Excavation of channel substrates and other construction related activity would contribute to elevated levels of suspended solids. Disturbances in the stream would temporarily increase turbidity for a short distance downstream of the construction area. These effects are expected to be minor and would persist only during active construction. Bank disturbances would be confined to solid rock and boulders, preventing soil erosion and sediment discharge into the stream. Project implementation activities (construction and renovation) would create localized soil disturbances that will have a short-term effect on stream conditions within the project area. These effects are

9 Reclamation would make a transfer of CAP water to SRP via existing Forest Service or CAP agreements.
10 The project lifespan is the period of time the barrier could reasonably be expected to hold up to forces of water and weather.

expected to be minor and would attenuate as vegetation recovers on project-impacted soils. The project would not affect long-term changes in water quality or stream dynamics.

Piscicide treatments would impact 9.5 miles of stream in total (see Section 2.3). The short-term-effects from use of antimycin A at recommended concentrations are generally restricted to fish and aquatic macroinvertebrates (see section 3.2.2). During treatment, humans and livestock could be exposed to 20 ppb or more (depending on bioassay results for target species) antimycin in surface waters for about 6 hours. Ingestion of normal quantities of water containing recommended piscicide concentrations during the peak of treatment would have no effect on humans or livestock (see Appendix E). Nonetheless, as a cautionary measure to avoid human exposure, signs would be posted along road-accessible segments of Fossil Creek advising the public of the renovation program. Treatments would occur when domestic livestock are not using pastures with access to the creek, or movement of livestock to other pastures during treatment would be coordinated with the range permittee.

Sunlight and natural physical and chemical characteristics of the stream would quickly break down antimycin into inert byproducts. To ensure complete neutralization, potassium permanganate would be added to the water at the downstream end of each treated segment of stream. The byproducts of neutralized antimycin are not harmful to fish or other organisms (Berger et al. 1969; Gilderhus et al. 1969; and Lee et al. 1971). Potassium permanganate is quickly broken down as it reacts to organic material and antimycin. Kemp et al. (1966) found $KMnO_4$ formed a biologically inert residue when it reacted to organic material. Breakdown components of $KMnO_4$ (potassium, manganese, and water) are common in nature and have no deleterious environmental effects at concentrations used for neutralization of antimycin (2-4 mg/l; Finlayson et al. 2000). Water chemistry within the treated reaches of stream is expected to return to pretreatment conditions within a few hours. No measurable effect on water quality is anticipated downstream of the project area during application of antimycin.

Nonwilderness Alternative

The impact on water resources would be very similar to those described in the Wilderness Alternative. Approximately 38 cubic yards of fill material, mostly in the form of concrete, would be discharged into jurisdictional waters during construction. Project activities would affect bedrock and boulder-dominated channel substrates, limiting the likelihood of down cutting and bank destabilization. After completion, sediment deposition would aggrade the streambed to a depth of 5 feet at the barrier, affecting approximately 200 lineal feet of stream above the structure and 0.1 acre of COE jurisdictional waters (Figure 6). Few riparian plants would be inundated by sediment.

Hydrology. Base flow at the nonwilderness site is 2 to 5 cfs. A 5-foot vertical drop would be created at the barrier. The barrier would be expected to impound about 0.3 acre feet of water for a short period of time. Trapped sediment would displace any ponded water and aggrade the channel approximately 5 feet to the top of the barrier. Sediment

deposition would flatten the stream gradient approximately 200 feet upstream. Aggradation of the channel bottom would raise the water surface elevation for a short distance upstream of the barrier. This effect on water surface elevation would be slightly greater than the wilderness site due to the larger width of the stream.

Little effect to channel structure would be expected. The channel in the vicinity of the barrier site is primarily a step/pool system dominated by natural falls and boulder complexes. Scour within the channel is limited by a bedrock channel bottom, and bedrock outcrops on both banks control lateral movement of the stream. Natural rock armoring would prevent channel destabilization and down cutting from the increased energy of water flowing over the drop structure.

Water Quality. Construction within the channel would have water quality effects similar to the proposed action. Piscicide application would affect 6.7miles of stream (see Proposed Wilderness Alternative for discussion of effects from use of antimycin A).

Cumulative Effects

Project effects from either action alternative will have minor additive effects to past, present, and reasonably foreseeable actions. Hydrologic effects are limited to the area immediately upstream and downstream of the fish barrier, and are expected to equilibrate within one monsoon season as sediment fills in behind the structure. There would be no incremental impacts of this project to hydrology effects since there are no known past, present, or reasonably foreseeable actions affecting hydrology. Most actions that have affected the hydrology of Fossil Creek (dewatering, diversion dam construction) occurred long in the past, and have created the existing conditions we see today.

Water quality effects from the piscicide are limited to the treated reach of the stream and and would occur during application, which is expected to be 4 hours per treated reach, with up to three treatments conducted per reach within a 2-3 week period. No other chemical applications have occurred or are expected to occur in Fossil Creek, so there are no cumulative chemical effects from this project. Barrier construction would contribute a minor amount of sedimentation during the construction period of about 1 month. The project would add a minor amount of sedimentation to effects from road and trail maintenance activities, installation of a buried fiber optic line that will cross Fossil Creek along the FR 708 road, and reconstruction of the Mail Trail above Fossil Springs.

3.2 Biological Resources

3.2.1 Affected Environment - Vegetation

Fossil Creek begins as an intermittent stream at the confluence of Sandrock and Calf Pen Canyons at an elevation of 4,600 feet. Changes in vegetation are evident as the stream descends on a meandering course almost 17 miles (and 2,050 vertical feet) to the Verde River. Riparian vegetation becomes more pronounced with the beginning of perennial flow at Fossil Springs, approximately 14.3 miles upstream of the Verde River.

Upper portions of the watershed occur within the Great Basin conifer woodland biotic community (Brown 1994), dominated by ponderosa (*Pinus ponderosa*), pinyon pines (*Pinus* spp), and juniper (*Juniperus* spp.). The lower basin, represented by the Interior Chaparral biotic community (Brown 1994), contains a diverse assemblage of shrubs and cacti. The riparian (Interior Riparian Deciduous Forest and Woodland) community along the stream also varies from the well-developed community at Fossil Springs to sparse, narrow stringers of trees in the lower reaches of Fossil Creek. The primary tree species are Fremont cottonwood (*Populus fremontii*), willow (*Salix* spp), Arizona sycamore (*Platanus wrightii*), velvet ash (*Fraxinus pennsylvanica*), and Arizona alder (*Alnus oblongifolia*). Vegetative components of specific stream reaches are described in Appendix F.

Existing riparian conditions are undoubtedly different than before flows were diverted for hydroelectric power generation in 1909 (Monroe 2000, Sayers 1998, Medina 1998). The significant reduction in base flow of Fossil Creek probably limits vegetative abundance and diversity, exacerbating the impacts of episodic floods on the Verde River (Sullivan and Richardson 1993). Floods are currently the dominant process influencing riparian habitat development (Malusa 1997), except for localized development in association with springs (Goodwin 1980). If full instream flows are restored under the decommissioning process, additional riparian habitat will develop on suitable streamside substrates. Most of Fossil Creek from Irving through "the narrows" is tightly constricted by boulders and bedrock, limiting potential lateral expansion of riparian vegetation.

In addition to the riparian community along Fossil Creek, a small wetland community exists in Stehr Lake. Stehr Lake, a regulating reservoir formerly 23 acres in size has been reduced to 3 acres due to sediment accumulation. The lake supports a small community of cattail (*Typha* sp.) and is surrounded by Goodding willow, Fremont cottonwood, velvet ash, Arizona walnut, and netleaf hackberry (*Celtis reticulate).* Should decommissioning of the Childs-Irving Hydroelectric Project occur, Stehr Lake would lose its source of water and gradually revert to an upland scrub community.

3.2.2. Environmental Consequences - Vegetation

No Action Alternative

No environmental consequences to vegetation resources would occur under this alternative.

Proposed Wilderness Alternative

Fish Barrier. Less than 1.4 acre of vegetated habitat would be impacted by project implementation activities. Use of the Stehr Lake area for road accessible project staging would affect about 0.5 acre of sparse upland scrub habitat, most of which has been previously disturbed by past recreation use and grazing. Vegetation clearing at the Stehr Lake contractor use area would be limited to shrubs and grasses.

A backup helispot for emergency helicopter landings and a small camping area on a terrace next to the stream would affect an additional 0.4 acre of scrub habitat in the Mazatzal Wilderness (Figure 5b). Helispot impacts would include trimming and/or removal of mesquite trees on approximately 0.25 acre. No vegetation would be removed from the camping area, although repeated foot traffic likely would trample ground cover on this 0.2 acre site.

The barrier would affect approximately 0.4 acre of stream channel. Bedload (sediment) deposition following construction would inundate approximately 0.1 acre of channel habitat consisting mostly of bedrock, open water, and desert broom (*Bacharis* sp.). A negligible (0.01 acre) amount of upland habitat immediately adjacent to the channel occurs within the construction area. Approximately 0.3 acre of riparian habitat would be utilized for crew access and material staging around the barrier (Figure 5a). The majority of this habitat consists of sand, gravel, exposed bedrock, and boulders with scattered trees. No riparian trees would be removed during construction.

Stream Renovation. Aquatic or riparian vegetation would not be harmed by application of antimycin.

Nonwilderness Alternative

Fish Barrier. Construction would affect less than 0.5 acre of habitat (Figure 6). Approximately 0.3 acre of previously disturbed roadside scrub habitat would be utilized for contractor staging. No vegetation clearing is anticipated. Barrier construction would result in approximately 0.1 acre of impact to the stream channel. After construction, sedimentation would inundate approximately 0.07 acres of channel habitat consisting mostly of bedrock, open water, and desert broom. A negligible (0.02 acre) amount of upland habitat and approximately 0.04 acre of riparian habitat consisting primarily of bare ground would be utilized for construction within and adjacent to the channel.

Stream Renovation. Aquatic or riparian vegetation would not be harmed by application of antimycin.

Cumulative Effects

Project effects on vegetation from either action alternative will have minor additive effects to past, present, and reasonably foreseeable actions. There are very few effects to vegetation in the affected area from past, present, and reasonably foreseeable projects. The project will impact a small amount of acreage of primarily understory vegetation in addition to ongoing livestock grazing impacts to riparian and upland understory vegetation.

3.2.3 Affected Environment - Terrestrial Wildlife and Human Health and Safety

Many species of terrestrial wildlife in the project area are highly mobile and can range from the headwaters of Fossil Creek on the Mogollon Rim all the way down to the confluence with the Verde River. The presence of riparian habitat enhances the species diversity. Large mammals are more mobile and species such as mule deer (*Odocoileus hemionus*), black bear (*Ursus americanus*), and mountain lion (*Felis concolor*) can move through the area. The coyote (*Canis latrans*), common throughout Arizona, and the javelina (*Tayassu tajacu*), common in desertscrub habitat below the Mogollon Rim, both range into the foothills along Fossil Creek. Other species that can be found in the project area include bobcat (*Felis rufus*), gray fox (*Urocyon cinereoargenteus*) and raccoon (*Procyon lotor*). Small mammals common in the chaparral and pinyon-juniper habitat include desert cottontail (*Sylvilagus floridanus*), spotted (*Spilogale gracilis*) and striped (*Mephitis mephitis*) skunks, cliff chipmunk (*Eutamias dorsalis*), white-footed mouse (*Peromyscus leucopus*), brush mouse (*Peromyscus boylii*), and white-throated woodrat (*Neotoma albigula*).

Avian species associated with chaparral habitat include scrub-adapted birds such as the scrub jay (*Aphelocoma californica*), bushtit (*Psaltriparus minimus*), canyon wren (*Catherpes mexicanus*), crissal thrasher (*Toxostoma crissale*), spotted towhee (*Pipilo maculatus*), canyon towhee (*Pipilo fuscus*), rufous-crowned sparrow (*Aimophila ruficeps*), and black-chinned sparrow (*Spizella atrogularis*). Species associated with higher quality riparian habitat include yellow warbler (*Dendroica petechia*), summer tanager (*Piranga rubra*), Lucy's warbler (*Vermivora luciae*), broad-tailed hummingbird (*Selasphorus platycercus*), Bullock's oriole (*Icterus bullockii*), and Lincoln's sparrow (*Melospiza lincolnii*). Raptors in the project area include species dependent on riparian habitat like the common black hawk (*Buteogallus anthracinus*) and bald eagle (*Haliaeetus leucocephalus*) as well as the red-tailed hawk (*Buteo jamaicensis*), Harris hawk (*Parabuteo unicinctus*), and golden eagle (*Aquila chrysaetos*).

Reptile relationships within chaparral habitat are generally ill-defined (Brown 1994) but include side-blotched lizard (*Uta stansburiana*), and eastern fence lizards (*Sceloporus undulates*). The Sonora lyre snake (*Trimorphodon biscutatus lambda*), the western blindsnake (*Leptotyphlops humilis*), and Arizona night lizard (*Xantusia arizonae*) prefer rocky hillsides; the glossy snake (*Arizona elegans*) prefers more open habitats; and the western black-headed snake (*Tantilla planiceps*) can utilize either type of habitat. The Sonora mountain kingsnake (*Lampropeltis pyromelana*) and the Arizona alligator lizard (*Gerrhonotus kingi*) are often found near moist environments. Rattlesnakes include the western rattlesnake (*Crotalus viridis*) and western diamondback rattlesnake (*Crotalus atrox*).

There is a 6.7-acre private inholding along a 2,100 foot segment of Fossil Creek approximately 0.9 mile upstream from Sally May Wash. The property includes a cabin and other minor improvements. Permission from the property owner would be required to access this stream segment prior to renovation. No other private properties are located within the project area.

3.2.4 Environmental Consequences - Terrestrial Wildlife and Human Health and Safety

No Action Alternative

No environmental consequences to terrestrial wildlife and human resources would occur under this alternative.

Proposed Wilderness Alternative

Fish Barrier. The effects of construction on terrestrial wildlife would be minimal and temporary in nature. Habitat disturbances would be very minor compared with the total amount of similar habitat available on both the Tonto and Coconino National Forests, resulting in no permanent loss of terrestrial habitat. Short-term effects would be limited to approximately 1.4 acre. There may be temporary disturbance related impacts to larger mammals from construction (noise and human activity). However the limited construction area and timeframe will minimize these impacts. Operational aspects of the barrier would not affect terrestrial wildlife.

Stream Renovation. Humans, wildlife, and livestock could be exposed to concentrations in excess of 20 ppb antimycin A in surface waters of the project area for about 6 hours each for up to three treatments. Among vertebrate animals, toxicity of antimycin when applied in a piscicide formulation is generally restricted to fish (Herr et al. 1967). Beck (1950) found no effect on cockroaches. Others (Walker et al 1964; Gilderhus et al. 1969) found antimycin has low toxicity to mice, rabbit, and quail, and no effect on turtles, salamanders, frogs, snakes, herons, and ducks at concentrations toxic to fish. Direct ingestion of normal quantities of stream water during peak treatment would not affect humans and livestock (see Appendix E). Antimycin-killed fish that escape collection, and burial would be quickly consumed by crayfish and other scavengers. The effects of consuming dead fish produced by stream renovation are poorly studied, but there have never been any reports of negative effects to humans or wildlife (Berger et al. 1967, Gilderhus et al. 1969). Antimycin degrades rapidly under natural stream conditions, and when exposed to potassium permanganate, and the remaining byproducts after neutralization are not harmful to humans or other organisms (Berger et al. 1969; Gilderhus et al. 1969; Lee et al. 1971; and Marking and Dawson 1972). During active treatment, human consumption of stream water or fish killed by antimycin will be discouraged, and signs will be posted along nonwilderness segments of the stream noting this prohibition. If present in pastures with access to the stream, domestic livestock would be moved to other pastures during the treatment.

Nonwilderness Alternative

Fish Barrier. The effects of construction on terrestrial wildlife would be minimal and temporary in nature. Potential roadside contractor use areas contain sparse ground cover of low habitat value. Terrestrial habitat impacts would be limited to approximately

0.3 acre. There may be temporary disturbance related impacts to larger mammals from construction (noise and human activity). However, the limited construction area and timeframe will minimize these impacts. Operational aspects of the barrier would not affect terrestrial wildlife.

Stream Renovation. As previously noted, no direct or long-term impact on terrestrial wildlife would result from stream renovation. Other impacts on terrestrial wildlife are similar to the proposed action.

Cumulative Effects

Direct and indirect project effects of barrier construction and chemical renovation on terrestrial wildlife and humans from either action alternative would be short-term and minor. There are no other past, present, and reasonably foreseeable projects where chemicals would be applied, or would otherwise occur within the same area or before effects from barrier construction and piscicide application have dissipated.

3.2.5 Affected Environment - Fish and Aquatic Wildlife

Fossil Creek is one of few perennial, warm water streams in Arizona. Water originating at Fossil Springs is a constant 70 degrees Fahrenheit, sustaining stream temperatures greater than 70 Fahrenheit during the summer. With a constant source of 70 Fahrenheit water, Fossil Creek is suitable for warm water aquatic species, but would not support high-quality coldwater fish such as trout.[11]

The existing native fish community in Fossil Creek consists of headwater chub (*Gila nigra*), roundtail chub, speckled dace (*Rhinichthys osculus*), longfin dace (*Agosia chrysogaster*), Sonora sucker (*Catostomus insignis*), and desert sucker (*Pantosteus clarki*). Colorado pikeminnow, spikedace, loach minnow, Gila topminnow, and razorback sucker occurred historically in the Verde River basin, and probably occurred in Fossil Creek before flows were diverted out of the creek in the early 1900s. Although no records exist, it is likely that other species including woundfin, flannelmouth sucker, desert pupfish, etc., also inhabited suitable habitats within the Verde River basin, and may have accessed Fossil Creek. Protection against incursion by nonnative fishes has been afforded to the uppermost 0.3 mile perennial reach of stream by the Fossil Springs diversion dam. Above the dam, a purely native fish community comprised of headwater chub, speckled dace, and desert sucker has flourished. Below the dam, the community dominance of nonnatives (smallmouth bass, green sunfish, flathead catfish, and yellow bullhead) is gradually moving upstream from the Verde River and lower reaches of Fossil Creek to the Irving power plant and above. Green sunfish has invaded to near the base of Fossil Springs diversion dam, and crayfish have invaded the reach between Irving and the natural barrier 2.0 miles below Fossil Springs diversion dam. Flathead catfish has also recently invaded the lower reaches of Fossil Creek (AGFD 2001).

11 Trout stocked above Fossil Springs diversion dam in the past did not survive.

The original source of sport fishes now in Fossil Creek is believed to be a result of historic stockings by the AGFD into the mainstem Verde River, its impoundments, perennial tributaries, and major stock-watering tanks (AGFD stocking records). Although yellow bullhead and green sunfish are not specifically listed in AGFD records, they may have been mixed with supplier stocks of bluegill (*Lepomis macrochirus*) and channel catfish (*Ictalurus punctatus*) that were widely introduced to the Verde River drainage. Private stock pond owners also often introduce sport fishes for their personal use, although they require a permit from AGFD to do so. Crayfish were historically stocked and sold commercially as bait in Arizona; however, current AGFD rules restrict or prohibit possession and transportation of live crayfish.

Introduction of nonnative fishes and crayfish from these sources to Fossil Creek was by either natural upstream movements from the Verde River, possibly from downstream spills of Stehr Lake that was intentionally stocked with bluegill, channel catfish, and other nonnative sport species, or by illegal "bait bucket" transfers by anglers or recreationists. Bait bucket transfer is the transport and subsequent release of aquatic biota through sport fishing activities into a basin where it previously was absent (Ludwig and Leitch 1996). Although most intentional stockings of these species by AGFD have ceased, bait bucket transfers continue to be a problematic source of nonnative fish and bait species contaminations to Arizona waters.

Several restrictions to using live baits for fishing have been made recently by AGFD in an attempt to minimize the bait bucket transfer problem, and monetary rewards against illegal stockings are available. A public information and education program addressing the bait bucket transfer problem also is ongoing. However, use of live baitfish (including sunfishes and crayfish) is legal along the Verde River in the vicinity of Fossil Creek, and thus potential reintroductions of nonnative aquatic biota via this avenue remain a concern.

Smallmouth bass were not recorded from upper Fossil Creek until 1995 (Roberson et al. 1996), despite being present in lower reaches of Fossil Creek. Prior to 1995, a 4-foot falls approximately 1 mile below Stehr Lake that functioned as a natural fish barrier was washed out by an extreme flood that occurred in February 1995 (Roberson et al. 1996). The proposed barrier would functionally replace the natural barrier that was destroyed.

The nonnative northern crayfish (*Orconectes virilis*) has invaded and established in Fossil Creek to near the base of Fossil Springs diversion dam. Northern crayfish function as primary consumers, carnivores, and decomposers, and therefore do not fit within a single trophic level (Childs 1999a). The species can modify instream habitats through removal of aquatic vegetation, as well as prey upon macroinvertebrates and smaller individuals of native aquatic and semi-aquatic vertebrates (Rosen and Schwalbe 2002). Northern crayfish can suppress Sonoran mud turtle, leopard frog, and garter snake populations by limiting recruitment of young via predation (Fernandez and Rosen 1996), but effects on native fish populations are equivocal (Carpenter 2000, White 1995). Laboratory studies demonstrate that crayfish are strong competitors with native fishes for food (Carpenter 2000) and space (White 1995, Childs 1999b), and laboratory predation

by northern crayfish on a native minnow (speckled dace) was documented (Childs 1999b). The latter study, however, questioned whether similar predation would occur in the wild. Predation by northern crayfish on eggs of another native minnow, the Little Colorado spinedace (*Lepidomeda vittata*), was demonstrated in the wild (White 1995). Although poorly documented in Arizona, studies showing crayfish predation on fishes in other regions are relatively common, and it is clear that crayfish introductions minimally have potential to destabilize and restructure native communities (reviewed by Childs 1999a).

3.2.6 Environmental Consequences - Fish and Aquatic Wildlife

No Action Alternative

In the absence of Federal action to protect the native fish community, the trend of increasing nonnative populations and decreasing native populations would continue, and Fossil Creek would likely become a smallmouth bass, green sunfish, and catfish dominated stream. This could result in potential loss of the current native fish assemblage and adversely affect amphibians and reptiles associated with the stream. These adverse effects could extend to the segment of stream above the Fossil Springs diversion dam if that structure is decommissioned and removed. Additionally, return of full flows without removal of nonnative fish would increase habitat and populations of nonnatives, intensifying impacts on native aquatic species.

Proposed Wilderness Alternative

Fish Barrier. The proposed wilderness barrier is expected to have substantial, positive benefits to native fish and other aquatic vertebrate populations by preventing upstream invasions of nonnative fishes and other undesirable aquatic biota into middle and upper reaches of Fossil Creek. These effects should also benefit leopard frog populations, in that they have also been shown to be negatively impacted by presence of nonnative fishes (Rosen et al. 1995). A similar benefit resulting from control of nonnative organisms should accrue to populations of Mexican garter snake, narrow-headed garter snake (Rosen and Schwalbe 1988), and Sonoran mud turtle (Rosen and Fernandez 1996).

Placement of a barrier would affect gene flow among native fish populations to some extent. Native fish below the barrier would not be able to move upstream of the barrier, but some individuals above the barrier are likely to go over the fish barrier during flood flows. However, most native fishes currently found in Fossil Creek (and those planned for repatriation) occur in very low densities or are absent altogether in the lower reaches of the stream and the Verde River (Roberson et al. 1996). Thus, the native species are already genetically isolated from downstream populations, and no genetic effects to the much larger upstream populations are anticipated. The continued presence of nonnative fishes below the barrier will likely preclude establishment of native fish populations there. If at a future time, enhanced genetic interchange is deemed desirable, it can be accomplished by periodically moving individuals from downstream to the segment of stream above the barrier.

At the species level, the fish barrier would prevent movements and integration of genetic materials of native fishes derived from other stream systems to Fossil Creek populations. Genetic communication among diverse populations is desirable to maintain long-term (100s of generations) genetic health of a species by allowing influx of novel genes that may better enable a species to adapt to changing environments. However, the condition of stream systems within the Gila River basin over the past century has deteriorated to the point that little, if any, communication among tributary fish populations through connecting mainstem river corridors (such as the Verde River) occurs. Presence of an array of nonnative fish predators near tributary mouths and especially in mainstem rivers, like the Verde River, coupled with fragmentation of river drainages via stream diversions, channelization, groundwater pumping, reservoirs, etc., render long-distance movements of fishes among streams within a drainage unlikely (Fagan et al. 2002). The dire status of native fishes today makes the need to protect remaining populations more immediate than ensuring that longer-term evolutionary needs are met. If obstacles presented by the presence of nonnatives can be removed in the future, the need for the barrier would be eliminated, and it would be breached.

Downstream drift of larvae of native fishes past the barrier would result in some losses to the upstream population, as they would be unable to move back upstream past the barrier. Drift of native larval fishes in streams and rivers of the Colorado River basin is a common phenomenon, but varies greatly among species (Bestgen et al. 1985; Valdez et al. 1985; Robinson et al. 1998; Remington 2002). For example, of nearly 20,000 larval fishes collected from the drift in the Gila River, New Mexico, in March-May, 1984, only 2 percent were minnows (Family Cyrinidae; including roundtail chub), and the rest were suckers (Family Catostomidae; Bestgen et al. 1985). In the Bestgen et al. (1985) study, most (87 percent) minnow drift occurred during daylight, and distances drifted were estimated to be short.

Distances drifted by native fish species in Fossil Creek have not been determined, but two lines of evidence suggest that drift losses over the fish barriers would be negligible under the proposed project. First, drift of larval stages of these species has not been shown to be a significant feature of their life histories, and most drift that occurs is during daylight when drift distances are short (Bestgen et al. 1985). Second, a recently-completed study of native fish drift in Aravaipa Creek, Arizona, determined that drift of longfin dace, desert sucker, and Sonora sucker was relatively short (on the order of 10s of meters; Remington 2002). Therefore, unless drift transport distances are relatively long (several kilometers or more), large losses from this avenue are not expected.

Downstream transport of older life stages of fishes during flood or by other avenues of dispersal would also result in some losses of fishes below the barriers, although native fishes in general are adapted to avoid the worst hydraulic conditions of flood events, and they resist downstream transport (Minckley and Meffe 1987). However, entire year classes of native fishes can be destroyed from floods that occur during larval rearing periods (Robinson et al. 1998). For reasons similar to those explained for genetic isolation impacts (above), losses of native species from flood transport are expected to be minimal and of little significance to upstream populations.

As with early life stages of native fishes, floods that occur during larval development of leopard frogs have the potential to decimate a given year's cohort. Such effects would occur with or without the presence of the fish barrier, however. In the absence of flooding during larval development, downstream losses of larvae of leopard frogs over the barriers should be minor, since sites of oviposition and larval rearing are in areas of slack water with relatively little potential for entrainment in currents that could transport larvae downstream. Significant downstream drift of amphibian larvae in streams has not been noted in the literature.

No substantial impacts to later life stages (juvenile and adult metamorphs) of leopard frogs are expected from placement of fish barriers. Because the proposed fish barrier would function similar to other natural stream structures, such as debris or travertine structures, the impacts would be similar. Fish barriers should not be a complete barrier to upstream movements by terrestrially-mobile adult frogs, Mexican garter snake, or Sonoran mud turtle, but movements would be hindered.

Impacts to instream habitats in the sedimentation zone immediately upstream of the fish barrier would be primarily a result of lowering of the local stream gradient. Thus, certain habitat types such as steep-gradient riffles and rapids would be less likely to reform after construction of the barrier and resulting sedimentation. Decreases in mean sediment size, and increases in channel sinuosity and braiding, are other possible localized effects associated with lower gradient. However, gradient of Fossil Creek is relatively steep (2 to 3 percent), and the channel at the barrier is confined by solid rock and boulders, limiting the effect of sedimentation to approximately 240 linear feet (0.1 acre).

The wilderness barrier would afford protection to more diverse aquatic habitat. If full instream flows are restored under the decommissioning process, more than 4 miles of stream below Fossil Springs is likely to become travertine dominated. This calcium carbonate saturated environment may affect differences in native fish and invertebrate production and population density relative to lower reaches of Fossil Creek. With the wilderness barrier, there is a doubling of the non-travertine dominated habitat (i.e., 5 miles vs. 2.2 miles of non-travertine dominated stream) available to aquatic fauna. The additional 2.8 miles of stream protected by the wilderness barrier would contribute pool, run, riffle, and glide habitat that is free of travertine formations.

Access to the wilderness site is difficult. The area is roadless, and hiking conditions are relatively challenging. Bait bucket transfers from immediately below the barrier to above it would compromise stream protection, but the difficult access would make this unlikely to occur. The inadvertent or purposeful transfer of nonnative fishes has been shown to increase proportionately with the level of human use of the resource (Ludwig and Leitch 1996).

Stream Renovation. Treatment with antimycin A would affect approximately 9.5 miles of stream between the proposed barrier and the Fossil Springs diversion. Antimycin would not be applied downstream of the barrier or upstream of the Fossil Springs diversion dam.

Effects of antimycin on aquatic invertebrates are variable. Any effects on aquatic insect populations are usually short-term, as kills are incomplete and recolonization is rapid (Jacobi and Degan 1977, Minckley and Mihalick 1981, Gray 1981, Gray and Fisher 1981). Kiner et al. (2000) found no significant difference in species abundance for pre- and post-treatment sites, but found significant differences in relative abundances of some invertebrate groups. In Arizona, Minckley and Mihalick (1981) concluded that long-term changes in the aquatic invertebrate fauna resulting from antimycin treatment of Ord Creek were minimal, but that a few taxa may have been locally eliminated. Lopez (1991) reported no loss of taxa 1 month following antimycin renovation of Hayground Creek, Arizona. Jacobi and Degan (1977) found that although macroinvertebrate populations were drastically reduced 2 days after treatment with antimycin in Seas Branch Creek, Wisconsin, all common taxa identified before treatment were present 1 year later, and total benthic biomass approached or exceeded that before treatment. Others (Walker et al. 1964, Vezina 1967, Gilderhus et al. 1969, Lennon and Berger 1970, Snow 1974, Houf and Campbell 1977, and Morrison 1979) failed to discern adverse effects of antimycin on invertebrates in general. Source populations for recolonization of aquatic invertebrates will be available in nontreated reaches above Fossil Springs diversion dam and below the fish barrier.

Prior to 2001, aquatic invertebrates were poorly studied in Fossil Creek, raising concerns about potential loss of unique or rare aquatic invertebrates associated with the travertine-forming Fossil Creek. However, sampling conducted by Northern Arizona University (NAU) found only a single invertebrate species unique to Fossil Creek, the Fossil Springsnail (*Pyrgulopsis simplex*) (see Section 3.2.9, *MIS Invertebrates*). This species has been documented only in the outflows of Fossil Springs, and will not be affected by renovation. Limited surveys have also identified at least nine macroinvertebrate species in the Fossil Springs area that have not been found below the diversion dam (Goodwin 1980, Burbridge and Story 1974, Overby and Benoit 1997). A survey and monitoring study conducted by NAU is ongoing, and it will attempt to identify other rare or unique invertebrates in Fossil Creek. Should any be detected, attempts would be made to collect and hold a large sample alive during the renovation for restocking afterward. We note, however, that travertine formation below the Fossil Creek diversion dam has been halted for more than 85 years, and species obligately-associated with travertine likely perished long ago. Return of full flows to the lower stream (with associated new travertine formation) would result in distributing rare forms from above the diversion dam to the stream below. Recolonization of macroinvertebrates from the untreated segment of stream below the barrier would also occur.

Antimycin is not effective at total removal of crayfish populations. A limited study is in progress that is examining the success of trap and dip net removals of crayfish in Fossil Creek, and another is performing a comprehensive literature review of crayfish removal techniques. A few chemicals are known to eliminate crayfish while leaving fish populations intact (Ray and Stevens 1970, D. Mitchell, AGFD, personal communication), but none are currently registered for such use by the Environmental Protection Agency.

Although it is desirable to eliminate northern crayfish from Fossil Creek, their continued presence is not expected to jeopardize the success of the proposed repatriation of native fishes and restoration of the historical native fish community. Crayfish have not been shown to interfere with native fishes to the point where fishes cannot successfully complete their life cycles and sustain populations. Presence of northern crayfish is a significant detraction from restoration of a native aquatic community in Fossil Creek, however, and investigations are ongoing to develop methods to eliminate them. Once developed, application of the removal technique to Fossil Creek will be proposed in a separate analysis if it is needed. Mechanical removal of crayfish is currently being tested in Fossil Creek.

Stream renovation would eliminate all fishes within treated reaches. A portion of the native fish community would be salvaged and returned to the stream following treatment. Native fishes upstream of the Fossil Springs diversion dam would also be a source for natural recruitment. There is no definitive number of fish that must be salvaged to ensure that genetic variability is preserved for repatriation following chemical renovation (T.E. Dowling, Arizona State University, personal communication). The recommended goal is to retain at least 90 percent of the wild genetic variation in captive breeding programs of endangered species (Soule et al. 1986); and in stream renovation, the best way to achieve that goal is to sample as much of the source population as possible. If wild populations are already low due to impacts from stream diversion or presence of nonnative fishes, for example, it is likely that a portion of the original genetic variation already has been lost. Genetic "repopulation" will have to rely upon a combination of salvaged individuals, inputs from populations above the diversion dam, and possibly translocations from other local stream sources that are genetically similar. Without the renovation, the likely result will be continued loss of genetic variability (and potential extinction) as native populations continue to dwindle in response to presence of nonnative species.

Repatriation of native fishes would have beneficial environmental consequences. Repatriations will restore the original fish community that is believed to have resided in Fossil Creek prior to stream diversion and introductions of nonnative species, and will initiate a long-overdue recovery process for the imperiled warm water native fish fauna of the Gila River basin. Similar action at other streams within the basin may eventually lead to downlisting and delisting of some fishes from the Endangered Species Act and may help remove the need to list others.

No ongoing uses (assuming decommissioning of the Childs-Irving Hydropower Project) in the Fossil Creek basin are expected to be greatly affected by the native fish restoration project, and some (such as the native chub fishery) may be enhanced. Analysis of economic responses to potential environmental protections of this sort suggests that long-term health of the economy seems compatible with, and may benefit from, the long-term health of the environment (Niemi 2002).

Nonwilderness Alternative

Fish Barrier. The nonwilderness barrier would affect fish and aquatic wildlife in a manner similar to the wilderness barrier, except that a shorter segment of stream would be protected. Nonnatives would be excluded from 6.7 miles of stream below Fossil Springs diversion dam. This alternative carries a higher probability of nonnative transfer across the barrier due to public access to the site.

The nonwilderness alternative would increase the percentage of travertine dominated stream protected relative to other habitat types. Over 4 miles (60 percent) of the 6.7 miles of stream protected under the nonwilderness alternative is likely to develop travertine formations following return of full instream flows. This environment is very different chemically from lower stream reaches that are not influenced by calcium carbonate and may have a different response in terms of native fish and invertebrate production and population density. Under the nonwilderness alternative, the non-travertine dominated habitat available to native aquatic species would be less (about 2.2 miles vs. 5 miles of non-travertine dominated stream), resulting in less diversity of stream protected. Although very limited site-specific habitat data is available for the 2.8 miles of Fossil Creek between the non-wilderness and wilderness sites, this segment of stream likely contains pool, riffle, run, and glide habitat that increases the system's capacity for several, if not all, of the existing and proposed native fishes.

The nonwilderness site is relatively accessible to the public, and the "waterfall effect" created by the barrier may attract concentrated use at the structure. Public recreation along road accessible portions of Fossil Creek is expected to increase with restoration of flows in 2004. Ease of public access to this site would introduce greater risk that bait bucket transfers across the barrier would compromise stream protection. The inadvertent or purposeful transfer of nonnative fishes has been shown to increase proportionately with the level of human use of the resource (Ludwig and Leitch 1996).

Stream Renovation. Treatment with antimycin would affect approximately 6.7 miles within the middle and upper reaches of Fossil Creek. There would be 2.8 miles less stream restored to a purely native fish assemblage than in the proposed action, and therefore less long-term benefit to native fish and other native species. Other aspects of renovation would be similar to the proposed action.

Cumulative Effects

Direct and indirect effects of barrier construction and chemical renovation on fish and aquatic wildlife would be short-term and minor, with long-term beneficial effects after implementation. Minor sedimentation impacts from barrier construction would be additive to other past, present, and reasonably foreseeable projects such as livestock grazing and road maintenance. There are no other past, present, and reasonably foreseeable projects where chemicals would be applied, or would otherwise occur within the same area or before effects from barrier construction and piscicide application have dissipated.

3.2.7 Affected Environment –Federally-Listed Species

Table 2 presents FWS-listed, proposed, and candidate species that occur in Gila and Yavapai counties. Listed species are afforded protection under the ESA. Candidate species are those for which FWS has sufficient information to propose them as endangered or threatened, but for which listing is precluded due to other higher priority listings. Proposed species have been formally proposed to be listed.

Table 2 – Federally-listed and candidate species in Gila and Yavapai Counties (March 2003).

Common Name	Scientific Name	Status
Lesser Long-nosed Bat	*Leptonycteris curasoae yerbabuenae*	Endangered
Bald Eagle	*Haliaetus leucocephalus*	Threatened
Mexican Spotted Owl	*Strix occidentalis lucida*	Threatened
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Endangered
Brown Pelican	*Pelecanus occidentalis californicus*	Endangered
Cactus Ferruginous Pygmy-owl	*Glaucidium brasilianum cactorum*	Endangered
Yuma Clapper Rail	*Rallus longirostris yumanensis*	Endangered
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	Candidate
Chiricahua Leopard Frog	*Rana chiricahuensis*	Threatened
Razorback sucker	*Xyrauchen texanus*	Endangered
Colorado pikeminnow	*Ptychocheilus lucius*	Endangered
Gila topminnow	*Poeciliopsis occidentalis occidentalis*	Endangered
Loach minnow	*Tiaroga cobitis*	Threatened
Spikedace	*Meda fulgida*	Threatened
Gila Chub	*Gila intermedia*	Proposed Endangered
Gila Trout	*Oncorhynchus gilae*	Endangered
Desert Pupfish	*Cyprinodon macularius*	Endangered
Apache (Arizona) Trout	*Oncorhynchus apache*	Threatened
Page Springsnail	*Pyrgulopsis morrisoni*	Candidate
Arizona Agave	*Agave arizonica*	Endangered
Arizona Hedgehog Cactus	*Echinocereus triglochidiatus arizonicus*	Endangered
Arizona Cliffrose	*Purshia subintegra*	Endangered

The following species would not be effected by the project due to the lack of suitable habitat and/or because the current range for the species is outside of the project area: Arizona agave, Arizona hedgehog cactus, Arizona cliffrose, Apache (Arizona) trout, Gila chub, Gila topminnow, Gila trout, desert pupfish, lesser long-nosed bat, cactus ferruginous pygmy-owl, brown pelican and Page springsnail. A Biological Assessment concluding no effect to any listed species and no adverse modification to critical habitat was submitted to the FWS on October 24, 2002. Species discussed below may occur in the vicinity of Fossil Creek.

The 2001 CAP biological opinion addressed impacts to aquatic species for barrier construction, which was tiered to the Biological Assessment for the proposed project. The proposed project includes stream renovation activities, which were not covered under

the biological opinion. Although no listed or proposed aquatic species occur in the project area, the lower 4.7 miles of Fossil Creek (which includes the lower 0.2 mile of the project area) has been designated as critical habitat for spikedace and loach minnow.

Bald Eagle - In 1978 all bald eagles in 43 of the 48 contiguous United States, including Arizona, were classified as endangered (43 FR 6233, February 14, 1978), and those in Minnesota, Wisconsin, Michigan, Oregon, and Washington were classified as threatened. A recovery plan (FWS 1982) was established to delineate specific research and management objectives for the population in the Southwest. Since DDT was banned from use in the United States in 1972, there has been a steady increase in both the number of breeding pairs and the number of young reared per breeding attempt in most North American populations (Gerrard and Bortolotti 1988). In Arizona, the number of known bald eagle Breeding Areas (BA's) has steadily increased from 1 or 2 in 1970, to 41 in 2002 (AGFD 2002). The bald eagle was reclassified as threatened on July 12, 1995 (FR 60 (133): 36000).

There are two bald eagle Breeding Areas (BAs) on the Verde River downstream of the project area. The East Verde BA nest site is located on the Verde River, 1.2 miles downstream of the Fossil Creek confluence. The nearest nest within the Coldwater BA, located on the Verde River approximately 2 miles upstream from the Fossil Creek confluence, has not been active since 1998. The most frequently utilized nests within the Coldwater BA are located on the Verde River, 5.6 and 10 miles upstream of the Fossil Creek confluence (AGFD 2002).

The Coldwater eagles frequently use the Verde River reach between Child's and the Fossil Creek confluence for foraging (Personal Communication, James Driscoll, Bald Eagle Program Manager, AGFD, June 5, 2000). Telemetry in 1987 (Hunt et al. 1992) indicated the East Verde male foraged for spawning suckers and used hunting perches 2.5 miles up Fossil Creek. This site is 2 miles downstream of the project area and would remain unaffected by barrier construction or stream renovation activities. Hunt et al. (1992) denoted that Fossil Creek is an important tributary of the Verde River to protect to ensure maintenance of fish populations and riparian communities. There are no records of bald eagle use at Stehr Lake, although the lake and its shoreline may provide minimal foraging and nesting habitat. Due to infill and vegetation encroachment, the lentic community of Stehr Lake has been reduced from 23 acres to approximately 3 acres in size. This affects the quality of the habitat for eagles and its potential suitability for nesting or foraging. No bald eagle nests are located on Fossil Creek; the closest nest location is the East Verde BA over 2 miles (straight-line distance) southwest of the project area.

Wintering bald eagle populations tend to be scattered and highly mobile, usually foraging and roosting in small groups. Wintering eagles prefer areas of plentiful food resources, usually near water. Individual or small groups of eagles often occur in terrestrial habitats when open bodies of water freeze over. Grubb and Kennedy (1982) reported that the National Forests provided habitat for the most significant concentrations of wintering eagles in Arizona. Coconino County consistently records the highest number of bald eagles during annual mid-winter surveys; eagles are consistently detected on the

Verde River between the East Verde and West Clear Creek (Beatty 1992, Beatty et. al 1995a, Beatty et. al 1995b, Beatty and Driscoll 1999). Bald eagles use communal night roosts that may be related to food finding (Hansen et al. 1980) or energetic considerations (Keister 1981, Knight et al. 1983). Night roosts are often on slopes (Platt 1976, Hansen et. al 1980, Dargan 1991) or are protected from prevailing winds by surrounding vegetation (Sabine 1981, Steenhof 1976). Individual roost trees are larger and have open canopies (Stalmaster and Newman 1979, Hansen et al. 1980, Anthony et al. 1982, Keister and Anthony 1983, Dargan 1991).

Fossil Creek above its confluence with the Verde River is not included in any midwinter survey routes, and there is no information available regarding winter foraging or roosting use. Potential roosting habitat (large trees, protected from the wind by adjacent slopes) occurs along the creek. However, this habitat is primarily in the upper portion of Fossil Creek. No large roosting trees occur near the proposed fish barrier location with the exception of Stehr Lake (approximately 1.3 miles upstream). The existing fishery in Fossil Creek provides limited foraging habitat for eagles.

Stehr Lake provides potential foraging and roosting habitat for bald eagles, although eagles are not known to use the lake, and habitat may be marginal. Given the flat topography, and the presence of better roosting habitat in upper Fossil Creek, Stehr Lake's use as a winter roosting area is questionable.

The 2001 biological opinion identified the following activities that would be considered "take" under Section 9 of the ESA: (1) barrier site selection occurred within 1 mile of an active bald eagle nest site; (2) barrier construction exceeded the bounds of the anticipated disturbance area as determined by Reclamation, with FWS concurrence, prior to construction initiation; and (3) helicopter use occurred within 1 mile (horizontal radius or 2000 feet above a known bald eagle nest. None of these conditions would be violated. No "take" would occur for the bald eagle.

Mexican Spotted Owl - On the Coconino and Tonto Forests, the Mexican spotted owl (MSO) occupies mixed conifer and ponderosa pine/Gambel oak vegetation types, usually characterized by high canopy closure, high stem density, multi-layered canopies within the stand, numerous snags, and downed woody material. Much of the time, suitable nesting and roosting habitat is located on steep slopes or in canyons with rocky cliffs, where dense vegetation, crevices or caves provide cool moist microsites for nests and roosts.

Surveys have not been conducted for MSO's in the project area. According to the Mexican Spotted Owl Recovery Plan (FWS 1995a), the riparian area along Fossil Creek and the Verde River qualifies as restricted habitat, and the lands within Mazatzal Wilderness boundaries and the Fossil Springs Botanical Area qualify as protected MSO habitat. Riparian habitat along Fossil Creek does not provide vegetative density and structure needed for suitable nesting habitat. Several small patches of habitat occur along

the stream in association with small seeps and springs, but are very small and widely separated. Overall, the majority of the riparian forest along the creek is too sparse, and/or lacks the complex structure, particularly in the understory, to provide nesting habitat.

While many owls stay on their breeding areas throughout the year, in winter some birds migrate to lower, warmer elevations and more open woodland or scrub habitats (Ganey and Dick 1995). Fossil Creek and the adjacent pinyon-juniper woodlands and desert scrub habitats provides suitable wintering and possibly dispersal habitat for MSO's. Construction activities would not take place during the winter months, thereby, avoiding direct impacts should any owls be present. Approximately 1 acre of upland habitat consisting of shrubs and grasses would be temporarily impacted by construction activities. This amount of habitat is insignificant when compared to the total habitat available within both forests. The closest nesting owl Protected Activity Center is located approximately 3 miles from the project area.

Yuma Clapper Rail - This subspecies of the clapper rail is found along the Colorado River from Needles, California to the Gulf, at the Salton Sea and other localities in the Imperial Valley, California, along the Gila River from Yuma to at least Tacna, Arizona and several areas in central Arizona including Picacho Reservoir (Todd 1986, Rosenberg et al. 1991). The FWS (1983) estimated a total of 1,700 to 2,000 individuals throughout the range of the subspecies. Based on call count surveys, the population of Yuma clapper rail in the United States appears to be holding steady (personal communication, Ron McKinstry, [formerly] FWS, no date).

Yuma clapper rails were thought to be a migratory species with the majority of birds migrating south into Mexico during the winter and only a small population resident in the United States. Eddleman (1989) concluded the Yuma clapper rail was not as migratory as once thought and estimated approximately 70 percent remained in or near their home range during the winter.

Yuma clapper rails live and nest in freshwater marshes where moist to wet soil and dense vegetation (at least 15 inches in height) occur (Todd 1986, Eddleman and Conway 1998). Flooded areas are important, but generally the rail uses areas of shallow water (less than 1 foot) near shore. Habitat with gradual slopes between the dry land and the flooded areas are used more than areas with steep land-water gradients. Where rails are found further from shore, decadent, lodged vegetation of previous years growth of cattails or bulrush usually provide above-water substrate that facilitates foraging and provides support for the nests. Most studies of Yuma clapper rails have indicated a preference for habitats dominated by cattails and bulrush (Anderson and Ohmart 1985, Conway et al. 1993, Eddleman 1989, Todd 1986). Crayfish (*Procambarus clarki*) are the preferred prey of Yuma clapper rails comprising as much as 95 percent of the diet of some populations (Ohmart and Tomlinson 1977). Yuma clapper rails also feed on other arthropods (such as water beetles, dragonflies, and spiders) and fish (Ohmart and Tomlinson 1977).

Clapper rails have been recorded, but not confirmed, at Tavasci Marsh (which is located adjacent to Coconino National Forest approximately 40 miles northwest of the proposed barrier location). Winter records for clapper rails at Tavasci Marsh are under dispute due to the similarity in calls between least bittern and Yuma clapper rails (personal communication, Troy Corman and Bill Burger, AGFD, February 26, 2003).

Currently, suitable nesting and foraging habitat for the Yuma clapper rail in Fossil Creek occurs above the Fossil Springs diversion dam where cattails and emergent vegetation is present. The patch size is not large enough to provide suitable wintering habitat. Because excess water from rain and flood events flow over the dam, there is minimal fluctuation in the water level above the dam. Constant water levels are particularly necessary to Yuma clapper rails during the breeding season to prevent nest inundation. The habitat above the dam supports an abundance of rail food items including insects, fish, frogs, tadpoles, spiders, plant matter, small mammals, birds, reptiles, and eggs.

Suitable nesting, foraging and wintering habitat occurs in Stehr Lake although surveys in 1998 failed to detect nesting rails. The closest nesting rail population is located in Phoenix, Arizona. In 2002, a single clapper rail was found at Roosevelt Lake approximately 50 miles away. No surveys for wintering rails have occurred at Stehr Lake.

Southwestern Willow Flycatcher - The southwestern willow flycatcher (SWF) was listed as endangered in Federal Register Vol. 60, No. 38, February 27, 1995 (FWS 1995b). The breeding range includes southern California, Arizona, New Mexico, and the extreme southern portions of Nevada, Utah, and western Texas.

Nesting SWFs prefer dense riparian thickets in areas where perennial flow, surface water, or saturated soil is present from April through September. In most riverine situations, associated channels are wide and shallow with a well-defined floodplain and a broad valley. Vegetative species composition and structure varies across the range of the SWF. The variation ranges from homogeneous patches of one or several species with a single canopy layer to heterogeneous patches of numerous species with under, mid, and over stories. Canopy covers are consistently high (greater than 90 percent) throughout the range (Spencer et al. 1996). In the Verde Valley, nesting SWF's occur in tamarisk and mixed riparian habitats. Patch width of breeding sites in both tamarisk and mixed riparian habitat types tend to be more linear, varying from 460 feet to 1,640 feet in maximum width (Sferra et al. 1995). Overstory canopies average between 50 and 55 feet tall (Spencer et al. 1996). Patch size varies from 5 to 121 acres in mixed riparian and tamarisk (Spencer et al. 1996).

Currently, Fossil Creek and Stehr Lake do not support suitable SWF nesting habitat. Riparian habitat along Fossil Creek differs from habitats typically occupied by SWF in Arizona, in that the riparian vegetation is too narrow and the mid and understory vegetation layers are relatively open. The closest nesting SWFs are at Camp Verde approximately 30 miles away (personal communication, Susan Sferra, Bureau of Reclamation, July 10, 2002).

Western Yellow-billed Cuckoo - On July 25, 2001, the FWS published a notice in the Federal Register (FR 66(143)) that the petition to list the western yellow-billed cuckoo (yellow-billed cuckoo) was warranted, but precluded by higher listing actions. The yellow-billed cuckoo remains a candidate species. The yellow-billed cuckoo is a late migrant associated with large tracts of undisturbed riparian deciduous forest where willow, cottonwood, sycamore, or alder is present. Yellow billed cuckoos require fairly large tracts (minimum of 25 acres) of habitat for nesting at least 300 feet wide (Latta et al. 1999). However, recent research (personal communication, Murrelet Halterman, January 29, 2003) indicates that yellow-billed cuckoos can successfully reproduce in smaller habitat patches consisting of narrow stringers of trees. Preliminary information on the San Pedro River indicates cuckoos utilized patches between 10 and 50 acres in size. In all sites, cottonwood/willow patches were surrounded by mesquite and hackberry. Cuckoos on the Bill Williams River appear to utilize larger patches. Yellow-billed cuckoos in higher elevations may be found in mesquite and tamarisk. The yellow-billed cuckoo feeds almost entirely on large insects, and if food stressed, may also feed on berries and fruit. A yellow-billed cuckoo was detected in Fossil Creek by Coconino National Forest biologist Cathy Taylor (Fossil Creek database, Red Rock Ranger District). The AGFD conducted a survey for the cuckoo at Verde Hot Springs along the Verde River, however, no cuckoos were detected. Yellow-billed cuckoos could potentially occur in Fossil Creek from Fossil Springs down to the Verde confluence.

Chiricahua Leopard Frog - The Chiricahua leopard frog, described by Platz and Mecham (1979), had already suffered serious reduction in geographic range in Arizona by 1987 (Clarkson and Rorabaugh 1989). This species was listed as threatened on June 13, 2002 (FR 67 (114): 40790-40811).

The Chiricahua leopard frog has two forms: the southern form, found in southeastern Arizona, portions of southwestern New Mexico, and a portion of Mexico; and the Rim form, a disjunctive population occurring along the southern edge of the Colorado Plateau and headwater drainages in the White Mountain and along the Mogollon Rim in Arizona (Sredl et al. 1997). Fossil Creek and Mud Tanks Mesa appear to represent the eastern boundary of the Rim form's current range (Sredl 1998). Chiricahua leopard frog populations in central Arizona are distinctive, and will soon be described as a new species (Platz, personal communication, from Sredl and Healy, 1999). Habitat ranges from 3,500 to 8,890 feet. Chiricahua leopard frog distribution overlaps with northern leopard frog (*Rana pipiens*) habitat at higher elevations and lowland leopard frog (*Rana yavapaiensis*) habitat at lower elevations. Fossil Springs, at an elevation of 4,280 feet, is within the elevation range for all leopard frogs. The Chiricahua leopard frog is the most aquatic of all the leopard frogs (Sredl 1998). According to Sredl et al. (1997), the Rim form of the Chiricahua leopard frog has declined dramatically. Since 1993, only 15 of 871 surveyed sites contained leopard frogs. Eighty-four percent of historical sites are unoccupied. Four of the 15 occupied sites are on the Coconino and seven are on the Tonto National Forest.

The AGFD and a consulting firm (EnviroNet 1998b) have conducted surveys for leopard frogs in the Fossil Creek area, including stock tanks in the uplands above the rim. Four tanks that are located just over the rim above Fossil Springs and upper Fossil Creek supported populations of Chiricahua leopard frog, but none were found in Fossil Creek, Fossil Springs, or Stehr Lake (APS 1998). Although currently occupied by lowland leopard frogs, the Fossil Springs area also has habitat characteristics suitable for Chiricahua leopard frogs and is within the documented elevation range for the Rim form. Because of the presence of Chiricahua leopard frogs immediately above the Fossil Creek drainage, dispersal and colonization into currently unoccupied habitat in the Fossil Creek drainage is possible.

Razorback Sucker - The razorback sucker was listed as endangered on October 23, 1991 (FR 56(205): 54957). Critical habitat was designated on March 21, 1994 (FR 59(54): 13374) and includes portions of the Verde, Gila and Salt Rivers. This species was once common throughout the Colorado River basin, but now exists sporadically in only about 750 miles of river in the upper basin. In the lower basin, a substantial population exists only in Lake Mohave with occasional individuals occurring both upstream in Lake Mead and the Grand Canyon and downstream in the mainstem and associated impoundments (FWS 1991a). Razorback suckers have been stocked in numerous locations in the Gila, Salt, and Verde River basins in an attempt to recover the species. Razorback suckers were stocked above Irving dam in 1988, where they grew to lengths greater than 15 inches. None have been collected in Fossil Creek since 1992 (Barrett 1992, Hendrickson 1992, 1993). However, the aquatic habitat there is complex, the fish are secretive, and surveys have not been intense.

Loach Minnow - The loach minnow was listed as threatened on October 28, 1986 (FR 51(208): 39468), and unoccupied critical habitat was designated in the lower 4.7 miles of Fossil Creek in 2000 (FR 65(80):24328). The loach minnow is a small, short-lived fish, endemic to streams of the Gila River Basin. The species has been extirpated from most of its historic range, surviving as a relatively large population only in Aravaipa Creek, Arizona (Minckley 1981), and the upper Gila and San Francisco river systems in New Mexico (Propst 1999). Smaller populations in Arizona inhabit the East Fork Black River (Marsh 1997), Blue River, Campbell Blue River, White River, San Francisco River, and Eagle Creek.

The loach minnow is a current-loving species, inhabiting interstices of gravel and rubble in shallow, well-defined, stream riffles (FWS 1990a, Rinne 1992). Loach minnow has never been recorded from Fossil Creek, but the species is a likely candidate for repatriation if an action is selected for implementation. The constituent elements for loach minnow are described in the Federal Register for critical habitat designation (FR 65 (80): 24328).

Critical habitat for the loach minnow was designated on April 25, 2000 (FR 65, (80): 24328) on the lower 4.7 miles of Fossil Creek. Fish barrier construction and stream renovation would occur in a 0.2 mile-reach of critical habitat on Fossil Creek. Over

900 miles of critical habitat has been designated for this species; the 0.2 mile of habitat along Fossil Creek represents an infinitesimal amount of the entire critical habitat designated.

Spikedace - Spikedace was listed as threatened on July 1, 1986 (FR 51(126): 23769). Spikedace is a small-bodied, short-lived fish endemic to the Gila River Basin that has been extirpated from most of its historic range. Spikedace remain only in Aravaipa Creek, a portion of the upper Verde River, and Eagle Creek (FWS 1990b). The species is extremely rare in the Verde River, Eagle Creek, and portions of the upper Gila River watershed in New Mexico. Spikedace occupy flowing pools generally less than 3 feet deep over sand, gravel, or mud bottoms below riffles or in eddies (Minckley 1981, Rinne 1992). Although spikedace have never been recorded from Fossil Creek, the stream appears to provide suitable habitat for this species.

Over 780 miles of critical habitat for the spikedace was designated on April 25, 2000 (FR 65 (80): 24328), including the lower 4.7 miles of Fossil Creek. Under the proposed action, fish barrier construction and stream renovation would occur in a 0.2-mile reach of critical habitat on Fossil Creek.

Colorado Pikeminnow - The Colorado pikeminnow[12] was listed as endangered on March 11, 1967 (FR 32(43): 40001). On July 24, 1985, the Salt River from Roosevelt Dam upstream to U.S. Highway 60 bridge and the Verde River from Horseshoe Dam upstream to Perkinsville were designated as locations for experimental, nonessential populations of Colorado pikeminnow (FR 50(142):30188), meaning that their loss would not appreciable reduce the survival of the species in the wild. Those areas were subsequently stocked with the species. The pikeminnow was once common throughout the Colorado River system, including the Gila River basin, but natural populations are now found only in scattered areas of the upper Colorado River system in Utah, Colorado, and New Mexico (FWS 1991b).

Historically, Colorado pikeminnow was the top fish predator in the Colorado River basin, relying almost exclusively on other fishes for food once they grew past a few inches in length. The species can make migrations of several tens of miles to spawn in very specific canyon-like habitats. Following hatching, larvae drift downstream with the currents for several thousand feet before settling in backwaters and initiating feeding (Tyus 1990). Colorado pikeminnow are stocked annually in the Verde River near Childs. Although none have been detected in Fossil Creek, in theory the species could enter lower reaches, if enough base flows are present, and a suitable native fish prey base reestablishes.

12 The former common name of this species is Colorado squawfish.

3.2.8 Environmental Consequences–Federally-Listed Species

No Action Alternative

Repatriation of listed fishes into Fossil Creek would not occur. No improvement to the recovery status of listed species would occur.

Proposed Wilderness Alternative

Bald Eagle – No suitable nesting and only limited foraging habitat occurs on Fossil Creek. Fossil Creek is not recognized as wintering habitat for bald eagles. Helicopter flights to and from the project area would avoid the Coldwater and East Verde BAs or fly above the 2,000-foot limit. Consumption of antimycin-killed fish would not be expected to harm foraging bald eagles.

The 2001 CAP biological opinion identified the following activities that would be considered "take" under Section 9 of the ESA: (1) barrier site selection occurred within 1 mile of an active bald eagle nest site; (2) barrier construction exceeded the bounds of the anticipated disturbance area as determined by Reclamation, with FWS concurrence, prior to construction initiation, and (3) helicopter use occurred within 1 mile (horizontal radius or 2000 ft above a known bald eagle nest. None of these conditions would be violated. No adverse effect or "take" would occur.

Mexican Spotted Owl – The project area does not provide suitable nesting habitat for this species. No breeding spotted owls would be affected by this project. The Fossil Creek drainage does provide suitable habitat structure, but its small size probably precludes its use by nesting owls. The Fossil Creek drainage may provide suitable winter habitat for roosting and dispersing owls. Project construction would occur during late spring or early fall and only minor impacts will occur to less than 2 acres of upland habitat. Helicopter flights to the project area will avoid known spotted owl Protected Activity Centers.

Yuma Clapper Rail – No suitable habitat for the Yuma clapper rail occurs on Fossil Creek below Fossil Springs diversion dam. Suitable habitat is present at Stehr Lake, but would not be impacted by this project. No Yuma clapper rails have been recorded at Stehr Lake. No wetland habitat would be impacted by this project.

Southwestern Willow Flycatcher – The riparian habitat present in the project area does not provide the structure or density necessary to support nesting SWFs. The nearest nesting SWF territory is 30 miles from the project area. No impact would occur to the SWF from this project.

Yellow-billed Cuckoo – There is one record of yellow-billed cuckoo on Fossil Creek (Red Rock Ranger District). No habitat currently suitable for yellow-billed cuckoos would be disturbed by the project; nor would barrier construction preclude development

of suitable habitat. The yellow-billed cuckoo would not be present during the implementation of the proposed project, consequently there would be effects to the yellow-billed cuckoo's prey base from the use of antimycin.

Chiricahua Leopard Frog – Extensive surveys for Chiricahua leopard frogs were conducted in Fossil Creek (EnviroNet 1998b). Although no Chiricahua leopard frogs were located, there is potential for frogs to disperse into currently unoccupied habitat in the stream. Removal of nonnative species from upper and middle reaches of Fossil Creek would have a potential beneficial effect on Chiricahua leopard frogs.

Chiricahua leopard frog surveys would be completed prior to renovation of stock tanks. If present, native tadpoles would be removed, held temporarily in aerated 5-gallon buckets and returned to the source tanks following renovation. This action would have a minor effect on Chiricahua leopard frogs.

Razorback Sucker – No razorback suckers are present in Fossil Creek; no adverse effect would occur to this species. The project would have a beneficial effect on razorback sucker by protecting habitat for possible repatriation.

Colorado Pikeminnow – There are no records of the Colorado pikeminnow from Fossil Creek; no adverse effect would occur to this species. The project would have a beneficial effect on Colorado pikeminnow by protecting habitat for possible repatriation.

Loach Minnow – Loach minnow have never been recorded from Fossil Creek; no adverse effect would occur to this species. The project would have a beneficial effect on loach minnow by protecting habitat for possible repatriation.

Loach Minnow Critical Habitat – Adverse modification of critical habitat is defined in the FWS Consultation Handbook (FWS 1998) as: "a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species." The FWS has previously determined that barrier construction will not adversely modify critical habitat for loach minnow (FWS 2001). The proposed antimycin-A application would not (1) alter living areas of adult, juvenile, or larval loach minnow habitat, or (2) modify streambed substrate, pool, riffle, or run complexes, stream gradient or water temperature, or (3) modify the stream hydrology. Application of antimycin-A to remove nonnative fish species above the fish barrier on Fossil Creek would improve the value of critical habitat for the survival or recovery of the loach minnow. The project would have a beneficial effect on a 0.2-mile segment of critical habitat.

Spikedace – Spikedace have never been recorded from Fossil Creek; no impact would occur to this species. The project would have a beneficial effect on spikedace by protecting habitat for possible repatriation.

Spikedace Critical Habitat – The FWS has previously determined that barrier construction will not adversely modify critical habitat for spikedace (FWS 2001). Application of antimycin-A to remove nonnative fish species above the fish barrier on Fossil Creek would not diminish the value of critical habitat for the survival or recovery of the spikedace. The project would have a beneficial effect on a 0.2-mile segment of critical habitat.

Nonwilderness Alternative

The effects on federally-listed species would be the same as discussed for the proposed wilderness alternative. There would be less beneficial effect for native aquatic species because 2.8 fewer miles of stream habitat would be protected, and the probability of recontamination with nonnatives would be greater due to human access to the barrier site. There would be no effect, beneficial or otherwise, to loach minnow and spikedace critical habitat.

Cumulative Effects

There are little to no direct or indirect effects to federally-listed species from this project and, therefore, there would be little cumulative effect when added to any past, present, or reasonably foreseeable projects within the same area, or that would occur before project effects from barrier construction and piscicide application have dissipated.

3.2.9 Affected Environment – Forest Service Sensitive Species/Management Indicator Species/Other Species of Concern

Both Coconino and Tonto National Forests have compiled lists of sensitive species (Table 3) from the Regional Forester's Sensitive Species List (July 21, 1999) for Region 3. Placement on the Regional Forester's sensitive list is determined by concern for population viability because of significant current or predicted downward trends in population numbers or density and downward trends in habitat capability that would reduce a species' distribution. For some species on the list that are thought to be rare, particularly plants and invertebrates, there is little information and limited surveys to accurately determine status. In addition to the official list, Coconino and Tonto National Forests have expressed concern about all native fish species in Fossil Creek. Conservation of species designated as sensitive is required by FSM 2670.

Management Indicator Species (MIS) serve as barometers of management effects on other species with similar habitat. The presence (and relative abundance) of a MIS indicates that the habitat type is present and of suitable quality to support associated wildlife species. Changes in the population of MIS are believed to indicate the effect of forest management activities. Twelve vertebrate species, plus macro-invertebrates, are listed as MIS from the respective Forest Plans for riparian and other habitat within the project area.

Table 3 - List of Forest Service Sensitive Species, other Sensitive Species, and Management Indicator Species for the Fossil Creek area, Arizona.

Common Name	Scientific Name	Status
Sensitive Mammals		
Southwestern River Otter	*Lutra canadensis sonora*	SC, WC, Sen
Sensitive Birds		
American Peregrine Falcon	*Falco peregrinus anatum*	WC, Sen
Common Black Hawk	*Buteogallus anthracinus*	WC, Sen, MIS
Bell's Vireo	*Vireo bellii*	Sen, MIS
Sensitive Fish		
Sonora sucker	*Catostomus insignis*	*
Desert sucker	*Catostomus clarki*	*
Longfin dace	*Agosia chrysogaster*	*
Speckled dace	*Rhinichthys osculus*	*
Headwater chub**	*Gila nigra*	WC, Sen
Roundtail chub**	*Gila robusta*	WC, Sen
Sensitive Amphibians		
Lowland Leopard Frog	*Rana yavapaiensis*	WC, Sen
Northern Leopard Frog	*Rana pipiens*	WC, Sen
Arizona Toad	*Bufo microscaphus microscaphus*	Sen
Sensitive Reptiles		
Narrow-headed Garter Snake	*Thamnophis rufipunctatus*	WC, Sen
Mexican Garter Snake	*Thamnophis eques megalops*	WC, Sen
Arizona Night Lizard	*Xantusia vigilis arizonae*	Sen
Sensitive Snails		
Fossil Springsnail	*Pyrgulopsis simplex*	Sen
Sensitive Invertebrates		
Maricopa Tiger Beetle	*Cicindela oregona maricopa*	Sen
Tiger Beetle	*Cicindela hirticollis corpuscular*	Sen
Freeman's Agave Borer	*Agathymus baueri freemani*	Sen
Blue-black Silverspot Butterfly	*Speyeria nokomis nokomis*	Sen
Mountain Silverspot Butterfly	*Speyeria nokomis nitocris*	Sen
Obsolete Viceroy Butterfly	*Limenitis archippus obsolete*	Sen
Early Elfin	*Incisalia fotis*	Sen
Comstock's Hairstreak	*Callophrys comstocki*	Sen
Spotted Skipperling	*Piruna polingii*	Sen
Neumogen's Giant Skipper	*Agathymus neumoegeni*	Sen
Aryxna Giant Skipper	*Agathymus aryxna*	Sen
Evansi Brigadier	*Agathymus evansi*	Sen
Netwing Midge	*Agathon arizonicus*	Sen
Hoary Skimmer	*Libelula nodisticta*	Sen
Arizona Snaketail	*Ophiogomphus arizonicus*	Sen
Sensitive Plants		
Tonto Basin Agave	*Agave delamateri*	Sen
Eastwood Alumroot	*Heuchera eastwoodiae*	Sen
Flagstaff Penstemon	*Penstemon nudiflorus*	Sen
Hualapai Milkwort	*Polygala rusbyi*	Sen
Chihuahua Sedge	*Carex chihuahuensis*	Sen
Arizona Giant Sedge	*Carex ultra*	Sen
Mapleleaf False Snapdragon	*Mabrya acerifolia*	Sen
Gila Rock Daisy	*Perityle gilensis var. salensis*	Sen
Aravaipa Sage	*Salvia amissa*	Sen

Other Management Indicator Species		
Macro-invertebrates		MIS
Yellow-breasted Chat	*Icteria virens*	MIS
Cinnamon Teal	*Anas cyanoptera*	MIS
Lucy's Warbler	*Vermivora luciae*	MIS
Lincoln's Sparrow	*Melospiza lincolnii*	MIS
Hairy Woodpecker	*Picoides villosus*	MIS
Summer Tanager	*Piranga rubra*	MIS
Hooded Oriole	*Icterus cucullatus*	MIS
Arizona gray squirrel	*Sciurus arizonensis*	MIS
Warbling Vireo	*Vireo gilvus*	MIS
Western Wood Pewee	*Contopus sordidulus*	MIS

Table Legend:

WC = Wildlife of Special Concern in Arizona (AGFD draft 3/16/96)
Sen = On Regional Forester's Sensitive Species List (7/21/99)
MIS = Tonto and/or Coconino Management Indicator Species from Forest Plans
* Not formally listed as a sensitive species but populations are presumed trending downward in Fossil Creek.
** Headwater chub recently described as distinct from roundtail chub, therefore considered here as if a sensitive species.

Sensitive Mammals.

A sensitive mammal that may occur in Fossil Creek is the southwestern river otter. The Louisiana subspecies of the river otter (*L. c. lataxina*) was introduced into Fossil Creek and the Verde River in 1981 and 1982 (Agyagos and Overby 2000). This subspecies is successfully reproducing and may eventually cause genetic swamping of the native form, if any still exist.

Sensitive Birds.

Of the three sensitive bird species, all but the Bell's vireo are on the Arizona State list, and all are associated with riparian habitat or water. The peregrine falcon was removed from the Endangered Species list on August 25, 1999 (FR 64 (164): 46542). Peregrine falcons require rock cliffs for nesting and a large foraging area within 10 to 20 miles of water. The common black hawk is dependent upon mature, relatively undisturbed habitat supported by a permanent flowing stream. Black hawks forage on crayfish, amphibians, reptiles and fish. The common black hawk has been observed from Fossil Springs to the Fossil Creek/Verde River confluence. The common black hawk prefers to nest in large trees within a grove (Latta et al. 1999). Bell's vireos occupy dense riparian thickets as well as mesquite and oak thickets near water. This species can commonly be found where suitable habitat is present.

Sensitive Fish.

Two sensitive fish species (headwater chub and roundtail chub) were identified for Fossil Creek. Due to concerns about their status, both chubs have been recently petitioned to be federally-listed under the ESA (Center for Biological Diversity, April 2, 2003).

Sensitive Reptiles and Amphibians.

All of the listed amphibians and reptiles are associated with aquatic environments with the exception of the Arizona night lizard. The Arizona toad occurs in rocky streams, canyons, and floodplains with dense riparian vegetation in elevations between 2,000 and 6,000 feet. The northern leopard frog occurs in vegetated montane streams, wetlands, and high-elevation wet meadows, whereas, the lowland leopard frog occurs below 5,500 feet and prefers permanent streams over other aquatic habitats. Lowland leopard frogs have been recorded in the Fossil Springs area and Fossil Creek below the Fossil Springs diversion dam. Reproducing populations of lowland leopard frogs have not been found in recent surveys below the diversion dam, possibly due to the presence of predaceous nonnatives fish species and crayfish (Overby and Agyagos 2000). Both species of garter snake on the Forest Service list are aquatic. The narrow-headed garter snake is the most aquatic of all garter snakes, but has never been recorded from Fossil Creek. Suitable habitat occurs throughout Fossil Creek. The narrow-headed garter snake may potentially occur in the Verde River from West Clear Creek to Fossil Creek (Sullivan and Richardson 1993). The Mexican garter snake is known to be associated with leopard frogs, a major prey species. Although Mexican garter snakes are not known from Fossil Creek, there have been a number of sightings along the Verde River and several of its tributaries, and Fossil Creek provides potential habitat (personal communication, Erika Nowak, USGS, to Janie Agyagos, USFS). Arizona night lizards are found in central Arizona in the chaparral-oak belt, desert scrub, and grassland habitat of the central Plateau (Stebbins 1985). It is found under exfoliating flakes of large granite boulders, rock crevices, under clumps of yucca (*Yucca* spp.), nolina (*Nolina* spp), agave plants, and other debris.

Sensitive Invertebrates.

The remaining species (snails and invertebrates) only occur on the Regional Forester's sensitive list. The 15 invertebrates include: 9 butterflies, 3 aquatic species, 2 tiger beetles, and the Freeman's agave borer. The Fossil springsnail occurs only in the headspring of Fossil Creek. Both tiger beetles occur on sandy banks and beaches, but the hairy-necked tiger beetle can also be found well away from riparian areas. The Freeman's agave borer is not tied to riparian habitat and requires agave as a host plant.

The blue-black silverspot, mountain silverspot, and obsolete viceroy butterflies are riparian dependent species. They utilize different host plants; the silverspot's larvae feed on species of *Viola* and the adults feed on thistle nectar. The larvae and adult of the viceroy feed on cottonwood and willow species. Both the early elfin and Comstock's hairstreak utilize habitat at elevations above the proposed project area. The spotted skipperling, Nuemogen's giant skipper, and the Aryxna giant skipper occur outside of riparian areas.

The remaining three aquatic species (netwing midge, hoary skimmer, and Arizona snaketail) prefer different water regimes (i.e., flowing versus still) and most likely occur in Fossil Creek.

Sensitive Plants.

Nine plant species have been identified for the project area from the sensitive species lists for the two Forests. The Tonto basin agave occurs in the upland habitat, usually near major drainages with perennial streams and has been found in association with archaeological features. Both the eastwood alumroot and the Flagstaff penstemon occur at higher elevation from the project area. The Hualapai milkwort occurs between 3200 and 5000 ft and appears to be limestone dependent. The Chihuahua sedge occurs on north and northwest facing slopes in wet soils. Both the mapleleaf false snapdragon and the Gila rock daisy grow on moist cliff faces or rock ledges. The Aravaipa sage prefers riparian areas. The Arizona giant sedge prefers southeast facing seeps and springs, however the project area is outside of the known distribution.

Other Species of Concern

Four native species (speckled dace, longfin dace, Sonora Sucker, and desert Sucker) are trending downward in numbers and distribution within the stream and elsewhere in their range, but they are not currently designated sensitive species. Along with the Forest Service sensitive round tail and headwater chubs, these species are considered important to restoration of the native fish community in Fossil Creek.

MIS Mammals.

The Arizona gray squirrel inhabits deciduous and mixed forest, canyon bottoms, and riparian areas of mountain ranges. The project area contains suitable nesting and foraging habitat for the squirrel especially near the larger deciduous trees along Fossil Creek and dry washes draining into Fossil Creek.

MIS Birds.

Cinnamon teal are an indicator species for wetland and aquatic habitats. The primary selection of cinnamon teal as a MIS was that they were considered a sensitive indicator of livestock grazing in wetlands and were economically important. The Forest-wide trend for cinnamon teal is inconclusive. Population data is limited; wetlands on the Coconino National Forest tend to be small and unconnected resulting in increased aerial predation.

Lucy's warblers are secondary cavity nesters, and as such depend on the presence of primary cavity nesters and/or flaking bark on suitable sized nest trees in low elevation riparian habitats. The Forest-wide trend for Lucy's warbler is inconclusive. Overall habitat trend has improved, but there is limited information to determine Forest-wide population trends.

The yellow-breasted chat requires habitat with dense understory in low elevation riparian forests. The Forest-wide trend for yellow-bellied chats is inconclusive. Overall habitat trend has improved, but there is limited information to determine Forest-wide population

trends. Limited local information may indicate a slightly declining population trend (consistent with a national trend) while information for Arizona indicates a possible slight increase.

The Lincoln's sparrow is a management indicator for high elevation riparian scrub habitat comprised primarily of willow (Coconino National Forest 2002). Information of the abundance and distribution of Lincoln's sparrow is limited. It is a fairly common summer resident over 5,000 foot elevation. Wintering sparrows use wetland habitat on the lower areas of the forest. Habitat for this species is present at Stehr Lake.

The summer tanager and hooded oriole are management indicator species for low elevation riparian habitat. Suitable habitat for these species is present at Fossil Springs and Stehr Lake.

The hairy woodpecker is a management indicator species for the snag component of ponderosa pine, mixed conifer and spruce-fir forests. Suitable habitat is present for this species within both forests but outside of the project area.

The warbling vireo and western wood pewee occur in open deciduous and mixed deciduous-coniferous forests. Suitable habitat is present along Fossil Creek.

MIS Invertebrates.

The relative abundance and diversity of macroinvertebrates provides a natural barometer for detecting the health of the aquatic habitat in both high and low elevation riparian areas. Between July 2001 and June 2002, personnel from NAU collected and identified macroinvertebrates from nine locations along Fossil Creek. Their Final Report (Dinger and Marks 2002) identified 119 taxa representing nine major orders of aquatic insects, and six orders of non-insect aquatic fauna macroinvertebrates. The greatest species diversity was located in the "Below Dam" habitat area (62 species) and in the "Below Irving Power Plant" habitat area (51 species). The lowest species diversity was found in the "Dam Backwaters" (18 species), and the area 1 mile downstream of the 708 Road Bridge (21 species).

Only one species of special concern were found during the survey. Fossil springsnails (Gastropoda: Hydrobiidae: *Pyrgulopsis simplex*) were found in association with the "Spring Head" and "Above Dam" collection sites, being most abundant at the springs and less so away from the springs.

The results of this 2001/2002 sampling should be considered preliminary, since invertebrate distribution can vary from season to season, and from year to year. This recent sampling of macroinvertebrates is the most intensive survey known to have occurred in Fossil Creek, and should, therefore, be considered as baseline information from which to compare future collections. Additional survey and monitoring of macroinvertebrates in Fossil Creek is being conducted by NAU.

3.2.10 Environmental Consequences – Forest Service Sensitive Species/Management Indicator Species/Other Species of Concern

No Action Alternative

Native chubs (and other native fishes not formally listed as sensitive), leopard frogs, and garter snakes would be adversely affected by increased community dominance of nonnative aquatic species. Reproduction of chubs (and other native fishes) and leopard frogs below Fossil Springs diversion dam could be significantly suppressed by predaceous nonnative fishes.

These adverse effects could extend to the segment of stream above the Fossil Springs diversion dam if that structure is modified or removed through decommissioning of the power plants. Additionally, return of full flows without removal of nonnative fish would increase habitat and populations of nonnatives, intensifying impacts on native aquatic species.

Proposed Wilderness Alternative

Sensitive Mammals.

Southwestern River Otter – River otters require permanent flowing water or ponds. Fossil Creek below the Irving reach does not currently support habitat frequented by river otters elsewhere in the Verde Valley (Overby and Agyagos 2000). Barrier construction would have no affect on the river otter, if present. Research indicates that affects of antimycin on mammals is minimal. There have been no reported negative effects to nontarget wildlife from ingestion of antimycin-killed fish.

Sensitive Birds.

American Peregrine Falcon – The area has not been surveyed since the early 1990s; there are no reports of nesting peregrine falcons in the project area. Suitable nest sites are present, but would not be impacted by this project. No foraging habitat for the peregrine falcon would be impacted by this project.

Common Black Hawk – No impact will occur to any suitable nesting habitat from either the stream renovation or barrier construction. The application of antimycin A during the stream renovation process will not affect foraging opportunities. Potential food sources such as reptiles and adult amphibians would not be affected by antimycin (Walker et al. 1964, Gilderhas et al. 1969). The effects to fish would be temporary, native fish species would be quickly reintroduced into Fossil Creek. The common black hawk could forage on alternate species for the short time fish are unavailable.

Bell's Vireo – Suitable foraging/nesting habitat is present primarily in upper Fossil Creek at Fossil Springs. Further downstream suitable habitat is limited to seeps and springs where the vegetation is denser. Stream renovation activities would not affect any Bell's vireo habitat. Vegetation density at the barrier location is currently not suitable for Bell's vireos.

Sensitive Fish.

Headwater Chub, and Roundtail Chub – Impacts from the salvage operation would be minimized to the maximum extent possible. In the short term, stream renovation would kill any and all native fishes that are not captured during salvage operations prior to application of antimycin within the treated reaches of stream. In the long term, barrier construction and stream renovation activities would remove competition from nonnative species and improve conditions for these species.

Sensitive Reptiles and Amphibians.

Lowland Leopard Frog – Impacts from the salvage operation would be minimized to the maximum extent possible. Barrier construction and stream renovation activities would remove competition from nonnative species and improve conditions for this species, resulting in a long-term beneficial effect. Antimycin application would not affect juvenile or adult frogs, however, tadpoles would be adversely affected if present. In recent years, this species has been found in tadpole stages only in the Irving reach of the project area (EnviroNet 1998). However, current surveys have failed to detect reproducing populations of lowland leopard frogs below Fossil Springs diversion dam (Overby and Agyagos 2000). A survey of the Irving reach would be conducted prior to treatment if logistical factors necessitate stream renovation during months when tadpoles might be present. Any Ranid eggs and tadpoles that are detected prior to treatment would be removed and placed in temporary holding tanks for repatriation later. Removal of nonnatives would improve conditions for leopard frogs.

Northern Leopard Frog - Impacts from the salvage operation would be minimized to the maximum extent possible. Barrier construction and stream renovation activities will remove competition from nonnative species and improve conditions for this species, resulting in a long-term beneficial effect. Anytimycin application will not affect juvenile or adult frogs, however, tadpoles would be adversely affected if present. Ranid eggs and tadpoles that are detected prior to stream treatment would be removed and placed in temporary holding tanks for repatriation later.

Arizona Toad – This species occupies habitat similar to leopard frog; impacts to the Arizona toad would be similar to those described for the leopard frogs.

Narrow-headed Garter Snake – This species has not been recorded from Fossil Creek. However, if present, impacts would be limited to short-term loss of prey availability (fish and tadpoles); adult and juvenile leopard frogs would not be impacted by the antimycin

application and would be available as a prey source. Removal of nonnatives and improved conditions for leopard frogs will result in long-term benefit to narrow-headed garter snakes.

Mexican Garter Snake – Barrier construction would have minimal impact to this species. Stream renovation activities would temporarily reduce the availability of particular prey, such as frogs and fish. This species also forages on mice and lizards and could supplement its diet with alternative prey during the antimycin application. Removal of nonnatives and improved conditions for leopard frogs would result in long-term benefit to Mexican garter snakes.

Arizona Night Lizard – No surveys have been done for this species. Upland impacts are limited to less than 2 acres and unlikely to affect this species.

Fossil Springsnail – This species is only found in the headspring and upper sections of outflow, upstream of the Fossil Springs diversion dam. No activities would be conducted in this area.

Sensitive Invertebrates.

Maricopa Tiger Beetle – Habitat supporting this species (sandy beaches) does not occur at the barrier location. Stream renovation activities may result in loss of some tiger beetles within the project area. Studies indicate that effects to aquatic invertebrates that respire through gills are short-term, loss of individuals is not 100 percent and recolonization is rapid (Minckley and Mihalick 1981).

Hairy-necked Tiger Beetle – This species can be found further from the riparian zone, which would limit any potential impacts. Impacts to those species found near the water would be the same as described for the Maricopa tiger beetle.

Freeman's Agave Borer – This species inhabits canyons and requires agave host plants. It is not tied to riparian systems, and no agaves would be disturbed by this project.

Blue-black Silverspot Butterfly, Mountain Silverspot Butterfly, Obsolete Viceroy Butterfly – These species of butterfly are riparian dependent for their host plants. No cottonwood trees would be impacted, and no *Viola* were observed in the project area. Due to the limited riparian impact zone, little impact would occur to these species from barrier construction.

Early elfin – The elevation preferred by this species (6,000 to 7,000 feet) will not be impacted. The project elevations occur between the diversion dam below Fossil Springs (approximately 4,300 feet) and the fish barrier construction (approximately 3,000 feet). No impact would occur to this species.

Comstock's hairstreak – This species prefers dry, rocky areas of foothills and canyons of between 5,000-6,000 feet in elevation. The project elevations occur between the diversion dam below Fossil Springs (~4,300 feet) and the fish barrier construction (~3,000 feet). No impact would occur to this species.

Spotted Skipperling – This species is thought to utilize a grass species (*Dactylis glomerata*) as a food plant. Only one survey has been conducted in the upland habitat, and the grass was not found. Limited ground-disturbing activity in upland habitats would reduce any potential impact to this species if present.

Nuemogen's Giant Skipper – This species inhabits open woodland or shrub-grasslands and requires agave host plants. It is not tied to riparian systems, and no agaves would be disturbed by this project.

Aryxna Giant Skipper – This species prefers well-vegetated desert canyons or canyons with periodic water and open grassy woodlands. The caterpillar feeds on agave. Suitable habitat occurs in the project area, but impacts to this habitat type from barrier construction would be limited. No agaves would be impacted by this project.

Netwing Midge, Hoary Skimmer, and Arizona Snaketail – Suitable habitat is present for these species in Fossil Creek. Impacts associated with stream renovation activities are likely to be short-term as kills are usually incomplete and recolonization is rapid (Minckley and Mihalick 1981, Gray 1981, Gray and Fisher 1981).

Sensitive Plants.

Tonto Basin Agave, Eastwood Alumroot, Flagstaff Penstemen, Hualapai Milkwort, Chihuahua Sedge, Arizona Giant Sedge, Mapleleaf False Snapdragon, Gila Rock Daisy, and Aravaipa Sage – None of the sensitive plant species have been documented in Fossil Creek during any of the numerous plant surveys (Goodwin 1980, Sayers 1998, and Burbridge and Story 1974). The limited impact to terrestrial habitats outside of previously disturbed sites should lessen any possible impact to these plant species should they be present in the area.

Other Species of Concern

Impacts to speckled dace, longfin dace, Sonora sucker, and desert sucker from the salvage operation would be minimized to the maximum extent possible. In the short term, stream renovation would kill any and all native fishes that are not captured during salvage operations prior to application of antimycin within the treated reaches of stream. In the long term, barrier construction and stream renovation activities would remove competition from nonnative species and improve conditions for these species.

Management Indicator Species. The cinnamon teal has not been sighted on Fossil Creek. Habitat for the hairy woodpecker does not occur within the project area. The remaining species (yellow-breasted chat, Lucy's warbler, Lincoln's sparrow, summer

tanager, hooded oriole, warbling vireo, western wood pewee and Arizona gray squirrel) may occur at Fossil Springs and various places along Fossil Creek. None of the species likely occur at the barrier location as the riparian habitat is extremely limited in nature. There will be minimal impacts on riparian habitat, and no riparian trees would be removed. Less than 1.4 acres of upland habitat will be affected. There would be no impact to these species from the stream renovation activities. Based on the studies by NAU, at least 51 species of macroinvertebrates have been identified below the Irving reach. Impacts to macroinvertebrates would be similar to impacts previously described for the tiger beetles.

Nonwilderness Alternative

The effects on terrestrial species would be the same as discussed under the wilderness alternative. There would be less beneficial effect for special status aquatic and semi-aquatic species because a shorter segment of stream would be protected (see Table 4), and the probability of recontamination with nonnative species would be greater due to increased human use of the barrier site.

Table 4. Comparison of the two action alternatives in relation to special status aquatic species.

	Non-Wilderness Alternative	Wilderness Alternative
Miles of Fossil Creek protected for native fish	6.7	9.5
Percent of Fossil Creek below the Fossil Springs diversion dam protected for native fish	48%	68%
ESA Critical Habitat protected (miles)	0	0.2 of spikedace and loach minnow designated Critical Habitat
Federally-listed fish species now present	Razorback may be present	Razorback may be present
Federally-listed fish species known to historically occur in Fossil Creek	Not known with certainty, but potential species include Gila chub, spikedace, loach minnow, razorback sucker and Colorado pikeminnow	Not known with certainty but potential species include Gila chub, spikedace, loach minnow, razorback sucker, and Colorado pikeminnow
Federally-listed fish species which were previously introduced into Fossil Creek	Razorback sucker (Endangered), Gila topminnow (Endangered)	Razorback sucker (Endangered), Gila topminnow (Endangered)
Federally-listed fish species which have been proposed for introduction (or re-introduction) into Fossil Creek	Razorback sucker, spike dace, loach minnow, Gila topminnow, Colorado pikeminnow	Razorback sucker, spike dace, loach minnow, Gila topminnow, Colorado pikeminnow,
Existing sensitive species for which FWS has expressed concern over their population status	Roundtail chub	Roundtail chub

Existing sensitive species for which FWS has expressed concern over their population status	Headwater chub	Headwater chub
Native species found in approximate vicinities of the two sites by AGFD in 1994 (Station 4 is located 7.8 miles below Fossil Springs dam and Station 5 is located 13 miles below Fossil Springs dam) and 1996.	Sonora sucker (*Catostomus insignis*), desert sucker (*Pantosteus clarki*), roundtail chub, longfin dace (*Agosia chrysogaster*) Note: in 1996 the same species were found, except longfin dace was absent.	Sonora sucker, desert sucker In 1996 only desert sucker was observed at Station 5
Nonnative species located at the same AGFD monitoring sites.	None in 1994. None in 1996.	Green sunfish, smallmouth bass, yellow bullhead in 1994. Yellow bullhead, common carp, flathead catfish and smallmouth bass in 1996.
Other native Forest Service sensitive species that would benefit from native fish restoration	Lowland leopard frog, Mexican garter snake, narrow-headed garter snake, Southwestern (Arizona) toad	Lowland leopard frog, Mexican garter snake, narrow-headed garter snake, Southwestern (Arizona) toad

Source: Forest Service 2003

Cumulative Effects

Direct and indirect effects from this project on most Forest Service sensitive, management indicator species or other species of concern are primarily beneficial; however, there will be short-term impacts on species such as the roundtail chub and macroinvertebrates. The Forest Service is proposing management changes within the Fossil Creek area resulting from a future Forest Plan amendment (DEIS available in early spring 2004). This proposed amendment would place more emphasis on soils, riparian vegetation, and fish and wildlife habitat (FR 68 (115)) and implementation of specific actions could have additive effects to this project. The piscicide treatment for stream renovation will have a negative, short-term impact on existing native fishes (namely roundtail chub), and macroinvertebrates. These impacts would occur to those fishes and macroinvertebrates not salvaged prior to treatment; and only within that length of stream within which the treatment is applied. Effects from the piscicide treatment do not add cumulatively to any other past, present, or reasonably foreseeable future actions. The minor increase in sedimentation from barrier construction would be additive to effects from ongoing livestock grazing, road and trail maintenance activities, installation of a buried fiber optic line that will cross Fossil Creek along the FR 708 road, and reconstruction of the Mail Trail above Fossil Springs.