U.S. Department of the Interior
Bureau of Reclamation
Lower Colorado Region
Phoenix Area Office

Final Environmental Assessment

NATIVE FISH RESTORATION IN FOSSIL CREEK

U.S. Department of Agriculture
Forest Service
Southwestern Region

Coconino and Tonto National Forests, Arizona

May 2004

DECISION NOTICE
AND
FINDING OF NO SIGNIFICANT IMPACT
FOR
NATIVE FISH RESTORATION IN FOSSIL CREEK

U.S. FOREST SERVICE
COCONINO AND TONTO NATIONAL FORESTS

GILA AND YAVAPAI COUNTIES, ARIZONA

Action and Its Purpose

This decision notice summarizes my decision to implement actions proposed in the Final Environmental Assessment (EA) for native fish restoration in Fossil Creek, located along a portion of the border between the Coconino and Tonto National Forests in Arizona. The purpose of the actions is to enhance and protect the native fish community and their habitat within 9.5 miles of Fossil Creek below Fossil Springs diversion dam by constructing a fish barrier within the Mazatzal Wilderness; salvaging (capture and temporary holding) a portion of native fishes for restocking; eradicating non-native fishes through the application of antimycin A (Fintrol®) in four contiguous stream reaches; protecting habitat to maintain options for future repatriation of fish species extirpated from the Verde basin; and integrating public information and education into the project components.

The existing native fish species to be enhanced and protected, thus helping to avoid the need to list them as threatened or endangered under the Endangered Species Act (ESA), are headwater chub (*Gila nigra*), roundtail chub (*Gila robusta*), speckled dace (*Rhinichthys osculus*), longfin dace (*Agosia chrysogaster*), Sonora sucker (*Catostomus insignis*), and desert sucker (*Pantosteus clarki*). The razorback sucker (*Xyrauchen texanus*) was stocked into Fossil Creek above Irving Dam in 1988, and may also be encountered during restoration actions. The non-native fish known to occur in Fossil Creek include invasive green sunfish (*Lepomis cyanellus*), yellow bullhead (*Ameiurus natalis*), flathead catfish (*Pylodictis olivaris*), and smallmouth bass (*Micropterus dolomieui*).

The laws, regulations, and policies applicable to this decision include the National Forest Management Act (NFMA), the Endangered Species Act (ESA), the National Environmental Policy Act (NEPA), the National Historic Preservation Act (NHPA), the Clean Water Act (CWA), the Wild and Scenic Rivers Act, the Wilderness Act, and other legal mandates. This project is a result of cooperation and collaboration with the Bureau of Reclamation (BOR), Arizona Game and Fish Department (AGFD), and USDI Fish and Wildlife Service (USFWS). The actions will also help meet Executive Order 13112 regarding the prevention and control of invasive species.

This decision helps implement the standards and guidelines of the Coconino National Forest Land and Resource Management Plan (USDA 1987, as amended); specifically, the

standards that require: use of the best available resource data and technical expertise to identify habitat objectives for federally listed, sensitive, and unlisted species (page 64); consultation and cooperation with AGFD (page 65-12); improve threatened and endangered (T&E) and sensitive species habitat (page 66); and improve fisheries habitat by constructing barriers as appropriate and based on environmental analysis (page 175). This decision helps implement the standards and guidelines of the Tonto National Forest Land and Resource Management Plan (USDA 1985, as amended), specifically, the standards to manage warm water streams to support Gila sucker and longfin dace (page 41); to cooperate and consult with AGFD, USFWS, state universities, professional societies, and various conservation organizations regarding proposals and programs concerned with management of wildlife habitat (page 42); to maximize coordination with USFWS regarding Federal T&E animal species and their habitats (page 42); to maximize coordination with AGFD regarding state listed species and their habitats (page 42); and to manage the Mazatzal Wilderness as established in the Wilderness Implementation Plan (USDA Forest Service 1994), which includes those portions of the wilderness within the Coconino National Forest (Coconino National Forest Plan, page 104).

Decision and Rationale

It is Forest Service policy (FSM 2100) that pesticide use in designated wilderness areas occurs only when necessary to restore significant values within the wilderness, and to base actual use on analyses of effectiveness, specificity, environmental impacts, economic efficiency, and human exposure. As the Deciding Officer, I am responsible for reviewing and approving or disapproving all proposed pesticide uses on National Forest System wilderness lands in the Southwestern Region. Authority for approval of pesticide application in wilderness cannot be delegated. The decision to construct a barrier in wilderness to control non-native fish is also reserved to the Regional Forester. The decision for non-emergency use of a helicopter and motorized equipment in wilderness is also reserved to me as the Regional Forester or to a Deputy Regional Forester.

Based on the results of the analysis documented in the Environmental Assessment (EA) and project record, it is my decision to implement the Proposed Action (Wilderness) alternative as described in the EA in Chapter 2.3, with minor modifications which do not change or affect the analysis of impacts. These modifications are to include expansion of the allowed period of motorized equipment and helicopter use to include weekends (see specific activity 3); based on final hydrological analysis, two additional cubic yards of concrete material to be used at two bedrock slots on the left bank (see specific activity 2); campfires in wilderness will not be allowed; and dead fish will not be buried but will be disposed of by general dispersal on-site or hauled off-site.

I am selecting the alternative for construction of a fish barrier in the Wilderness based on several factors.

- In weighing competing/conflicting wilderness values at stake, in this case I am favoring restoration of ecological functionality over limited temporal and spatial intrusions in wilderness associated with building a permanent structure.
- Rarity of values was also a significant consideration. Arizona ranks as the number one state in the United States for the percentage of native fish species at

risk (Stein 2002). Since there are very few opportunities for restoration, the additional 2.8 miles of native fish habitat within the Mazatzal Wilderness provided by the Wilderness barrier alternative is disproportionately important. Reintroduction and perpetuation of native fishes within wilderness helps restore natural conditions and will allow for reintroduction of threatened and endangered fishes which are likely to have previously occupied the 2.8 miles within wilderness.

- Finally, the probability of achieving the fish restoration objective is significantly greater with the Wilderness barrier alternative because of the reduced probability of introduction of nonnative species if the barrier is located in an area that does not attract recreational use that could lead to "lifting" nonnative species over the barrier.

In addition, this alternative also helps to protect 0.2 mile of federally-designated Critical Habitat for spikedace *(Meda fulidga)* and loach minnow *(Tiaroga cobitis),* which are listed as Threatened species under the ESA. A Minimum Tools Analysis (included as Appendix I of the Final Environmental Assessment) was prepared to determine which tools would have the least impact to the wilderness resource. Implementation of the Proposed Action (Wilderness) alternative encompasses the following specific activities:

1. Construction of a barrier consisting of three reinforced concrete plugs within three existing bedrock slots and a ten-foot concrete apron in the channel of Fossil Creek within the Mazatzal Wilderness 4.5 miles upstream from the confluence with the Verde River. The barrier will be textured and colored to blend into the surrounding environment.

2. Construction of a gabion in a side channel approximately 100 feet east of the low flow channel. Water flows through this side channel during infrequent high floods (in excess of a 5-year recurrence interval). A gabion has the ability to shift in response to a moving foundation that is likely at this site (since the site is not bedrock constrained), unlike a concrete structure which could crack and potentially fail. Based on final hydrological analysis two bedrock slots between the gabion and wetted channel will be filled with 2 cubic yards of concrete to prevent flow except for events in excess of a 50 year occurrence interval. This material will also be textured and colored to blend into the surrounding environment.

3. Use of a helicopter to long-line equipment, material, and supplies from Stehr Lake staging site to the job site within designated wilderness. Long-lining of concrete will incur contact with the ground, which is considered to be a "landing." Use of motorized equipment and the helicopter within designated wilderness was originally recommended to be restricted to weekdays. Upon further consideration of actions that would lead to a reduction in the time of wilderness intrusion and expedite construction, use of the motorized equipment and helicopter will be allowed during the weekend. A site will be identified within the Wilderness that will accommodate the landing of aircraft; however, actual landing of aircraft is

only to occur in emergency situations. The preparation of this back-up site will require limited brush clearing (EA at page 22). Final Bureau of Reclamation air operations plans will be documented as part of the project construction permit and approved by the responsible Forest Service official.

4. Construction crews will be required to hike a flagged route into the job site to minimize pedestrian traffic impacts on soils, cultural resources and wilderness. Crew members will be required to go through "Leave No Trace" training before working or camping in the Wilderness. The trail will be rehabilitated following completion of the construction.

5. Using a combination of electroshocking, nets, and angling, as many native fishes as possible would be captured alive, placed in livecars (small-mesh holding nets), and collected by designated stream reach. A helicopter will transport the fishes to a series of holding tanks located at the Irving facility site. Fish from one section of stream will be separated in holding tanks. Captured fish would be tended and held until at least two days beyond antimycin treatment, then released by helicopter long-line operation into the same general vicinity as their capture. Final Bureau of Reclamation air operations planning for the fish renovation will be documented in an overall project operation permit and approved by the responsible Forest Service official.

6. Antimycin will be applied to the stream by a combination of drip stations, backpack sprayers and sand formulation in the designated reaches under the supervision of certified pesticide applicators. The amount of antimycin to be applied will be calculated through stream discharge measurements, with an inert dye used to help determine residence time and mixing potential. The target concentration is 20 ppb, except where yellow bullheads occur (the lower reaches), where a higher concentration will be required. Laboratory and field bioassays will determine the upper concentration needed to kill yellow bullhead, which is expected to be between 20-200 ppb. To ensure effectiveness, a second treatment of each reach will occur within 1- 7 days after the initial treatment, followed by a third treatment if live fish are observed during or after the second treatment.

7. Potassium permanganate will be used to neutralize the antimycin. A drip station will be set up at the bottom of each reach, with a back-up drip station set up further downstream to ensure complete neutralization. Potassium permanganate will be applied at a concentration of 2-4 ppb and field bioassays will be conducted to produce the appropriate concentration of potassium permanganate with constant oversight of the neutralization station by qualified personnel.

8. Temporary signage will be placed at public access sites along Fossil Creek prior to and during renovation to explain the project and list public precautions.

9. Five stock tanks that drain into Fossil Creek within the Coconino NF will also be treated with piscicides to remove nonnative fishes. Stock tank renovations will be

coordinated with USFWS, AGFD, the permittees and the Forest Service to minimize and/or avoid impacts to wildlife and livestock.

10. Permanent signs will be placed outside wilderness at strategic points to inform the public about the native fishes of Fossil Creek and the other unique features of this stream system, such as the travertine geology. A sign plan will be developed jointly between the Coconino NF and the Tonto NF.

11. Post treatment and periodic monitoring in cooperation with BOR, AGFD, Northern Arizona University, and USFWS will determine the status of the native species, including macroinvertebrates and amphibians, and success of the treatment. No motorized equipment will be used in the wilderness in association with these actions after the barrier construction and the 2004 fish renovation.

12. Procedures and responsibility for monitoring and maintenance of the barrier will be documented in agreements and/or special use permits with the USDA Forest Service and the appropriate agencies. The permit for the structure will be issued by the Regional Forester and administered by the Tonto NF.

13. The introduction of additional fish species, native to the Verde River, may occur after appropriate agency consultation and documentation of appropriate procedures, including identification of donor populations and monitoring plans for such efforts.

Mitigation Measures

- Public information and education materials describing the project's effects and benefits will be prepared.
- Standard dust abatement practices will be used to minimize generation of airborne particles.
- Sediment and erosion control measures will be established where appropriate to protect water quality and soils.
- Upland sites disturbed by project activities will be seeded with native vegetation.
- Archaeological surveys have been completed and documented for the wilderness alternative.
- An archaeologist and wilderness specialist will periodically monitor construction activities.
- Pedestrian access for crews will be marked with flagging to avoid impacts outside of authorized areas (i.e. cultural resource sites) and any trails that develop incidental to the project will be obliterated.
- Boundaries of the temporary contractor use areas at Stehr Lake will be delineated with flexible construction fence to avoid impacts outside authorized areas.
- Boundaries of the wilderness camping area will be designated with materials that are visually unobtrusive and minimize impacts to wilderness character.

- Crews will receive "Leave No Trace" training, including instruction on minimum camping techniques. Campfires will not be allowed within wilderness, to minimize impacts. Sanitation facilities will be provided for work crews.
- Construction will be allowed seven days a week if it will accelerate construction and completion of the barrier, thus reducing the impact on wilderness values.
- The concrete barrier and apron will be colored and textured to blend with surrounding rock. Such color and texturing will be approved by the Forest Service.
- Application of antimycin will be timed to minimize possible effects to leopard frogs.
- Strict adherence to the piscicide label is required for transportation, storage, mixing and personal protective equipment.
- Daily use records must be kept to document the use of the piscicide. This will be done by unit area, formulation, and application technique.
- Dead fish will be disposed of by general dispersal on-site or hauled off-site. I decided that these methods would have lesser impacts to the wilderness or other resources that could be of concern with ground disturbing activities associated with burying fish.

Public Involvement and Scoping

The original scoping process was initiated by inclusion of the project on the Coconino National Forest's Schedule of Proposed Actions (SOPA) in April 2002. Scoping information was mailed to 63 individuals, agencies and organizations on 25 April 2002. Seventeen respondents submitted written comments. The project was added to the Tonto National Forest's SOPA in July 2003.

The public comments were generally supportive of the project. Several respondents requested analysis and disclosure of the effects of the proposed action on water quality, human health and safety; effects of renovation chemicals on non-target biota; specifics on application of the chemicals; specifics on salvage of native fishes; disclosure of barrier construction on sediment transport and stream dynamics; and disclosure of the importance of Fossil Creek to native fish restoration and recovery.

The *Draft Environmental Assessment for Native Fish Restoration in Fossil Creek*, which was prepared by the Bureau of Reclamation and the Forest Service (Coconino and Tonto National Forests) in cooperation with the United States Fish and Wildlife Service and the Arizona Game and Fish Department, was mailed to all interested persons, organizations, and agencies on 23 December 2003. Eleven comments were received by 28 January 2004, of which one was signed by four conservation groups (American Rivers, Sierra Club-Grand Canyon Chapter, Friends of Arizona Rivers, and the Center for Biological Diversity). The comments resulted in minor clarifications to the *Draft Environmental Assessment for Native Fish Restoration in Fossil Creek*. Responses to specific comments were also prepared as an appendix to the *Final Environmental Assessment for Native Fish Restoration in Fossil Creek*. The final document is being sent to all who commented on the Draft Environmental Assessment by 28 January 2004.

Issues

Following initial scoping and interdisciplinary team analysis, significant issues were identified. None were identified from public scoping, but instead were identified internally by the Forest Service as follows:

- Effect of nonconforming uses in wilderness (i.e., a fish control barrier and the use of motorized equipment)
- Effect on Wild and Scenic River eligibility and classification
- Potential for non-native fishes to be reintroduced into the creek at some time after chemical renovation

Alternatives Considered

The alternatives compared in detail included a No Action Alternative (2.2), a Proposed Action Wilderness Alternative (2.3), and a Non-wilderness Alternative (2.4). Additional alternatives and variations were considered in Chapter 2.1, but eliminated from detailed study. These were:

A. Construction of the fish barrier closer in proximity to the confluence with the Verde River.
B. Use of electrical barriers for preventing upstream fish movement.
C. Use of nets, angling, and electrofishing to remove non-native fishes.
D. Use of rotenone for chemical renovation.
E. Renovation with antimycin without construction of a fish barrier.
F. Construction of a fish barrier without chemical renovation.
G. A wilderness alternative that was substantially motorized (Minimum Tools Alternative A).
H. A wilderness alternative that used mules for transport of materials and equipment and allowed only handtools, such as rock drilling by double jacking and the mixing of concrete by hand (Minimum Tools Alternative B).

Although A would have best met the purpose and need to "... restore and allow a native fish assemblage to persist in as much of Fossil Creek as possible," it was not analyzed in detail because a barrier closer to the Verde River would have had substantial impacts on the Mazatazal Wilderness and the Wild and Scenic Verde River, and did not meet siting criteria for effective barrier construction (i.e., presence of a restricted bedrock channel). B and C were considered too expensive, ineffective, and impractical. D was not analyzed in detail because antimycin would fulfill project goals with fewer environmental and social consequences. E would be impractical and ineffective, since the effects of treatment would be negated by continued upstream incursion of nonnative fishes into most of Fossil Creek from the Verde River, and the opportunity to implement Mazatzal Wilderness Implementation Plan actions to re-establish federally-listed species and reduce impacts of non-indigenous species on natural ecological processes in the Mazatzal Wilderness would be foregone. F would protect the stream above the barrier from future incursion of nonnative aquatic species, but existing nonnative species above the barrier would continue to adversely affect native species. G was not considered further because it would not reduce impacts to wilderness values from motorized equipment. H was not advanced for detailed analysis because the mules create impacts from trailing and increase the risk of noxious weed spread, and the use of some of the required handtools is

not operationally feasible. Both use of mules and primitive handtools would also significantly lengthen the project time, increasing impacts to the Wilderness, and increasing the possibility that the project could not be implemented prior to return of full flows to Fossil Creek by 31 December 2004 when the Childs-Irving hydroelectric project is currently proposed to be decommissioned (Final Environmental Assessment for Surrender of License, Childs Irving Project, March 2004).

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and based upon the analysis presented within the attached Final Environmental Assessment on Native Fish Restoration in Fossil Creek, I have determined that proposed efforts to improve and restore a native fishery in Fossil Creek will not be a major Federal action significantly affecting the quality of the human environment. Thus, an environmental impact statement will not be prepared. I based my finding on the following:

Context. This project is a site-specific action that by itself does not make international, national, region-wide or statewide decisions. The Final Environmental Assessment (EA) describes potential impacts from construction of a fish barrier, stream renovation with the piscicide antimycin A, and restocking native fishes in Fossil Creek. The selected location for the barrier is within the Mazatzal Wilderness. The selected alternative, with modifications as described above, has the shortest duration of effects resulting from construction activities in the wilderness of any alternative considered. A minimum tool analysis was conducted to aid in the selection of the construction methods.

Intensity. The following discussion is organized around the ten intensity factors described in the National Environmental Policy Act (NEPA) regulations (40 CFR 1508.27) as it pertains to the context of building a fish barrier and renovation of the stream for native fish as described in the selected alternative.

1. Impacts that may be both beneficial and adverse.

Direct, indirect, and cumulative effects of project activities on resources are discussed in the final EA (Chapter 3). Project activities will not significantly affect any resource.

2. The degree to which the proposed action affects public health or safety.

Public safety issues consist mainly of possible public encounters with antimycin A. Direct ingestion of normal quantities of stream water during peak treatment would not affect humans and livestock, and there are no reports of negative effects to humans or wildlife from consuming dead fish produced by stream renovation. Antimycin degrades rapidly. During active treatment, there will be signing describing the activities to discourage human consumption of stream water or fish killed by the treatment. There will be no significant effects on public health and safety (Chapter 3.2.4).

3. Unique characteristics of the geographic areas such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

There will be no significant effects on unique characteristics of the area. The project area does not contain park lands or prime farmlands. Wetlands are limited in extent and no adverse impacts to wetlands, or to ecologically critical areas, are associated with this proposed project.

The Forest Service has approved project implementation in the Mazatzal Wilderness subject to compliance with mitigation specified in the final EA (Chapter 2.5 and 3.6). Restoration of ecological functionality through barrier construction and piscicide application will have limited temporal and spatial intrusions on wilderness character.

The project will not affect Fossil Creek's eligibility as a future wild and scenic river. A Forest Service analysis concluded that barrier construction will have a negligible effect on overall function and free-flowing character of Fossil Creek and would protect and enhance 9.5 miles for fish and wildlife Outstandingly Remarkable Values (ORV) with no adverse impacts on other ORVs. If the fish barrier were to impound water in the long-term, the potentially eligible wild classification could be affected; however, anticipated effects are that sediment will fill in within a short period of time after construction, and no impoundment will be present. Therefore, wild classification may be appropriate when evaluated in a future suitability study. Project implementation will not affect the Verde Wild and Scenic River corridor into which Fossil Creek flows.

4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.

There is no known controversy over project effects on the quality of the human environment, based on the analysis and public comments received. There is no scientific controversy regarding the effects of this project on the quality of the human environment (EA Section 1.7 and Chapter 3 including Section 3.2.4).

5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

The effects analysis shows that the degree of possible effects on the human environment is not highly uncertain, nor are there unique or unknown risks involved (Chapter 3).

Antimycin A has been used for several decades for fisheries management, with hundreds of miles of stream treated in Arizona and New Mexico. Antimycin is registered by the EPA as a fish toxicant. When used within the label directions, antimycin does not pose a unique or unknown risk (Chapter 1.4, 3.2.4, Appendix E). Direct ingestion of normal quantities of stream water during peak treatment would not affect humans and livestock, and there are no reports of negative effects to humans or wildlife from consuming dead

fish produced by stream renovation. Antimycin will be applied under the supervision of certified piscicide applicators within the EPA label directions and the mitigation measures in the Final EA.

6. **The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.**

Barrier construction and piscicide use are activities that have been used to protect and enhance imperiled native fish communities in many locations in the Southwest (Chapter 1.4, Appendix C) and in other parts of the United States, such as California, Montana, Tennessee, and Utah. Future actions will be evaluated through the NEPA process and will stand on their own as to the environmental effects and project feasibility.

7. **Whether the action is related to other actions with individually insignificant but cumulatively significant impacts.**

Effects are discussed in Chapter 3 of the EA. The cumulative impacts are not significant (EA, Chapter 3, sections 3.2.2, 3.2.4, 3.2.6, 3.2.8, 3.2.10, 3.3.2, 3.4.2, 3.5.2, 3.6.2, 3.7.2, and 3.8.2).

8. **The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the national Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.**

The action will have no significant adverse effect on districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places.

The project will not cause the loss or destruction of significant scientific, cultural, or historic resources. Measures recommended in a Class III (intensive) archaeological inventory of the project area will be implemented by the Bureau of Reclamation to avoid impacts to cultural resources. Prehistoric and historic sites in the area will be located, marked, and then avoided prior to any ground disturbing activity. The analysis shows that a "no effect" would be the appropriate determination for Section 106 compliance if all mitigations are followed (Chapter 3 Section 3.3.2). The Forest Service submitted a no effect determination to the State Historic Preservation Office. The State Historic Preservation Office concurred with the no effect determination on December 10, 2003. The Project Record contains cultural resources clearance reports and concurrence from the State Historic Preservation Officer.

9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

The project will have no adverse effects on threatened, endangered, candidate, or Forest Service listed sensitive species (Chapter 3 Section 3.2.7 and 3.2.8). A 2001 Biological Opinion was prepared by the USFWS for the Bureau of Reclamation's Central Arizona Project Biological Assessment regarding impacts to listed species and critical habitat from the barrier construction activities. A Biological Assessment prepared by the Bureau of Reclamation in 2002 concluded there will be no effect to federally listed species or adverse modification of designated critical habitat due to project activities associated with stream renovation.

10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

The action will not violate Federal, State, or local laws or requirements for the protection of the environment.

Applicable laws and regulations were considered. Additional requirements are project consistency with the Coconino and Tonto National Forest Land and Resource Management Plans (LRMP's, 1987 and 1985 respectively, as amended). This project will help meet the goals, standards, and guidelines of the LRMPs for fish and wildlife. The project is located in Management Areas 1 and 2 (Coconino LRMP), and 4a and 4F (Tonto LRMP) and is consistent with the stated emphasis of the areas, except for the use of helicopters and the construction of a fish control structure, which are non-conforming uses analyzed in the EA. This project will not involve road construction, reconstruction, or road access changes within the project area on either the Coconino or Tonto National Forests.

Implementation of the selected alternative is consistent with applicable law, including but not limited to:

- ESA section 7 (documented in a 2001 Biological Opinion (BO) written for the Bureau of Reclamation for the Central Arizona Project, of which this project is one component of the BO for the Central Arizona Project).
- National Forest Management Act (NFMA) and its implementing regulations at 36 CFR 219.19 and 219.26 (population viability and biological diversity requirements).
- Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and its implementing regulations at 7 USC 136 (certification of individuals to use or supervise use of a restricted use pesticide).
- State of Arizona and Environmental Protection Agency (EPA) requirements for use of pesticides according to their label.
- The Wilderness Act (Public Law 88-577) which provides that wilderness be devoted to public purposes including conservation and scientific uses.

- Clean Water Act complies with Arizona State laws regarding natural resource protection, including but not limited to water quality.
- Executive Order 12898 (Environmental Justice) is complied with because implementation of the selected alternative is not anticipated to cause disproportionate adverse human health or environmental effects to minority or low-income populations.
- Clear Air Act is complied with because the selected action is not anticipated to cause disproportionate adverse human health or environmental effects to air quality.
- Executive Order 11990 (Protection of Wetlands) whose basic requirement is that a Federal agency avoid construction or management practices that would adversely affect wetlands unless that agency finds that (1) there is no practical alternative, and (2) the proposed action includes all practical measures to minimize harm to the wetlands. Executive Order 11990 directs all Federal agencies to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance the natural beneficial of wetlands.
- Migratory Bird Treaty Act (MBTA) implementation is consistent with the selected alternative, as well as agency guidelines for conformance with the MBTA.

Administrative Review

This decision is subject to administrative review pursuant to 36 CFR 215 or 36 CFR 251, Subpart C. Appeals may be filed under either 215 or 251, but not both. Appeal rights under 36 CFR 251 are only available to those who hold grazing permits, or other written authorizations to occupy and use National Forest System lands, that will be affected by implementation of the decisions to treat stock tanks. The appeal must be filed (regular mail, fax, email, hand-delivery, or express delivery) with the Appeal Deciding Officer.

Send appeals to:

Appeal Deciding Officer, USDA Forest Service, Stop 1104
Ecosystem Management Coordination Staff
1400 Independence Avenue, SW, Washington, DC 20250-1104 (regular mail).

Federal Express and hand-delivery address is:

USDA Forest Service, Ecosystem Management Coordination
201 14th Street SW, 3rd Floor, Central Wing
Washington, DC 20024

Telephone is 202-205-0895; and fax number is 202-205-1012.

The business hours for those submitting hand-delivered appeals are: 8:15 a.m. to 4:45 p.m. ET, Monday through Friday, excluding holidays. An electronic appeal must be

submitted in a format such as an email message, plain text (.txt), rich text format (.rtf), or Word (.doc) to *appeals-chief@fs.fed.us*. The appeal must have an identifiable name attached or verification of identity will be required. A scanned signature may serve as verification on electronic appeals. In cases where no identifiable name is attached to an electronic message, a verification of identity will be required.

Appeals, including attachments, must be filed within 45 days from the publication date of the notice in the *Arizona Republic*, the newspaper of record. The publication date in the *Arizona Republic* is the exclusive means of calculating the time to file an appeal. Those wishing to appeal this decision should not rely upon dates or timeframe information provided by any other source.

Individuals or organizations appealing under 36 CFR 215, who submitted substantive comments during the comment period specified in 36 CFR 215.6 may appeal the decision. The notice of appeal must meet the appeal content requirements at 36 CFR 215.14.

For appeals filed under 36 CFR 251, the notice of appeal must contain sufficient narrative evidence and argument to show why a decision should be reversed or changed and include the content specified at 36 CFR 251.90. A copy of the appeal also must be simultaneously sent to the Regional Forester at:

Regional Forester
Southwestern Region
333 Broadway Blvd. SE
Albuquerque, NM 87102

Implementation Date

If no appeals are filed within the 45-day time period implementation of the decision may occur on, but not before, five business days from the close of the appeal filing period established in the Notice of Decision in the *Arizona Republic*. If an appeal is filed, implementation may occur on, but not before, the 15th business day following the date of the last appeal disposition.

Information Contact

For additional information concerning this decision or the Forest Service appeal process, contact Carl Taylor, Public Service Group Leader, 602-225-5230, Tonto National Forest, 2324 East McDowell Road, Phoenix, AZ 85006, or Amy Unthank, Regional Fisheries Program Manager, 505-842-3263, USDA Forest Service, Southwestern Region, 333 Broadway SE, Albuquerque, NM 87102.

for HARV FORSGREN
Regional Forester
Southwestern Region

June 8, 2004
Date

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NOTICE OF DECISION

NATIVE FISH RESTORATION IN FOSSIL CREEK
USDA FOREST SERVICE SOUTHWESTERN REGION
COCONINO AND TONTO NATIONAL FORESTS
GILA AND YAVAPAI COUNTIES, ARIZONA

On June 8, 2004, Abel M. Camarena, acting for Southwestern Regional Forester Harv Forsgren signed a Decision Notice and Finding of No Significant Impact (FONSI) to implement the Wilderness Alternative of the Fossil Creek Native Fish Restoration Project. The Wilderness Alternative includes construction of a barrier to fish passage on Fossil Creek within the Mazatzal Wilderness, treatment of Fossil Creek both within and outside Mazatzal Wilderness to remove non-native fishes, and the salvage of native fishes for re-introduction back into Fossil Creek. The actions inside wilderness will help restore natural conditions and will allow for the reintroduction and perpetuation of native fishes to 2.8 miles of Fossil Creek.

The associated Environmental Assessment and Decision Notice/Finding of No Significant Impact are available upon request from the USDA Forest Service, Tonto National Forest, Carl Taylor, 2324 East McDowell Road, Phoenix, AZ 85006 or USDA Forest Service, Southwestern Region, Amy Unthank, 333 Broadway SE, Albuquerque, NM 87102.

Decision Subject to Appeal

This decision is subject to administrative review pursuant to 36 CFR 215 or 36 CFR 251, Subpart C. Appeals may be filed under either 215 or 251, but not both. Appeal rights under 36 CFR 251 are only available to those who hold grazing permits, or other written authorizations to occupy and use National Forest System lands, that will be affected by implementation of the decisions to treat stock tanks. The appeal must be filed (regular mail, fax, email, hand-delivery, or express delivery) with the Appeal Deciding Officer.

Send appeals to:

Appeal Deciding Officer, USDA Forest Service, Stop 1104
Ecosystem Management Coordination Staff
1400 Independence Avenue, SW, Washington, DC 20250-1104 (regular mail).

Federal Express and hand-delivery address is:

USDA Forest Service, Ecosystem Management Coordination
201 14th Street SW, 3rd Floor, Central Wing
Washington, DC 20024

Telephone is 202-205-0895; and fax number is 202-205-1012.

The business hours for those submitting hand-delivered appeals are: 8:15 a.m. to 4:45 p.m. ET, Monday through Friday, excluding holidays. An electronic appeal must be submitted in a format such as an email message, plain text (.txt), rich text format (.rtf), or Word (.doc) to *appeals-chief@fs.fed.us*. The appeal must have an identifiable name attached or verification of identity will be required. A scanned signature may serve as verification on electronic appeals. In cases where no identifiable name is attached to an electronic message, a verification of identity will be required.

Appeals, including attachments, must be filed within 45 days from the publication date of the notice in the *Arizona Republic*, the newspaper of record. The publication date in the *Arizona Republic* is the exclusive means of calculating the time to file an appeal. Those wishing to appeal this decision should not rely upon dates or timeframe information provided by any other source.

Individuals or organizations appealing under 36 CFR 215, who submitted substantive comments during the comment period specified in 36 CFR 215.6 may appeal the decision. The notice of appeal must meet the appeal content requirements at 36 CFR 215.14.

For appeals filed under 36 CFR 251, the notice of appeal must contain sufficient narrative evidence and argument to show why a decision should be reversed or changed and include the content specified at 36 CFR 251.90. A copy of the appeal also must be simultaneously sent to the Regional Forester at:

Regional Forester
Southwestern Region
333 Broadway Blvd. SE
Albuquerque, NM 87102

Implementation of Decision

If no appeals are filed within the 45-day time period, implementation of the decision may occur on, but not before, 5 business days from the close of the appeal filing period. When appeals are filed, implementation may occur on, but not before, the 15th business day following the date of the last appeal disposition.

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United States Department of the Interior
Bureau of Reclamation
Lower Colorado Region
Phoenix Area Office

FINDING OF NO SIGNIFICANT IMPACT

Native Fish Restoration
in Fossil Creek

Coconino and Tonto National Forests
Gila and Yavapai Counties, Arizona

Approved: _____
Carol L. Erwin
Area Manager, Phoenix Area Office
Bureau of Reclamation

Date: 6/8/04

FONSI No. 04-1

Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and based upon the analysis presented within the attached Final Environmental Assessment (EA) on Native Fish Restoration in Fossil Creek, the Bureau of Reclamation (Reclamation) has determined that construction and operation of a fish barrier and other associated activities in Fossil Creek will not be a major Federal action significantly affecting the quality of the human environment.

BACKGROUND

In 1994, the Fish and Wildlife Service (FWS) issued a final biological opinion (Opinion) on the transportation and delivery of Central Arizona Project (CAP) water to the Gila River basin and its potential to introduce and spread nonnative aquatic species. The Opinion concluded that long-term operation of the CAP would jeopardize the continued existence of several federally-listed species of native Arizona fishes. The Opinion also identified a reasonable and prudent alternative to avoid jeopardy that included construction of several fish barriers. In 2001, the FWS, in consultation with Reclamation, revised this Opinion and included construction of a fish barrier in Fossil Creek as a required measure.

The EA describes potential impacts from construction of a fish barrier, stream renovation with the piscicide antimycin A, and restocking native fishes in Fossil Creek. Two barrier location alternatives (wilderness site vs. nonwilderness site) and no action are evaluated in the EA. Numerous other alternatives were considered and rejected due to technical and biological infeasibility or ineffectiveness.

Scoping information was sent to 63 addressees soliciting comments for the project on April 25, 2002. The proposal was also listed on the Coconino and Tonto National Forest's Schedule of Proposed Actions. Several issues were identified from discussions among interdisciplinary team members and comments from 17 respondents during public scoping. Concern about effects on nontarget biota, sediment transport, water quality, human health, wilderness, potential Wild and Scenic River Act designation, and project logistics were raised. These issues formed the basis for refining the project and developing mitigation measures.

A draft EA was mailed to more than 90 addressees on December 23, 2003, for 30-day public comment. In addition, a public notice was published in the Arizona Republic and news releases were sent to six other newspapers in Arizona regarding availability of the draft EA. The draft EA was also available on the Coconino National Forest NEPA website and at specified offices of the Coconino and Tonto National Forests. Eleven letters were received in response to the draft EA during the 30-day comment period.

FINDING OF NO SIGNIFICANT IMPACT

Reclamation has determined the proposed action will not significantly impact the environment, and preparation of an environmental impact statement is not warranted. This decision is based upon the following considerations:

1. Adverse aquatic habitat impacts will be insignificant. Localized and minor increases in stream turbidity attributable to the project will be substantially restricted to a 1-month period of active construction. No long-term effect on water quality, stream dynamics, or sediment transport is anticipated. The application of antimycin A in selected reaches of stream has the potential to temporarily reduce the abundance of certain groups of aquatic macroinvertebrates, but long-term effects are expected to be minimal in regard to number, biomass, and diversity. Effects to other nontarget species will be limited to native fishes within treatment areas that escape capture prior to application of antimycin. All stream treatments will include potassium permanganate drip stations to detoxify antimycin below treatment areas. Degradation byproducts of potassium permanganate and antimycin will have a negligible effect on water quality or aquatic biota. Use of piscicides on National Forest lands is consistent with Forest Service policy, which allows chemical treatments for reestablishment of indigenous, threatened, or endangered native species or to correct undesirable conditions caused by human influence.

2. A Clean Water Act Section 404 permit was issued by the U.S. Army Corps of Engineers for the Fossil Creek fish barrier on October 30, 2003. The Arizona Department of Environmental Quality issued a 401 water quality certification for activities associated with the project on June 24, 2003. Coverage under the Section 402 Arizona Pollutant Discharge Elimination System general storm water permit for construction activities will be obtained prior to construction.

3. Effects of the project on terrestrial biota are insignificant. The project will have limited and discountable impacts on less than 1.4 acre of upland and riparian habitat. Human activities associated with construction and stream renovation will not result in substantial disturbances to terrestrial wildlife.

4. The project will have no significant effects on threatened, endangered, candidate, or Forest Service listed sensitive species. A biological assessment prepared by Reclamation concluded there will be no adverse effect to federally-listed species or adverse modification of designated critical habitat.

5. The project will not cause the loss or destruction of significant cultural or historic resources. Measures recommended in a Class III (intensive) archaeological inventory of the project area will be implemented by Reclamation to avoid impacts to cultural resources. Based on the inventory data and associated mitigation commitments, the Forest Service submitted a no effect determination to the State Historic Preservation Office. The State Historic Preservation Office concurred with the no effect determination on December 10, 2003.

6. The project will not affect Fossil Creek's eligibility as a wild and scenic river. A Wild and Scenic River Act Section 7(a) analysis conducted by the Forest Service concluded that barrier construction will have a negligible effect on overall function and free-flowing character of Fossil Creek in respect to possible future designation under the Act. Project implementation will not affect the Verde Wild and Scenic River corridor.

7. Effects of the project on the Mazatzal Wilderness are insignificant. In its June 2004 Decision Notice, the Forest Service approved project implementation in the Mazatzal Wilderness subject to compliance with mitigation specified in the final EA. Based on prior precedent and Forest Service policy, barrier construction and piscicide use are accepted activities to protect imperiled native fish communities within Wilderness.

8. Recreation and visual quality effects of the project are insignificant. Fishing recreation is light, and removal of the nonnative sport fishery will have a minor effect on the angling public. The barrier will be colored and textured to visually conform to surrounding terrain.

9. Effects to soils and air quality are insignificant. Total impact to soils, including sediment impounded by the barrier, is estimated to be less than 1.5 acre. Exposed bedrock and rocky substrates at the barrier site and along the stream banks will limit erosion potential. Temporary and highly localized air emissions from construction will have a minor effect on air quality.

10. Rights to surface water within Fossil Creek will not be significantly affected by the project. These water rights are held by the Salt River Project (SRP). Reclamation will compensate SRP for water losses attributable to construction and operation of the barrier.

11. There are no known or expected adverse effects to public health, safety, or populations defined by Executive Order 12898 (Environmental Justice).

12. Indian Trust Assets will not be affected.

13. The mitigation and monitoring requirements identified in the final EA will be implemented by Reclamation and the Forest Service.

Documents related to this action are listed below.

Archaeological Consulting Services, Inc. 2003. Cultural Resources Survey of 34 Acres Along Fossil Creek in the Vicinity of Proposed Fish Barriers, Yavapai County, Arizona. ACS Project No. 03-038, Cultural Resources Report No. 136.

Forest Service. 2004. Decision Notice and Finding of No Significant Impact for Native Fish Restoration in Fossil Creek. USDA Forest Service. Coconino and Tonto National Forest, Gila and Yavapai Counties, Arizona.

U.S. Bureau of Reclamation. 2002. Biological Assessment for Native Fish Restoration in Fossil Creek. Phoenix Area Office, Phoenix, Arizona.

U.S. Bureau of Reclamation. 2004. Final Environmental Assessment, Native Fish Restoration in Fossil Creek. Phoenix Area Office, Phoenix, Arizona. Attached.

Final Environmental Assessment

NATIVE FISH RESTORATION IN FOSSIL CREEK

Coconino and Tonto National Forests, Arizona

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CHAPTER 1 - PURPOSE AND NEED

1.1 Introduction

The Bureau of Reclamation (Reclamation) and the Forest Service have prepared this Environmental Assessment (EA) to analyze potential effects to physical, biological, and cultural resources that may result from construction of a fish barrier and other native fish recovery efforts in Fossil Creek. The EA was prepared in accordance with the National Environmental Policy Act (NEPA), Council on Environmental Quality regulations (40 CFR 1500-1508), Reclamation NEPA Handbook, and Forest Service NEPA Handbook 1909.15. Reclamation and the Forest Service are the lead Federal agencies pursuant to NEPA. The U.S. Fish and Wildlife Service (FWS) and Arizona Game and Fish Department (AGFD) are cooperating agencies.

This document is organized into six chapters:

- *Chapter 1 – Purpose and Need:* Presents information on the history of the project proposal, the purpose of and need for the project, and the lead agencies' proposal for achieving that purpose and need. This section also details how the lead agencies informed the public of the proposal and how the public responded.

- *Chapter 2 – Comparison of Alternatives, including the Proposed Action:* Provides a detailed description of the lead agencies' proposed action; alternative methods for satisfying the stated purpose and need; and significant issues raised by the public, project proponents, and other agencies. This discussion includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.

- *Chapter 3 – Affected Environment and Environmental Consequences:* Describes the environmental effects of implementing the proposed action and other action alternative. The analysis is organized by resource topic. Within each section, the affected environment is described first, followed by the effects of no action and the action alternatives.

- *Chapter 4 – Agencies and Persons Consulted:* Lists preparers and agencies consulted during the development of the EA.

- *Chapter 5 – Environmental Laws and Directives:* Lists Federal environmental laws and directives that are relevant to the project.

- *Chapter 6 – Literature Cited:* Lists documents used in the preparation of this EA.

- *Appendices:* The appendices provide more detailed information to support the analysis presented in this EA.

1.2 Background

Native Arizona fishes[1] are among the most endangered group of aquatic species in the United States. Twenty of 35 native fish species (54 percent) are federally listed as endangered or threatened. This sharp decline in status is partly the result of a long history of poor watershed practices and water development in Arizona which has dramatically altered riverine habitats (Minckley 1997). Human utilization of land and water resources has dramatically affected the characteristics of streams (water quality, hydrology, and geomorphology) and associated biotic communities since the early 1900s. Surface water diversions and ground-water pumping have gradually turned major segments of perennial streams into ephemeral-flow channels, resulting in lost interconnectivity of aquatic ecosystems and habitat fragmentation. Compounding these effects, predatory nonnative fish, crayfish, and bullfrogs have decimated or eliminated populations of native fishes and aquatic wildlife in many areas where perennial flows persist. Destabilization of riverine systems has lead to a typical pattern in Arizona where native species tend to be restricted to the upper reaches of major drainage basins (FWS 2001). The decline of native fishes is particularly acute in the Gila River basin, which drains the southern half of Arizona and portions of New Mexico and Sonora.

Gila River Basin Fishes. Within the past century, the effects of habitat modification and interaction with nonnative species have significantly reduced the abundance and distribution of native fishes in the Gila River basin (see Appendix A, Table A-1). Nearly 66 percent of the 20 species of native fishes that historically occupied the Gila River basin are currently imperiled or have disappeared (11 are federally listed as endangered or threatened, 1 is proposed endangered, and 1 recently became extinct). At one time, all of the basin's native fishes not formally listed under the Endangered Species Act (ESA) were on the Candidate list, until a regulatory change reassigned most to the category of "species of concern." Populations of native fishes within the basin continue to decline.

Since the early 1900s, at least 40 species of nonnative fish have become established in the Gila River basin (see Appendix A, Table A-2). Many of these nonnatives were purposefully introduced to increase the diversity of the sport fishery, and some were accidentally released as bait or ornamental fish. Regardless of the mode of arrival, nonnative fishes have had a detrimental effect on native aquatic species. The introduction and proliferation of nonnative aquatic fauna, especially fish, is increasingly viewed as one of the most serious long-term threats to the status and recovery of native aquatic vertebrates, equaled in severity only by the effect of habitat destruction (Minckley 1991, Rosen et al. 1995, Pacey and Marsh 1998, Marsh and Pacey in press).

---

1 "Native" (also indigenous, endemic, and aboriginal) refers to organisms that occur, or formerly occurred, in a particular region as a result of ecological processes. This is opposed to organisms that have been intentionally or accidentally introduced outside their natural historic ranges by human activity. The introduced fish species that proliferate in the Verde River and threaten Fossil Creek evolved in the Great Lakes and Mississippi drainage systems, but are not native to the Colorado, Gila, or other western river basins.

Potential future releases and dispersal of new nonnative aquatic species poses an additional threat that could further hasten the extirpation of endemic species (Rosen et al. 1995).

Direct impacts of nonnative fishes to native forms include predation, competition, hybridization, and parasite and pathogen transmission. Predation on early life stages (eggs, larvae, juveniles) is considered the primary avenue by which nonnative fishes depress and often eliminate what are considered predator-naive native species (Minckley 1991). These effects are often exacerbated by habitat degradation. Case history shows that fishes as diverse as the "big river" razorback sucker (*Xyrauchen texanus*) and diminutive Gila topminnow (*Poeciliopsis occidentalis*) can live and reproduce in degraded habitats as long as they are unaccompanied by nonnative fishes, but they commonly wane or disappear when nonnatives become established (Pacey and Marsh 1998).

Native fishes, with only a few exceptions, are broadcast spawners that afford no parental care to their progeny, while nonnative kinds are predominated by nest-builders that provide some degree of parental protection of eggs and young (Pacey and Marsh 1998). Furthermore, there is broad overlap among native and nonnative fishes in their use of physical habitats and biological resources, with the exception that most nonnatives are piscivores[2] or omnivores[3] (Pacey and Marsh 1998). Thus, predation on early life stages is an intense, ever-present limiting factor inhibiting successful completion of native fish life cycles where the two groups coexist. For this reason, removal of nonnative fishes from native fish habitats, followed by stocking depleted or extirpated native species in concert with actions to prevent reinvasion by nonnatives, are among the foremost objectives of native fish recovery efforts in the Gila River basin (FWS 1994, 2001).

Effects of Central Arizona Project (CAP) on Gila River Basin Fishes. On September 30, 1968, Congress passed the Colorado River Basin Project Act (Act). This Act authorized the Secretary of the Interior, through Reclamation, to construct the CAP to deliver Colorado River water for agricultural, industrial, and municipal uses in central and southern Arizona. The CAP, which was declared "substantially complete" in 1993, conveys Colorado River water through a 336-mile long system of pumping plants, aqueducts, dams, and reservoirs.

During the late 1980s, the issue of introduction and spread of nonnative aquatic species through the CAP began to receive serious consideration among fisheries biologists. Because the CAP is an interbasin water transfer system, concern was expressed that the CAP could accelerate the rate at which nonnative species are spread across basins and invade habitats occupied by native fishes. Recognizing the CAP could potentially affect protected native fishes, Reclamation, in 1991, requested formal consultation with the FWS, pursuant to Section 7(a)(2) of the ESA. On April 15, 1994, the FWS issued a final biological opinion on the delivery of CAP water to the Gila River basin (FWS 1994).

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2 Animals that consume fish.
3 Animals that consume both animal and plant material.

In March 1997, the Southwest Center for Biological Diversity filed suit, alleging that the biological opinion's reasonable and prudent alternative did not sufficiently remove jeopardy to threatened or endangered native fishes or adverse modification to their critical habitats. A U.S. District Court ruling in September 2000, upheld the FWS' jeopardy conclusion in the 1994 biological opinion, but also held that subsequent amendments to the reasonable and prudent alternative were arbitrary and capricious. As a result, Reclamation and the FWS reentered formal consultation, which culminated in the FWS issuing a revised biological opinion on CAP water delivery (FWS 2001).

The FWS, in its 2001 biological opinion, concluded that interbasin water transfer through the CAP seriously and adversely affects the endangered Gila topminnow and razorback sucker and the threatened spikedace (*Meda fulgida*), loach minnow (*Tiaroga cobitis*), and bald eagle (*Haliaeetus leucocephalus*). The FWS also determined that CAP operations adversely modify critical habitat of the razorback sucker, spikedace, and loach minnow. Potential for establishment of nonnative aquatic species within the CAP system, and their subsequent escape and invasion into habitats occupied by protected native fishes, were cited as reasons for these adverse effects. Canal systems using CAP-supplied water, and associated irrigation releases to the rivers of the Gila River basin, were identified by the FWS as principal routes, among others, by which nonnative species could move from the CAP to the Gila River and its tributaries.

The 2001 CAP biological opinion incorporated the 1994 reasonable and prudent alternative and mitigative commitments proposed by Reclamation during reconsultation, which are collectively referred to in the 2001 opinion as conservation measures. These conservation measures required construction and operation of a single drop-type fish barrier in Fossil Creek and other specified drainage systems of the Gila River basin in Arizona and New Mexico.[4] In its 2001 biological opinion, the FWS concluded that the strategic placement of fish barriers, when combined with other proposed conservation measures, would avoid the likelihood that operation of the CAP will jeopardize the continued existence of listed species or adversely modify designated critical habitat.

Fish barriers built pursuant to the 2001 CAP biological opinion are subject to NEPA compliance. According to the opinion, if any of these barriers cannot be constructed, Reclamation must reinitiate formal consultation with the FWS, unless an acceptable alternative site can be identified.[5]

Forest Service Policy. Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to implement programs for the conservation of threatened and endangered species. Chapter 5 provides a list of other laws that guide Forest Service management relative to this project.

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4 The drainages consist of the Verde River between the town of Clarkdale and the confluence of Sycamore Creek; Bonita Creek near its confluence with the Gila River; Hot Springs, Redfield, and O'Donnell canyons in their lower reaches; Blue River near its confluence with the San Francisco River; and a stream to be identified in the Tonto Creek basin.

5 Reinitiation of formal consultation would be required if an acceptable site on an alternative stream cannot be identified or barrier construction at the alternative site results in adverse effects to listed species that are not already addressed in the 2001 CAP biological opinion.

Forest Service policy is to recover threatened and endangered species so that special protection measures provided under the ESA are no longer necessary, and to ensure, through development and implementation of appropriate management practices, that nonlisted species do not become threatened or endangered because of Forest Service actions (FSM 2602, 2670). Policy also is to encourage or initiate the repatriation of listed species onto suitable unoccupied habitat when such actions promote recovery of the species (FSM 2674). The National Forest Management Act of 1976 requires the Forest Service to provide for the biological diversity of national forests consistent with overall multiple-use objectives of the planning area and to maintain viable populations in the planning area. The Coconino and Tonto Forest Plans (Forest Service 1987 and 1985, as amended) have goals, objectives, standards, and guidelines for maintaining viable populations of native fishes, and for recovering federally-listed species. Forest Plans also have management direction for many other resources and designations such as Wilderness and Wild and Scenic Rivers. Because the project area includes a portion of the Mazatzal Wilderness, the Wilderness Implementation Plan (Forest Service 1994) is also relevant to this project.

Childs-Irving Hydroelectric Project. Arizona Public Service Company (APS) owns and operates the Childs and Irving hydroelectric facilities on Fossil Creek. Built in the early 1900s, these facilities utilize stream flow diverted from Fossil Creek to generate hydroelectric power. An important element of the hydroelectric system is the Fossil Springs diversion dam, which captures and directs nearly all of the stream's 43 cubic feet per second (cfs) base flow through a series of flumes, tunnels, and pipes to supply the Childs and Irving power plants.

In December 1992, APS filed an application with the Federal Energy Regulatory Commission (FERC) to relicense the Childs-Irving Hydroelectric Project for 30 years. On August 14, 1997, FERC issued a draft EA on the relicensing proposal and invited public comment. After a period of negotiation with a coalition of groups including American Rivers, The Nature Conservancy, the Yavapai-Apache Tribe, the Northern Arizona Audubon Society, the Sierra Club, and the Center for Biological Diversity, APS signed an Agreement in Principle in 1999 to decommission the facilities and return full flows to Fossil Creek. FERC is currently analyzing the effects related to decommisioning and facility removal in the stream corridor and watershed.

Potential decommissioning of the Childs-Irving Hydroelectric Project is driving the schedule for implementing native fish restoration actions in Fossil Creek. If decommissioning occurs according to the terms of the Agreement in Principle, APS will return base flows of approximately 43 cfs to Fossil Creek no later than December 31, 2004. Native fish restoration work would need to be completed before full flows are returned to the stream. Once full flows are returned, renovation and any in-stream work would be logistically and economically much more difficult to achieve successfully.

1.3 Purpose and Need for Action

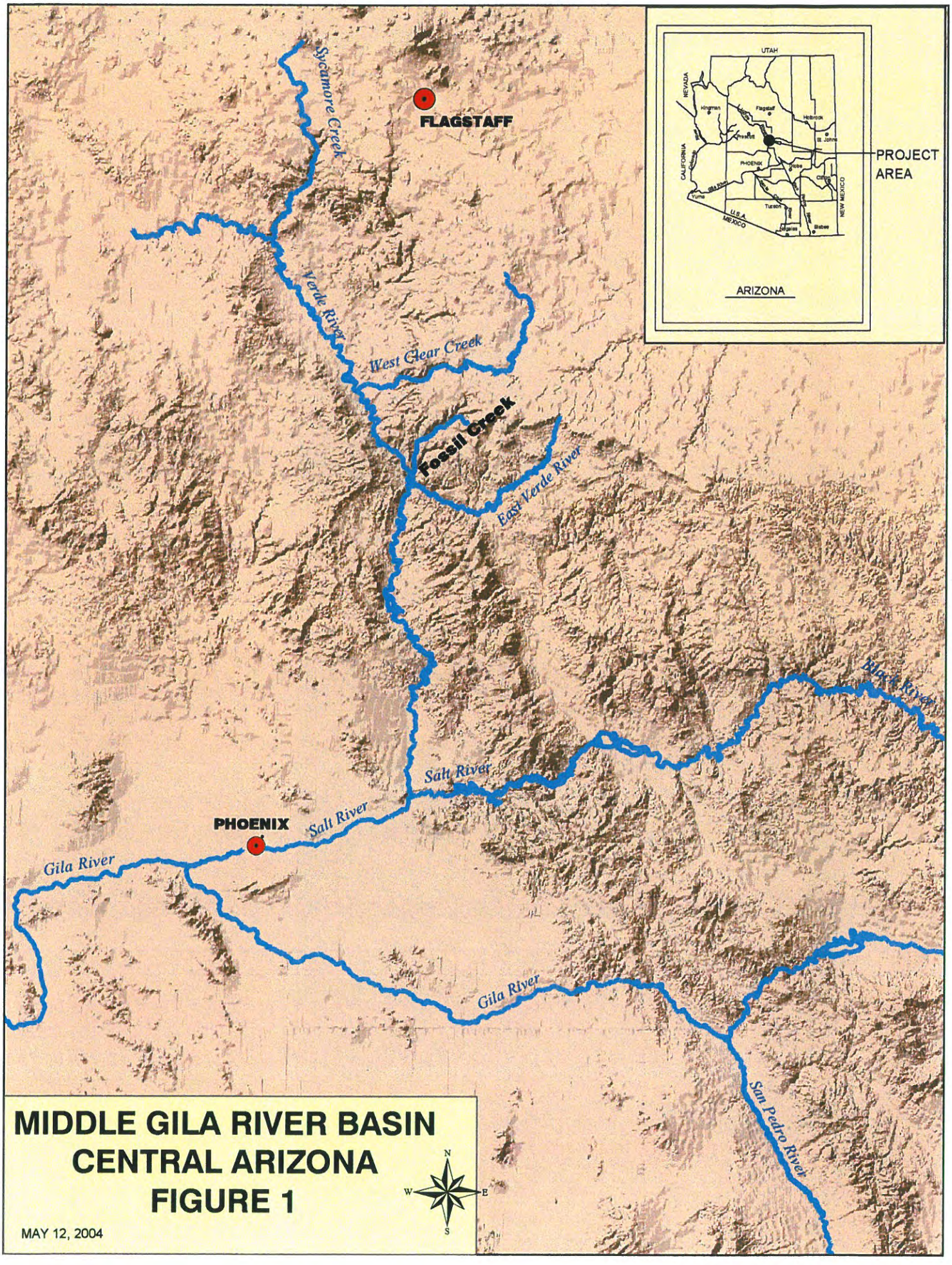
The purpose of the proposed project is to restore and allow a native fish assemblage to persist in as much of Fossil Creek as possible. The project would secure middle and upper reaches of Fossil Creek for use by existing native fishes and future repatriated species that have been extirpated from the system.

Located within the northern portion of the middle Gila River basin (Figure 1), Fossil Creek supports an abundant and diverse native fish community. However, since the mid-1990s, community dominance of nonnative species has moved upstream from lower reaches of Fossil Creek and the Verde River. Competitory and predatory interactions by nonnatives fishes have reduced reproduction and recruitment of native fishes in the 10.6-mile segment below Irving (AGFD 2001), threatening the long-term viability of native fish populations in most of Fossil Creek. Action regarding native fish restoration in Fossil Creek is needed because:

- Fossil Creek is one of a few perennial, warmwater streams remaining in Arizona with multiple species of native fish that still exist together, and actions taken now would prevent continued declines or losses that are probable in the foreseeable future;
- nonnative fishes and other aquatic organisms such as crayfish and bullfrogs are moving up Fossil Creek from the Verde River and adversely affecting native populations;
- native fish populations in Fossil Creek (and the remainder of the Gila River basin) are declining as nonnative fish populations are increasing in numbers and extent; self-sustaining populations of native fish may not persist in the long term if action is not taken;
- existing low flows in the creek provide conditions where restoration actions are likely to be the most effective; and
- improved status for recovery of listed species would be achieved pursuant to the 2001 CAP biological opinion.

Fossil Creek is unique on the Coconino and Tonto National Forests for its potential to contribute to native, warmwater fish restoration and recovery. A combination of factors makes Fossil Creek particularly distinctive as compared to other streams in the Gila River basin.

- a native assemblage of six fish species persists in headwater reaches of the stream, indicating it has high potential for assisting recovery, if nonnatives can be eliminated;
- restoration of high base flows and the resulting travertine deposition below the Fossil Springs diversion dam will create more complex and diverse instream habitats capable of supporting a high diversity of native fishes and other biota;



MIDDLE GILA RIVER BASIN
CENTRAL ARIZONA
FIGURE 1

MAY 12, 2004

- the present low-flow reaches of Fossil Creek below the diversion dam, which have been invaded by several nonnative species, are conducive to treatments to rid the stream of nonnative fishes and to construct a fish barrier to prevent reinvasions;
- the area is relatively wild and remote and is used very little as a sport fishery for nonnatives, providing ideal conditions for restoring and emphasizing a native fishery; and
- the stream is almost entirely in Federal ownership with only one small parcel of private land.

One of the most important potential uses for Fossil Creek is as a replication site for endemics like the rare Verde River population of spikedace. That population, which is substantially different from all other spikedace populations, is the last remaining in the Verde River drainage, and its replication in another stream would be a major step toward initiating recovery and preventing its extinction. Additionally, Fossil Creek is recognized as having potential to contribute to recovery of razorback sucker (EnviroNet Inc. 1998) and several other native species, including Gila topminnow, desert pupfish (*Cyprinodon macularius*), and loach minnow (Forest Service 1997). The potential for some of these species partly depends upon how habitats develop following flow restoration and travertine formation (see below).

Restoring a native fish community in Fossil Creek would also benefit native fishes in the Verde River. Removing nonnative fish from Fossil Creek would reduce the total nonnative biotic load of the Verde system and prevent Fossil Creek from becoming a major source of nonnative fishes that would contribute nonnative numbers and species to the Verde River. Repatriation of native fish into Fossil Creek would provide a secure source population of several species to the Verde River and, thereby, enhance or establish populations there. For some species, such as razorback sucker, a restored and renovated Fossil Creek would serve as a grow-out area to greatly increase the success of existing repatriation efforts in the Verde River that have been ongoing for 20 years.

1.4 Proposed Native Fish Recovery Project

The project proposed by Reclamation and the Forest Service to meet the purpose and need is to construct a single reinforced concrete fish barrier and renovate a segment of Fossil Creek. Elements of the project that are described in this section are common to the two action alternatives that are discussed in this EA. Additional detail describing the project is presented in Chapter 2.

Fish Barrier. The fish barrier is intended to create an effective impediment to fish movement upstream during stages of stream flow most likely to foster ingress of nonnative fishes from the Verde River and lower reaches of Fossil Creek (i.e., base flow, lower flood discharges, and ascending and descending stages of higher floods). Upstream movement of fishes is not expected during peak flooding due to high flow velocities and sediment loads. The barrier would also prevent reinvasion of nonnative

aquatic fauna that are transported out of the stream during flooding and function as a downstream control site for eradication of nonnative fishes between the barrier and the Fossil Springs diversion dam. See Section 2.3 for information on construction.

Nonnative fishes that have invaded Fossil Creek include green sunfish (*Lepomis cyanellus*), smallmouth bass (*Micropterus dolomieu*), flathead catfish (*Pylodictis olivaris)* (Roberson et. al 1996), and yellow bullhead (*Ameiurus natalis*). Green sunfish is an aggressive invader of small streams in the Gila River basin, to the point of being nearly ubiquitous. The species has invaded Fossil Creek to near the base of Fossil Springs diversion dam (Appendix A, Table A-3), and it has been shown to be an effective predator on young native fish (Dudley and Matter 2000). For example, distributions of Gila chub (*Gila intermedia*) and green sunfish in Sabino Creek, Arizona, are complementary; where green sunfish have invaded, Gila chub are absent. Young life stages of Gila chub apparently cannot persist in the presence of green sunfish (Dudley and Matter 2000). Suppression of native fish populations by green sunfish was also documented by Lemly (1985).

Smallmouth bass has recently invaded Fossil Creek to below the natural falls at Irving (Appendix A, Table A-3). This species is a renowned predator of fishes that is also capable of suppressing reproductive success by native Arizona fishes, and displacing them (Minckley 1973). Comparisons of roundtail chub (or headwater chub) habitat use in Fossil Creek (in the absence of smallmouth bass) and the adjacent Wet Beaver Creek (in the presence of smallmouth bass) support the conclusion that smallmouth bass negatively interact with chub (Barrett and Maughan 1992).

Yellow bullhead is a highly carnivorous species that readily consumes fishes (Minckley 1973). The species primarily inhabits pools and slow-flowing runs. Yellow bullhead has been introduced to most major drainages of the State, and is commonly found in mainstem and tributary waters of the Santa Cruz, Verde, Salt, Gila, and San Pedro River basins. Little is known concerning its impacts to native species in the southwest, but its tendency to piscivory undoubtedly impacts native populations where the two co-occur.

Fish Salvage. Prior to stream renovation, native fishes would be salvaged for holding and restocking. Electrofishing, angling, and netting would be deployed to capture native fishes alive. Captured fish would be transferred to large holding tanks and released to the stream following the piscicide treatment. Small samples of native sentinel fish would be held in live cages in the treated section to ensure the stream is no longer toxic, prior to releasing salvaged native fishes. See Section 2.3 for further information on fish salvage.

Stream Renovation. Renovation would entail eradicating populations of nonnative fishes through application of the piscicide antimycin A (trade name Fintrol; see Appendix B). Antimycin A has proven especially effective and safe for stream renovations. It has been tested with no detectable effect on terrestrial wildlife and non-gill breathing aquatic animals when applied in recommended formulations, nor does it affect plants. Antimycin naturally breaks down in flowing water within a few hours to a few days of treatment and can be readily detoxified with potassium permanganate. Application of this piscicide for

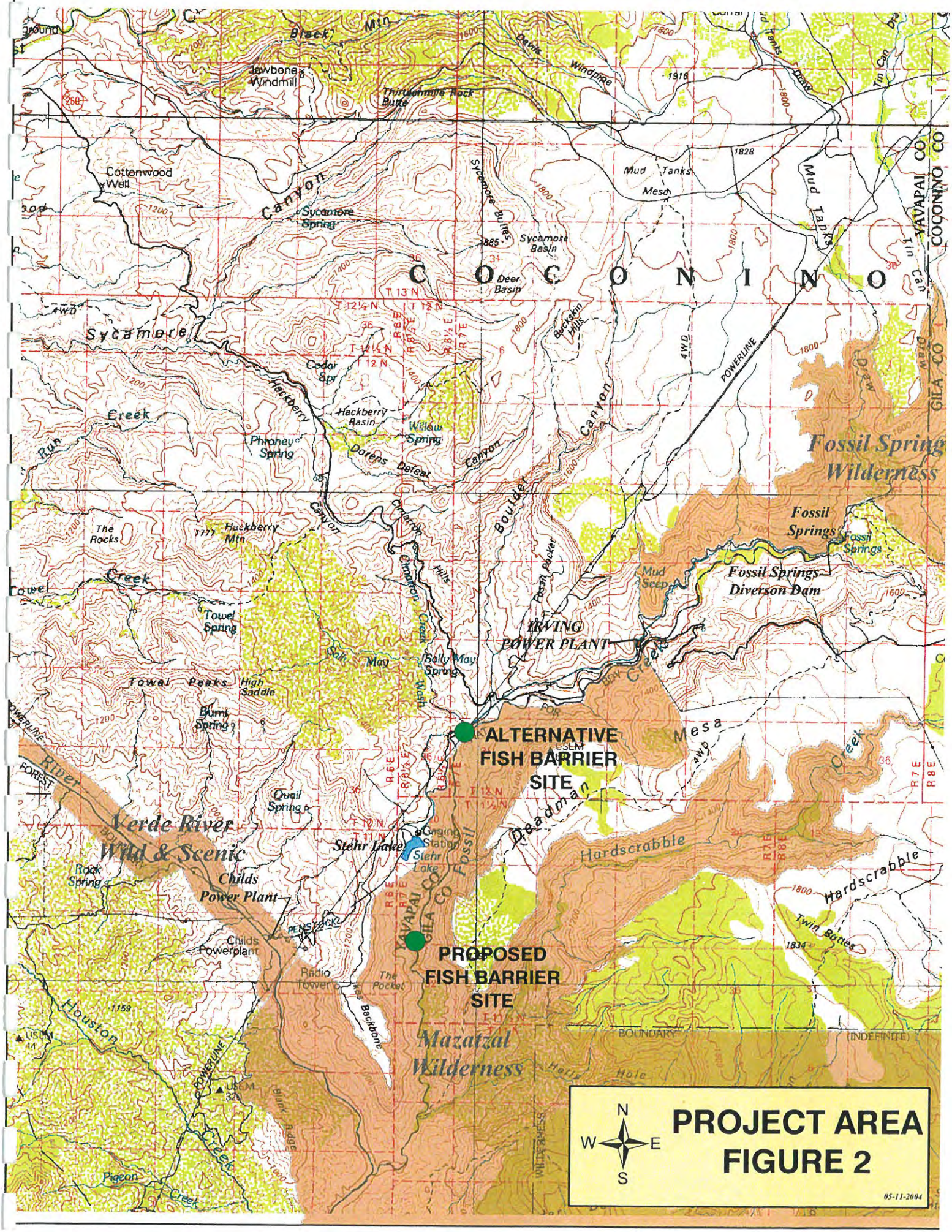
modern fishery management has been practiced successfully for many decades. Antimycin A has been effective and safe for Apache trout (*Oncorhynchus apache*) renovations in Arizona and Gila trout (*O. gilae*) and Rio Grande cutthroat trout (*O. clarki virginalis*) renovations in New Mexico, where in total hundreds of miles of stream have been successfully treated to remove nonnative fishes without incident (S. Gurtin, AGFD, and D. Propst, New Mexico Department of Game and Fish, personal communication; also see project list in Appendix C, Table C-1). Several renovations of streams in Arizona to eliminate green sunfish for the benefit of native populations have recently been implemented (e.g., Arnett Creek, O'Donnell Canyon, and Romero Canyon), and others are in planning stages. See Section 2.3 for further information on stream renovation.

Repatriation of Native Fishes. Native fishes salvaged prior to the treatment would be released near their point of capture once the stream has detoxified. Based on sampling and discussions among agency biologists and academic experts, fishes captured in the untreated reach above Fossil Springs diversion dam may also be released at several points upstream of the fish barrier if the numbers of salvaged fish repatriated are inadequate. Natural downstream movements of fishes from above the dam would likewise serve as a source for repatriation to the treated stream reach. A key goal is to secure the rare Verde River population of spikedace in a hatchery environment, build up its numbers through artificial propagation, and replicate the population into Fossil Creek. In addition, repatriations into Fossil Creek of other rare Gila River basin native fishes such as Gila topminnow and loach minnow, the latter having been extirpated from the entire Verde River drainage, are also planned. See Section 2.3 for further information on repatriation of native fishes.

Rationale for the Proposed Project. The strategy of combining barrier construction with stream renovation and repatriation of native fishes has been practiced successfully for decades in the southwest with native salmonids and species of warmwater fishes. Past renovations for at-risk native fishes prevented immediate extinctions of rare populations, stabilized those populations, and replicated them, all essential steps in a rare species recovery program. Except for unique circumstances, renovation of surface waters with an approved piscicide is the only method that has a high assurance of total removal of nonnative fish from a system. Antimycin A is the most effective piscicide for renovation of streams, and it has been used extensively in the southwestern U.S. for several decades.

1.5 Project Area Description

The project area is located on Fossil Creek, in the Mazatzal Mountains of central Arizona (Figure 2). Fossil Creek forms the boundary between Yavapai and Gila Counties, as well as Tonto and Coconino National Forests over most of its course. Except for a private inholding that encompasses a short segment of the stream south of Irving, the project area consists entirely of National Forest System lands, and includes the northern portion of the Mazatzal Wilderness. No State, tribal, or other lands are included in this area.


ALTERNATIVE FISH BARRIER SITE
PROPOSED FISH BARRIER SITE
PROJECT AREA
FIGURE 2
05-11-2004
N
W
E
S
COCONINO
YAVAPAI CO
GILA CO
Fossil Spring Wilderness
Mazatzal Wilderness
Verde River Wild & Scenic
IRVING POWER PLANT
Childs Power Plant
Childs Powerplant
Fossil Springs Diversion Dam
Stehr Lake
Gaging Station
Stehr Lake
Sycamore Canyon
Hackberry Creek
Towel Creek
Towel Peaks
Hackberry Mtn
Cottonwood Well
Sycamore Spring
Hackberry Basin
Willow Spring
Phoney Spring
Towel Spring
Burnt Spring
Quail Spring
Rock Spring
Radio Tower
The Pocket
Backbone
Deadman Mesa
Hardscrabble
Twin Buttes
Mud Tanks
Mud Tanks Mesa
Sycamore Basin
Deer Basin
Buckskin Hills
Cinnamon Hills
Boulder Canyon
Fossil Springs
Mud Seep
Salt May
Belly May Spring
Thirteenmile Rock Butte
Lawbone Windmill
Black Mtn
Windpipe
Tin Can Draw
Drew
POWERLINE
4WD
Houston Creek
Pigeon Creek
Black Ridge
Hells Hole
BOUNDARY (INDEFINITE)
WILDERNESS

Fossil Creek is one of Arizona's rare warmwater perennial streams, flowing from a complex of springs, known as Fossil Springs, 14.3 miles through rugged and isolated terrain before entering the Verde River. Fossil Springs produces a constant water temperature of approximately 70 degrees Fahrenheit and flow of 43 cfs (slightly more than 320 gallons per second), most of which is captured by APS at the 25-foot high Fossil Springs diversion dam located 0.3 mile downstream of the springs. Base flows below the diversion dam vary between 2 cfs and 5 cfs, although episodic flows of much higher magnitude are possible from rainfall and snowmelt. The project area considered in this analysis includes a 9.5-mile reach of Fossil Creek between the Fossil Springs diversion dam and the lowermost barrier site proposed by Reclamation, including 2.8 miles of stream in the upper portion of the Mazatzal Wilderness.

1.6 Decision to be Made

Reclamation and the Forest Service must decide whether to implement the proposed action, other action alternative, or no action. If the project is implemented, Reclamation would construct the fish barrier on National Forest System land. Long-term maintenance of the structure would be performed by the Central Arizona Water Conservation District. The Central Arizona Project Fund Transfer Program, established under the 1994 and 2001 CAP biological opinions, would provide funding for renovation of Fossil Creek and repatriation of native fishes. Renovation of the stream would be a joint effort involving AGFD, Reclamation, FWS, and Forest Service.

The Regional Forester is the official responsible for approving the construction of the fish barrier, application of antimycin, and deciding the conditions where motorized equipment or non-emergency mechanical transport, including helicopters and non-emergency helispots, may be allowed within wilderness. The Area Manager of Reclamation's Phoenix Area Office has authority to implement construction of the barrier project once Forest Service approval has been granted.

1.7 Public Involvement

The proposal has been listed in the Coconino National Forest's Schedule of Proposed Actions (SOPA) since April 2002, and the Tonto National Forest's SOPA since July 2003. A scoping letter which described the proposal was also distributed to the public and other agencies during scoping. Scoping information was mailed to 63 individuals, agencies, and organizations on April 25, 2002. Seventeen respondents submitted written comments.

Several issues were identified from discussions among interdisciplinary team members and other agencies, and comments from the public during scoping. These issues defined the range of actions, alternatives, and impacts that are addressed in this document, and served as the basis for refining the project and developing mitigation measures.

The interdisciplinary team evaluated issues raised during public scoping and categorized each according to possible significance or lack thereof. Significant issues were defined as those that form the basis for alternative development and met the following criteria: (1) were within the scope of the project (i.e., satisfy the purpose and need); (2) were not already decided/required by law, regulation, or other previous decisions; (3) were relevant to the decision being made; and (4) were amenable to scientific analysis rather than conjecture. No significant issues were identified for this project through public scoping. However, the interdisciplinary team identified several issues that could affect the location alternatives for the barrier.

Public comments were generally supportive of the project, but many respondents asked the agencies to conduct thorough analyses and disclose effects of the actions being proposed. These comments are summarized as follows:

- disclosure of effects of renovation and neutralization chemicals on water quality
- disclosure of effects of renovation and neutralization chemicals on human health and safety
- disclosure of effects of renovation chemicals on non-target biota
- disclosure of how renovation and neutralization chemicals will be applied
- disclosure of how native fish will be salvaged and returned
- disclosure of effects of fish barrier construction on sediment transport and stream dynamics
- disclosure of effects of fish barrier on gene pool of aquatic macroinvertebrates and fish
- disclosure of importance of Fossil Creek to native fish restoration and recovery

Although no significant issues were identified from public scoping, the Forest Service has identified the following significant issues for the project:

- effect of nonconforming uses in wilderness (i.e., nonconforming structure and use of motorized equipment)
- effect on Wild and Scenic River eligibility and classification
- potential for nonnative fishes to be reintroduced into the creek at some time after chemical renovation

The draft EA was mailed to more than 90 addressees on December 23, 2003, for 30-day comment. In addition, a public notice was published in the Arizona Republic, and news releases were sent to other news media regarding availability of the draft EA. The draft EA was also available on the Coconino National Forest NEPA website and at specified offices of the Coconino and Tonto National Forests. Eleven respondents submitted written comments on the native fish restoration project during the 30-day public comment period. These comments and agency responses are included in Appendix L of this final EA.

CHAPTER 2 - DESCRIPTION OF ALTERNATIVES

This chapter describes the alternatives considered for the native fish restoration project in greater detail. It includes two action alternatives and no action.

2.1 Alternatives Considered but Not Analyzed in Detail

During the early planning phase, several alternative actions for meeting the purpose and need were considered but eliminated from detailed analysis for reasons stated below. These alternatives included consideration of different fish barrier sites and methods for restoration of the native fish community.

- *Fish Barrier Locations other than the Action Alternatives.* Reconnaissance-level field investigations of possible barrier sites in Fossil Creek were conducted by fishery biologists from Reclamation, the Forest Service, and Arizona State University in 2000. Selection criteria for identifying viable barrier sites were (1) the presence of a narrow bedrock channel to solidly anchor the barrier and minimize site impacts and (2) proximity to the stream's convergence with the Verde River to maximize the length of stream protected and minimize fragmentation of existing native fish populations. No viable sites were found in the lower 3-mile reach of stream between "the narrows" and the confluence with the Verde River.

  A fish barrier constructed at or near Fossil Creek's confluence with the Verde River would best meet the purpose and need identified in the scoping document to ". . . restore and allow a native fish assemblage to persist in as much of Fossil Creek as possible." However, the wide stream channel and deep alluvial deposits at this location would substantially increase the size, complexity, and cost of the barrier, and increase project impacts in the Mazatzal Wilderness. A large concrete structure spanning the stream channel and floodplain would be much more difficult to blend with the surrounding terrain, and would represent a significant visual intrusion in the Wilderness. Construction in this area would affect the Verde Wild and Scenic River corridor and might affect bald eagles. Bald eagle territories and wintering areas are located near the confluence, and construction and maintenance activities in this area may result in take of eagles through disruption of breeding, feeding, or sheltering. This alternative was dropped from detailed analysis because it did meet the siting criteria for barrier construction.

- *Electrical Fish Barriers.* Electrical fish barriers have been deployed in some streams and canals across the country for the purpose of preventing upstream fish movements. Electrical barriers work by passing electric current across a water column with sufficient voltage to stun fishes that attempt to pass upstream. Recent experience with the effectiveness of electrical barriers in Arizona, however, suggests that the complexity of these systems prevents their sustained, uninterrupted operation (Clarkson, in press). In addition, electrical barriers have

not been deployed in desert streams that are subject to flashy and severe flooding, such as Fossil Creek. The high complexity and costs of constructing, operating, and maintaining an electrical barrier at a remote site such as Fossil Creek precluded further analysis of this alternative.

- *Renovation Methods.* Entanglement gear (gill and trammel nets), seines, angling, and electrofishing were considered as alternative means of removing nonnative fishes from the segment of stream between the fish barrier and Fossil Springs diversion dam. These alternative methods may temporarily reduce densities of nonnative fishes when practiced intensively, but fish populations normally rebound to previous levels once the effort is curtailed (Finlayson et al. 2000). Electrofishing and netting also are nonselective, and repeated use of these methods would likely kill many individual native fishes in the long term. Disturbance of the stream channel and banks and handling of fish during frequent mechanical removal attempts would introduce substantial negative effect to habitat and fish. Netting and seining cannot be used effectively in boulder-strewn streams, and the inaccessibility of portions of the project area makes use of these devices impracticable at removing all nonnative fish. Electrofishing is not likely to be successful in the removal of all target fish (Larson et al. 1986; Moore and Larson 1989; West et al. 1990), although there is a single example of successful removal of rainbow trout from a short reach of stream in Tennessee where electrofishing was intensively applied (Kulp and Moore 2000). Use of electrofishing on Fossil Creek would be particularly problematical because of the remoteness of much of the stream, stream morphology (very deep boulder-strewn pools in some locations), length of stream to be treated, and demonstrated ineffectiveness of this technique in capturing all fishes even where access is good and stream morphology appropriate. These alternative methods would also be labor intensive and costly in the long term, requiring multiple treatments every year to significantly reduce densities of nonnative fishes and prevent population rebound. Because protection of existing native fish communities and future repatriated species requires complete removal of nonnative fishes, use of entanglement gear, seines, angling, and electrofishing were not advanced for detailed analysis.

  Use of rotenone for chemical renovation of Fossil Creek was also considered but eliminated. Rotenone is a naturally occurring substance derived from roots of tropical plants in the bean family (Leguminosae). It has been used for centuries for capture of fishes by native peoples where the plants are naturally found. In North America, rotenone has been used for modern fishery management purposes since the 1930s. Rotenone is also used as an insecticide for use on crops and livestock (Finlayson et al. 2000). Rotenone must be applied at higher doses than those needed for antimycin to achieve similar results, has longer environmental degradation times, can be detected by fish and evaded in areas of incomplete mixing, its effects are reversible, and it does not kill fish eggs. In addition, because of longer degradation times and some poorly-administered projects that resulted in undesired downstream fish kills, rotenone use has become publicly

controversial. Because antimycin would fulfill project goals with fewer environmental and social consequences, use of rotenone for chemical renovation was dropped from further analysis.

Temporary dewatering of the stream to remove fishes was determined to be infeasible. Seepage through the Fossil Springs diversion dam, inability of the conduit at the Irving Power Plant to transport full base flows, presence of large bedrock pools (some up to 15 feet deep) that hold water for extended periods, and minor discharges from springs below the Fossil Springs diversion dam prevent a total dry up of the stream even under existing power plant operations. If decommissioning and full flow restoration occurs, temporary dewatering to do any needed follow up treatments could not occur at all.

Use of explosives was not considered practical because of low probability of total removal of all target species and potential undesirable habitat impacts.

- *Renovation without Fish Barrier.* Stream renovation without a barrier was considered impractical because the effects of treatment would be negated by continued upstream incursion of nonnative fishes into most of Fossil Creek from the Verde River. Minimal long-term protection would be afforded to the existing native fish community. The presence of natural falls between Irving and the Fossil Springs diversion dam would provide short-term protection to native fish populations in the stream's upper reaches. However, because the Irving reach is easily accessible to people and already contaminated with nonnative fishes, the risk of inadvertent or intentional "bait bucket" transfer of these fishes over the natural barriers into protected upper reaches is high. In the absence of the proposed constructed barrier, the agencies would also forgo an opportunity to implement Wilderness Plan direction to re-establish federally-listed species and reduce impacts of non-indigenous species on natural ecological processes in the Mazatzal Wilderness (Forest Service 1994).

  The no barrier alternative is also equivalent to "no action" for Reclamation because of the nexus between the need for the project and the 2001 CAP biological opinion. This alternative was not advanced for detailed analysis because it did not meet fundamental objectives of the project to maximize the length of stream protected and construct a barrier pursuant to the 2001 CAP biological opinion.

- *Fish Barrier without Renovation.* This alternative would protect the stream above the barrier from future incursion of nonnative aquatic species, but established populations of nonnative fishes would continue to interact with the native fish community. Although natural events such as flooding may periodically reduce densities of nonnative fishes, additional human intervention would likely be needed to completely eradicate nonnatives from the stream. This alternative was not advanced for detailed analysis, because it did not satisfy the purpose of and need for the project.

- *Alternative Construction and Transportation Methods in Wilderness.* Two additional Wilderness alternatives were considered but eliminated. A minimum tools analysis was completed for this project by a team comprised of wilderness managers, an archaeologist, and a wildlife biologist. Three alternatives were analyzed: a substantially motorized alternative (Minimum Tools Alternative A), a totally non-motorized alternative (Minimum Tools Alternative B), and a recommended alternative (which was used in the proposed action). These alternatives would be the same as the proposed action in terms of the design of the fish barrier, and the basic elements of the fish salvaging, the stream renovation, and the native fish repatriation. What would differ from the proposed action is how the project would be accomplished in terms of the use of aircraft, motorized equipment, and mechanical transport. Following is a description of Minimum Tools Alternatives A and B, and the reasons for discarding them:

  Minimum Tools Alternative A: Materials, equipment, camping gear, and sanitation facilities would be flown in by helicopter and long-lined to the staging area near the job site. People working on the project would also be transported to and from the site by helicopter. This would involve flights at the beginning and end of each work week. A helicopter would be used to transport the 55 gallon drums containing captured fish from and back to Fossil Creek. A helicopter would also be used to fly concrete into the project, and pour it into the temporary formwork at each of the slots. An estimated total of 10 to 12 days of flight time would be involved. The following motorized equipment would be used: generators, air compressors, jackleg drills, dewatering pumps, concrete vibrators, and power saws (including chainsaws). This equipment could be used at any time during the project.

  This alternative was discarded because the minimum tools team felt that the project could be reasonably implemented with less of the generally prohibited uses of motorized equipment, landing of aircraft, or mechanical transport, thus having a lesser impact to wilderness values.

  Minimum Tools Alternative B: Mules would be used to haul in equipment, tools, materials, concrete, and aggregate, requiring numerous trips by mule train during construction. Use of mules would require construction of a trail over rocky and steep terrain from Stehr Lake to the job site.

  No use of motorized equipment would be allowed. Fish would be removed from and returned to Fossil Creek by foot, and transported in backpacks. Rock drilling would be accomplished by double jacking. This involves one person holding the drill in place on the rock, and a second person driving the rock drill by hitting it with a sledgehammer. Concrete would be mixed and poured by hand. A manual pump would be used for dewatering the creek. Power saws would be replaced by handsaws. The remaining tools would be hand tools.

This alternative was discarded for a number of reasons. First, it would take approximately three times longer to complete the project (compared to the proposed action), thus impacting wilderness users for a longer period of time. Secondly, the trail built for the mule traffic would be very difficult to obliterate and would lead to increased visitor use to the barrier location, which is not desired. Noxious weeds may be spread through seeds contained in the mule droppings, and the trail could result in increased soil erosion.

Finally, there is some question as to whether the use of the double jack drill is feasible in terms of achieving sufficient depth of holes needed for anchoring the fish barrier in place, as well as whether this primitive skill is available. The safety of this method is also of concern.

2.2 No Action Alternative

The no Federal action alternative provides the baseline for comparison of environmental effects of the action alternatives. Under the no action alternative, Reclamation and the Forest Service would not implement the fish barrier and stream renovation project. This alternative takes no steps to alter the gradual upstream progression of community dominance by nonnative fishes in Fossil Creek. No action by the agencies would result in the following:

- the native fish community in Fossil Creek would decline,
- repatriation of extirpated native fishes into Fossil Creek would not be undertaken,
- recovery of listed fish species would not occur in Fossil Creek,
- non-listed native fish species would trend towards a need for listing under ESA,
- Reclamation would fail to implement a required conservation measure stipulated in the 2001 CAP biological opinion, necessitating negotiation of an acceptable new barrier site on an alternative stream or reinitiation of formal ESA Section 7(a)(2) consultation with the FWS,
- no nonconforming structures would be built in the Mazatzal Wilderness, and
- natural ecological processes in Fossil Creek would continue to be disrupted by nonnative fishes.

It is highly unlikely that in the future this project would ever be proposed again due to the return of full stream flows, the higher costs associated with barrier construction and stream renovation, and the lower likelihood of long-term success.

2.3 Proposed Action (Wilderness Alternative)

The proposed action consists of the following key elements: (1) construct a fish barrier to prevent further upstream incursion of nonnative aquatic species, (2) renovate the stream between the barrier and Fossil Springs diversion dam to remove nonnative fishes, (3) repatriate native fishes, (4) monitor the stream to gauge long-term success, and (5) educate the public about the importance of native fish communities and the impact of casual introduction of nonnative species.

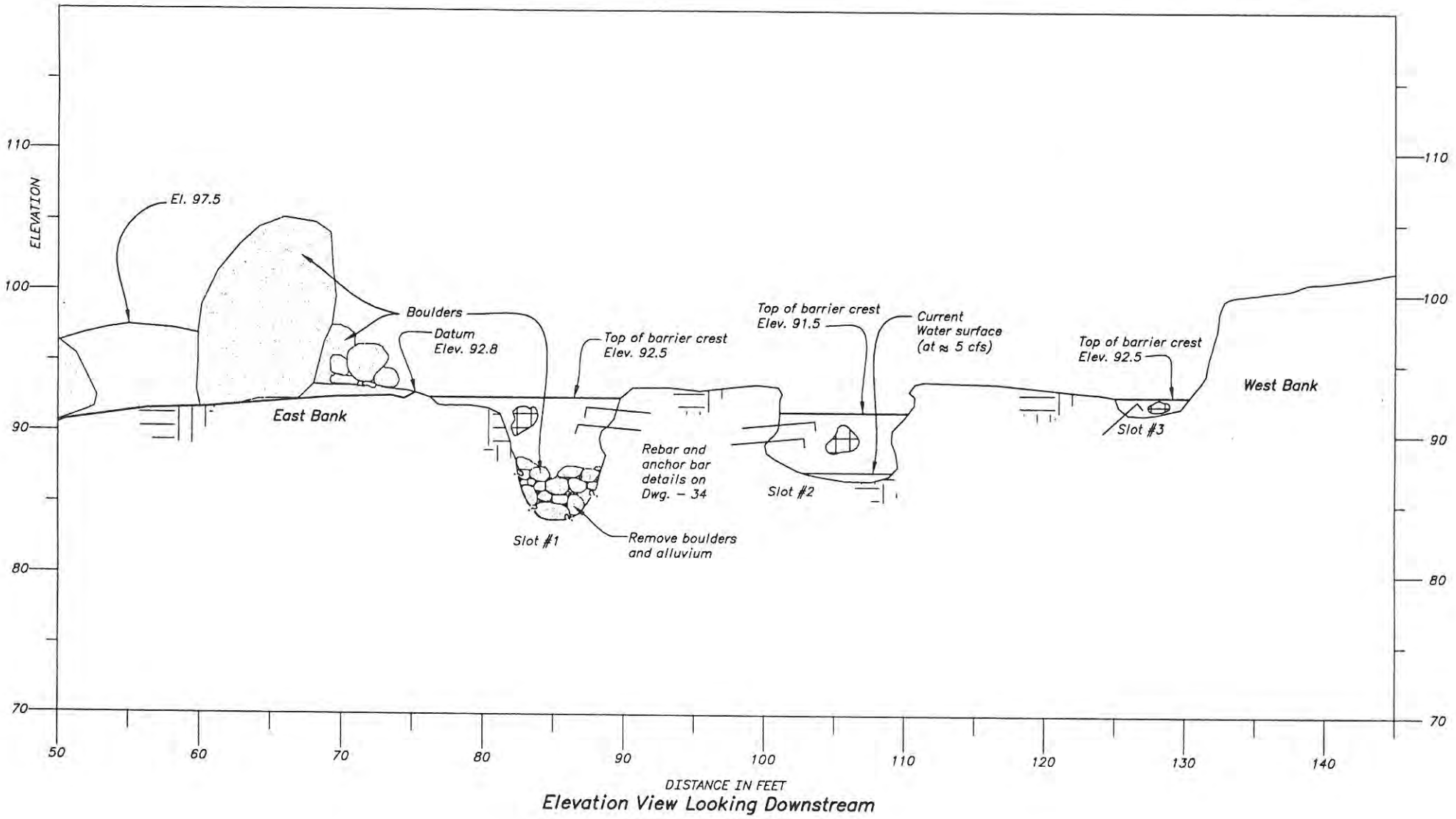
Barrier Construction. Reclamation would construct a single reinforced concrete fish barrier in Fossil Creek approximately 4.5 miles upstream from the Verde River confluence. Construction activities would affect the northern portion of the 250,517-acre Mazatzal Wilderness, southeast of Stehr Lake. The wilderness barrier would protect 9.5 miles of Fossil Creek below Fossil Springs diversion dam (almost 20 percent more stream than the other action alternative considered in this EA), including 2.8 miles of stream in the Mazatzal Wilderness and 0.2 mile of designated critical habitat for spikedace and loach minnow.

The proposed location restores as much of Fossil Creek as possible while avoiding greater impacts to the Wilderness that would occur at sites closer to the Verde confluence. As compared to upstream sites that would be more accessible to the public, project implementation at the wilderness location is thought to carry a lower risk of nonnative fish transfer due to its inaccessibility and resultant greater protection against accidental or intentional transfer of nonnatives over the structure.

Geomorphic characteristics at the wilderness site are ideally suited for constructing a barrier with relatively minimal stream impact. Solid rock abutments and bedrock confine the low-flow channel and provide natural rock armoring to anchor the barrier in place. Streamflow has carved three vertical slots into the channel bedrock, creating openings that vary from 5 to 9 feet in width and 2 to 9 feet in height. Low flows presently course through the center slot and descend rapidly through a boulder complex into a deep pool. The water surface in this pool is approximately 8 to 10 feet lower than the water surface immediately upstream of the slots. Prevailing channel gradient above the barrier site is relatively flat for the first 60 feet, increasing to more than 2 percent beyond that point.

The barrier would be created by filling all three slots with separate steel reinforced concrete plugs (Figure 3). To ensure stability against boulders and vegetative debris carried by high magnitude flows, the concrete would be anchored to abutment and foundation bedrock with anchor bars that are drilled and grouted into place. Concrete would be airlifted to the jobsite and poured directly into temporary formwork at each of the three slots. The concrete would be poured in two phases to allow for stream diversion: the first phase would fill two slots, and the second phase would fill the remaining slot. The estimated time for transporting and pouring the concrete would be 2 days. All formwork would be removed after construction. Most of the site is free of alluvium (except for an estimated 17 cubic yards of alluvium and boulders in the east slot) and would require minimal foundation cleanup prior to concrete placement.

Streamflow would be diverted around in-channel work areas with temporary dikes, pipes, or inflatable berms. Material excavated from the east slot would be used to build these temporary diversion features. Diverted streamflow would remain within the existing low-flow channel. Following construction, the dikes would be removed and the material spread along the upstream side of the barrier to minimize pool development. Sediment impounded by the barrier would eventually cover this material.



Elevation View Looking Downstream

Figure 3
Proposed Fish Barrier
(Wilderness Site)

The crest elevation of the center plug would be about 1 foot lower than the crests of the right and left plugs. This configuration would direct base flow through the center slot and keep it centered in the channel. A small concrete apron would be built below each plug to maintain high flow velocities along the downstream toe of the barrier.

On the east embankment directly above the proposed barrier site are two slots in the bedrock that allow the passage of 15-year frequency flows. These slots would be plugged with approximately 2 cubic yards of concrete to prevent flows with less than a 50-year frequency from overtopping the bank.

Concrete used in the embankment plugs and main barrier would be colored and textured to conform in appearance with surrounding native substrates.

Approximately 100 feet east of the low flow channel is a side channel that runs during 25-year frequency floods. Flows that enter this side channel do so through a 6-foot space between two 20-foot diameter boulders, over tightly compacted 1- to 5-foot boulders. To block upstream fish movement through this side channel, a gabion structure would be constructed in the space between the two boulders. The added height afforded by the gabion structure would prevent flows with less than a 50-year recurrence interval from passing over this site.

During high magnitude floods, there could be some shifting of the invert boulders in the side channel. The 20-foot diameter boulders are thought to be stable, but slight movement is possible. A gabion structure was selected for this site because it has the ability to shift in response to a moving foundation without sustaining significant damage, unlike a concrete structure which could crack and potentially fail.

The gabion structure would consist of a wire fabric basket with a hexagonal pattern, filled with 4 to 8-inch diameter imported rocks. Gabion dimensions would be approximately 4 feet high, by 6 feet wide, by 3 feet long in the direction of flow. A colored mortar fascia would be applied to the gabion to blend its appearance into the surrounding environment.

Anticipated types of mechanized equipment to be used in construction at the wilderness site are limited to the following: helicopter, generator, compressor, jackleg drill, and concrete vibrator (see Appendix D). The generator, compressor, and drill would be used for drilling anchor bar holes in rock substrates. No other power tools would be allowed. Use of helicopters and motorized equipment would be restricted to weekdays.

Construction Staging Areas and Transportation. Due to lack of road access, the majority of construction equipment and supplies would be transported to the construction site by helicopter. Project staging would be confined to a temporary contractor use area and helipad that would be constructed adjacent to Forest Road (FR) 502 at Stehr Lake. Activities at the staging area would consist of unloading materials and supplies, equipment storage, and vehicle parking. The boundaries of the contractor use area would be delineated with flexible construction fence to avoid impacts outside authorized areas.

The volume of construction traffic would be low, and the transport of equipment and materials would not be expected to disrupt public use of roadways. No road closures or traffic delays associated with construction activities are anticipated.

Equipment, material, and supplies needed for construction would be long-lined by helicopter from the staging area at Stehr Lake to the job site. Concrete mixer trucks from a commercial ready mix plant would transport concrete to the Stehr Lake staging area, where the concrete would be transferred to buckets, delivered to the job site by helicopter long line, and poured directly into the structural formwork of the barrier. Limited staging of material delivered by helicopter would be conducted at the job site (Figure 5b – See Page 36).

Due to tight airspace constraints within Fossil Creek canyon, a backup helispot would be established near the job site for emergency landings (e.g., medivac rescue or mechanical failure of the helicopter), if needed. The backup helispot would be located on a stream terrace in the Wilderness. Preparation of the backup landing site would require limited brush clearing.

Crews would be required to hike a 1- to 2-mile route that descends over steep and rugged terrain from FR 502 to the job site. Recreation trails are absent in this area, consequently the specific route selected would be reviewed by the Forest Service and flagged to minimize the effects of pedestrian traffic on soils, cultural resources, and Wilderness. In order to expedite completion of the project, a crew camp would be placed near the job site to accommodate up to 10 workers. The boundaries of the wilderness camping area would be delineated with materials that are visually unobtrusive and minimize impacts to the wilderness character. Crews would go through "Leave No Trace" training before working and camping in the Wilderness. A Forest Service wilderness specialist would ensure minimum impact requirements are met. Campfires would not be allowed within the Wilderness. Forest Service approved portable sanitary facilities would be airlifted to the project site to minimize impacts.

Project construction would be scheduled to take advantage of seasonal low streamflows, either Spring or Fall 2004. Use of helicopters and mechanized equipment would be restricted to daytime hours and weekdays. Approximately 1 month would be required for barrier construction.

The quantitative characteristics of the barrier are listed below (calculations include a 10-foot apron).

- Crest width = 13 feet (east notch), 9 feet (middle notch), 6 feet (west notch)
- Scour depth = 3 feet (east notch), 0 feet (middle notch), 0 feet (west notch)
- Drop height = 5 feet (east notch), 5 feet (middle notch), 6 feet (west notch)
- Foundation depth = 3 feet (east notch), 0 feet (middle notch), 0 feet (west notch)
- Surface area of structure = 0.01 acres
- Surface area to be excavated = 0.002 acres

- Excavated volume of alluvium = 17 cubic yards (east notch)
- Total volume of concrete = 29 cubic yards

Fish Salvage. The AGFD has authority to manage fish and wildlife resources of the State, and ultimately would approve and oversee activities associated with fish salvage and renovation. Native fish salvage operations would begin a week or two prior to treatment of the stream with antimycin. Using a combination of electrofishing (for shallow waters), seines, trammel nets, hoop nets, and angling (for chubs), major habitats in each treated reach would be sampled to capture as many native fishes alive as possible. If trammel and gill nets are deployed, they would be run at 1 to 2 hour intervals to minimize mortalities from crayfish predation on the trapped fish. Local angler groups would be contacted for assistance with angling for chubs. Captured native fishes would be placed in live cars (small-meshed holding nets) that would be positioned in approximately every other large pool in the to-be-treated reach. Live cars would have meshed covers to prevent fish from jumping out. Backpack frames equipped with 5-gallon buckets and battery-powered air stones would be available to transport fishes from their place of capture to the live cars. Nonnative fishes that are captured would be euthanized with tricaine methanosulphonate (MS-222) and their carcasses buried or covered with rocks. Crayfish that are captured incidental to the salvage effort would be killed and buried.

Once sufficient sampling effort has been applied to the stream reach so that additional captures of native fishes are rare and all captured fishes are in the live cars, a helicopter would be deployed to transport the fishes from the live cars to a series of holding tanks at Irving. The helicopter would be based at a site at either Irving or Stehr Lake, and would transport a 55-gallon drum or other similar container from a sling line to each live car site. The drum would either be filled with water by crews on the ground at the live car site or at Irving, the fish deposited into the container, and transported to the Irving holding tanks. Another ground crew would unload the fish from the container to the holding tanks. This process would be repeated until all live cars are emptied of fish. The live cars would then be packed out of the stream. Fish from one section of the stream would be held together in one holding tank so that they can be released later to the same general vicinity from where they were captured.

A set of at least four holding tanks would be set up at a site to be determined at Irving. Tanks would consist of either commercially available self-standing, soft-sided swimming pools, or portable folding tanks available from the Forest Service. These tanks each hold several thousand gallons of water, and would be equipped with covers to prevent fish from jumping out. A hose would be run from the flume or penstock above the tanks to gravity feed each tank with fresh water that originates from the stream above Fossil Springs diversion dam. These passive flow-through systems should be adequate to maintain appropriate oxygen and temperature conditions, as well as flush organic waste products from the tanks. Compressed oxygen tanks equipped with air stones would also be available should the flow-through system prove inadequate to maintain oxygen levels. Commercially available AC-powered filtration system packs would also be present for use should a build-up of waste products occur. Fish would be held in these tanks for at

least 2 days beyond the final antimycin treatment and until caged sentinel fish show no effects of the treatment. At that time, fish would be transported back to the stream via helicopter long-line and released in pools in the general vicinity from where they were captured.

Variations in detail of the salvage operation may occur on the ground in response to need and equipment availability and effectiveness.

Stream Renovation. Renovation activities would be coordinated among AGFD, Reclamation, and the Forest Service. The stream would be divided into four reaches for the purpose of renovation, first treating the most upstream reach and moving downstream with the subsequent treatments. The first reach to be treated with antimycin would be from the Fossil Springs diversion dam to a natural 18-foot falls located 2.3 miles downstream. Next, the 1.3-mile long reach between the falls and the Irving diversion channel would be treated, followed by the 3.1-mile reach from Irving to a point where the power lines first cross Fossil Creek (the alternative constructed barrier site; see Section 2.4), and finally by the 2.8-mile reach between the utility lines and the proposed site for the constructed fish barrier. It would be necessary to construct a low (approximately 2 foot), temporary barrier out of sand bags at the power line crossing to prevent upstream movements of nonnative fishes prior to treatment of the third and fourth reaches. Renovation of each reach is expected to take 2 to 3 weeks, including salvage and repatriation operations; piscicide would be applied over a 2- to 4-hour time interval for each treatment.

Antimycin A (Fintrol) would be applied under the supervision of a certified pesticide applicator in accordance with a treatment plan approved by the Forest Service. Each reach would be treated with a combination of aqueous antimycin A (Fintrol-Concentrate) and sand coated antimycin A (Fintrol-15). Fintrol-Concentrate is comprised of the active ingredient antimycin A and inert ingredients soy lipids, acetone (diluents), biethyl phthalate (a surfactant), and nonoxyl-9 (a detergent). Fintrol-concentrate is applied by drip station (Stefferud and Propst 1996), sprayer, or mixed in buckets with water and dispersed by hand. Fintrol-15 is comprised of antimycin A coated over a grain of sand that is then coated with other inert materials that dissolve slowly when in water to allow the antimycin to be released over a depth of 15 feet when applied at the surface. Fintrol-15 is applied by hand or with a hand-held seed or fertilizer spreader.

Prior to treatment of each reach, stream discharge and volume would be calculated using direct measurements. An inert fluorescence dye would be applied at the head of a few test pools to determine residence time and mixing potential in the larger pools. Results of the dye study would assist in determining how best to apply the antimycin to ensure all possible areas of the stream are treated at target concentrations. Appropriate calculations would then be made to determine the amounts of antimycin necessary to treat the stream reach. These calculations would be double-checked by a certified pesticide applicator.

Different taxa of fish have differing susceptibilities to antimycin. The most resistant target species in Fossil Creek is the yellow bullhead. Working with the closely-related species black bullhead (*Ameiurus melas*), Berger et al. (1969) determined that the concentration of antimycin needed to kill half of the laboratory population was 45 parts per billion (ppb). One hundred percent mortality of black bullhead from antimycin ranged from 25 to 200 ppb. Other targeted species (green sunfish and smallmouth bass) are susceptible to mortality at antimycin concentrations of 20 ppb. Because yellow bullhead has penetrated upstream in Fossil Creek only to the lowermost treatment reach, that reach would be treated at 20 and above ppb to arrive at the most effective concentration. The upper three reaches are expected to be treated at 20 ppb. Identification and use of specific concentrations would be based on environmental conditions and results of on-site bioassays conducted pretreatment.

Once application targets have been definitely determined, specified amounts of antimycin would be applied to each reach. Controlled amounts would be released at constant-flow drip stations (Stefferud and Propst 1996) to be located every 330 to 490 feet (100 to 150 meters) along the treated reach, over a 2- to 4-hour time period. Roving crews would treat shallow backwaters and poorly-mixed shorelines with backpack sprayers. Other crews would disperse Fintrol-15 into deeper areas of the stream. To ensure effectiveness of the first treatment, a second antimycin application using procedures identical to the first would be made 1 to 7 days following the initial treatment. If no fish are observed alive during the second treatment, the renovation would be considered successful and completed. In the event live fish are observed in the section being treated, a third treatment would be undertaken immediately following the second.

At the lower end of each antimycin-treated reach, a drip station similar to that described for application of antimycin would be established to meter approximately 1 part per million (ppm) aqueous potassium permanganate ($KMnO_4$) into the stream during the course of each antimycin treatment. Potassium permanganate is a strong neutralizing agent for antimycin (see Appendix B). A cage with sentinel fish would be placed in the stream approximately 300 feet below the $KMnO_4$ station to ensure that detoxification is occurring as intended. Should neutralization not occur as expected, potassium permanganate concentrations would be increased. A second drip station would be set up further downstream if necessary to ensure complete neutralization.

Temporary signage would be placed at public access sites along Fossil Creek immediately prior to and during renovation that will explain the project and list public precautions. Permanent signs will be placed at strategic points along the creek outside of wilderness to inform the public about the value of Fossil Creek as a repository of native fishes, its unique geology (relative to travertine formation), penalties for moving fishes alive from their point of capture, and availability of a monetary reward for information leading to conviction of any persons that knowingly release fishes to areas other than their point of capture.

Additional applications of antimycin may be needed in the future if monitoring shows that nonnative fish have been reestablished in the stream. Prior to implementing future antimycin treatments, the Forest Service would prepare a supplemental information report to evaluate if the treatment(s) are consistent with this EA, or if additional environmental analysis needs to be conducted (FSH 1909.15, Ch. 18.03).

Control of Other Upstream Sources of Nonnative Fishes. Reclamation, in cooperation with Arizona State University, flew by helicopter the entire watershed of Fossil Creek on June 27, 2002, for the purpose of locating stock tanks or tributary streams that could serve as a source of nonnative fishes that theoretically could recontaminate Fossil Creek. Of the 122 tanks identified on maps and otherwise observed or identified, 46 had water, 66 were dry (and thus would not be surveyed for fish, but could have water and introduced fishes in the future), and 10 were of uncertain status due to dense obscuring vegetation or could not be located. No tributaries were identified that had surface water present or that might reconnect with Fossil Creek during wetter periods to allow invasion by and harbor fishes from Fossil Creek. Surveys of the 46 watered and 10 undetermined tanks for presence of fishes are underway. These tanks would also be examined[6] for the presence of Chiricahua leopard frogs (*Rana chiricahuensis*) and other species. Following completion of these surveys, tanks with nonnative fishes would be renovated with antimycin A prior to renovation of Fossil Creek. Although most of the tanks are on National Forest land, a few are privately owned. Agreements with landowners would be necessary for treatment of tanks on private property. Both surveys and treatments would proceed in an upper watershed to lower watershed direction, and watersheds that drain to Fossil Creek below the constructed barrier site would not have to be treated.

Potential stock tank renovations would be coordinated with the AGFD, FWS, and Forest Service in a manner to minimize or avoid impacts to wildlife and livestock. Based on the literature, potential stock tank treatments are not expected to harm adult or larval (tadpole) leopard frogs (Walker et al. 1964, Gilderhus, et al. 1969). But because frog larvae are gill-breathers, if native tadpoles are found an attempt would be made to capture and hold alive as many as possible prior to renovation. Five-gallon buckets would be filled with stock tank water and aerated with battery-powered air stones. Tadpoles would be captured and held in these buckets (partially submerged in the stock tank to prevent overheating) for at least 24 hours before being returned to the source stock tank. A small sample of tadpoles would be placed in sentinel cages in the treated stock tank beginning 24 hours after the treatment to assure detoxification before the remainder are repatriated. If the tank does not detoxify within 24 hours, the process will be repeated until it is, or application of potassium permanganate will be considered to speed the process.

Stehr Lake is a potential source of nonnative fishes in the watershed directly above the proposed barrier site. If decommissioning of the Childs-Irving Hydroelectric Project occurs, Stehr Lake will lose its source of water by January 2005 and gradually dry up. Since stream renovations would occur prior to that date, it is theoretically possible that the lake could overflow during an unusual precipitation event or anglers could transport fish from the lake to the stream. Stehr Lake is integral to the Childs-Irving Hydroelectric

6 Ranid surveys would be conducted in accordance with FWS protocol.

Project, and taking it offline prior to decommissioning would impact power generation. The APS is planning a temporary drawdown of the lake to facilitate chemical renovation of that water body. If this action proves infeasible, there would be a small risk that nonnative fishes from Stehr Lake could contaminate the small, already-renovated reach of Fossil Creek. Should such an event occur, actions detailed under the *Monitoring* section would be followed to eliminate those fishes.

Monitoring. An ongoing study (initiated June 2002) conducted by Northern Arizona University is monitoring six sites on Fossil Creek seasonally over 2 years, with plans to extend the monitoring period significantly past the December 31, 2004, expected flow restoration date. Monitored taxonomic groups include primary producers (algae and macrophytes), invertebrates, fish, amphibians, and reptiles. Sites selected for monitoring include ephemeral pools above Fossil Springs, the springs area, directly upstream from the Fossil Springs diversion dam, the dewatered reach below the dam, below Irving, and above the confluence with Verde River. Reclamation is currently assessing the suitability of this study for meeting post-project monitoring needs, and may assist or expand the study through additional funding if certain areas seem deficient. At minimum, this study should provide a comprehensive species list for comparing pre- and post-renovation, and pre- and post-flow restoration (J.C. Marks, Northern Arizona University, personal communication).

A separate monitoring program would be established after the barrier is constructed and stream renovated to detect any incursion of new nonnative fishes,[7] and to monitor responses of native fishes and amphibians (e.g., leopard frogs). This monitoring would be funded by Reclamation in cooperation with the AGFD. At least annually, intensive qualitative surveys of the fish community above the constructed barrier, above Irving, and above the Fossil Springs diversion dam would be undertaken for this purpose. Methods would include electrofishing, seining, and netting. This specific monitoring program would span at least 5 years post-renovation, and a lesser effort would likely continue for the foreseeable future as part of a longer-term native fish recovery program.

In the event that a nonnative species is detected upstream of the barrier, the first level of management action would be an immediate, intensive investigation of the species' distribution and relative abundance, with removal using traditional sampling methods (electrofishing, seining, and netting). Reach-wide surveys would expand both upstream and downstream from the point of detection to include all areas potentially accessed by the nonnative species. Mobilization of personnel in addition to the original monitoring team would likely be required for this increased sampling effort.

During this period of intensive monitoring and fish removal, managers and species experts would meet to determine possible management actions to be applied against the new species. If the detection is early following its initial invasion and the species has not spread throughout the entire stream, successful elimination of the species is possible through removals during intensive monitoring. New travertine formations following

7 Bait bucket introduction of nonnative fishes by anglers and other recreationists is possible along road accessible reaches of Fossil Creek.

restoration of full flows, as well as existing natural barriers, may enhance the likelihood of confining the area of the introduction. If mechanical removal of the new species is not successful, another chemical renovation of the affected stream reach would likely be contemplated. A supplemental information report to this EA would be prepared as previously described in the "Stream Renovation" section.

Repatriation. The project would include potential repatriation[8] of rare Gila River basin native fishes. Repatriation activities would be coordinated among AGFD, FWS, Reclamation, and the Forest Service. One of the important uses for a renovated Fossil

Creek is to replicate the rare population of Verde River spikedace, and other native fishes not currently in the stream that were known or are presumed to have historically inhabited Fossil Creek. In addition to spikedace and the six species already inhabiting the stream, other native fishes to be potentially repatriated include loach minnow, Gila topminnow, desert pupfish, razorback sucker, Colorado pikeminnow (*Ptychocheilus lucius*), woundfin (*Plagopterus argentissimus*), and flannelmouth sucker (*Catostomus latippinnis*). As previously stated, the potential for some of these species depends on how habitat develops following flow restoration.

Surveys are planned in coming months to find and transport Verde River spikedace into appropriate holding/propagation facilities. Propagation studies are underway to determine methods to effectively house and reproduce large numbers of spikedace, loach minnow, and other species in the lab. Facilities in which to house and propagate these fishes are also being readied. These techniques and facilities would be needed to build up numbers of rare fishes for repatriations into Fossil Creek. As suitable numbers of appropriate populations of rare fishes are obtained, they would be repatriated into Fossil Creek to restore the historic native community there.

The proposed repatriations would be consistent with some of the specific implementation actions identified in the Mazatzal Wilderness Plan, which include removal of nonnative species, preservation and/or recovery of listed species, and reestablishment of native species (Forest Service 1994). All species proposed to be repatriated are identified in the Mazatzal Wilderness Implementation Plan, except for the desert pupfish and flannelmouth sucker.

Information and Education. A public information and education component would be integrated into the project. Precautionary signage would be placed along roadside segments of Fossil Creek, and a free pamphlet describing goals, objectives, and activities would be developed prior to project implementation. The Forest Service and Reclamation would investigate the feasibility of producing several large color signs to be placed at permanent kiosk sites along the stream to inform the public about Fossil Creek restoration and related issues, including the danger of introduction of nonnative aquatic fauna. All signs would be placed outside of the Wilderness. Long-term Reclamation-funded native fish information and education media will include video and pamphlet productions, teaching materials, advertisements, monetary rewards, and other actions

8 "Repatriation" refers to the restoration of a species to suitable habitat within its historic range.

intended for state-wide distribution. Prior to undertaking major aspects of the proposed project, information and education specialists from the Forest Service, Reclamation, AGFD, and other agencies and organizations would meet to formalize these concepts in a directed public information plan.

2.4 Nonwilderness Alternative

The alternative action consists of the same key elements as the proposed action: (1) construct a fish barrier to prevent further upstream incursion of nonnative aquatic species, (2) renovate the stream between the barrier and Fossil Springs diversion dam to remove nonnative fishes, (3) repatriate native fishes, (4) monitor the stream to gauge long-term success, and (5) educate the public about the importance of native fish communities and the impact of casual introduction of nonnative species.

Barrier Construction. The alternative fish barrier site considered by Reclamation and the Forest Service is located in Fossil Creek immediately outside the Mazatzal Wilderness boundary near the FR 502 bridge over Sally May Wash. Channel and abutment substrates in this area are composed almost entirely of solid rock and boulders with minimal amounts of alluvium. No artificial armoring would be necessary to stabilize bank materials. Approximately 6.7 miles of stream habitat below Fossil Springs diversion dam would be protected by the barrier.

The nonwilderness site is much more accessible to the public. Recreational use along roadside portions of Fossil Creek is expected to increase with restoration of full flows in 2005. Ease of public access to the alternative 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). This alternative also has less value to native fishes because it protects 2.8 miles (20 percent) less stream below Fossil Springs diversion dam, results in less diversity of habitat restored, and offers no protection to native fishes in the Mazatzal Wilderness.

A fish barrier constructed at the alternative site would consist of a reinforced concrete vertical drop structure with a minimum height of approximately 5 feet and width of 44 feet (Figure 4). A 10-foot long concrete apron would be installed to ensure water velocities are high and depths shallow along the downstream toe of the drop structure.

Like the wilderness barrier, this structure would require installation of anchor bars in foundation bedrock and construction of temporary formwork prior to placement of concrete. The formwork would be removed after construction. Most of the site is free of alluvium and would require minimal foundation cleanup prior to concrete placement.

Streamflow would be diverted around in-channel work areas with temporary dikes, pipes, or inflatable berms. Diverted streamflow would remain within the existing channel prism. Lack of alluvial substrate within the channel may require importation of material for the diversion. The concrete would be poured in two phases to allow for stream

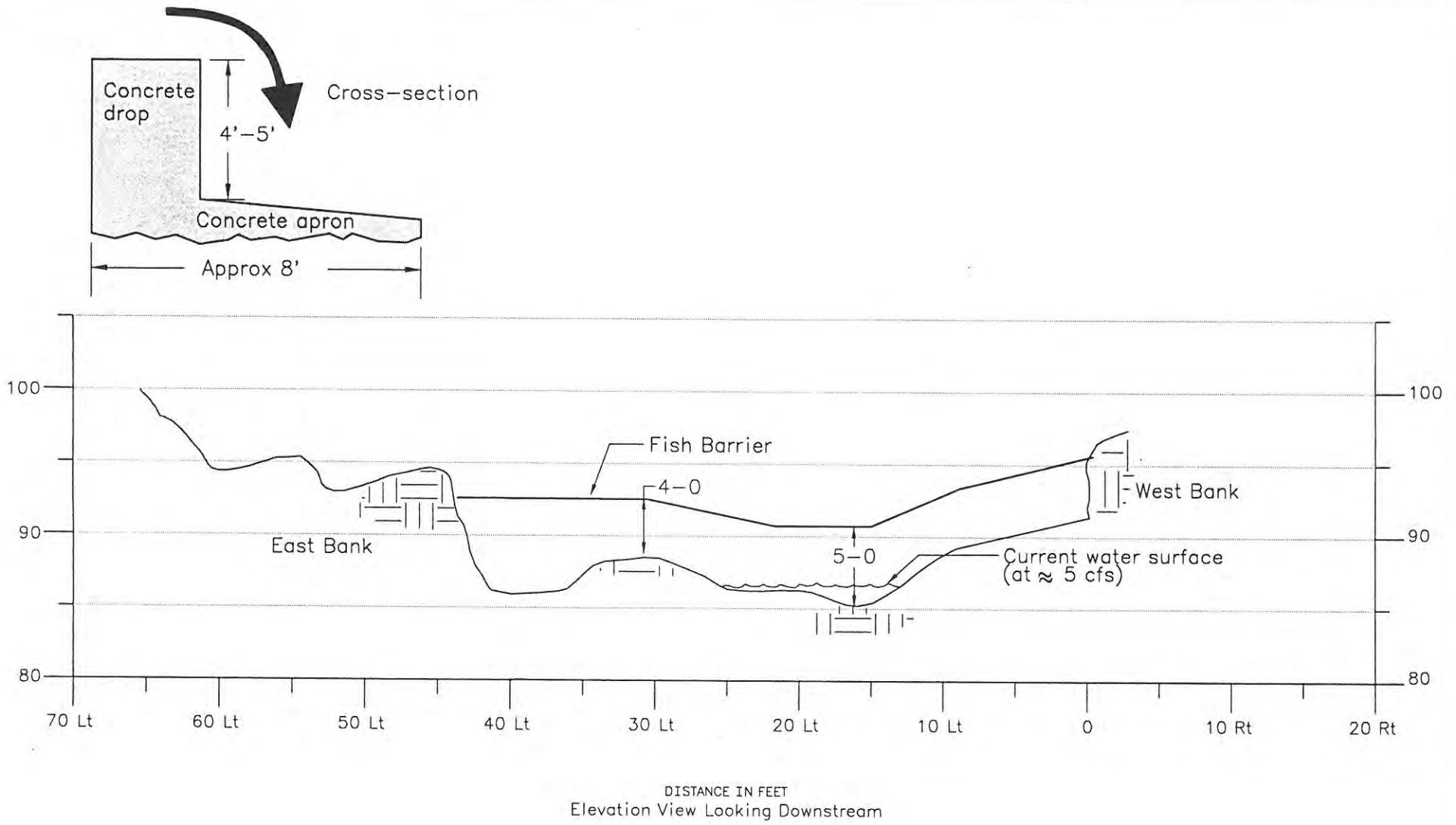


Figure 4
Fish Barrier
(Non-Wilderness Site)

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diversion: the first phase would construct approximately ¾ of the barrier, and the second phase would construct the remaining portion of the structure. After construction, sediment carried by seasonal high flows or floods would be deposited upstream of the barrier and displace any pooled water within a relatively short period of time.

Staging Areas and Transportation. FR 502 allows vehicle access to within 50 yards of the work site. There are three roadside parking areas that would provide adequate space for staging equipment and material. Activities at the staging area would consist of unloading materials and supplies, equipment storage, and vehicle parking. From this staging area, equipment would be hauled to the stream by hand or transferred into place with a crane. Commercially batched concrete would be trucked to the project area and poured directly into the structural formwork from the road with a boom assemblage or other similar conveyance.

The volume of construction traffic would be low, and the transport of equipment and materials would not be expected to disrupt public use of roadways. No road closures or traffic delays associated with construction activities are anticipated. Construction would be restricted to weekdays and daytime hours. Project construction would be scheduled during periods of seasonal low flow, either Spring or Fall 2004. The duration of construction is estimated to be 1 month.

The quantitative characteristics of this barrier are:

- Crest width = 44 feet
- Scour depth = 0 feet
- Drop height = 5 feet
- Foundation depth = 0 feet
- Surface area of structure footprint = 0.02 acres
- Surface area to be excavated = 0 acres
- Excavation volume = 0 cubic yards
- Total volume of concrete = 38 cubic yards
- Length of apron = 10 feet

The anticipated types and use of mechanized equipment is listed in Appendix D.

Native fish restoration activities involving salvage, stream renovation, repatriation, monitoring, and public education would be similar to those described in the proposed action. Restoration activities would affect 6.7 miles of stream between the Fossil Springs diversion dam and the northern boundary of the Mazatzal Wilderness.

2.5 Mitigation and Monitoring

Mitigation measures are prescribed to avoid, reduce, or compensate for adverse effects of an action. The following measures would be implemented for the project:

- Public information and education materials describing project effects and benefits will be prepared (both action alternatives).
- Standard dust abatement practices will be used to minimize generation of airborne particulates (both action alternatives).
- Sediment and erosion controls will be established where appropriate to protect water quality and soils (both action alternatives).
- Upland sites disturbed by project activities will be seeded with native vegetation (wilderness alternative).
- Archaeological survey of the 34.4-acre area of potential effect encompassing the wilderness site and adjacent upland terrace (already completed for wilderness alternative).
- An archaeologist will periodically monitor construction activities (both action alternatives).
- Pedestrian access for crews will be marked with flagging to avoid impacts outside of authorized areas; any trails that develop incidental to construction will be obliterated (wilderness alternative).
- The boundaries of temporary contractor use areas at Stehr Lake will be delineated with flexible construction fence to avoid impacts outside authorized areas (wilderness alternative).
- The boundaries of the wilderness camping area will be delineated with flagging to avoid impacts outside authorized areas (wilderness alternative).
- Crews working in the Mazatzal Wilderness would receive "Leave No Trace" training, including instruction on minimum impact camping techniques. A Forest Service wilderness specialist would ensure this requirement is met. Campfires would not be allowed within wilderness. Sanitation facilities would be provided for work crews (wilderness alternative).
- The concrete barrier and apron will be colored and textured to blend with surrounding rock. Such color and texturing would be approved by the Forest Service (both action alternatives).
- Road accessible reaches of Fossil Creek will be posted prior to application of antimycin A (both action alternatives).
- Antimycin A applications will be seasonally timed to minimize effects to leopard frogs (both action alternatives).
- Programmatic Clean Water Act (CWA) Section 404 mitigation for impacts to vegetation was implemented by Reclamation for all Arizona fish barriers proposed under the 2001 CAP biological opinion. This mitigation consists of acquisition of a Conservation Easement on 1,420 acres of land along the San Pedro River in southern Arizona.
- Strict adherence to the pesticide label is required for transportation, storage, mixing, and personal protective equipment.
- Daily use records must be kept to document the use of the piscicide. This will be done by unit area, formulation, and application technique.

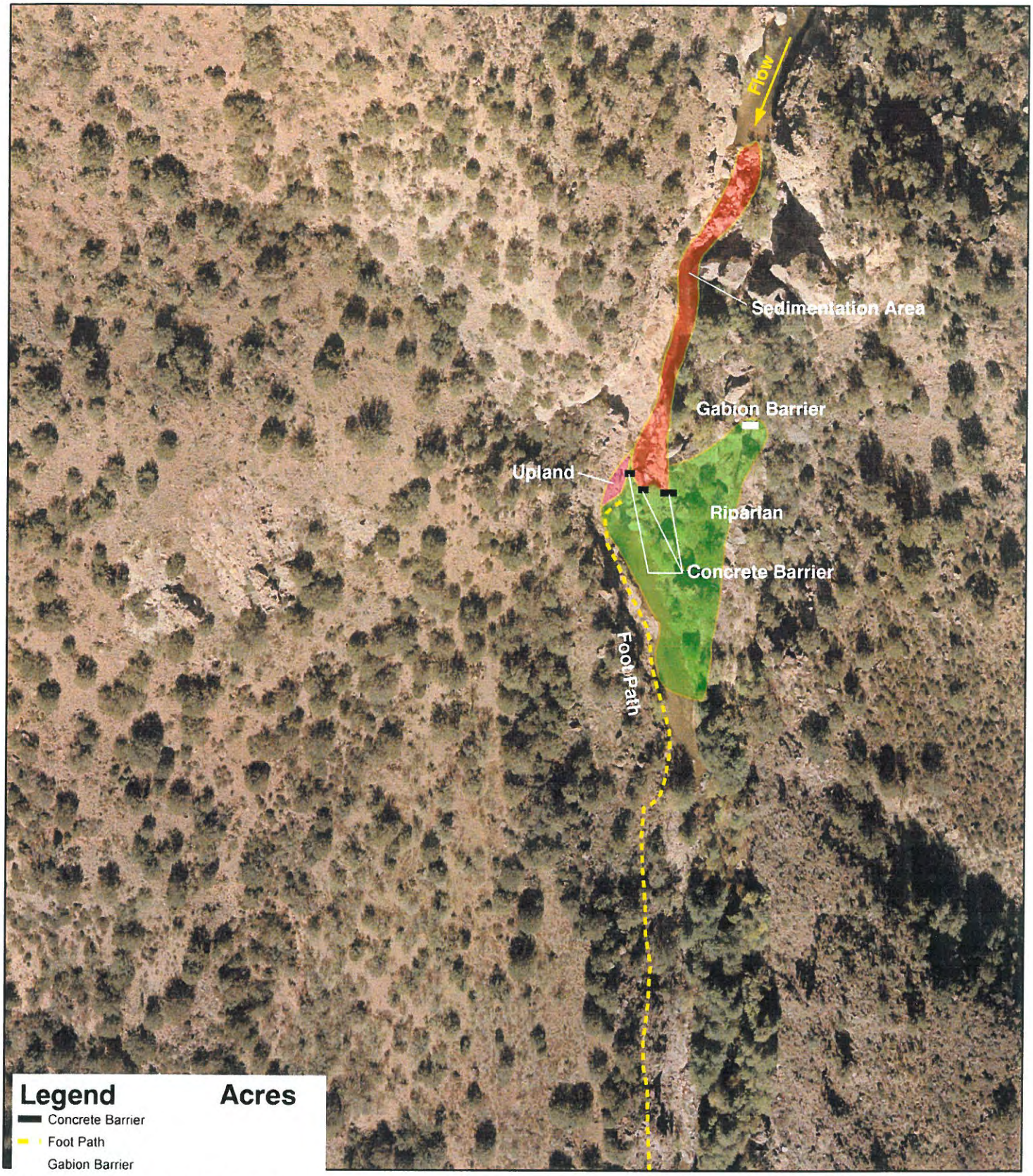
2.6 Comparison of Alternatives

Table 1 summarizes the three alternatives and environmental consequences of each as a basis for comparison. Project impact areas are illustrated in Figures 5a, 5b, and 6.

Table 1 – Summary of environmental consequences by alternative.

Resource Issue	Alternative		
	No Action	Wilderness (Proposed)	Non-wilderness
Vegetation	No effect	Temporary disturbance to 1.4 acre (including 0.9 acre in wilderness) of habitat. No impact from Piscicide application.	Temporary disturbance to 0.4 acres of habitat. No impact from piscicide application.
Fish and Aquatic Wildlife	Nonnative fish community dominance increases. Continuing adverse effects to native fish, leopard frogs, garter snakes, and other aquatic species.	Elimination of nonnative fish community from 9.5 miles of stream; short-term reduction in macroinvertebrate density; lower likelihood of nonnative fish re-establishment than the alternative action. Greatest positive effects to native fish, leopard frogs, garter snakes, and other aquatic species by eliminating and preventing upstream re-invasion of nonnative fish.	Elimination of nonnative fish community from 6.7 miles of stream; short-term reduction in macroinvertebrate density; higher likelihood of nonnative fish re-establishment than the proposed action. Positive effects to native fish, leopard frogs, garter snakes, and other aquatic species, but less so than proposed action due to less length of stream restored/protected and higher likelihood of nonnative fish re-establishment.
Terrestrial Wildlife	No effect	Temporary noise disturbance to large mammals. Minor disturbances to small mammals and herpetofauna.	Same as proposed action
Special Status Species	Continuing impacts on headwater chub, roundtail chub, lowland leopard frog, northern leopard frog, Arizona toad, narrow-headed garter snake, Mexican garter snake	Would contribute to delisting of loach minnow, Gila topminnow, and spikedace; positive impacts to Chiricahua leopard frogs and Forest service sensitive species including several native fish species and other aquatic/riparian species.	Positive impacts to some special status species but less so than the proposed action due to less length of stream restored/protected and higher likelihood of nonnative fish re-establishment.
Water Quality	No effect	Short-term impact to 9.5 miles of stream from antimycin; minor increase in turbidity and suspended solids during active construction	Short-term impact to 6.7 miles of stream from antimycin; minor increase in turbidity and suspended solids during active construction
Cultural Resources	No effect	No Effect with mitigation	No Effect with mitigation.

Recreation	Nonnative species would diminish or eliminate the native chub fishery.	Shift in angling opportunities from nonnative to native species along 9.5 miles of stream.	Shift in angling opportunities from nonnative to native species along 6.7 miles of stream.
Wilderness	No disturbance effects. Continued and increasing impacts to the natural ecologic conditions along 2.8 miles of Fossil Creek within the Mazatzal Wilderness from introduced, nonnative fish. No construction of a permanent improvement (nonconforming structure).	Temporary disturbances during construction and renovation (e.g. helicopter use, more ground activities); permanent impact to 0.01 acres (barrier/gabion footprint). Restoration of natural ecologic conditions through native fish restoration along 2.8 miles of Fossil Creek within the Wilderness. Construction of a permanent improvement (nonconforming structure) within Wilderness.	Potential minor increase in downstream turbidity during active construction. Continued and increasing impacts to the natural ecologic conditions along 2.8 miles of Fossil Creek within the wilderness from introduced, nonnative fish. No construction of a permanent improvement (nonconforming structure) within Wilderness
Wild and Scenic River Status	Eligibility as WSR maintained. No effect on free-flow. Adverse effects on fish and wildlife Outstanding Remarkable Values (ORVs); no effect on other ORVs. Wild and recreation classifications would not change.	Eligibility as WSR maintained. Minor effect on free-flow. 9.5 miles of habitat protected/enhanced for fish and wildlife ORVs; no adverse effects on other ORVs. Recreation classification would not change; wild classification may be affected, but could still be appropriate when evaluated for suitability in the future.	Eligibility as WSR maintained. Slightly greater effect on free-flow. 6.7 miles of habitat protected/enhanced for fish and wildlife ORVs; no adverse effects on other ORVs. Wild and recreation classifications would not change.
Air Quality	No effect	Highly localized minor effect during construction resulting from fugitive dust and engine emissions	Same as proposed action
Soils	No effect	Disturbance to 1.4 acres of soil and rock substrates	Disturbance to 0.4 acres of soil and rock substrates
Visual Quality	No effect.	Smaller structure, less accessible by people, less visible than non-wilderness site; would shift scenic integrity of barrier site from Preservation to Retention Visual Quality Objective (VQO)	Larger structure, more accessible by people, more visible than proposed action; would shift scenic integrity of barrier site from Retention to Partial Retention VQO



Legend	Acres
Concrete Barrier	
Foot Path	
Gabion Barrier	
Construction Impact Area out of Channel	
Upland (Access / Staging)	0.01
Construction Impact Area in Channel	
Riparian (Access / Staging)	0.31
Sedimentation Zone	0.12
Total Arces	**0.44**

Figure 5a
Wilderness Fish Barrier - Impact Area

N

100 50 0 100 Feet

1 inch equals 100 feet

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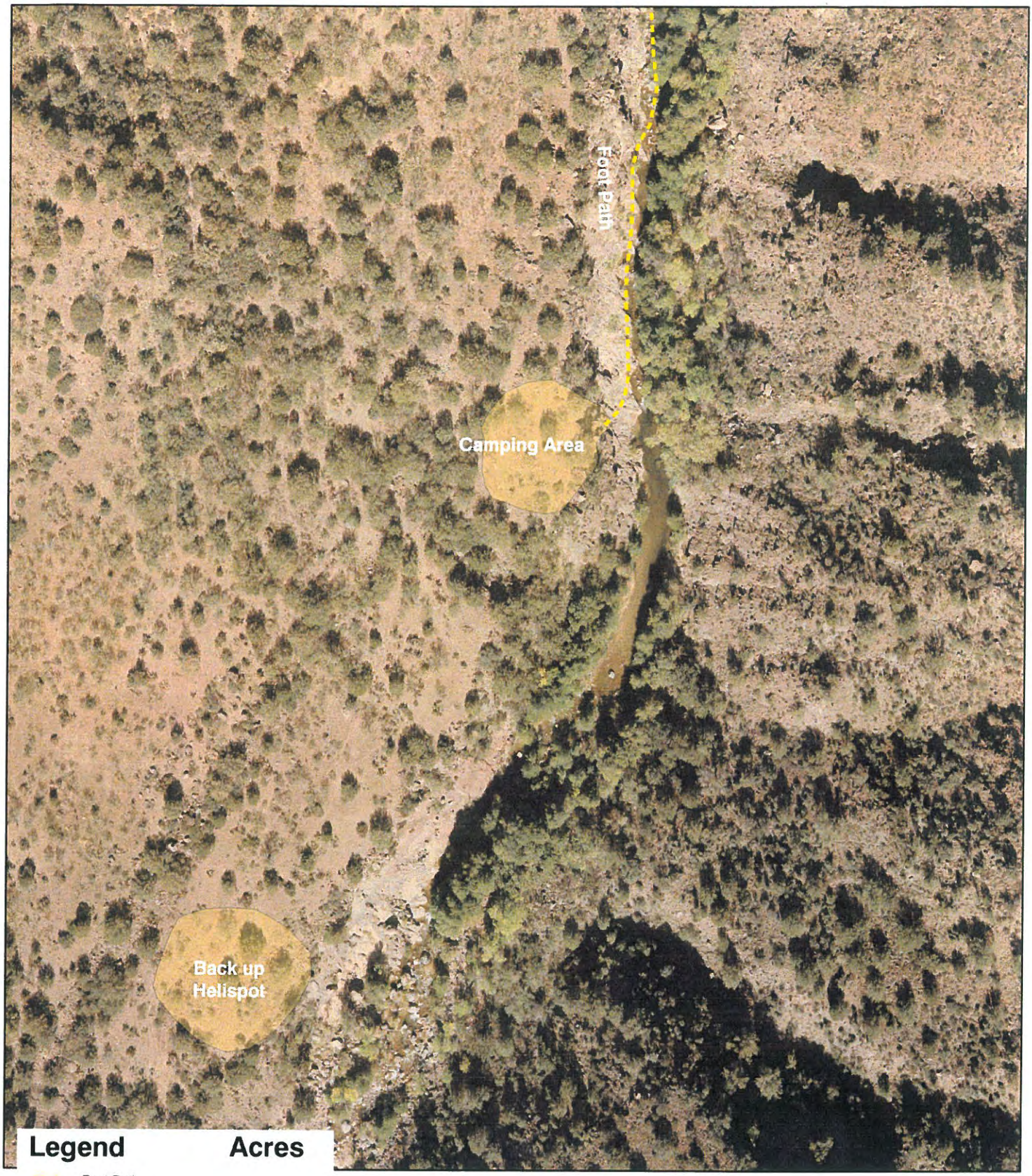

Legend	Acres
Foot Path	
Contractor Use Impact Areas	
Use Area - Stehr Lake (Not Shown)	0.50
Use Area - Wilderness (Camping / Helispot)	0.43
Total Acres	0.93

Figure 5b
Wilderness Fish Barrier - Impact Area

Feet
100 50 0 100
1 inch equals 100 feet

N

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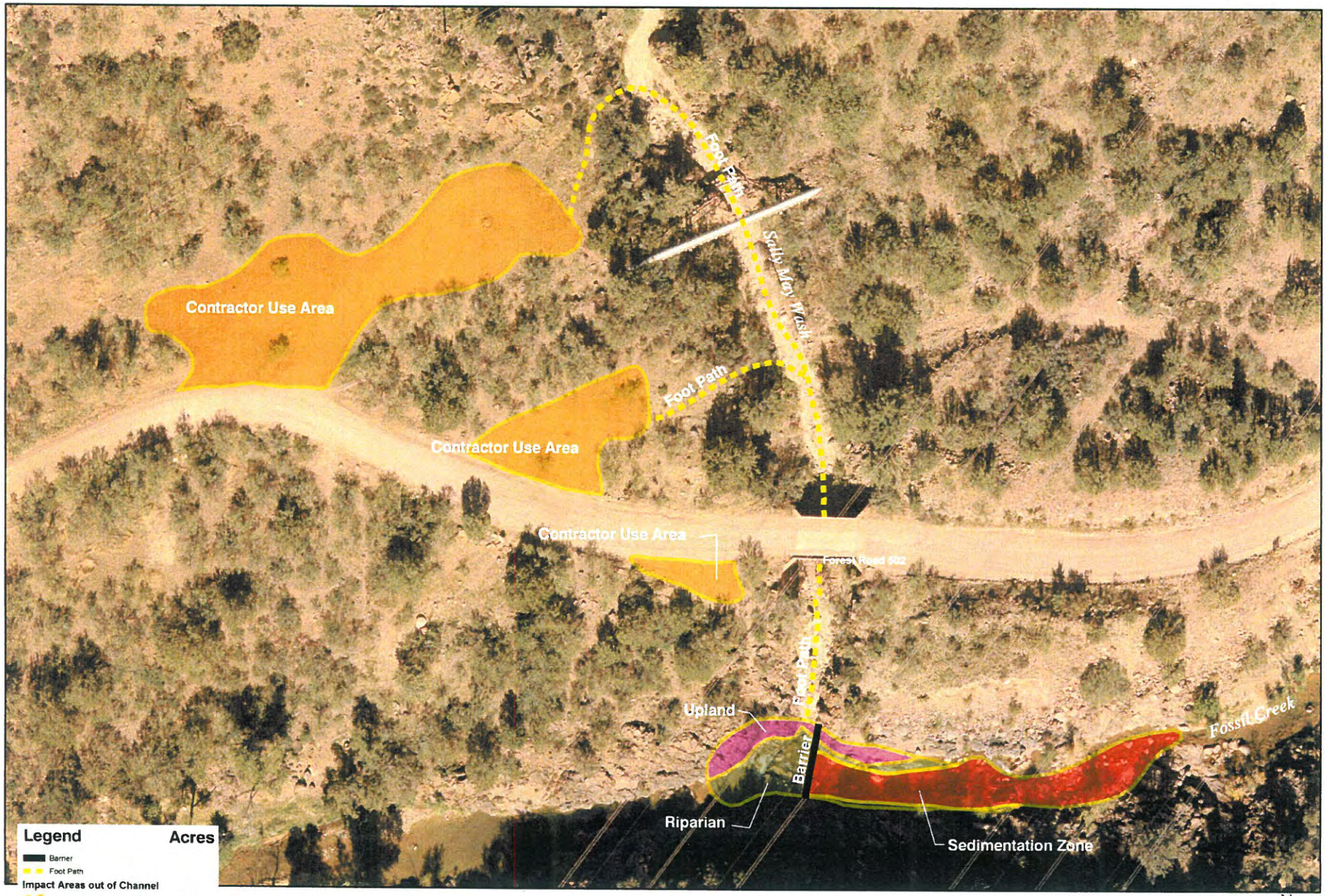

Figure 6
Fish Barrier Outside Wilderness - Impact Area

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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.

3.3 Cultural Resources

3.3.1 Affected Environment

Initial observations suggested that the Fossil Creek valley was continuously occupied by the Southern Sinagua from about A.D. 800 to 1300 and was later intensively occupied by the Apache or Yavapai, or both (see Appendix G for information on the cultural history of the Verde Valley). The valley encompassing the wilderness site is the largest relatively flat, potentially inhabitable area in the lower 7.3-mile segment of Fossil Creek from Sally May Wash to its confluence with the Verde River. This segment is a rugged, steep-sided canyon that is too steep for occupation except for a few small, discontinuous terraces or benches and the broad terrace at the Verde confluence. Consequently, these relatively flat surfaces of the valley landscape potentially contain archaeological features and artifacts.

The latest Forest Service listing for the National Register of Historic Places was consulted; no sites listed or formally determined eligible for inclusion on the Register are known within the project area, although several sites are eligible for inclusion. Preliminary observations suggest that the portion of the valley near the wilderness site location is a potential National Register District.

No areas of traditional cultural importance or areas of specific tribal concern are known within the project area, based on previous consultations between the Forest Service and Native American Indian groups and Forest research into tribal uses of the National Forest.

Reclamation and Forest Service archaeologists conducted a preliminary archaeological survey of the area of potential effect for this project, which included the fish barrier sites, contractor staging areas, and a terrace above the wilderness site. Archaeological Consulting Services Limited, under contract to Reclamation, conducted an intensive (Class III) survey of approximately 34.4 acres encompassing the wilderness barrier site and associated wilderness contractor use areas (Boston et al. 2003). Much of the information presented in this section is taken from that report. A geological assessment of the project area conducted as a part of this survey identified four terraces above the active floodplain. The lowest of these is a degrading landform, and the potential for intact, buried cultural deposits is low. In contrast, thick alluvial and colluvial sediments have accumulated on the three upper terraces, and buried cultural deposits are likely.

The survey area was systematically examined using pedestrian transects at 15 meter intervals. Three newly discovered sites were recorded, and two previously identified sites were rerecorded within the project area. All of these sites are considered eligible for inclusion on the National Register of Historic Places, and all are likely to include buried cultural deposits, given their geologic settings.

3.3.2 Environmental Consequences

No Action Alternative

No environmental consequences to cultural resources would occur under the No Action alternative.

Proposed Wilderness Alternative

Preliminary and intensive archaeological surveys of the area of potential effect for the proposed action have been completed, including the Wilderness barrier site, Stehr Lake contractor staging area, and a bench or terrace above the channel where project-related activities (possibly including daily foot travel, camping for up to 1 month, limited staging, and storage of valuable equipment) would occur in the Wilderness.

No cultural resources were identified at the proposed barrier site itself or the Stehr Lake contractor use area. An archaeological site near the contractor use area at Stehr Lake would be avoided. The boundaries of the contractor use area would be fenced and a construction monitor would ensure that activities stay within the authorized use area.

Five archaeological sites considered eligible for inclusion on the National Register of Historic Places have been recorded on the terrace above the floodplain in the vicinity of the proposed barrier site; the largest of these is located in the area closest to the proposed barrier site and thus is most likely to be adversely affected by construction-related activity.

Access to the stream channel from Stehr Lake has the potential to adversely affect these sites without appropriate avoidance or mitigation. Ground disturbance and impacts to archaeological sites between Stehr Lake and the wilderness barrier site would be reduced by bringing in materials and equipment by helicopter and lowering them by sling line directly onto the fish barrier construction site.

To reach the barrier site, construction crews will be required to hike a 1 to 2 mile route that descends over steep and rugged terrain to the job site. This access route would be surveyed and flagged to minimize effects on cultural resources. The trampling impact of recurrent pedestrian traffic would likely result in the formation of a trail from the Stehr Lake staging area to and through areas that are archaeologically sensitive. Trail development also has the potential to facilitate public access, which would have a long-term negative effect on the archaeological qualities of this relatively pristine valley. Project-created trails would be obliterated following construction, with particular attention paid to removing evidence of the trailhead to minimize possible future use.

In order to expedite completion of the project and minimize trail development, construction crews of no more than 10 people would be allowed to camp on a terrace near the stream for the estimated month-long construction period. This area also would be used for emergency helicopter landing, and possibly some unloading and staging of

construction supplies, and camping. There is a potential impact to archeological sites in the area from construction crews and other project personnel. This includes trampling and moving artifacts. However, this would be avoided by restricting activities to designated areas. No foot traffic or storing of materials or supplies would be allowed outside authorized areas, and monitoring by qualified personnel would be required to minimize the likelihood of impacts. Following construction, access to Fossil Creek for native fish salvage and restoration and long-term monitoring activities would be managed to avoid impacts to cultural resources.

If all mitigations are followed and sites are avoided, a "no effect" would be the appropriate determination for Section 106 compliance with the National Historic Preservation Act.

Nonwilderness Alternative

The staging area for the alternative barrier incorporates both the north and south sides of FR 502 west of the confluence of Sally May Wash and Fossil Creek. This area was once occupied by a circa 1910 to 1950 structure (called the Sally May House) associated with APS employees who worked at the Irving Power Plant. The structure was razed in the 1950s leaving scattered pieces of metal, glass, and crockery on the north side of the road. This area has been graded and is used today for parking and camping. No cultural resources were recorded in a survey of the alternative barrier location or in the short distance between the staging area and barrier site (Forest Service 2000).

Use of part of the house site for construction staging would not result in new impacts to cultural resources. The boundaries of this previously impacted area would be flagged to delineate the contractor use area and confine staging activities. Project activities would be monitored periodically by Reclamation or Forest Service staff to ensure that sites outside the authorized area are not disturbed. Access to Fossil Creek for native fish salvage and stream restoration and long-term monitoring activities would be managed to avoid impacts to cultural resources.

Cumulative Effects

No environmental consequences or cumulative effects to cultural resources are anticipated under either action alternative.

3.4 Recreation and Visual Aesthetics

3.4.1 Affected Environment

Scenic Condition. The project area includes a diverse range of natural landscapes that are visually interrupted by APS power generating and transmission facilities and Forest roads (FR 708 and FR 502). Distinctive natural features with high scenic quality dominate these landscapes. Views include rugged canyon slopes, a meandering stream valley, and high surrounding desert. Over the past several years, adverse visual impacts

along road-accessible streamside areas have resulted from increasing evidence of human activity such as fire rings, soil destabilization, and damage to vegetation. These intruding visual elements locally detract from the overall natural character of the valley landscape. Restoration of full flows and removal of APS facilities under the proposed FERC decommissioning process would permanently change the baseline for scenic conditions. The term "scenic integrity" is used by the Forest Service as a measure of the degree to which a landscape is altered from a purely natural condition. Scenic integrity is also indirectly expressed in Forest Plans as the Visual Quality Objective (VQO).[13] VQOs are intended to indicate the potential expectations of the visitor by considering the frequency a management area is viewed and the degree to which an area has been modified by human activity. The VQO defined in the Coconino and Tonto Forest Plans for the nonwilderness portion of the project area (Coconino National Forest Management Area 11 and Tonto National Forest Management Area 4F) is Retention[14] of the characteristic landscape, although the VQO is actually closer to Partial Retention[15] along road accessible areas due to the extent to which human activity has fundamentally altered the landscape. In contrast, the VQO within the Mazatzal Wilderness (Coconino National Forest Management Area 1 and Tonto National Forest Management Area 4A) prescribes Preservation[16] of the natural landscape.

Recreation. Exceptional scenery and perennial stream flow have created a demand for recreation in upper and middle portions of Fossil Creek. Forest Plan emphasis for management of visitor use in these areas calls for dispersed recreation. Within the project area, the most popular recreational activities include sightseeing, hiking, primitive camping, wildlife viewing, hunting, and angling. Sightseeing, camping, and angling are most intensively practiced in road accessible areas along a 2.9-mile segment of Fossil Creek south of Irving. Recreational use within wilderness segments of the project area is low due to general remoteness, rugged terrain, and lack of recreation trails.

Flow restoration would enhance the attractiveness of roadside segments of the stream between Irving and Sally May Wash for dispersed day use and camping. Preliminary studies of the Coconino National Forest Fossil Creek Planning Team predict public use in the Fossil Creek area will increase if decommissioning of the APS hydroelectric facilities occurs. Increases in public use would result in higher visitor densities and greater demands on resources along roadside segments of Fossil Creek. Proximity to the rapidly growing greater Phoenix metropolitan area will likely sustain high recreation pressure into the foreseeable future. The Coconino and Tonto National Forests are preparing an environmental analysis document to address future management changes designed to protect streamside resources within the Fossil Creek area.

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13 VQOs are desired levels of visual quality based on the physical and sociological characteristics of an area. They refer to the degree of acceptable alteration of the characteristic landscape.
14 Retention is a degree of alteration in which management activities area generally not evident to the casual visitor.
15 Partial retention is a degree of alteration in which management activities generally may be evident but must remain subordinate to the characteristic landscape.
16 Preservation refers to a natural state that provides for ecological change only.

Fishing recreation as measured by angler days is very light. Total angler days per year is estimated at less than 300 (AGFD 2001), with most use occurring in the roadside segment of stream. Poor access, low angler interest in available fish species (primarily smallmouth bass, green sunfish, and yellow bullhead), and small average size of sport fishes contribute to the light fishing pressure. Fossil Creek also lacks a long angling history of significance. In 1995, flooding destroyed a natural barrier that previously kept smallmouth bass and yellow bullhead restricted to the segment of stream below the project area.

3.4.2 Environmental Consequences

No Action Alternative

There would be no effect to scenic condition under this alternative.

There would be no effect to most recreational uses in the area, however, in the absence of Federal action to recover native fishes in Fossil Creek, the nonnative sport fishery could improve as more smallmouth bass and catfish move into upstream reaches. Return of full flows might enhance this nonnative fishery by allowing larger catfish and smallmouth bass to move farther upstream. However, a proportionate increase in fishing pressure would not be expected because of the low interest in this type of fishery throughout the Verde River watershed. Creel survey data collected by AGFD indicate that little demand exists among anglers for warm water fishes in the tributaries of the Verde River watershed (AGFD 1999). Upstream dominance of nonnative species would diminish or eliminate the native chub fishery.

Proposed Wilderness Alternative

Scenic Condition. High rock abutments and steeply sloping canyon walls would conceal the barrier, embankment plugs, and rock gabion structure from distant viewpoints, minimizing impacts within the context of the overall viewshed. Visual access to the site is limited by rugged terrain and an absence of recreation trails. Concrete used in the barrier and embankment plugs would be colored and textured to blend these structures into the surrounding environment. The gabion structure would be visually isolated from the barrier by intervening boulders, and concealed somewhat from nearby viewpoints by a colored mortar fascia. These attempts to visually conform the barrier, embankment plugs, and gabion structure to the surrounding terrain would render them largely unobtrusive to the casual observer. However, the presence of "non-conforming" structures in Wilderness creates subtle changes in the natural landscape that would lower the scenic integrity rating of the project site equivalent to a Retention VQO.

Recreation. Stream renovation would eliminate the present assemblage of nonnative, warm water sport fishes from the 9.5-mile segment of Fossil Creek between the proposed barrier and the Fossil Springs diversion dam. Fishes in the 4.5-mile reach below the barrier would not be affected. The existing populations of roundtail chub and headwater

chub would replace the nonnative sport fishery, providing a continuing and unique angling opportunity available in few other streams. Loss of nonnative sport fishes would displace a few anglers to other nearby drainages, such as the Verde River, West Clear Creek, Wet Beaver Creek, Dry Beaver Creek, and Oak Creek. The impact on fishing recreation is low due to the weak demand for the nonnative fishery in Fossil Creek and the proximity of other warm water fishing opportunities in the Verde River watershed.

Construction support activities outside of wilderness would result in temporary noise and visual impacts from helicopter operations and equipment use at the Stehr Lake staging area. Ambient noise levels along forest roads would temporarily increase as a result of increased vehicle traffic associated with construction and may detract from visitor enjoyment; however, construction traffic and equipment operation would be infrequent and limited to daytime hours and weekdays. Once construction is complete, noise levels would return to pre-project conditions.

Nonwilderness Alternative

Scenic Condition. Implementation of the alternative action would result in minor modification of the scenic integrity of the area, shifting the Retention VQO to Partial Retention at the barrier. The barrier would be concealed from vehicular traffic on FR 502 by a high bluff that forms the west bank of Fossil Creek. Visual impacts would be greatest within the channel prism immediately downstream of the barrier. To minimize these effects, all structural concrete would be colored and textured to blend with surrounding rock.

Recreation. Effects of the alternative action are very similar to the proposed action but confined to areas outside Wilderness. With possible return of full flows and increasing demand for water-based recreation, visitor use along roadside segments of stream will increase. The waterfall effect created by the barrier may attract concentrated use at the structure and result in localized impacts to soil and vegetation. If full instream flows are restored, the drop structure could pose a hazard for certain water-based activities like tubing.

Cumulative Effects

A Qwest fiber optic line installed along FR 708 will be buried, and there are no other past, present, or reasonable foreseeable projects that could affect scenic quality within the project area.

There are no past, present, or reasonable foreseeable projects that would be additive to the project's minor effects on sportfishing opportunities and ambient noise levels that could impact recreationists.

3.5 Wild and Scenic River Status

3.5.1 Affected Environment

In 1993, the Forest Service conducted a preliminary analysis of rivers on six national forests in Arizona to determine their potential eligibility for inclusion in the National Wild and Scenic River (WSR) System (National System). This process was conducted at the request of the Arizona Congressional delegation, and completed by an interdisciplinary team, who determined that of the rivers analyzed, 57 appeared to meet eligibility requirements of the Wild and Scenic Rivers Act (WSRA). Fossil Creek was one of the 57 rivers determined free-flowing, and possessing one or more "outstandingly remarkable" values (ORVs). The segment of Fossil Creek between the Fossil Springs diversion dam and the Mazatzal Wilderness Boundary (6.9 miles) received a preliminary classification of "recreational," and the segment from the Mazatzal Wilderness boundary to the Verde Wild and Scenic River boundary (6.6 miles) was classified as "wild." Outstandingly remarkable values were listed as: Geologic, Fish, Wildlife, Historic, and Riparian/Ecological. Free-flowing is defined in the WSRA, in part, as ". . . existing or flowing in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway."

In a recent court case on the status of the 57 rivers, the 9th Circuit Court of Appeals determined the findings of the 1993 report constituted eligibility (July 7, 2003).

Only rivers in the National System or authorized by Congress for study under Section 5(a) of the WSRA are afforded statutory protection. In the case of Fossil Creek, a river identified by a Federal land managing agency for study under Section 5(d)(1) of the WSRA, protection of the river's free-flow and other values is provided through agency policy. The Forest Service Handbook (FSH 1909.12, 8.12) directs protection in the following ways:

1. "To the extent the Forest Service is authorized under law to control stream impoundments and diversions, the free flowing characteristics of the identified river cannot be modified.
2. Outstandingly remarkable values of the identified river area must be protected and, to the extent practicable, enhanced.
3. Management and development of the identified river and its corridor cannot be modified to the degree that eligibility or classification would be affected (i.e., classification cannot be changed from wild to scenic or scenic to recreational)."

Forest Service policy (FSM 2354.76) identifies a 10-step process to use when evaluating proposed water resources projects on a river included in the National Wild and Scenic Rivers System or authorized by Congress under Section 5(a) of the WSRA. In the absence of a required or alternative process for eligible rivers such as Fossil Creek, the

10 steps identified in FSM 2354.76 have been addressed in detail and summarized in a separate report prepared by the Forest Service as a means to analyze potential effects to the creek's eligibility (free flow and ORVs) and classification.

The closest designated Wild and Scenic River is the Verde River, which is located approximately 4.5 miles south of the project area. A 40.5-mile segment of the Verde River was added to the National System by Congress in 1984 with enactment of the Arizona Wilderness Act. The project would not affect the free-flowing character, or scenery, recreational, or wildlife values of the Verde WSR that were present on the date of designation.

3.5.2 Environmental Consequences

No Action

Eligibility. Fossil Creek's eligibility as a wild and scenic river would not be affected.

Free Flow. With no fish barrier construction in Fossil Creek, free-flow would not be affected.

Outstandingly Remarkable Values. This alternative would have no effect on geologic, historic, and riparian/ecological ORVs.

Fish and wildlife ORVs are being adversely affected in Fossil Creek by nonnative fish. Without action to remove nonnative fish from the creek, native fish and wildlife populations would continue to decline. Reintroduction of extirpated native species would not be successful with the increasing dominance of nonnative fish, and some native species would trend towards the need for federal listing under the Endangered Species Act.

Classification. Classification for either the wild or recreational segments of Fossil Creek would not be affected.

Proposed Wilderness Alternative

Eligibility. The proposed project would not affect Fossil Creek's eligibility as a wild and scenic river (see discussion below).

Free Flow. Given the definition of "free-flow" in the WSRA, the proposed fish barrier would have a minor effect on free-flow at the barrier site because it would result in a slight modification of the waterway. However, the selected location and the design of the barrier minimize the impacts to the free-flowing characteristics of the stream to the extent practicable. The magnitude of effect would be negligible with regards to the overall stream function and the free-flowing character of Fossil Creek. The fish barrier would use the existing channel features to plug three notches carved in bedrock to blend with channel geomorphology, and would function within the natural step-pool stream

dynamic. The barrier would increase the height of an existing step in this reach of the creek and would mimic bedrock falls that currently exist throughout the system, and natural travertine formations that historically created and enhanced the step pool system in the upper reach of the stream. The 5-foot barrier would be within the size range of these natural features, which vary in size from a few inches to 22 feet in height. Additionally, the barrier would restore the protective function that a natural barrier provided until the mid-1990's near the proposed wilderness site. This natural rock structure was removed by massive flood flows in 1995 (Roberson et. al 1996; personal communication, C. Benedict, AGFD).

Outstandingly Remarkable Values. This alternative, which is designed to protect and enhance the fish ORV by improving 9.5 miles of stream, would also benefit the wildlife ORV, and would not adversely affect any other ORV.

Impacts to riparian habitat would be negligible, as the barrier site is bedrock dominated and no riparian trees are expected to be disturbed.

For the geologic ORV, travertine was the main feature of interest identified in the Resource Information Report (Forest Service 1993b). Before diversion of flows out of the creek, travertine precipitated out and formed natural falls in the upper 1/3 to ½ of Fossil Creek, as evidenced by many large travertine buttresses along the creek. Because about 5 cfs is being discharged into Fossil Creek from the Irving power plant, travertine is currently forming immediately downstream. Travertine will reform in the upper reach above Irving with return of additional flows to the creek, but is not expected to form significantly at the barrier site, although some marling or coating could occur. The Wilderness fish barrier would function similarly to travertine falls in the upper reach of the creek, like bedrock and boulder drops that occur throughout the system, and like the natural barrier that occurred near the site until the mid-1990s. These features all function by raising the water surface profile and creating a falls.

The historic ORV is primarily related to the Childs-Irving hydroelectric facilities and prehistoric southern Sinagua sites (Forest Service 1993b). The power plant facilities are listed on the National Register of Historic Places and are designated as a National Mechanical Engineering Landmark. Southern Sinagua site densities are high, with almost every site type known located within the corridor. The final cultural resources clearance concludes that implementation of the project at the wilderness site will not adversely affect cultural resources, and if all recommendations are followed, the appropriate finding would be "no effect."

As compared to the nonwilderness site, the wilderness barrier site provides greater protection and enhancement of native fish and wildlife ORVs. More habitat is restored (20 percent more of Fossil Creek), and long-term likelihood of success is greater, since the risk of nonnative fish being intentionally moved from below the barrier to above the structure is much lower due to difficult access to the wilderness site.

Classification. The preliminary classification given to the reach of Fossil Creek where the wilderness barrier would be constructed is "wild." Wild river areas are defined in the WSRA as being free of impoundments and generally inaccessible, with watersheds or shorelines essentially primitive and waters unpolluted. Impoundment is defined in the Wild and Scenic Rivers Guidelines as "a body of water formed by any manmade structure." Although the three plugs would create a small body of water for a short period of time, the site would quickly aggrade following storm events, the small pond would disappear, and the site would become naturalized so that the barrier itself will not be noticeable to the casual observer as the water flows over the plugs in a 5-foot high waterfall. The plugs would functionally replace the natural rock barrier that flooded out in the mid 1990's, and would augment the existing step at the site. The natural function and naturally-appearing nature of the creek would be maintained.

Classification will be evaluated at the time a suitability study is completed, probably at Forest Plan revision, expected to begin in a few years. When evaluating rivers for possible inclusion to the National System of wild and scenic rivers, policy direction allows for designations as wild, even with a few minor existing structures if they fit with the primitive and natural values of the viewshed (FSH 1909.12, Chapter 8). If the fish barrier were to impound water in the long-term, the wild classification would be affected, reducing it to recreational, since both wild and scenic classifications are to be free of impoundments. However, since it is anticipated that no body of water would be present above the fish barrier in a short period of time after construction, and the area would remain inaccessible and primitive otherwise, the wild classification may be appropriate when it is evaluated in the future.

Nonwilderness Alternative

Eligibility. The proposed project would not affect Fossil Creek's eligibility as a wild and scenic river (see discussion below).

Free Flow. Given the definition of "free-flow" in the WSRA, the proposed fish barrier would have a minor effect on free-flow at the barrier site, because it would result in a slight modification of the waterway. The structure would uniformly span the width of the channel and would have slightly more impact to free-flow than the Wilderness site because it modifies the waterway to a slightly greater extent. It may also be more difficult to create a naturally-appearing structure that harmonizes with the surrounding environment at this site. Despite the greater difficulty of harmonizing this structure with site conditions, the barrier would conform to the overall step/pool morphology of the stream, and would mimic bedrock falls that currently exist throughout the system, and travertine formations that historically created and enhanced the step-pool system in the upper reach of the stream. The 5-foot barrier would be within the size range of these natural features, which vary in size from a few inches to 22 feet in height. In contrast to the Wilderness site, no natural fish barrier is known to have existed at or near the nonwilderness barrier site; therefore, the structure will not restore any protective function to this part of the creek, but it would augment an existing step at the site.

Outstandingly Remarkable Values. This alternative, which is designed to protect and enhance the fish ORV by improving 6.7 miles of stream, would also benefit the wildlife ORV, and would not adversely affect any other ORV.

Impacts to riparian habitat would be negligible, as the barrier site is bedrock dominated, and no riparian trees are expected to be disturbed.

For the geologic ORV, travertine was the main feature of interest identified in the Resource Information Report (US Forest Service 1993b). Before diversion of flows out of the creek, travertine precipitated out and formed natural falls in the upper 1/3 to ½ of Fossil Creek, as evidenced by many large travertine buttresses along the creek. Because about 5 cfs is being discharged into Fossil Creek from the Irving power plant, travertine is currently forming immediately downstream. Travertine will reform in the upper reach above Irving with return of additional flows to the creek, but is not expected to form significantly at either barrier site, although some marling or coating could occur. The nonwilderness fish barrier would function similarly to travertine falls in the upper reach of the creek, and like bedrock and boulder drops that occur throughout the system. These features function by raising the water surface profile and creating a falls.

The historic ORV is primarily related to the Childs-Irving hydroelectric facilities and prehistoric southern Sinagua sites (USDA Forest Service 1993b). The power plant facilities are listed on the National Register of Historic Places and are designated as a National Mechanical Engineering Landmark. Southern Sinagua site densities are high, with almost every site type known located within the corridor. Use will occur on already impacted sites, so the project would have no new impacts.

As compared to the wilderness site, the nonwilderness barrier site provides less protection and enhancement of native fish and wildlife ORVs. Approximately 20 percent less habitat would be restored. Additionally, the long-term likelihood of success is lower, since the risk of nonnative fish being intentionally moved from below the barrier to above the structure is much greater, due to ease of accessibility from the road and nearby dispersed camping sites.

Classification. The preliminary classification given to the reach of Fossil Creek where the nonwilderness barrier would be constructed is "recreational." Recreational river areas are defined in the WSRA as rivers or sections of rivers that are readily accessible by road or railroad, may have some development along shorelines, and may have undergone some impoundment or diversion in the past. Classification would not be affected by the nonwilderness fish barrier.

Cumulative Effects

There are no past, present, or reasonably foreseeable projects that would be additive to the project's impacts on free-flow. Features such as the Fossil Springs dam, Irving dam, and the road crossing at Irving were in place prior to Fossil Creek being eligible for inclusion to the National System, and therefore define the existing condition. Cumulative impacts to fish and wildlife ORVs are disclosed in the fish and aquatic wildlife and other sensitive species sections.

3.6 Mazatzal Wilderness

3.6.1 Affected Environment

The southern 2.8-mile portion of the project area forms part of the northern boundary area of the Mazatzal Wilderness. Established as a primitive area by the Chief of the Forest Service in 1938, Congress designated the Mazatzal Wilderness with passage of the Wilderness Act on September 3, 1964. The Arizona Wilderness Act of August 28, 1984 increased the total size of the Wilderness Area to 250,517 acres. The Mazatzal Wilderness lies within the jurisdiction of Coconino and Tonto National Forests. Management responsibilities are shared by the two National Forests, with the Tonto having lead responsibilities.

The name of the Wilderness is from an old Indian culture in Mexico, and is correctly pronounced "Mah-zaht-zahl," meaning "land of the deer." The eastern side of the Wilderness predominantly consists of brush or pine-covered mountains, sometimes broken by narrow, vertical-walled canyons. On its west side below the steep brush-covered foothills, the Verde River flows through the Sonoran Desert. Elevations range from 2,060 feet along the Verde River to 7,903 feet on Mazatzal Peak. Fossil Creek forms part of the northwestern boundary of the Wilderness and is within the portion that was added in 1984. The rugged topography and remoteness of the area, combined with terrestrial and riparian habitats, provide a full range of wilderness qualities and opportunities.

The Mazatzal Wilderness is part of the 106 million acre National Wilderness Preservation System and represents 5.5 percent of the total Wilderness acreage in Arizona. Legislated Wildernesses are recognized as areas where the earth and its community of life are untrammeled or unchanged by man, where man himself is a visitor who does not remain. Wilderness is an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements of human habitation, which is protected to preserve its natural conditions and which generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable (1964 Wilderness Act).

Wilderness Law, Regulation, and Policy. The Mazatzal Wilderness Implementation Plan (Implementation Plan) (National Forest 1994) was developed to further specify and act on prescriptions contained within the Tonto Forest Land and Resource Management

Plan (LRMP) and expands on policies and guidelines within Forest Service Manuals and Handbooks. The Implementation Plan identifies desired future conditions and specific management policies and actions for the Wilderness.

Sec. 2 (c) of the Wilderness Act states that "A wilderness . . . is hereby recognized as an area where the earth and its community of life are untrammeled by man . . . an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvement or human habitation, which is protected and managed so as to preserve its natural conditions, and which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable. . . ."

Sec. 4. (c) goes on to say that ". . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area."

Federal regulations at 36 CFR 293.6 (c) specify that the Chief, Forest Service, may authorize . . . motorized equipment, mechanical transport, aircraft, . . ., or structures . . . to meet the minimum requirements for authorized activities to protect and administer the Wilderness and its resources. . . . Forest Service Manual direction at FSM 2326 identifies the Regional Forester as the line officer with delegated authority to approve transport and supply by aircraft and the use of portable motorized equipment to meet minimum needs for protection and administration of the area as wilderness, only as follows:

a. A delivery or application problem necessary to meet wilderness objectives cannot be resolved within reason through the use of nonmotorized methods.

b. An essential activity is impossible to accomplish by nonmotorized means because of such factors as time or season limitations, safety, or other material restrictions. Forest Service Manual direction at 2323 delegates the authority to approve fish control projects and pesticides to the Regional Forester. To allow the Regional Forester to approve these nonconforming uses requires that these actions be necessary to meet minimum requirements for administration of the area as Wilderness.

The key question relative to the necessity of building the proposed structure in wilderness is, "is it the minimum required for administration of the Mazatzal Wilderness in terms of restoring native fishes in Fossil Creek"? Another way to ask this question is, "is this particular structure absolutely necessary" (to be built in wilderness)? To address these questions, direction is available in FSM 2320.2, FSM 2323.3, the 1986 MOU for Policies and Guidelines for Fish and Wildlife Management in National Forest and Bureau of Land Management Wilderness, and the relevant sections of the Mazatzal Wilderness Plan. All of these documents are available in the project record.

The 1986 MOU for Policies and Guidelines for Fish and Wildlife Management in National Forest and Bureau of Land Management Wilderness (Appendix H) sums up the relevant direction as follows: All management activities within wilderness are to be done without motorized equipment or landing of aircraft, unless truly necessary to administer the area. Wilderness managers must determine that such use is the minimum necessary to accomplish the task. In rare instances, facility development and habitat alteration may be necessary to alleviate adverse impacts caused by human activities on fish and wildlife. Actions necessary to protect or recover threatened or endangered species must be necessary for the perpetuation or recovery of the species and it must be demonstrated that the actions cannot be done more effectively outside wilderness. Areas outside of wilderness that offer equal or better opportunities for species protection are preferable to areas within wilderness.

To answer the question of whether the location within the wilderness is superior to the location outside of wilderness, an analysis of the relative benefits to fisheries of the wilderness versus the nonwilderness sites was done. The summary of this document states: "the wilderness site provides protection for significantly more habitat for all the native species existing and proposed for Fossil Creek in the 2.8 miles below the nonwilderness site. The wilderness site would protect approximately .2 mile of critical habitat designated under the Endangered Species Act for spikedace and loach minnow. Although not designated as critical habitat, Fossil Creek upstream to around Irving may provide additional suitable habitat for the loach minnow. It better meets scientific, education, and species conservation values that contribute to an enduring wilderness resource." The "Fisheries Benefits Determination for Fossil Creek" can be found in the project record.

Finally, if it is determined that a project meets the minimum requirements for administration of the area as Wilderness, a minimum tools analysis is done. The purpose of this analysis is to identify the minimum tools needed to accomplish the work. A minimum tools analysis was completed for this project by a team comprised of wilderness managers, an archeologist, and a wildlife biologist. Three alternatives were analyzed: a substantially motorized alternative, a totally nonmotorized alternative, and a recommended alternative which drew on elements of the first two alternatives. The recommended alternative was developed to identify the minimum tools necessary to complete the work that resulted in the least impact to the physical resource and wilderness values. The recommended alternative was incorporated into the proposed action. The Minimum Tools Analysis is available in Appendix I. The alternatives discarded through the minimum tools analysis are further described in section 2.1 of this EA, Alternatives Considered but Eliminated.

For more information on relevant Wilderness Law, regulation, and policy, see the Review of Law, Regulations, and Policy Affecting Decision for Proposed Native Fish Restoration Activities and Structures on Fossil Creek within the Mazatzal Wilderness 9/16/03 in Appendix J.

3.6.2 Environmental Consequences

No Action Alternative

Social. Social wilderness values would remain largely unchanged since barrier construction and piscicide application would not occur.

Biophysical. Upstream incursion of nonnative fishes would continue to disrupt the native fish community in the project area's portion of the Mazatzal Wilderness, threatening continued loss of part or all of the native fishery and wilderness values associated with it. Natural processes in the Wilderness that are linked to native aquatic biota would be adversely affected by the increased dominance of nonnative fishes.

Wilderness values associated with native fish and other aquatic biota would not be restored or enhanced within 2.8 miles of Fossil Creek within the Mazatzal Wilderness and critical habitat for loach minnow and spikedace would not be improved.

Proposed Wilderness Alternative

Social. The fish barrier would be a non-natural permanent human made structure within the Wilderness. This is a nonconforming Wilderness use requiring Regional Forester approval. With full flows returned to Fossil Creek, it would not be visible to the casual observer.

Materials, equipment, camping gear, and sanitation facilities would be flown by helicopter and long-lined to the wilderness job site. The work would involve 7 to 9 days of helicopter flights including landings (contact with the ground through long-line delivery is considered a landing), and approximately 5 days of motorized equipment use. Actual landing of the helicopter aircraft itself would only occur in an emergency situation. Use of a helicopter is a nonconforming Wilderness use requiring Regional Forester approval.

Barrier construction would involve the use of limited mechanized equipment in addition to helicopter transport (e.g., generator, compressor, rock drill, and concrete vibrator). The generator, compressor, and drill would be used for drilling anchor bar holes in rock substrates. No other power tools would be allowed. Use of motorized equipment is a nonconforming Wilderness use requiring Regional Forester approval.

Concrete would be flown in by helicopter and long-lined to the job site. The concrete would be poured in two phases – the first phase to fill two slots, and the second phase to fill the remaining slot. Use of the helicopter and mechanized equipment would be restricted to weekdays to minimize conflicts with visitor enjoyment of the area.

A helicopter would also be used to transport 55-gallon drums containing captured native fish from Fossil Creek to holding facilities at Irving. The helicopter would again be used to ferry the native fish from Irving back into the creek following chemical treatment. Total helicopter use for fish transport is estimated at 2 days.

There would be a short-term and highly localized effect on the wilderness experience for visitors who encounter project implementation activities. Construction noise, helicopter operations, and increased presence of humans would result in sporadic auditory and visual intrusions for approximately 1 month. Weekday use of mechanical equipment would minimize some of that impact. The number of people impacted by the noise would be low since use in this part of the Wilderness is low. People recreating at Stehr Lake would likely hear the noise at the job site, leading some of them to investigate the noise at the project site, resulting in increased use, which is not desirable.

Use of piscicides in the Wilderness is a nonconforming Wilderness use requiring Regional Forester approval.

Biophysical. Crews would hike in to the site. No trail would be constructed, but the route would be flagged. Presence of a temporary trail could lead to increased visitation from the public at the job site. Creation of a trail is a concern because of increased Wilderness visitation and potential impacts to cultural resources. Use of the trail during the month-long construction phase could result in increased soil erosion. The trail would be rehabilitated after completion of construction activities.

There would be a short term trampling impact to soils and vegetation from on-the-ground activities at the camping area and job site. Some disturbance would occur to terrestrial wildlife that normally moves through the area from the occupancy of the camping area and job site.

Brush would need to be cleared to create a backup helispot near the Wilderness barrier.

Wilderness values associated with native fish and other aquatic biota would be restored or enhanced within 2.8 miles of Fossil Creek within the Mazatzal Wilderness. By removing introduced nonnative fish, 2.8 miles of habitat would be improved for the roundtail chub, which was recently petitioned to be federally listed. This alternative would correct human caused conditions (introduction of nonnative fish) in this portion of the species' range that could lead to the need for federal listing (FSM 2323.3(2)). Approximately 0.2 mile of loach minnow and spikedace critical habitat would be improved, and additional potential habitat would be created upstream from the critical habitat boundary. Creating conditions favorable for reintroducing loach minnow and spikedace and other listed species would contribute positively towards recovery of those species (FSM 2323.31(3)).

Project implementation would protect wilderness values associated with natural processes and functions that otherwise would decline with continued upstream incursion and dominance of nonnative aquatic fauna. Based on prior precedent, projects involving barriers and piscicide use are accepted activities to protect native fish communities within areas designated under the Wilderness Act.

Nonwilderness Alternative

Social. The alternative site is located outside the Wilderness boundary. Social wilderness values would not be affected by this alternative.

Biophysical. Upstream incursion of nonnative fishes would continue to disrupt the native fish community in the project area's portion of the Mazatzal Wilderness, threatening continued loss of part or all of the native fishery and wilderness values associated with it. Natural processes in the Wilderness that are linked to native aquatic biota would be adversely affected by the increased dominance of nonnative fishes.

Wilderness values associated with native fish and other aquatic biota would not be restored or enhanced within 2.8 miles of Fossil Creek within the Mazatzal Wilderness and critical habitat for loach minnow and spikedace would not be improved.

Construction activities at the nonwilderness site would not affect the Mazatzal Wilderness. No nonconforming structure would be built in the Wilderness.

Cumulative Effects

Project implementation effects on Wilderness soils and vegetation would be additive to disturbances caused by ongoing livestock grazing. These effects would be confined to temporary contractor use areas and access routes between Stehr Lake and the wilderness job site. There are no other past, present, or reasonably foreseeable projects that would result in nonconforming uses in the Wilderness, and no other projects that would have additive noise or Wilderness recreation effects.

3.7 Soils

3.7.1 Affected Environment

Soils within the project area consist of the following two classifications: Mesic Semiarid soils of the Graham-House Mountain Rock Outcrop association and the Cabezon-Thunderbird-Springville association, and Thermic Semiarid soils of the Lithic Torriorthents-Lithic Haplustolls Rock Outcrop association (Hendricks 1985). Many of these upland soils have a shallow depth to bedrock and are characteristically stony, cobbly, and gravelly loams with large rock fragments. The soils found in the river floodplain, terraces, and fans are well-drained and consist of coarse to fine textured grains with slopes that are nearly level to steep. Soils along streamside portions of the project area are primarily alluvial in nature. Stream channel substrates at the barrier sites

consist mostly of bedrock and boulders of Tertiary Period volcanic origin, with small percentages of cobble, gravel, and fine sediment. Bedrock is chiefly dark-gray basalt and tuff.

Soil conditions vary throughout the project area as a result of long-term grazing pressure and recreation. Livestock grazing on upland slopes has reduced ground cover, destabilized soils, and accelerated runoff and erosion during storm events. Dispersed recreation and grazing activities along 2.5 miles within the middle reach of Fossil Creek have damaged stream banks and sedimentation. The Forest Service has recently restricted or eliminated much of the livestock use adjacent to the stream in the middle reach.

In the future, partial or total removal of the Fossil Springs diversion dam could result from decommissioning of APS facilities. Removal of the dam would temporally increase sediment transport as impounded sediment is eroded by high seasonal flows and floods. Depending on the removal option selected for the dam (partial or full), part or all of the estimated 25,000 cubic yards of impounded sediment would be discharged downstream. FERC is currently analyzing the effects of sediment transport associated with partial or full removal of the dam.

3.7.2 Environmental Consequences

No Action Alternative

No environmental consequences to soils would occur under the No Action alternative.

Proposed Wilderness Alternative

Fish barrier construction would directly affect 0.4 acre of channel substrates consisting of bedrock, boulders, and alluvium. At the barrier, approximately 17 cubic yards of alluvium would be excavated and redeposited as backfill on the upstream side of the structure. The footprint of the completed barrier would occupy an area of approximately 0.01 acre. After construction, a temporary pool would inundate 0.1 acre of bedrock and boulders within the channel immediately upstream of the barrier. Sediment captured by the barrier would quickly displace the pooled water and form a new layer of bedload deposits over existing channel substrates. Deposition of material upstream of the barrier would be accelerated by sediment-laden storm flows and floods.

The Stehr Lake and Wilderness staging areas would affect 0.9 acre of upland soil. Soils at Stehr Lake already are heavily impacted by recreation and vehicle use. Livestock grazing has historically impacted the wilderness terrace site identified for project staging adjacent to stream channel. Total project impact on soils including sedimentation at the barrier is estimated to be 1.4 acres.

Overall, soil impacts from barrier construction and stream renovation would be minor. The trailing and trampling effects from work associated with barrier construction and stream renovation would be limited by the high rock fragment content of soils and solid rock substrates within the stream channel. The small volume of sediment impounded by the barrier would not affect long-term sediment transport and stream balance.

Nonwilderness Alternative

Construction at the alternative site would affect less than 0.1 acre of channel substrates. The footprint of the completed barrier would occupy an area of approximately 0.01 acre. After construction, a temporary pool would inundate approximately 0.1 acre of bedrock, boulders, and cobbles within the channel immediately upstream of the barrier. Alluvium captured by the barrier would eventually displace the pooled water. The contractor staging areas along FR 502 would affect 0.3 acre, most of which consists of bare and compacted soils. The total acreage impacted from barrier construction and operation is estimated to be slightly more than 0.4 acre.

The environmental consequences to soils resulting from barrier operation and stream renovation are similar to those described under the proposed action.

Cumulative Effects

Project impacts on soils and the effects of sedimentation would be minor and occur on very small acreages. These would be additive to ongoing livestock grazing impacts to riparian and upland vegetation and soils, as well as soil disturbance from installation of the Qwest fiber optic line installation, on-going road and trail maintenance activities, and reconstruction of the Mail Trail above Fossil Springs. 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 managing soils, riparian vegetation, and fish and wildlife habitat (FR 68 (115)) and implementation of specific actions associated with the proposed action may affect the same resources.

3.8 Air Quality

3.8.1 Affected Environment

Air quality is determined by the ambient concentrations of pollutants that are known to have detrimental effects. The U.S. Environmental Protection Agency (EPA) has promulgated National Ambient Air Quality Standards for six criteria pollutants: carbon monoxide, nitrogen dioxide, particulate matter (PM_{10}), ozone, sulfur dioxide, and lead. Gila and Yavapai counties are in attainment for all criteria pollutants. Ambient air quality in the project area is considered good.

The EPA has also established classes of air quality. Class I status under Section 162(a) of the Clean Air Act is designated for specified geographic areas where the cleanest and most stringent protection from air quality degradation is considered important. Class I areas include national parks over 6,000 acres and national wilderness areas over 5,000 acres. The Mazatzal Wilderness Area has been designated a Class I airshed. Air quality in the Wilderness is protected under provisions of the State Implementation Plan, which is administered by ADEQ.

The project area is representative of climates associated with high desert in Arizona. Traffic on unpaved forest roads contribute temporary and highly localized increased levels of fugitive dust that can affect portions of the project area and northern wilderness boundary. On a regional scale, periodic high winds can contribute to temporary increases in the levels of atmospheric dust. Pollutants carried from Verde valley communities and the Greater Phoenix Metropolitan Area may also influence air quality.

3.8.2 Environmental Consequences

No Action Alternative

No environmental consequences to air quality would occur under the No Action alternative.

Proposed Wilderness Alternative

During construction, sources of air pollution include fugitive dust from soils destabilized by construction activities, and tailpipe emissions from vehicles. Tailpipe emissions would exist only during active construction.

Dust picked up and dispersed by construction traffic on unpaved roads would increase the concentration of total suspended particulates. These effects would be temporary and confined mostly to areas outside the Class I airshed.

Construction activities within wilderness would result in temporary localized increases in fugitive dust and engine (helicopter) emissions. The effect on Class I air quality would be minor.

Nonwilderness Alternative

The air quality effects would be similar to those described under the proposed action for areas outside the Class I airshed.

Cumulative Effects

Minor and short-term project impacts to air quality would occur, but there are no past, present, or reasonable foreseeable projects anticipated to occur within the same area or during the same time that would result in additive impacts to air quality.

CHAPTER 4 - AGENCIES AND PERSONS CONSULTED

List of Preparers

John McGlothlen, Reclamation, Environmental Biologist
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Peter Pilles, Jr., Coconino National Forest, Forest Archaeologist
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Mark Whitney, Coconino National Forest, Fishery Biologist

List of Agencies and Persons Contacted

Advisory Council on Historic Preservation
Animal Defense League of Arizona
Arizona Department of Environmental Quality
Arizona Department of Health Services (Office of Environmental Health)
Arizona Bass Federation
Arizona Flycasters Club
Arizona Game and Fish Department
Arizona Outdoor News, Payson, AZ
Arizona Public Service Company
American Rivers
Arizona Riparian Council
Arizona State Historic Preservation Office
Arizona State University (Dr. Paul Marsh)
Arizona Wilderness Coalition

Arizona Wildlife Federation
Walt Bouchard, Flagstaff, AZ
Brett Boyer, Claremont, CA
Tom Cain, Elkins, WV
Center for Biological Diversity
Sam Coppersmith, Phoenix, AZ
Desert Fishes Council
Desert Splash Anglers
Don Steuter, Phoenix, AZ
Federal Energy Regulatory Commission
Forest Guardians
Friends of Arizona Rivers
Fund for Animals
Ted Gartner, Chandler, AZ
Gila County Board of Supervisors
Dena Gilbert, Claremont, CA
Grand Canyon Trust
Chris Hartzell, Bakersfield, AZ
Richard E. Henrich Trust
Charles Hoffman, Prescott, AZ
Law Offices of David V. Seyer
Living Rivers
L.L. Decker and Associates
Anita McFarlane, Sedona, AZ
Barbara Miller, Camp Verde, AZ
Steve Monroe, Flagstaff, AZ
Monsoon Warriors
Northern Arizona Flycasters (Richard Brown)
Northern Arizona University (Dr. Jane Marks, Charlie Schlinger, Joseph Shannon)
Northern Audubon Society (Frank Brandt, Herb Henderson)
Old Pueblo Trout Unlimited (Gilbert Castillo)
Joe Patton, Phoenix, AZ
Payson Roundup, Payson, AZ
Pine-Strawberry Archeological and Historical Society
Prescott Bassmasters
Prescott Flycasters
Red Creek Ranch
Scott Reger, Flagstaff, AZ
Jerry and Sally Stefferud, Phoenix, AZ
Rim Country Museum
Rocky Mountain Research Station (John Rinne, Steve Overby)
Salt River Project
Sierra Club (Sandy Bahr)
Sinagua High School (Kathy Flaccus)
Ellen Soles, Flagstaff, AZ
Don Steuter, Phoenix, AZ

Tom Taylor, Mesa, AZ
The Camp Verde Bugle, Camp Verde, AZ
The Nature Conservancy
The Verde Independent, Cottonwood, AZ
U.S. Army Corps of Engineers
University of Arizona (Bonnie Colby)
Jim Walters, Tempe, AZ
Yavapai-Apache Nation (Christopher Coder, Vincent Randall)

CHAPTER 5 - RELATED ENVIRONMENTAL LAWS/DIRECTIVES

The following is a list of Federal laws, Executive Orders, and other directives that apply to the action alternatives discussed in this EA:

National Environmental Policy Act of 1969, as amended (NEPA) - This law requires Federal agencies to evaluate the potential environmental consequences of major Federal actions. An action becomes "federalized" when it is implemented, wholly or partially funded, or requires authorization by a Federal agency. The intent of NEPA is to promote consideration of environmental impacts in the planning and decision-making process prior to project implementation. NEPA also encourages full public disclosure of the proposed action, accompanying alternatives, potential environmental effects, and mitigation.

This EA was prepared in accordance with the requirements of NEPA. Public scoping included listing the action in the Coconino and Tonto National Forest's Schedule of Proposed Actions, and distribution of scoping information to 63 entities on April 25, 2002.

The draft EA was mailed to more than 90 addressees on December 23, 2003, for 30-day public comment. In addition, a public notice was published in the Arizona Republic, and news releases were sent to other news media regarding availability of the draft EA. The draft EA was also available on the Coconino National Forest NEPA website and at specified offices of the Coconino and Tonto National Forests.

Fish and Wildlife Coordination Act of 1934, as amended (FWCA) - The FWCA provides a procedural framework for the consideration of fish and wildlife conservation measures in Federal water resource development projects. Coordination with the FWS and State wildlife management agencies are required on all Federal water development projects.

The proposed project is the result of ESA Section 7(a)(2) consultation between Reclamation and FWS. Coordination among Reclamation, FWS, and AGFD has been ongoing since the project's inception. The FWS concluded that the current level of coordination among the agencies is sufficient to meet any regulatory needs required by the FWCA.

Endangered Species Act of 1973, as amended (ESA) - The ESA provides protection for plants and animals that are currently in danger of extinction (endangered) and those that may become so in the foreseeable future (threatened). Section 7 of this law requires Federal agencies to ensure that their activities do not jeopardize the continued existence of threatened or endangered species or adversely modify designated critical habitat.

Construction of a fish barrier in Fossil Creek is a required measure of the 2001 CAP biological opinion. The possible effects to proposed and listed species and critical habitat resulting from project implementation were examined in a Biological Assessment prepared by Reclamation and submitted to the FWS on October 24, 2002. The biological assessment concluded with a no effect determination.

Migratory Bird Treaty Act of 1918, as amended (MBTA) – The MBTA is the domestic law that implements the United States' commitment to the protection of shared migratory bird resources. The MBTA prohibits the take, possession, import, export, transport, selling or purchase of any migratory bird, their eggs, parts or nests.

Implementation of this project will not violate provisions of the MBTA

Clean Air Act of 1963, as amended (CAA) - The CAA requires that any Federal entity engaged in an activity that may result in the discharge of air pollutants must comply with all applicable air pollution control laws and regulations (Federal, State, or local). It also directs the attainment and maintenance of National Ambient Air Quality Standards (NAAQS) for six different criteria pollutants, including carbon monoxide, ozone, particulate matter, sulfur oxides, oxides of nitrogen, and lead.

Air quality in the project area is in attainment of NAAQS. Short-term construction emissions associated with the proposed action would have localized and minor effects on air quality in the Mazatzal Wilderness Class I airshed. Construction outside the Wilderness would not affect the Class I airshed.

Clean Water Act of 1977, as amended (CWA) - The CWA strives to restore and maintain the chemical, physical, and biological integrity of the nation's waters by controlling discharge of pollutants. The basic means to achieve the goals of the CWA is through a system of water quality standards, discharge limitations, and permits. Section 404 of the CWA identifies conditions under which a permit is required for actions that result in placement of fill or dredged material into waters of the United States. In addition, a 401 water quality certification and 402 National Pollutant Discharge Elimination System (NDPES) permit are required for activities that discharge pollutants to waters of the U.S. The EPA has delegated responsibility to administer water quality certification and NPDES programs in Arizona to ADEQ.

The discharge of dredged and fill material resulting from construction of the barrier requires a CWA Section 404 permit from the COE. Reclamation submitted an application to the COE for 404 permit coverage of all barriers that will be constructed pursuant to the 2001 CAP biological opinion. Reclamation received a 404 permit for these barriers, including the Fossil Creek project, on October 30, 2003. All special conditions of the 404 permit would be implemented.

Reclamation received Section 401 water quality certification of the project from ADEQ on June 24, 2003. Coverage under the Section 402 Arizona Pollutant Discharge Elimination System General Permit for construction activities would be obtained prior to construction.

National Historic Preservation Act of 1966, as amended (NHPA) - Federally-funded undertakings that have the potential to affect historic properties are subject to Section 106 of the NHPA. Under this act, Federal agencies are responsible for the identification, management, and nomination to the National Register of Historic Places of cultural resources that would be affected by Federal actions. Consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Office (SHPO) (or Tribal Historic Preservation Office) is required when a Federal action may affect cultural resources on, or eligible for inclusion on, the National Register.

Cultural resource surveys of the area of potential effect were conducted by Reclamation and the Forest Service in accordance with NHPA Section 106. Consultation with the SHPO regarding affects to historic properties was completed by the Forest Service in 2003. No areas of traditional cultural importance or areas of specific tribal concern are known in the project area based on consultation with Native American Indian groups and Forest research into tribal uses of the Forest. Mitigation for project effects is listed in Section 2.5. The SHPO concurred with a no effect determination on December 10, 2003.

Wild and Scenic Rivers Act of 1968, as amended (WSRA) – The WSRA designated the initial components of a National Wild and Scenic Rivers System, and established a procedure for selecting additional rivers possessing outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values and preserving them in a free-flowing condition. Free-flowing is defined by the WSRA as: ". . . any river or section of a river . . . existing or flowing in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway. The existence, however, of low dams, diversion works, and other minor structures at the time any river is proposed for inclusion in the national wild and scenic river system shall not automatically bar its consideration for such inclusion; Provided, That this shall not be construed to authorize, intend, or encourage future construction of such structures. . . ."

Although Fossil Creek has not been formally proposed for inclusion in the national wild and scenic rivers system, future designation is being considered. Reclamation and the Forest Service believe the project would not preclude wild and scenic river status for Fossil Creek. The proposed fish barrier represents a minor structure that would have minimal and highly localized effects on stream dynamics, but would not substantially impede free flowing characteristics that are essential for wild and scenic river designation.

Wilderness Act of 1964 as amended – This Act is intended to preserve the primeval character of Federal lands designated by Congress as wilderness. The Act defines wilderness as an area of Federal land that "generally appears to have been affected

primarily by the forces of natures, with the imprint of man's work substantially unnoticeable." Operation of motorized vehicles, motorized equipment, aircraft landings, and construction of permanent facilities are prohibited unless authorized by the Secretary of Agriculture or delegated authority. Congress designated the Mazatzal Wilderness as part of the National Wilderness Preservation System on September 3, 1964. The Arizona Wilderness Act of 1984 added land to the Wilderness Area.

In the absence of the proposed action, wilderness values for natural processes and functions would decline as a direct result of the displacement of native fishes by nonnative fishes. Without protection against future incursion and dominance by nonnative species, the opportunity to successfully restore listed native fishes in this portion of the Mazatzal Wilderness would not be achieved. Based on prior precedent, projects involving barriers and piscicide use are accepted activities to protect native fish communities within areas designated under the Wilderness Act. The proposed action would require approval by the Regional Forester, because it would entail chemical treatments, operation of mechanized equipment, and construction of a nonconforming structure in Wilderness.

National Forest Management Act of 1976, as amended (NFMA) – NFMA requires the Forest Service, acting on behalf of the Secretary of Agriculture, to assess forest lands and develop resource management plans based on multiple-use, sustained yield principles for each unit of the National Forest System. The statute also requires the Forest Service to provide for the biological diversity of national forests consistent with overall multiple-use objectives of the planning area and to maintain viable populations in the planning area.

The project is consistent with the NFMA and Forest Service policy to maintain viable populations of native fishes and work toward recovery of federally-listed species.

Resource Conservation and Recovery Act, as amended (RCRA) - RCRA establishes thresholds and protocols for managing and disposing of solid waste. Solid wastes that exhibit the characteristic of hazardous waste, or are listed by regulation as hazardous waste, are subject to strict accumulation, treatment, storage, and disposal controls.

The project is not expected to generate hazardous waste as defined and regulated under RCRA. To minimize the possible impact of hazardous materials (petroleum, oil, and lubricants) used during construction, all equipment would be periodically inspected for leaks. Any significant leaks would be promptly corrected. Nonhazardous solid waste would be disposed of in accordance with State and Federal regulations at an EPA-approved landfill. Spills and disposal of contaminated media would be managed in accordance with State and Federal requirements.

Federal Insecticide, Fungicide, and Rodenticide Act, as amended (FIFRA) – FIFRA requires all persons who apply pesticides classified as restricted use be certified or that they work under the direct supervision of a certified applicator. Aquatic applicators must demonstrate a practical knowledge of the secondary effects that can be caused by improper application rates, incorrect formulations, and faulty application of restricted

pesticides. Applicators must have a practical knowledge concerning potential effects on plants, birds, beneficial insects and other organisms that may be present in aquatic environments.

Piscicides have been used by fisheries managers in National Forests for stream and lake renovation projects since the 1930s. The U.S. Department of Agriculture Policy Regulation 9500-4 provides broad policy direction for fish and wildlife management in National Forests, including use of piscicides. Antimycin A is registered under the product name Fintrol, which is approved for use on Forest Service lands. Application of Antimycin A in Fossil Creek would be under the direction of a certified applicator in accordance with a Forest Service approved Safety Plan. The applicator would be charged with ensuring that all label and safety requirements are are met. Piscicide applications would be consistent with relevant requirements of FIFRA.

Executive Order 11988 (Floodplain Management) - This Presidential directive encourages Federal agencies to avoid, where practicable alternatives exist, the short- and long-term adverse impacts associated with floodplain development. Federal agencies are required to reduce the risk of flood loss, minimize the impacts of floods on human safety, health and welfare, and restore and preserve the natural and beneficial values served by floodplains in carrying out agency responsibility.

The project is necessary for the protection of the existing native fish community and potential recovery of listed species. Because the nature of the project requires minor construction in an active channel, no practicable alternative exists. Floodplain effects would be highly localized and minor.

Executive Order 11990 (Wetlands) - This Order directs Federal agencies, in carrying out their land management responsibilities, to take action that will minimize the destruction, loss, or degradation of wetlands, and take action to preserve and enhance the natural and beneficial values of wetlands.

The project would not affect wetlands.

Executive Order 12898 (Environmental Justice) - This Order directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health and environmental effects of their programs, policies, and activities on minority and low-income populations.

The project area encompasses uninhabited National Forest land and a minor portion of a private inholding. No impact on low income or minority populations as defined by EO 12898 would result.

Indian Trust Assets (ITAs) ITAs are legal interests in assets held in trust by the U.S. Government for Indian tribes or individual Indians. Assets are anything owned that has monetary values. Assets can be real property, physical assets, or intangible property rights. Common examples of ITAs include lands, minerals, water rights, hunting rights, other natural resources, money, or claims.

The project would affect National Forest System land and one private (non-Indian) inholding. No ITAs would be affected.

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APPENDIX A

Distribution of Native and Nonnative Fishes in the Gila River Basin

Table A-1. Historical distributions, known extirpated populations, known occupied streams, and recommended replication sites for federal or state listed fishes of the Gila River basin, excluding trouts. T=threatened, E=endangered, S=State listed, Ex=Extinct, PE=proposed endangered. Parentheticals denote major subdrainage affiliations, question marks denote uncertain status.

Species	Historical Distribution	Known Extirpated Populations	Known Occupied Streams (exclusive of restoration sites)
Cyprinodon arcuatus (Ex) Santa Cruz (Monkey Spring) pupfish	Low elevation streams, springs, cienegas, backwaters, and margins of larger rivers in the Santa Cruz River basin	Santa Cruz River Monkey Spring (Santa Cruz) Sonoita Creek (Santa Cruz)	Species is extinct
Cyprinodon macularius (E) Desert pupfish	Low elevation streams, springs, cienegas, backwaters, and margins of larger rivers in the Gila River basin, including all major subbasins except the Santa Cruz River basin	Agua Fria River Gila River Hassayampa River Salt River San Pedro River Verde River	Gila River basin populations extirpated
Gila elegans (E) Bonytail	Low-intermediate elevation mainstem reaches of the Gila and Salt rivers	Gila River Salt River	Gila River basin populations extirpated
Gila intermedia (PE) Gila chub	Upper reaches of small-middle sized streams of the Gila River basin, including all major subbasins	Agua Fria River (Gila) Queen/Arnett creeks (Gila) San Simon River (Gila) Cave Creek/Seven Springs (Salt) Fish Creek (Salt) San Pedro River Binghampton Pond (San Pedro) Garden Canyon (San Pedro) Turkey Creek (San Pedro) Santa Cruz River Monkey Spring (Santa Cruz) Big Chino Wash (Verde)	Indian Creek (Agua Fria) Larry Creek (Agua Fria) Little Sycamore Creek (Agua Fria) Lousy Canyon (Agua Fria) Silver Creek (Agua Fria) Sycamore Creek (Agua Fria) Bonita Creek (Gila) Eagle/East Eagle Creek (Gila) Mineral Creek/Devil's Canyon (Gila) Turkey Creek, NM (Gila) San Carlos River Blue River (San Carlos) Dix Creek (San Francisco) Harden Cienega (San Francisco) San Pedro River, Mexico Babocomari River (San Pedro) Hot Springs/Bass Canyon (San Pedro) Los Fresnos River, Mexico (San Pedro) O'Donnell Creek (San Pedro) Post/Freeman canyons (San Pedro) Redfield Canyon (San Pedro) Cienega Creek (Santa Cruz) Empire Gulch (Santa Cruz) Mattie Canyon (Santa Cruz) Sabino Canyon (Santa Cruz) Sheehy Spring (Santa Cruz) Red Tank Draw (Verde) Spring Creek (Verde) Walker Creek (Verde) Williamson Valley Wash (Verde)

Species	Historical Distribution	Known Extirpated Populations	Known Occupied Streams (exclusive of restoration sites)
Gila nigra (S) Headwater chub	Middle to headwater reaches of middle-sized tributary streams in the Verde, Tonto, San Carlos, and upper Gila River (NM) subbasins	Beaver Creek (E Fk Gila River) Taylor Creek (E Fk Gila River) Christopher Creek (Tonto) Horton Creek (Tonto) Sharp Creek (Tonto) Rye Creek (Tonto) Dry Beaver Creek (Wet Beaver)	Gila River, upper San Carlos River Ash Creek (San Carlos) Tonto Creek Buzzard Roost (Tonto) Gordon Creek (Tonto) Gunn Creek (Tonto) Haigler Creek (Tonto) Marsh Creek (Tonto) Rock Creek (Tonto) Spring Creek (Tonto) Deadman Creek (Verde) East Verde River (Verde) Fossil Creek (Verde) Webber Creek (Verde) Wet Bottom Creek (Verde)
Gila robusta (S) Roundtail chub	Middle-sized to larger streams of the Gila River basin, including all major subbasins except the Santa Cruz River basin	Boneyard Creek (E Fk Black) Gila River, middle reach (AZ) Salt River, upper reach San Francisco River (Gila) Blue River (San Francisco) San Pedro River N Fk White River (White) ?	Gila River, upper Eagle Creek (Gila) Salt River, lower reach Salt River Project canals Black River (Salt) Canyon Creek (Salt) Carrizzo Creek (Salt) Cedar Creek (Salt) Cherry Creek (Salt) Cibeque Creek (Salt) Corduroy Creek (Salt) Salome Creek (Salt) White River (Salt) ? Aravaipa Creek and tributaries (San Pedro) Verde River Fossil Creek (Verde) Oak Creek (Verde) West Clear Creek (Verde) Wet Beaver Creek (Verde)
Meda fulgida (T) Spikedace	Low-intermediate elevation streams in the Gila River basin, including all major subbasins except the Santa Cruz River basin	Agua Fria River Salt River San Francisco River San Pedro River, US and Mexico	Eagle Creek (Gila) Gila River, Middle Fork Gila River, West Fork Gila River, East Fork Gila River, middle reach (AZ) Mangus Creek (Gila) Aravaipa Creek (San Pedro) Verde River
Plagopterus argentissimus (E) Woundfin	Low elevation streams in the Gila River basin, including all major subbasins except the Santa Cruz River basin	Gila River Salt River Verde River	Gila River basin populations extirpated

Species	Historical Distribution	Known Extirpated Populations	Known Occupied Streams (exclusive of restoration sites)
Poeciliopsis occidentalis (E) Gila topminnow	Low-intermediate elevation streams, springs, cienegas, backwaters, and margins of larger rivers in the Gila River basin, including all major subbasins	Gila River Ash Creek, North Fork (Gila) Salt Creek (Gila) San Simon River (Gila) San Carlos River (Gila) Salt River Tonto Creek (Salt) Frisco Hot Spring (San Francisco) San Pedro River Arivaca Creek (San Pedro) Cocio Wash (Santa Cruz) Potrero Creek (Santa Cruz) Sabino Canyon (Santa Cruz) Sheehy Spring (Santa Cruz) Tanque Verde Creek (Santa Cruz) Verde River Other unnamed waters	Bylas Springs (Gila) Santa Cruz River, upper reach (US and Mexico) Cienega Creek (Santa Cruz) Cottonwood Spring (Santa Cruz) Monkey Spring (Santa Cruz) Sharp Spring (Santa Cruz) Sonita Creek complex (Santa Cruz) Redrock Canyon Fresno Canyon Coal Mine Canyon Sonoita Creek
Ptychocheilus lucius (E) Colorado squawfish	Low-intermediate elevation streams in the Gila River basin, including all major subbasins except the Santa Cruz River basin	Gila River Salt River San Pedro River Verde River	Gila River basin populations extirpated
Tiaroga cobitis (T) Loach minnow	Low-high elevation streams in the Gila River basin, including all major subbasins except the Santa Cruz River basin	Gila River (AZ portion) Salt River San Pedro River, US and Mexico Verde River	Aravaipa Creek and tributaries (San Pedro) Black River, North Fork of East Fork (Salt) Blue River, and tributaries (San Francisco) Eagle Creek (Gila) Gila River, Middle Fork Gila River, West Fork Gila River, East Fork San Francisco River and NM tributaries White River, North Fork (Salt) White River (Salt) White River, East Fork (Salt)
Xyrauchen texanus (E) Razorback sucker	Low-intermediate elevation streams in the Gila River basin, including all major subbasins except the Santa Cruz River basin	Gila River Salt River San Pedro River Verde River	Gila River basin populations extirpated

Table A-2. Partial list of established nonnative fishes in the Gila River basin. Distribution acronyms are W = widespread, L = localized, R = rare. Trend acronyms are E = expanding distribution, S = stable distribution, R = recently introduced, trend uncertain.

Species	Status	
	Distribution	Trend
Fathead minnow, *Pimephales promelas*	W	E
Goldfish, *Carassius auratus*	L	S
Grass carp, *Ctenopharyngodon idella*	L	S
Common carp, *Cyprinus carpio*	W	E
Red shiner, *Cyprinella lutrensis*	W	E
Bigmouth buffalo, *Ictiobus cyprinellus*	L	S
Black buffalo, *Ictiobus niger*	R	
Smallmouth buffalo, *Ictiobus bubalus*	R	
Largemouth bass, *Micropterus salmoides*	W	S
Smallmouth bass, *Micropterus dolomieu*	W	E
Bluegill, *Lepomis macrochirus*	W	E
Redear sunfish, *Lepomis microlophus*	W	S
Green sunfish, *Lepomis cyanellus*	W	E
Black crappie, *Pomoxis nigromaculatus*	W	S
White crappie, *Pomoxis annularis*	L	S
Black bullhead, *Ameiurus melas*	W	E
Yellow bullhead, *Ameiurus natalis*	W	E

Species	Status	
	Distribution	Trend
Flathead catfish, *Pylodictis olivaris*	W	E
Channel catfish, *Ictalurus punctatus*	W	E
Mosquitofish, *Gambusia affinis*	W	E
Sailfin molly, *Poecilia latipinna*	L	S
Guppy, *Lesbistes reticulates*	L	S
Walleye, *Stizostedian vitreum*	L	S
Yellow perch, *Perca flavescens*	R	
Threadfin shad, *Dorosoma petenense*	W	S
African cichlids, *Tilapia* and *Oreochromis* spp.	L	E
Yellow bass, *Morone mississippiensis*	L	S
Striped bass, *Morone saxatilis*	L	E
White bass, *Morone chrysops*	L	E
Northern pike, *Esox lucius*	L	R
Arctic grayling, *Thymallus arcticus*[1]	L	S
Rainbow trout, *Oncorhynchus mykiss*[1]	W	S
Brown trout, *Salmo trutta*	W	S
Brook trout, *Salvelinus fontinalis*	W	S

[1] Routinely stocked.

Table A-3. Distribution of fishes and crayfish among Fossil Creek stream reaches defined according to chemical renovation control points. N = native species, I = introduced species.

Reach	Species
Above Fossil Springs Dam (0.3 mi)	Headwater chub (N) Speckled dace (N) Desert sucker (N) Razorback sucker[1] (N)
Fossil Springs Dam to natural barrier (2.3 mi)	Headwater chub (N) Roundtail chub (N) Longfin dace (N) Speckled dace (N) Desert sucker (N) Green sunfish (I)
Natural barrier to Irving barrier[2] (1.3 mi)	Roundtail chub (N) Speckled dace (N) Desert sucker (N) Green sunfish (I) Northern crayfish (I)
Irving barrier to Sally Mae Wash (3.1 mi)	Roundtail chub (N) Speckled dace (N) Desert sucker (N) Sonora sucker (N) Green sunfish (I) Smallmouth bass (I) Northern crayfish (I)
Sally Mae Wash to Wilderness barrier site (2.8 mi)	Roundtail chub (N) Longfin dace (N) Desert sucker (N) Sonora sucker (N) Smallmouth bass (I) Green sunfish (I) Yellow bullhead (I) Northern crayfish (I)
Wilderness barrier site to mouth (4.5 mi)	Desert sucker (N) Sonora sucker (N) Smallmouth bass (I) Green sunfish (I) Yellow bullhead (I) Flathead catfish (I) Common carp (I) Northern crayfish (I)

[1] Species was stocked in 1988, now likely extirpated
[2] No actual fish records are available from this reach; species list determined by comparison of fish presence in reaches above and below the reach, and visual data

APPENDIX B

Antimycin A

Antimycin A is an organic compound that was isolated from the bacterium *Streptomyces girseus* at University of Wisconsin in 1945 (Leben and Keitt 1948, Dunshee, et al. 1949). The chemical formula of antimycin is $C_{28}H_{40}N_2O_9$ (Rinne and Turner 1991:237), and it inhibits growth of some fungi but does not affect most bacteria. Antimycin was later found be toxic to fish and was patented as a piscicide in 1964. The formulation proposed for use in the Fossil Creek project is Fintrol-Concentrate (liquid form Antimycin A) and Fintrol 15 (Antimycin A coated sand). Fintrol and Fintrol 15 are registered with the Environmental Protection Agency under registration numbers 39096-2 and 8991-6, respectively. Antimycin A is recognized by the Arizona Department of Environmental Quality as acceptable under the conditions of the Arizona Water Quality Standards for Surface Waters. Antimycin A consists of 10 percent antimycin, a surfactant, and acetone.

Degradation of antimycin is by the following pathway (Hussain 1969):

antimycin A1 → blastmycic acid + antimycin lactone → fatty acids

These degradation compounds have very low toxicity for either fish or mammals (Herr et al. 1967). Detoxification of antimycin is accelerated by pH greater than 7.0 and exposure to sunlight (Lee et al. 1971, Marking and Dawson 1972). When exposed to sunlight, antimycin degrades completely in 1.0 to 1.5 hours (Lee et al. 1971). Degradation of antimycin may also be accelerated by warm water temperature, organic material, and water turbulence (Lee et al. 1971). The above-neutral pH and exposure to sunlight of Fossil Creek in the project area would result in relatively rapid and total degradation of antimycin. For this reason, antimycin application stations need to be established at 100 to150 meter (about 330 to 490 feet) intervals to maintain desired toxicity levels.

Antimycin acts at a cellular level to interrupt respiration (Schnick 1974:11). Cellular respiration is the process by which oxygen is used to extract energy from organic acids produced by glycolysis, with carbon dioxide being released as the end product (Kirk 1975:301). Cellular respiration occurs in mitochondria, which are organelles in the cytoplasm of cells (DeRobertis and DeRobertis 1980:14). Antimycin interrupts cellular respiration by inhibiting electron transport between cytochrome *b* and cytochrome *c* in Complex III of the cellular respiratory chain (Potter and Reif 1952, Rieske et al. 1967a, b).

In addition to rapid natural degradation of antimycin, potassium permanganate ($KMnO_4$) is used to neutralize antimycin at the downstream end of each treated segment of stream to prevent the piscicide from remaining active outside the treatment area. Potassium permanganate reduces the half-life of antimycin to 7 to 11 minutes in a laboratory setting. The normal half-life of antimycin in laboratory settings can range from 4.6 hours at pH 9.5 to 310 hours at pH 6.5; therefore, $KMnO_4$ is an excellent neutralizer for antimycin.

Potassium permanganate is a strong oxidizing agent and quickly breaks down to naturally occurring compounds that are not toxic (Archer 2001). However, $KMnO_4$ can be toxic to fish (Tucker and Boyd 1977, Archer 2001). In a laboratory setting, sustained exposure to 2 mg/l $KMnO_4$ was lethal to rainbow trout, but in antimycin-treated stream water $KMnO_4$

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). Monitoring stations consisting of caged live fish would be placed at the downstream limit of the project area to verify detoxification of antimycin and $KMnO_4$.

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APPENDIX C

List of Stream Renovation Projects in the Lower Colorado River Basin

Table C-1. Annotated list of stream renovation projects using antimycin in the lower Colorado River basin, and the Rios Sonoyta and Yaqui drainages in Arizona.

STATE/ COUNTY	STREAM	DATE OF PROJECT	PURPOSE OF PROJECT (primary species targeted for benefit)	NO. OF TREAT-MENTS	DID PROJECT ACHIEVE PURPOSE?	REPORT OF RENOVATION
AZ/Pinal	Arnett Creek	1996	remove nonnative fish for conservation of native fish (longfin dace, desert sucker, Gila topminnow)	1	yes	Bizios 1997
AZ/Apache	Bearwallow Creek	1981 1987	remove nonnative fish for conservation of native fish (Apache trout)	2	1981 yes* 1987 yes	Rinne and Turner 1991 AGFD and USFS unpub. records
AZ/Graham	Bylas Springs complex	1982 1984 1996 1997 2000	remove nonnative fish for native fish conservation (Gila topminnow)	3	1982 no 1984 yes* 1996-2000 yes	Marsh and Minckley 1990 Meffe 1983 Rinne and Turner 1991 Schleusner 2000a Schleusner 2000b
NM/Catron	Dry Creek	1984 1985	remove nonnative fish for conservation of native fish (Gila trout)	2	yes	Propst *et al.* 1992 USFWS 1993
AZ/Apache	Hay Creek	1989	remove nonnative fish for conservation of native fish (Apache trout)	1	yes*	AGFD and USFS unpub records
AZ/Apache, Greenlee	Home Creek	1987	remove nonnative fish for conservation of native fish (Apache trout)	1	yes	Rinne and Turner 1991 AGFD and USFS unpub. data
NM/Catron	Iron Creek	1981	remove nonnative fish for conservation of native fish (Gila trout)	?	no	Propst *et al.* 1992 USFWS 1993 Coman 1981
AZ/Apache	Lee Valley Creek	1982 1987 2002	remove nonnative fish for conservation of native fish (Apache trout)	3	1982 yes* 1987 yes* 2002 not yet known	Rinne and Turner 1991 AGFD and FWS unpub. data

STATE/ COUNTY	STREAM	DATE OF PROJECT	PURPOSE OF PROJECT (primary species targeted for benefit)	NO. OF TREAT-MENTS	DID PROJECT ACHIEVE PURPOSE?	REPORT OF RENOVATION
NM/Catron	Little Creek	1982	remove nonnative fish for conservation of native fish (Gila trout)	?	?	Propst *et al.* 1992 USFWS 1993
NM/Catron, Grant	Mogollon Creek	1987 1988 1989	remove nonnative fish for conservation of native fish (Gila trout)	3	yes	Propst *et al.* 1992 USFWS 1993
AZ/Santa Cruz	O'Donnell Creek	2002	remove nonnative fish for conservation of native fish (Gila chub)	3	yes	H. Blasius, AGFD, pers. comm., July 2002
AZ/Apache	Ord Creek	1977 1978 1980	removal of nonnative fish for conservation of native fish (Apache trout)	2	no (1977, 78,80)	Rinne *et al.* 1981 Minckley and Mihalick 1981 Rinne and Turner 1991
AZ/Pima	Sabino Canyon	1999	remove nonnative fish for conservation of native fish (Gila chub)	2	yes	Hayes 1999
AZ/Greenlee	Snake Creek	2002	remove nonnative fish for conservation of native fish (Apache trout)	1	not yet known	AGFD unpub. records
AZ/Apache	Stinky Creek	1994 2002	remove nonnative fish for conservation of native fish (Apache trout)	2	1994 yes* 2002 not yet known	AGFD and USFS unpub. records
NM/Catron	Trail Canyon	1986 1987	remove nonnative fish for conservation of native fish (Gila trout)	2	yes	Propst *et al.* 1992 USFWS 1993
AZ/Apache	West Fork Black River, including Burro Creek and Thompson Creek	1996	remove nonnative fish for native fish conservation (Apache trout)	1	yes	AGFD and USFS unpub. records
AZ/Cochise	West Turkey Creek	1999	remove nonnative fish for conservation of native fish (Yaqui catfish, longfin dace)	2	yes	Coleman and Minckley 1999

STATE/ COUNTY	STREAM	DATE OF PROJECT	PURPOSE OF PROJECT (primary species targeted for benefit)	NO. OF TREAT-MENTS	DID PROJECT ACHIEVE PURPOSE?	REPORT OF RENOVATION
NM/Catron	White Creek	1991	remove nonnative fish for conservation of native fish (Gila trout)	?	yes	Stefferud *et al.* 1991
AZ/Apache	Wildcat Creek	1988	remove nonnative fish for conservation of native fish (Apache trout)	1	yes	Rinne and Turner 1991 AGFD and USFS unpub. records
NM/Catron	Woodrow Canyon	1987 1988	remove nonnative fish for conservation of native fish (Gila trout)	2	yes	Propst *et al.* 1992 USFWS 1993

* Treatment was apparently successful, but reinvasion occurred, either from adjacent waters or by illegal introduction by humans.

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APPENDIX D

List of Powered Equipment

Helicopter (Wilderness Site only) - Provides transport for construction equipment and supplies, ready-to-pour concrete, and emergency evacuation.

Power Drills (Wilderness and Nonwilderness Sites) - Needed for drilling holes into the bedrock and abutments for the installation of anchor bars. Anchor bar holes need to be about 2 inches in diameter and approximately 3 feet into rock. A drill is essential for this purpose. There are presently no reasonable primitive tools for drilling holes into solid rock. Drilling may also be necessary to split alluvial rocks that are too large to be removed by hand. Air drills would be used, which require an air compressor.

Generator (Wilderness and Nonwilderness Sites) - Needed to supply electricity to the air compressor. The generator would power water pumps and power tools at the non-wilderness site.

Air compressor (Wilderness and Nonwilderness Sites) - This will be used to power drills, and clean and dry rock that will come in contact with the concrete. An air compressor is essential for rock drill operations. Compressors allow rock surfaces to be thoroughly cleaned, thereby producing better rock-concrete bond.

Concrete vibrators (Wilderness and Nonwilderness Sites) - Vibrators eliminate voids in the concrete, thereby obtaining good contact with rebar and anchor bars, and producing a visually appealing surface free of rock pockets. The use of vibrators to consolidate the concrete is very important. In lieu of this equipment, the concrete would be rodded, which is not as effective and will leave rock pockets on the outside.

Power tools (Nonwilderness Site only) - Used primarily for building forms, chipping rock, and mixing anchor bar grout. Power tools will probably consist of circular saws, jig saws, handheld drills and grout mixers, and pneumatic hammers.

Pumps (Wilderness and Nonwilderness Sites) - Pumps will be used to dewater the structure foundations. And, depending on the contractor's approach, may be used for stream diversion. The use of pumps is not absolutely necessary, but is highly desirable from a concrete quality standpoint. Non-powered pumps would be used in the Wilderness Area.

Concrete mixer trucks (8 to 10 cubic yards) - Deliver concrete to road accessible contractor use areas.

Flatbed supply trucks - Deliver material and equipment to road accessible contractor use areas.

Water truck (4000 gallon) - Dust control on public roads.

Contractor's personal use vehicles – Transportation to roadside contractor use areas.

APPENDIX E

Ingestion of Antimycin A

A review of toxicity studies relating to antimycin indicates that vertebrate animals must ingest high dosages before any adverse effect is apparent (Schnick 1974) In laboratory tests, oral LD_{50} values for mammals ranged from 1.0 mg antimycin/kg body weight for lambs to 55 mg antimycin/kg body weight for mice (Herr et al. 1967). Oral LD_{50} is defined as the amount of antimycin administered orally over a specified period of time that causes the death of 50 percent of the group of test animals. For example, if a person weighing 70 kg (154 lbs) consumed 1.5 liters (0.4 gallons) from a stream during treatment, that person would ingest 300 µg of antimycin, or 0.0042 mg antimycin/kg of body weight. A 70 kg person would have to ingest 630 liters (167 gallons) of treated water during the period that antimycin is active in the project area to ingest the amount required to achieve the LD_{50} for the most sensitive mammal tested (Guinea pig, LD_{50} = 1.8 mg antimycin/kg body weight). This translates to a water consumption rate of about 105 liters (28 gallons) per hour during an active treatment period lasting six hours. Similarly, a 363 kg (800 lb) horse would have to ingest about 3,265 liters (863 gallons) of treated water to reach the oral LD_{50} value of 1.8 mg antimycin/kg body weight for Guinea pigs. Again, consumption would have to occur before antimycin degrades (i.e. about a 6-hour period), which translates to a constant consumption rate of 542 liters (144 gallons) of treated water per hour for six hours.

Consumption of antimycin in water was alleged to have caused organ abnormalities and still-birth of two lambs in northern New Mexico in 1998 (Begel 2001). However, no evidence implicating antimycin in the still-birth of the two lambs was produced, and no adverse effects on animals in the surrounding area were reported (AFSFMCS et al. 2001). In addition, Grant and Catron counties in New Mexico contracted with an independent medical microbiologist to review the potential public health hazards of antimycin, and it was determined that antimycin was an effective and safe fish control agent for removal of fishes from streams with no potential for public health issues when applied at recommended concentrations (Brooks and Propst 2001). Vezina (1967) also concluded that antimycin is not hazardous to humans, livestock, and wildlife.

The potential 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 from ingestion of antimycin-killed fish that resulted from stream renovation (Berger et al. 1967, Gilderhus et al. 1969). Vezina (1967) reported that consumption of 2,900 mg (0.1 oz) undiluted antimycin/kg (2.2 lb) body weight was required to cause mortality of 50 percent of test mallard ducks in the laboratory. Similar tests on 4.5 kg (10 lb) domestic dogs required consumption of 5000 mg (0.18 oz) undiluted antimycin/kg (2.2 lb) body weight to cause mortality of 50 percent of the test population. In another laboratory study, trout killed with 10 ppb antimycin contained 76 to 388 ug/kg antimycin in their tissues (Ritter and Strong 1966). Using 20 times the high residual concentration of 388 ug/kg in trout reported by Ritter and Strong (1966) to account for targeted concentrations of 200 ppb antimycin in the proposed project, it would be necessary to ingest 374 kg (824 lbs) and 2,900 kg (6,390 lbs) of dead trout to be lethal to ducks or dogs, respectively. It is doubtful that any treated reach along Fossil Creek would produce

in total these amounts of dead fish. Because of limited available information, however, human consumption of fish killed by antimycin will be discouraged, and signs will be posted along the stream noting this prohibition.

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APPENDIX F

Fossil Creek Riparian Habitat

The riparian habitat along Fossil Creek varies in species composition and density from the upper-most reach on the rim to the confluence with the Verde River. For descriptive purposes, the riparian habitat along Fossil Creek can be divided into five distinct zones (Overby and Agyagos 2000).

Zone 1 comprises the portion of Fossil Creek upstream of Fossil Springs. This zone is characterized by Goodwin (1980) and Burbridge and Story (1974) as having a rocky channel with intermittent flows except for several small pools that are permanent during most years. Riparian trees are sparse and low in diversity with sycamore dominating but generally show good age class diversity. The understory is sparse and comprised of upland species. Zone 1 is outside the project area.

Zone 2 consists of the riparian area from Fossil Springs downstream to the Fossil Springs diversion dam. A key element of this zone is a diverse, well-developed riparian area, approximately 23 acres in size that is associated with Fossil Springs (Goodwin 1980) and is designated as the Fossil Springs Botanical Area in the Coconino Forest Plan and as a Natural Area in the Tonto Forest Plan. The basal area, crown density, and species diversity of the riparian tree species are high with good age class representation (Goodwin 1980, Burbridge and Story 1974, Sayers 1998). Compared to below the diversion dam, Zone 2 has a higher proportion of understory vegetation including grasses, ferns, and shrubs (Sayers 1998). Zone 2 is outside the project area.

Zone 3 consists of the channel between the Fossil Springs diversion dam and Irving Power Plant. Substrate type in Zone 3 shifts to more bedrock, especially where the canyon is narrow and straight walled (Sayers 1988, Goodwin 1980, Medina 1998). Sayers (1998) reports that although there is coarse alluvium where the canyon is wider, overall there is little soil to support understory vegetation. The primary vegetative difference compared to Zone 2 is a change in overstory dominance to Arizona sycamore (Goodwin 1980). This section also shows a change in age class distribution where mature trees represent the majority of the cover type and shrubs species are few to absent (Goodwin 1980, Sayers 1998, and Forest Service 1989). Stream renovation is proposed for Zone 3.

Zone 4 consists of the channel between the Irving Power Plant and the downstream extent of the narrows. Vegetation is quite sparse, except for localized development in association with springs (Goodwin 1980). Substrate consists primarily of bedrock, but small, localized areas with sand bars support cottonwood reproduction (Goodwin 1980). Existing large woody vegetation in this reach likely is supported by groundwater rather than stream flows (Medina 1998). The narrows, which occur below "The Pocket," consist of a narrow canyon with sheer walls and deep pools where little to no stream bank results in limited riparian vegetation (Goodwin 1980). Barrier construction and stream renovation would affect the reach of Zone 4 upstream of the narrows.

Zone 5 encompasses the remaining 3-mile segment of stream to the confluence with the Verde River. The canyon becomes wider and less steep below the narrows (Goodwin 1980, Sullivan and Richardson 1993). The broadening of the flood plain within 0.5 miles of the Fossil Creek/Verde confluence increases the potential for overbank flooding (Sullivan and Richardson 1993). The riparian community is poorly developed and becomes more depauperate and the overstory becomes sparser closer to the Verde River (Goodwin 1980). No activity is proposed in Zone 5.

Understory components (emergent vegetation, herbaceous species and shrubs) are very limited in Fossil Creek in Zones 3, 4, and 5 (APS 1992, Sayers 1998, Medina 1998, Sullivan and Richardson 1993). Tree species diversity is good throughout, but differences in overstory dominant species are found (Goodwin 1980, Sayers 1998), and reflect a riparian community adapted to different regimes (Medina 1998).

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APPENDIX G

Cultural History of the Verde Valley

Paleo-Indian Period

Little archaeological evidence of Paleo-Indian (12,000–8,000 B.C.) use of the Verde Valley has been recorded; however, Pleistocene megafauna, including horse, mastodon, and mammoth, have been found along the Verde (Tagg 1986). Given the recent alluvial deposition in the valley, evidence of Paleo-Indian use of the area is most likely deeply buried.

Archaic–Dry Creek Phase

Evidence of Archaic period (8,000 B.C.–A.D. 1) occupation of the Verde Valley is more abundant. The Dry Creek Site, believed to date to the late Archaic, is located just west of Sedona (Pilles and Stein 1981:608, Shutler 1950). Dry Creek phase sites have been identified along Dry Creek, Spring Creek, Oak Creek, and Coffee Creek; most of them reflect hunting and plant gathering activities. Artifact assemblages include ground stone, scrapers, choppers, knives, and hammer stones. Oval one-hand manos and basin metates, as well as small less formal ground stone implements, are ubiquitous on these late Archaic sites. No Archaic-period structures have been identified.

Squaw Creek Phase

Breternitz (1960) has suggested that shallow pit houses and surface dwellings were first built in the Verde Valley during the Squaw Peak phase (A.D. 1–800). Associated material culture resembles artifacts from San Pedro Cochise and Basketmaker II sites. Ceramics, which appear for the first time in this area at the end of the Squaw Peak phase, include Snaketown and Gila Butte Red-on-buff, Lino Gray, and Lino Black-on-gray. The shift from small basin metates and one-hand manos to larger manos and trough metates near the end of the phase has been attributed to a shift to a more sedentary life style and a greater reliance on agricultural products (Pilles 1981a:8).

Immigration into the region by Hohokam people, may have contributed to dramatic cultural changes that occurred in the Verde Valley around A.D. 700 (Pilles and Stein 1981:8–12). Hohokam Buff Ware and Pimeria Brown Ware ceramics. shell bracelets, clay figurines and stone palettes, as well as Hohokam-style ballcourts, houses, cremation burials, and irrigation technology have been identified. Other studies suggest that the presence of Hohokam material culture should be attributed to intensive trade rather than immigration (Fish and others 1980).

Camp Verde Phase

Many sites dating to the Camp Verde phase (A.D. 800–1125) have been located in the Upper and Middle Verde Valley. These sites are generally thought to have been occupied by the Southern Sinagua, an extension of the Sinagua cultural tradition

identified in the area around Flagstaff. The Southern Sinagua were sedentary farmers of corn, bean, squash, and cotton. Pottery manufactured by the Southern Sinagua was primarily undecorated Alameda Brown Ware, constructed with a paddle and anvil technique.

Two site types have been identified for this period: 1) small sites at elevations between 4,500–5,000 ft and 2) larger sites on the floodplain (Macnider and others 1991:5). The floodplain sites are often very large and include ballcourts, mounds and other public architecture. The early Camp Verde phase is characterized by Kana'a Black-on-white, Santa Cruz Red-on-buff, and Deadmans Black-on-red ceramics.

The late Camp Verde phase (A.D. 1000–1125) is marked by continued Hohokam influence in the Middle Verde Valley including red-on-buff ceramics, shell and stone ornaments, and clay figurines. Larger sites also often include Hohokam style houses, ball courts, cremation burials and adobe-capped mounds (Fish and Fish 1977; Pilles 1976). In the Upper Verde Valley, Hohokam influence seems to have ended by this period. Imported ceramics include mainly Winslow and Kayenta types, while plain wares are almost entirely Alameda Brown Ware (Fish and Fish 1977).

Honanki Phase

The Honanki phase (A.D. 1125–1300) is marked by changes in settlement patterns, architecture, and material culture. Sites dating to the Honanki phase tend to be located at higher elevations than sites from earlier phases and consist of small pueblos and cliff dwellings, pit houses, and contiguous masonry rooms. Hilltop sites, often with thick outer walls, also occur during the Honanki Phase, and some researchers believe them to be defensive sites or forts (Fish and Fish 1977; Wilcox and others 2001). Hohokam ceramics do not appear in assemblages from Honanki-phase sites.

Tuzigoot Phase

During the Tuzigoot phase (A.D. 1300–1425) the previously dispersed population aggregated; as many as 40 pueblos with at least 35 rooms each have been recorded. Tuzigoot, Montezuma Castle, and Hatalacva are the three largest sites attributed to this phase (Jackson and Van Valkenburgh 1954; Spicer and Caywood 1936; Spicer and Caywood 1934). Trade and influence in the Verde Valley seems to be mainly from the Flagstaff, Kayenta, and Winslow areas. Trade wares include Tusayan Black-on-white, Jeddito Black-on-yellow, and later proto-Hopi and Hopi wares. Wilcox (2001:158) has posited a Verde Confederacy, an alliance of large sites that stretched from Perkinsville to Davenport Wash along the Verde River, which was formed to protect the region against potential aggression by inhabitants of Perry Mesa. Wilcox (2001) includes three pueblo sites located along Fossil Creek in the Verde Confederacy. Fossil Creek Ruin (NA 3515) a 26-room, Pueblo IV pueblo, is approximately 20 km south of the project area at the confluence of the Verde River and Fossil Creek. Salome Ruin (NA 19,286), a 29-room defensive site, and Verde 10-12, a 30+ room defensive site, both are upstream from the project area.

Protohistoric Yavapai

Until recently, the Verde Valley was thought to have been abandoned about A.D. 1425, but the Yavapai obviously entered the Verde Valley prior to A.D. 1540 and perhaps as early as 1300. Five protohistoric Yavapai sites have been reported from the Jacks Canyon area near the Village of Oak Creek (Logan and others 1996:1108–1109). Yavapai sites are likely underrepresented in archaeological site inventories, as they difficult to identify. Yavapai material culture was easily transported and mostly perishable. Structures consisted of brush wickiups with rock placed outside the circle of brush; once the superstructure has disintegrated little would remain other than a small cleared area and possibly an arc or circle of rocks. A single course of rock is easily disguised by erosion, alluviation, or trampling by grazing herbivores. Don Keller and Pat Stein (1995) documented a twentieth-century Yavapai wickiup site near Prescott Arizona. Even with archival data, historic photos, and informant consultations, Keller and Stein (1995:4) had trouble distinguishing the structures: Within the study area at least 17 and perhaps as many as 29 individual wickiup shelter locations were seen (Figure 2). Each wickiup location consists of a vague clearing 10 to 15 feet in diameter relatively free of rocks and vegetation. Ill-defined semicircular clusters of stone, or stone alignments acting as retaining walls, are associated with some of the cleared areas.

Agave was a Yavapai staple, and roasting pits were constructed to cook it. Agave was also a staple of the Southern Sinagua, and roasting pits not directly associated with diagnostic artifacts have seldom been the subject of detailed studies that might determine cultural association.

Historic Yavapai and Apache

Historic use of the Middle Verde and Fossil Creek drainages included both Yavapai and Apache groups. Fur trappers observed the Southeastern (Kewevkapaya) and Northeastern (Wipukpaya) Yavapai and Northern Tonto Apache in the Verde Valley (Basso 1983; Khera and Mariella 1983). Both Yavapai and Apache followed a pattern of seasonal encampments located near ripening plant foods, and both groups supplemented their diet with agricultural crops. Agave was a staple for Yavapai and Apache alike, and Fossil Creek was an important food gathering area. Agave was available on the middle slopes around the creek, the mouth of the creek was important for mesquite beans, and the lower portion of the creek was a source of cactus fruit (Aschmann 1963: 24–29, 202–208). Ceramics from this period consist of Tizon Brown Ware, and projectile points are small triangular points referenced as Desert Side-notched (Fish and Fish 1977; Pilles 1981a: 168–170).

In 1871, the Camp Verde Indian Reserve was established along the Verde River near present day Camp Verde; in 1875, the Federal government forcefully moved the Yavapai and Apache people then living in the Verde Valley to San Carlos (Stein 1981:23). The original Camp Verde Indian Reserve was simply eliminated, and Anglo settlers and

miners laid claim to the lands. In the early 1900s, the Yavapai and Apache were allowed to return to the Verde Valley and in 1910, the Camp Verde Reservation was established (Munson 1981).

APPENDIX H

Policies and Guidelines for Fish and Wildlife Management
National Forest and Bureau of Land Management Wilderness

WILDERNESS MANAGEMENT HANDBOOK

Exhibit 1

POLICIES AND GUIDELINES FOR FISH AND WILDLIFE MANAGEMENT IN NATIONAL FOREST AND BUREAU OF LAND MANAGEMENT WILDERNESS (FS BLM & IAFWA--August 1986)

PURPOSE

This statement of policy and the following guidelines are intended to provide guidance to State and Federal personnel for the management of fish and wildlife in wilderness in accordance with the Wilderness Act of 1964 (16 USC 1131-1136). Both State and Federal agencies are responsible for fostering mutual understanding and cooperation in the management of fish and wildlife in wilderness. These guidelines should serve as a framework for cooperation among the Forest Service, Bureau of Land Management, and the States in the coordination of fish and wildlife management and in the development of cooperative agreements or other management plans.

These policies and guidelines were developed within the overall context of the purpose and direction of the Wilderness Act, and they should be made available to all agencies responsible for management of the National Wilderness Preservation System, to appropriate State fish and wildlife agencies, and to other interested parties.

GENERAL POLICY

Fish and wildlife management activities in wilderness will be planned and carried out in conformance with the Wilderness Act's purpose of securing an "enduring resource of wilderness" for the American people. The wilderness resource is defined in section 2(c) of the Act as an area essentially "untrammeled by man," where natural ecological processes operate freely and the area is "affected primarily by the forces of nature." The National Wilderness Preservation System will be managed to ensure that ecological succession, including fire and infestation of insects, operate as freely as possible with only minimum influence by humans.

Fish and wildlife management activities will emphasize the protection of natural processes. Management activities will be guided by the principle of doing only the minimum necessary to manage the area as wilderness.

Exhibit 1--Continued

Section 4(d)(7) of the Wilderness Act stipulates that "Nothing in this Act shall be construed as affecting the jurisdiction or responsibilities of the several States with respect to wildlife and fish in the National Forests." Angling, hunting, and trapping are legitimate wilderness activities, subject to applicable State and Federal laws and regulations.

This nation is fortunate in having a National Wilderness Preservation System encompassing a wide range of ecosystems. Specific on-the-ground conditions will result in slightly different application of these guidelines in so vast a system. These different applications are spelled out in National Forest Plans or wilderness management plans. This is both appropriate and proper, if we are to allow nature to play the dominant role.

1. USE OF MOTORIZED EQUIPMENT

Section 4(c) of the Wilderness Act states:

> Except as specifically provided for in this Act, and subject to existing private rights, there shall be no commercial enterprise and no permanent road within any wilderness area designated by this Act and, except as necessary to meet minimum requirements for this administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area.

The emphasis is on the management of the area as wilderness as opposed to the management of a particular resource. This language is viewed as direction that all management activities within wilderness be done without motor vehicles, motorized equipment, or mechanical transport, unless truly necessary to administer the area or specifically permitted by other provisions in the Act. It means that any such use should be rare and temporary; that no roads can be built; and that wilderness managers must determine such use is the

Exhibit 1--Continued

minimum necessary to accomplish the task. Any use of motorized equipment or mechanical transport requires advance approval by the administering agency.

2. FISH AND WILDLIFE RESEARCH AND MANAGEMENT SURVEYS

Research on fish and wildlife, their habitats, and the recreational users of these resources is a legitimate activity in wilderness when conducted "in a manner compatible with the preservation of the wilderness environment" (Sec. 4(d)(1) of the Wilderness Act). Methods that temporarily infringe on the wilderness environment may be approved if alternative methods or other locations are not available. Research or management surveys must be approved in writing, on a case-by-case basis, by the administering agency.

Helicopters and fixed-wing aircraft overflights may be used to conduct approved fish and wildlife research activities. Aircraft must be used in a manner that minimizes disturbance of other users, including humans and wildlife.

All fish and wildlife studies within and over wilderness must be conducted so as to preserve the natural character of the wilderness. Aerial counts and observations of wildlife may be permissible for management of wilderness wildlife resources. Capturing and marking of animals, radio telemetry, and occasional temporary installations (such as shelters for cameras and scientific apparatus and enclosures and exclosures essential for wildlife research or management surveys) may be permitted, if they are essential to studies that cannot be accomplished elsewhere.

Guidelines

a. Obtain specific written approval or permits from the administering agency before erecting any structure, enclosure, or exclosure.

b. Locate and construct all structures so as to make them unobtrusive on the landscape.

c. Construct structures of native materials or camouflage to make them blend with their natural surroundings.

Exhibit 1--Continued

d. Plan aircraft flights over wilderness to minimize disturbance. Consider time of day, season of the year, route and altitude of flight, and location of landing areas on the perimeter of the wilderness.

e. Research projects underway when a wilderness is designated may continue, but modify research methods to minimize disturbance of the wilderness environment.

f. Installation of permanent base stations within wilderness is not permitted for monitoring of radio-instrumented animals.

g. The administering agency should only approve capture methods that minimize the impact on the wilderness environment.

3. FACILITY DEVELOPMENT AND HABITAT ALTERATION

In rare instances, facility development and habitat alteration may be necessary to alleviate adverse impacts caused by human activities on fish and wildlife. For the benefit of wildlife that spend only part of the year in wilderness, give first priority to locating facilities or habitat alterations outside wilderness.

Flow-maintenance dams, water developments, water diversion devices, ditches and associated structures, and other fish and wildlife habitat developments necessary for fish and wildlife management (which were in existence before wilderness designation) may be permitted to remain in operation.

Clearing of debris that impedes the migratory movements of fish on primary spawning streams may be permitted, but only in a manner compatible with the wilderness resource.

Maintenance of existing water supplies and development of additional water supplies may be permitted, but only when essential to preserve the wilderness resource and to correct unnatural conditions resulting from human influence.

Exhibit 1--Continued

Guidelines

a. Submit proposals for new structures or habitat alterations to the administering agency for approval.

b. Build or maintain new and existing structures permitted for wildlife management in a manner that minimizes the visual impacts on the landscape.

c. Limit clearing of debris from spawning streams to those identified in the wilderness management plan as being critical to the propagation of fish.

d. Use only nonmotorized equipment to clear debris. Use explosives only when the use of hand tools is not practical, and only outside of heavy visitor-use periods.

e. The administering agency and the State agency will jointly make decisions to remove existing water-related improvements.

f. If it is necessary to restore essential food plants after human disturbance, use only indigenous plant species.

4. THREATENED AND ENDANGERED SPECIES

Many wilderness areas provide important habitat for Federally listed threatened and endangered species of wildlife. Actions necessary to protect or recover threatened or endangered species, including habitat manipulation and special protection measures, may be implemented in wilderness. But such actions must be necessary for the perpetuation or recovery of the species and it must be demonstrated that the actions cannot be done more effectively outside wilderness. Use only the minimum actions necessary and the methods most appropriate in wilderness.

Guidelines

a. Manage wilderness to protect known populations of Federally listed threatened or endangered species

Exhibit 1--Continued

where necessary for their perpetuation and to aid in their recovery in previously occupied habitat.

b. When alternative areas outside of wilderness offer equal or better opportunities for habitat improvement or species protection, take actions to recover threatened or endangered species outside of wilderness first.

c. Threatened and endangered species may be transplanted into previously occupied habitat within wilderness.

d. All transplants or habitat improvement projects require approval by the administering agency.

e. To prevent Federal listing, protect indigenous species that could become threatened or endangered or are listed as threatened or endangered by States.

5. ANGLING, HUNTING, AND TRAPPING

Angling, hunting, and trapping are legitimate wilderness activities subject to applicable State and Federal laws and regulations.

6. POPULATION SAMPLING

Scientific sampling of fish and wildlife populations is an essential procedure in the protection of natural populations in wilderness.

Guidelines

a. Use only methods that are compatible with the wilderness environment.

b. Gill netting, battery-operated electrofishing, and other standard techniques of population sampling may be used.

c. Closely coordinate sampling activities with the administering agency and schedule them to avoid heavy public-use periods.

Exhibit 1--Continued

7. CHEMICAL TREATMENT

Chemical treatment may be necessary to prepare waters for the reestablishment of indigenous species, to protect or recover Federally listed threatened or endangered species, or to correct undesirable conditions resulting from the influence of man. Species of fish traditionally stocked before wilderness designation may be considered indigenous if the species is likely to survive. Undesirable conditions and affected species shall be identified in wilderness plans.

Guidelines

a. Use only registered pesticides according to label directions.

b. In selecting pesticides, give preference to those that will have the least impact on non-target species and on the wilderness environment.

c. Schedule chemical treatments during periods of low human use, insofar as possible.

d. Immediately dispose of fish removed in a manner agreed to by the administering agency and the State agency.

8. SPAWN TAKING

The collection of fish spawn shall be permitted from wilderness when alternative sources are unavailable or unreliable, or where spawn taking was an established practice before wilderness designation.

Guidelines

a. Do not use motorized equipment to assist in collecting and removing spawn.

b. Use of techniques and facilities necessary to take spawn, which were in existence before wilderness designation, may continue as provided for in the wilderness management plan.

Exhibit 1--Continued

c. Facilities for spawn-taking stations approved after wilderness designation must be removed after the termination of each season's operation.

d. Decisions to prohibit spawn taking, where it was an established practice before wilderness designation, will be made jointly by the administering agency and the State agency.

9. FISH STOCKING

Fish stocking may be conducted by the State agency in coordination with the administering agency, using means appropriate for wilderness, when either of the following criteria is met: (a) to reestablish or maintain an indigenous species adversely affected by human influence; or (b) to perpetuate or recover a threatened or endangered species.

Selection of species for stocking will be determined jointly by the administering agency and the State agency. Exotic species of fish shall not be stocked. The order of preference for stocking fish species is (a) Federally listed threatened or endangered indigenous species, (b) indigenous species. Species of fish traditionally stocked before wilderness designation may be considered indigenous if the species is likely to survive. Numbers and size of fish and time of stocking will be determined by the State agency.

Barren lakes and streams may be considered for stocking, if there is mutual agreement that no appreciable loss of scientific values or adverse effects on wilderness resources will occur.

Guidelines

a. The State agency shall make fish stocking schedules available to the administering agency, indicating what species and numbers are planned for each water within a wilderness.

b. Adjust stocking rates to minimize the likelihood of exceeding the carrying capacity of the water being stocked so as to reduce the chance of producing a

Exhibit 1--Continued

population imbalance and to minimize the likelihood of attracting overuse detrimental to the wilderness resource.

10. AERIAL FISH STOCKING

Aerial stocking of fish shall be permitted for those waters in wilderness where this was an established practice before wilderness designation or where other practical means are not available. Aerial stocking requires approval by the administering agency.

Guidelines

a. As justification for aerial stocking, the State agency will supply the administering agency a list of those waters where stocking with aircraft was an established practice before wilderness designation, indicating the type of aircraft used (fixed-wing or helicopter). This justification will become a part of the wilderness management plan.

b. To stock waters that had not been aerially stocked before wilderness designation, the State agency will demonstrate to the administering agency the need for using aircraft.

c. Plan aircraft flights over wilderness to minimize disturbance. Consider season of year, time of day, route and altitude of flight, and location of landing areas on the perimeter of the wilderness.

11. TRANSPLANTING WILDLIFE

Transplants (removal, reintroduction, or supplemental introduction) of terrestrial wildlife species in wilderness may be permitted if necessary: (a) to perpetuate or recover a threatened or endangered species; or (b) to restore the population of an indigenous species eliminated or reduced by human influence.

Transplants shall be made in a manner compatible with the wilderness character of the area. Transplant projects,

Exhibit 1--Continued

including follow-up monitoring, require advance written approval by the administering agency.

Guidelines

a. Motorized methods and temporary holding and handling facilities may be permitted if they are the minimum necessary to accomplish an approved transplant.

12. WILDLIFE DAMAGE CONTROL

Wildlife damage control in wilderness may be necessary to protect Federally listed threatened or endangered species, to prevent transmission of diseases or parasites affecting other wildlife and humans, or to prevent serious losses of domestic livestock. Control of nonindigenous species also may be necessary to reduce conflicts with indigenous species, particularly if the latter species are threatened or endangered.

Guidelines

a. Acceptable control measures include lethal and nonlethal methods, depending upon need, justification, location, conditions, efficiency and applicability of State and Federal laws.

b. Control measures will be implemented by the Animal and Plant Health Inspection Service, the administering agency, the State fish and wildlife agency, or other approved State agency, pursuant to cooperative agreements or memoranda of understanding. Wildlife damage control must be approved by the administering agency on a case-by-case basis.

c. Direct control at individual animals causing the problem.

d. Use only the minimum amount of control necessary to solve the problem.

Exhibit 1--Continued

e. Use pesticides only where other measures are impractical. Use only registered pesticides according to label directions and subject to the following restrictions:

1) Pesticides may be applied only by certified pesticide applicators.

2) The placement of pesticides shall be accurately indicated on the largest scale USGS map available.

3) Place warning signs at the entrance to the area where pesticides are being used to warn the public of any dangers to themselves or their pets.

4) In the selection of pesticides, give preference to those that will have the least impact on non-target species and on the wilderness environment.

13. VISITOR MANAGEMENT TO PROTECT WILDERNESS WILDLIFE RESOURCES

Many wildlife species are sensitive to human encroachments on their ranges. Grizzly bear, bighorn sheep, elk, mountain goat, birds of prey (such as peregrine falcon and bald eagle), other migratory and resident birds, and certain other wilderness wildlife species cannot tolerate excessive human disturbance, particularly during certain seasons of the year.

When necessary to reduce human disturbance to a wildlife species, the administering agency, in coordination with the State agency, may take direct or indirect management actions to control visitor use.

Guidelines

a. Specify in the wilderness management plan the management actions necessary and the agency responsible to reduce conflicts with wildlife.

b. If and when it becomes apparent that public use is significantly degrading the wilderness wildlife resources, limitations on visitor use may be imposed

Exhibit 1--Continued

and enforced by the appropriate agency. Any limitations will be applied equitably to all wilderness visitors.

14. MANAGEMENT OF FIRE

The objectives of fire management in wilderness are to: (a) permit lightning-caused fires to play, as nearly as possible, their natural ecological role within wilderness and (b) reduce, to an acceptable level, the risks and consequences of ~~wildfire~~ within wilderness or escaping from wilderness. Fire ignited by lightning will be permitted to burn or will be suppressed as prescribed in an approved plan. Prescribed fires ignited by man may be permitted to reduce unnatural buildup of fuels only if necessary to meet objectives (a) and (b) above. Although additional benefits may result from man-ignited prescribed fire, vegetative manipulation will not be used to justify such fires.

APPENDIX I

Minimum Tools Analysis

Native Fish Restoration in Fossil Creek

Minimum Tools Analysis for Wilderness Alternative

9/16/03, Modified 11/17/03

ALTERNATIVE A – Allow use of Motorized Equipment and Mechanical Transport.

Project Description: Construct a single reinforced concrete fish barrier in Fossil Creek at a location approximately 4.5 miles upstream of the confluence of the Verde River, and renovating the stream above the barrier with the piscicide antimycin A. The barrier would be created by placing steel reinforced concrete plugs into three 5' to 9' wide by 2' to 9' tall notches in river channel bedrock. A small concrete apron would be placed in the river channel below each filled slot. A gabion structure would be built on a side channel in a six foot space between two 20 foot diameter boulders. The gabion structure would be 4' x 6' x 3' in size.

Uses associated with Alternative A:

- Use of temporary road? No
- Use of motor vehicles? Yes
  - A. Materials, equipment, camping gear, and sanitation facilities would be flown in by helicopter and long-lined to the staging area near the project site. These items would be transported to the site in a day or less, and removed from the site in a day or less. The sanitation facilities would require servicing during construction, which would be done at the same time that crew transportation is done.
  - B. Concrete would be flown in and poured directly into temporary formwork at each of the three slots. The concrete would be poured in two phases – the first phase to fill two slots, and the second phase to fill the remaining slot. The estimated time for transporting and pouring the concrete would be two days.
  - C. People would be transported to the site by helicopter. This would involve flights at the beginning and end of each workweek.
  - D. A helicopter would be used to transport 55 gallon drums containing captured fish from Fossil Creek to Irving. This could be accomplished in 2 days.
  - E. Total days of flying would be 10 to 12.
- Use of motorized equipment? Yes. Use of generators, air compressors, jackleg drills, dewatering pumps, concrete vibrators, and power saws (including chainsaws). Any of these tools could be in use any day during construction.
- Use of motorboats? No
- Landing of airplanes? No
- Landing of helicopters? Yes.
- Use of mechanical transport? No
- Creating a structure or installation? Yes. The main structure would be concrete and would be colored and textured to blend with the surrounding rock. A gabion structure would be built on a side channel. This structure would be covered with natural rocks to make it more natural appearing. Rock collected for filling the gabions would be collected from within the main or side channel, or brought in

from outside the Wilderness. If the rocks are brought in, they must be similar in appearance to the natural rocks. This is a non-conforming use requiring Regional Forester approval.

- Other impacts to wilderness character?
  A. A crew camp would be placed near the job site, with up to 10 people in residence. The crew would need to be informed of, and practice, minimum impact camping techniques including not digging around tents, not damaging trees, etc. A Forest Service project monitor would ensure this requirement is met. Campfires would be allowed only with wood brought from outside the Wilderness. Fires would be built on a surface that would eliminate impacts to the ground and ashes would be removed from the campsite and properly disposed of. Cultural sites would be flagged for avoidance. Sanitation facilities would be required.
  B. Clearing of vegetation for a helicopter landing spot would be required.
  C. Piscicides would be used for removal of non-native fish.

Environmental Effects associated with Alternative A:

Biophysical:
Brush would need to be cleared to create a helispot. There would be a short term trampling impact to soils and vegetation from on the ground activities at the camp, staging area, and at the job site. Some disturbance would occur to terrestrial wildlife that normally moves through the area from the occupancy of the camp, staging area and job site.

Social and Recreation:
The fish barrier would be a non-natural permanent human made structure within the Wilderness. With full flows returned to Fossil Creek, it would not be visible to the casual observer. Ten to twelve days of helicopter flights, and month long noise from motorized equipment at the job site, would be intrusive noise to people expecting to hear predominantly natural quiet within the Wilderness. The number of people impacted by the noise would be low since use in this part of the Wilderness is low. People recreating at Stehr Lake would likely hear the noise at the job site, leading some of them to investigate the noise at the project site. Helicopters would exceed the FAA cruising level of 2000 feet above ground level.

Construction of a permanent human made structure, use of piscicides, and use of motorized equipment in the Wilderness are non-conforming uses requiring Regional Forester approval.

Timing:
The motorized alternative would complete the project more quickly than Alternative B, thus having less impact on the Wilderness resource in terms of duration.

Heritage Resources:
There is a potential impact to the archeological sites. This includes trampling and moving artifacts. However, the draft cultural resources survey (6/25/03) concludes that the project would have no adverse effects to cultural resources. Additionally, if all mitigation recommendations are followed, there should be No Effect to cultural resources (8/18/03 letter from P. Pilles to J. Czaplicki, BOR). Helicopter landings to drop off passengers would cause more damage to the sites than with long lining. An archeologist approved by the Forest Service would monitor the project.

ALTERNATIVE B – No use of motorized equipment or mechanical transport.

Project Description: Construct a single reinforced concrete fish barrier in Fossil Creek at a location approximately 4.5 miles upstream of the confluence of the Verde River, and renovating the stream above the barrier with the piscicide antimycin A. The barrier would be created by placing steel reinforced concrete plugs into three 5' to 9' wide by 2' to 9' tall notches in river channel bedrock. A small concrete apron would be placed in the river channel below each filled slot. A gabion structure would be built on a side channel in a six foot space between two 20 foot diameter boulders. The gabion structure would be 4' x 6' x 3' in size.

Uses associated with Alternative B:

- Use of temporary road or trail? Yes. Mules would haul in equipment, tools, materials, concrete, and aggregate. A trail would have to be constructed to accommodate the mule traffic. The trail would be at a location least likely to be used in the future, and would require rehabilitation after the project is completed. An alternative to the Stehr Lake access point would be Ike's Backbone Road (502C). The trail location would be flagged on the ground with the Forest Service to minimize impacts to Wilderness, archeological, soils, and native fish resources. If hay is used for mule feed, it must be weed free.
- Use of motor vehicles? No.
- Use of motorized equipment? No. Rock drilling would be accomplished by double jacking. This involves one person holding the drill in place on the rock and a second person driving the rock drill by hitting it with a sledgehammer sized implement. Concrete would be mixed and poured by hand. It may not be feasible to drill the holes by the double jack method. A manual pump would be used for dewatering the creek. Power saws would be replaced by handsaws. The remaining tools would be hand tools. Fish would be removed from and returned to Fossil Creek by foot, and transported in backpacks.
- Use of motorboats? No
- Landing of airplanes? No
- Landing of helicopters? No, except in the case of emergencies. Authority for approving emergency landings rests with Forest Supervisor on the Tonto National Forest, and the District Ranger on the Coconino NF.
- Use of mechanical transport? No
- Creating a structure or installation? Yes. The main structure would be concrete and would be colored and textured to blend with the surrounding rock. A gabion

structure would be built on a side channel. This structure would be covered with natural rocks to make it more natural appearing. Rock collected for filling the gabions would be collected from within the main or side channel, or brought in from outside the Wilderness. If the rocks are brought in, they must be similar in appearance to the natural rocks. This is a non-conforming use requiring Regional Forester approval.

- Other impacts to wilderness character?
    A. A crew camp would be placed near the job site, with up to 10 people in residence. The crew would need to be informed of, and practice, minimum impact camping techniques including not digging around tents, not damaging trees, etc. A Forest Service project monitor would ensure this requirement is met. Campfires would be allowed only with wood brought from outside the Wilderness. Fires would be built on a surface that would eliminate impacts to the ground and ashes would be removed from the campsite and properly disposed of. Cultural sites would be flagged for avoidance. Sanitation facilities would be required.
    B. Clearing of vegetation for a helicopter landing spot would be required.
    C. Piscicides would be used for removal of non-native fish.

Environmental Effects associated with Alternative B:

Biophysical:
Presence of a trail would lead to increased visitation from the public at the job site. This is a concern because of increased Wilderness visitation and potential impacts to cultural resources. It would be more difficult to obliterate a constructed trail than to obliterate a trail created by use (Alternative C). Noxious weeds may be spread through seeds contained in mule droppings. The trail would result in increased soil erosion.

Because the project would be constructed through primitive means, the duration of the project would be longer. This would result in more soil compaction and increased trampling at the camp, staging area, and job site, in comparison with Alternative A or C. Disturbance to terrestrial wildlife would be greater than A or C because of the lengthened project duration.

Brush would need to be cleared to create a helispot at the staging area.

Social and Recreation:
The fish barrier would be a non-natural permanent human made structure within the Wilderness. With full flows returned to Fossil Creek, it would not be visible to the casual observer.

Noise generated by this alternative is not from motorized equipment.

The sense of impact to visitors from project implementation would be of longer duration.

Health and Safety:
The operation of a double jack drill is hazardous.

Timing:
Project implementation time would approximately triple.

Heritage Resources:
There is a potential impact to the archeological sites. This includes trampling and moving artifacts. However, the draft cultural resources survey (6/25/03) concludes that the project would have no adverse effects to cultural resources. Additionally, if all mitigation recommendations are followed, there should be No Effect to cultural resources (8/18/03 letter from P. Pilles to J. Czaplicki, BOR). Impacts under this alternative would be greater than with Alternatives A or C because of the lengthened duration of the project. An archeologist approved by the Forest Service would monitor the project.

ALTERNATIVE C – Wilderness Preferred Alternative

Project Description: Construct a single reinforced concrete fish barrier in Fossil Creek at a location approximately 4.5 miles upstream of the confluence of the Verde River, and renovating the stream above the barrier with the piscicide antimycin A. The barrier would be created by placing steel reinforced concrete plugs into three 5' to 9' wide by 2' to 9' tall notches in river channel bedrock. A small concrete apron would be placed in the river channel below each filled slot. A gabion structure would be built on a side channel in a six foot space between two 20 foot diameter boulders. The gabion structure would be 4' x 6' x 3' in size.

Uses associated with Alternative C:

- Use of temporary road or trail? Yes. The trail would be flagged on the ground with the Forest Service to minimize impacts to the Wilderness, archeological, soils, and native fish resources. The trail would not be constructed, but would be created by use. The trail would be at a location least likely to be used in the future, and would require rehabilitation after the project is completed. An alternative to the Stehr Lake access point would be Ike's Backbone Road (502C).
- Use of motor vehicles? Yes.
  A. Materials, equipment, camping gear, and sanitation facilities would be flown in by helicopter and long-lined to the staging area near the project site. These items would be transported to the site in a day or less, and removed from the site in a day or less. The sanitation facilities would require servicing during construction, which would be done weekly.
  B. Concrete would be flown in and poured directly into temporary formwork at each of the three slots. The concrete would be poured in two phases – the first phase to fill two slots, and the second phase to fill the remaining slot. The estimated time for transporting and pouring the concrete would be two days.
  C. A helicopter would be used to transport 55 gallon drums containing captured fish from Fossil Creek to Irving. This could be accomplished in 2 days.
  D. Total days of flying would be 7 to 9.

E. Use of helicopters would be allowed on weekdays only.

- Use of motorized equipment? Yes. The following equipment would be allowed: generator, compressor, drill, and concrete vibrator (if absolutely necessary). The generator, compressor, and drill would only be used for drilling the holes in the rock. No other power tools would be allowed. Use of motorized equipment would only be allowed on weekdays.
- Use of motorboats? No
- Landing of airplanes? No
- Landing of helicopters? Yes. Contact with the ground through long-line delivery is considered a landing. Landing of the aircraft itself would only occur in emergency situations.
- Use of mechanical transport? No
- Creating a structure or installation? Yes. The main structure would be concrete and would be colored and textured to blend with the surrounding rock. A gabion structure would be built on a side channel. This structure would be covered with natural rocks to make it more natural appearing. Rock collected for filling the gabions would be collected from within the main or side channel, or brought in from outside the Wilderness. If the rocks are brought in, they must be similar in appearance to the natural rocks.
- Other impacts to wilderness character?
    A. A crew camp would be placed near the job site, with up to 10 people in residence. The crew would need to be informed of, and practice, minimum impact camping techniques including not digging around tents, not damaging trees, etc. A Forest Service project monitor would ensure this requirement is met. Campfires would be allowed only with wood brought from outside the Wilderness. Fires would be built on a surface that would eliminate impacts to the ground and ashes would be removed from the campsite and properly disposed of. Cultural sites would be flagged for avoidance. Sanitation facilities would be required. Use of the camp and job site would be limited to Monday through Friday.
    B. Clearing of vegetation for a helicopter landing spot would be required.
    C. Piscicides would be used for removal of non-native fish.

Environmental Effects associated with Alternative C:

Biophysical:

Presence of a trail could lead to increased visitation from the public at the job site. Access from the 502C road would make the temporary trail less noticeable to the public; alternately, a trail originating from Stehr Lake could be disguised to some degree to make it less obvious as a take off point to the public. This is a concern because of increased Wilderness visitation and potential impacts to cultural resources. It would be less difficult to obliterate a user made trail than to obliterate a constructed trail (Alternative B). Use of the trail during the month-long construction phase could result in increased soil erosion.

There would be a short term trampling impact to soils and vegetation from on the ground activities at the camp, staging area, and at the job site. Some disturbance would occur to terrestrial wildlife that normally moves through the area from the occupancy of the camp, staging area and job site.

Brush would need to be cleared to create a helispot at the staging area.

Social and Recreation:
The fish barrier would be a nonnatural permanent human made structure within the Wilderness. This is a non-conforming use requiring Regional Forester approval. With full flows returned to Fossil Creek, it would not be visible to the casual observer. Seven to nine days of helicopter flights, and approximately 5 days from motorized equipment, would be intrusive noise to people expecting to hear predominantly natural quiet within the Wilderness. Weekday use only would minimize some of that impact. The number of people impacted by the noise would be low since use in this part of the Wilderness is low. People recreating at Stehr Lake would likely hear the noise at the job site, leading some of them to investigate the noise at the project site.

Use of piscicides in the Wilderness is a non-conforming use requiring Regional Forester approval.

Helicopters would exceed the FAA cruising level of 2000 feet above ground level.

Timing:
This alternative would complete the project more quickly than Alternative B, but would take slightly more time than Alternative A.

Heritage Resources: There is a potential impact to the archeological sites. This includes trampling and moving artifacts. However, the draft cultural resources survey (6/25/03) concludes that the project would have no adverse effects to cultural resources. Additionally, if all mitigation recommendations are followed, there should be No Effect to cultural resources (8/18/03 letter from P. Pilles to J. Czaplicki, BOR). An archeologist approved by the Forest Service would monitor the project.

APPENDIX J

Review of Law, Regulations, and Policy Affecting Decision for Proposed Native Fish Restoration Activities and Structures on Fossil Creek in the Mazatzal Wilderness

Review of Law, Regulations, and Policy Affecting Decision for Proposed Native Fish Restoration Activities and Structures on Fossil Creek within the Mazatzal Wilderness
11/12/03

Summary

The proposed structure would be a nonconforming wilderness use. It would be consistent with law and policy to build the proposed structure in wilderness if it is determined to be necessary to meet minimum requirements for administration of the area as wilderness, and if the results of the project inside wilderness would be superior to the results gained outside of wilderness. If the decision is to build the structure within wilderness, the second analysis required is which tool or method should be used to complete the project that results in the least impact to the physical resource or wilderness values.

To answer the question of whether it is necessary to meet minimum requirements for wilderness administration, review the sections below that refer to FSM 2320.2, FSM 2323.3 the 1986 MOU for Policies and Guidelines for Fish and Wildlife Management in National Forest and Bureau of Land Management Wilderness, and the relevant sections of the Mazatzal Wilderness Plan.

To answer the question of whether the location within the wilderness is superior to the location outside of wilderness, see the "Fisheries Benefits Determination for Fossil Creek" prepared by Amy Unthank.

To answer the question about the minimum tools needed to implement the wilderness alternative, see the "Minimum Tools Analysis" prepared by the Wilderness Team.

Review of Relevant Sections of Wilderness Law and Policy

Law and policy concerning management of wildlife and fish within wilderness areas relevant to the proposed action (referred to hereafter as the PA) are defined in the Wilderness Act of 1964, 36 CFR 293.6, FSM 2323, FSM 2326, the 1986 MOU for Policies and Guidelines for Fish and Wildlife Management in National Forest and Bureau of Land Management Wilderness, and the Mazatzal Wilderness Management Plan.

The following cites sections of these documents, followed by a discussion, as needed.

Wilderness Act

Sec. 2 (c) "A wilderness...is hereby recognized as an area where the earth and its community of life are untrammeled by man...an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvement or human

habitation, which is protected and managed so as to preserve its natural conditions, and which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable...."

Sec. 4. (c) "... except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area."

Sec. 4 (d)(4) "...the President may...authorize...other facilities needed in the public interest...."

Regulations

36 CFR 293.6 (c) The Chief, Forest Service, may authorize ... motorized equipment, mechanical transport, aircraft, ..., or structures ... to meet the minimum requirements for authorized activities to protect and administer the Wilderness and its resources....

Forest Service Manual Policy

Decision Authorities

FSM 2326.04b – The Regional Forester is responsible for approving:...Transport and supply by aircraft...Hand portable motorized equipment...FSM 2326.1, 5. To meet minimum needs for protection and administration of the area as wilderness, only as follows: a. A delivery of application problem necessary to meet wilderness objectives cannot be resolved within reason through the use of nonmotorized methods, or b. An essential activity is impossible to accomplish by nonmotorized means because of such factors as time or season limitations, safety, or other material restrictions.

Discussion: The Regional Forester may approve use of aircraft and hand-portable motorized equipment to meet minimum needs for protection and administration of the area as wilderness.

FSM 2323.04c – Regional Forester is responsible for...approving fish control projects...approving control measures for predators or problem fish and wildlife species... approving the use of pesticides within wilderness.

FSM 2320.2 - Objectives

1. Maintain and perpetuate the enduring resource of wilderness as one of the multiple uses of National Forest System land.

2. Maintain wilderness in such a manner that ecosystems are unaffected by human manipulation and influences so that plants and animals develop and respond to natural forces.
3. Minimize the impact of those kinds of uses and activities generally prohibited by the Wilderness Act, but specifically excepted by the Act or subsequent legislation.
4. Protect and perpetuate wilderness character and public values including, but not limited to, opportunities for scientific study, education, solitude, physical and mental challenge and stimulation, inspiration, and primitive recreation experiences.
5. Gather information and carry out research in a manner compatible with preserving the wilderness environment to increase understanding of wilderness ecology, wilderness uses, management opportunities, and visitor behavior.

FSM 2323.3 Management of Wildlife and Fish

FSM 2323.31 - Objectives

FSM 2323.31(1) – Provide an environment where the forces of natural selection and survival rather than human actions determine which and what numbers of wildlife species will exist.

Discussion: A central question regarding the PA is whether it would "provide an environment where the forces of natural selection and survival rather than human actions determine which and what numbers of wildlife species will exist". The PA clearly defines several "human actions" that "determine which and what numbers of wildlife species will exist" (Fossil Creek Fish Restoration Project PA); however, the "forces of natural selection and survival" have obviously been heavily altered within the Fossil Creek watershed to the extent that T&E and indigenous species have likely been extirpated both before and following Wilderness designation (Fossil Creek EA Draft). Other indigenous species are still present, but are being adversely impacted by the human action of introduction of species that are not indigenous to the Southwest. The question then is whether to attempt remedy of past "human actions" that have affected "the forces of natural selection and survival", or to ignore those past affects and allow the "forces" to begin their selection and survival functions with the presence of species alien to the ecology of the area that have come to dominate much of the stream system. (Reference Mazatzal WMP for language addressing alien species).

FSM 2323.31(2) – Consistent with objective 1, protect wildlife and fish indigenous to the area from human caused conditions that could lead to Federal listing as threatened or endangered.

Discussion: PA implementation using the Wilderness barrier site would "protect....fish indigenous to the area from human caused conditions that could lead to Federal listing as threatened or endangered". Note: the project is designed to benefit native fish currently present in the system below Fossil Springs dam, as well as species that have likely been extirpated from the creek." At present nonindigenous species occur throughout Fossil Creek, except for approximately ¼ mile above Fossil Springs dam, which will likely be

partially or completely removed with the decommissioning of the Childs-Irving hydroelectric project. Because the indigenous species remaining in Fossil Creek are being adversely affected, there is concern about declining population trends that could lead to species' being listed under the Endangered Species list. Roundtail chub, for instance, occupy only 18% of their historic range in the Colorado River Basin, and are identified as sensitive species or species of concern by the Forest Service (Southwestern Region), Arizona Game and Fish Department, and U.S. Fish and Wildlife Service. As of April, 2003, the roundtail chub has been petitioned to be listed under the ESA.
FSM 2323.31(3) – Provide protection for known populations and aid recovery in areas of previous habitation, of federally listed threatened or endangered species and their habitats.

Discussion: The PA would not "provide protection for known populations" of T&E species since none exist presently on Fossil Creek above the proposed Wilderness barrier site. The PA would "aid recovery in (likely, but not known with certainty since reliable and complete fish surveys have not been completed until recently) areas of previous habitation, of federally listed threatened or endangered species and their habitats."

FSM 2323.32(2) – Wildlife and fish managed programs shall be consistent with wilderness values.

Discussion: A more narrow focus on the "human actions" proposed in the PA would tend to favor a "no action" response to protect wilderness values; while a broader interpretation of human actions to include the full range of actions affecting the watershed over the past century (introduction of non-native fish to the system, diversion of the stream flow, elimination of travertine dams, etc.) would tend to favor PA implementation as a remedy "consistent with wilderness values" (see discussion of FSM 2323.31(1) above).

FSM 2323.32(3) – Discourage measures for direct control (other than normal harvest) of wildlife and fish populations.

Discussion: The PA implementation would be counter to 2323.32(3), however, FSM 2323.34f specifically allows for use of chemical treatments to prepare waters for reestablishment of indigenous and threatened and endangered species, or to correct undesirable conditions caused by human influences.

FSM 2323.32(4) – Manage wilderness to protect known populations of federally listed threatened or endangered species where necessary for their perpetuation and aid in their recovery in areas of previous habitation. When alternative areas outside of wilderness offer equal or better protection, take actions to recover threatened or endangered species outside of wilderness areas first.

Discussion: PA implementation would not "protect known populations of federally listed threatened or endangered species" (2323.32(4)) since no T&E populations are known to exist in Fossil Creek, but would "aid in their recovery in areas of (likely*) previous

habitation" (*according to the draft Fossil Creek EA, T&E species were likely to have occurred in Fossil Creek, based on remnant populations in the adjacent Verde River, and on anecdotal evidence, but no base line data exists to prove this).

FSM 2323.33a – Reintroductions. Reintroduce wildlife species only if the species was once indigenous to an area and was extirpated by human induced efforts. Reintroductions shall be made in a manner compatible with the wilderness environment. Motorized or mechanical transport may be permitted if it is impossible to do the approved reintroduction by nonmotorized methods.

Discussion: Assuming the prior existence of T&E species in Fossil Creek, the PA would be consistent with 2323.33a that directs reintroduction of wildlife species "only if the species was once indigenous to an area and was extirpated by human induced events".

FSM 2323.34 – Fisheries Management. Emphasize quality and naturalness in managing fisheries in wilderness.

FSM 2323.34a – Stocking Programs. In cooperation with the States, develop fish-stocking programs that meet wilderness management objectives.

FSM 2323.34b – Stocking Methods. Stocking shall normally be done by primitive means...landings are prohibited.

FSM 2323.34c – Stocking Policy. The order of preference for stocking fish is: a. Federally listed threatened or endangered, indigenous species. b. Indigenous species. c. Threatened or endangered species if species is likely to survive and spawn successfully. d. Native species if species is likely to survive and spawn successfully.

Policies and Guidelines for Fish and Wildlife Management in National Forest and Bureau of Land Management Wilderness (FS BLM & IAFWA—August 1986):

All management activities within wilderness are to be done without motorized equipment or landing of aircraft, unless truly necessary to administer the area. Wilderness managers must determine that such use is the minimum necessary to accomplish the task. In rare instances, facility development and habitat alteration may be necessary to alleviate adverse impacts caused by human activities on fish and wildlife. Actions necessary to protect or recover threatened or endangered species must be necessary for the perpetuation or recovery of the species and it must be demonstrated that the actions cannot be done more effectively outside wilderness. When areas outside of wilderness offer equal or better opportunities for species protection, take action there.

Matzatzal Wilderness Implementation Plan:

III. C. 3.h. - Management of Wildlife, Fish, and Habitat (All Species not on Federal Threatened and Endangered List). Non-indigenous species entering the Wilderness (washing down of swimming upstream) is acceptable for those species which were

established before this area's designation as Wilderness. (Note – this part of the Wilderness was designated in 1984. Although one species of nonnative fish may have been present prior to 1984, the remaining three nonnative species have only recently invaded Fossil Creek).

III.C.4.d. – Management of Wildlife, Fish, and Habitat (All Species not on Federal Threatened and Endangered List). Where necessary to minimize their negative affects on the Wilderness resource, non-indigenous species now established in the Wilderness will be eliminated, with consultation and approval of AG&F Commission.

III.D. Threatened and Endangered Plant and Animal Species (Federally-listed). Implementation Objective: To re-establish all Federally-listed Threatened and Endangered (T&E) species known to have inhabited the Mazatzal Wilderness; and to maintain viable populations of those species still found there.

III.D.3.d. Threatened and Endangered Plant and Animal Species (Federally-listed). Native species may be re-established (if eliminated by human influence) following NEPA analysis and in a manner compatible with the Wilderness environment.

APPENDIX K

Forest Service Manual
Title 2300 - Recreation, Wilderness, and Related Resource Management
Section 2354.76

Amendment No. 2300-94-4
Effective July 8, 1994

2354.76 - Evaluation Procedures. Evaluate proposed water resources projects using the following ten steps. Consider all activities which meet the definition of water resources projects found at 36 CFR Part 297 to be water resources projects for the purposes of the evaluation as outlined in this section. Also, use the procedure of applicable parts of it, to evaluate activities proposed outside a designated or study river corridor to determine if the actions result in indirect effects that invade the area, or unreasonably diminish the scenic, recreation, or fish and wildlife values present in the area.

1. Establish Need. Define the need for the proposed activity and make a preliminary determination whether the proposed activity is consistent with the management goals and objectives for the river. If management goals and objectives have not been formalized through a river planning process, utilize Forest Plan standards and guidelines and any applicable state fish and wildlife, water quality, or other state agency management plans or policies consistent with identified values to develop objectives for each of the outstanding river values.

If the activity does not evidence a compelling need or is inconsistent with the management goals and objective or other applicable laws, the project need not be considered further. If there is a need for the activity and it appears consistent with management goals and objectives, proceed with Steps 2-10. In conducting and documenting the analysis, the scope of the evaluation is to be consistent with the magnitude and complexity of the proposed activity.

2. Define the Proposed Activity. Objectively describe the proposed activity in terms of the:

a. Project proponent(s);

b. Purpose/need for the project(document results of Step 1);

c. Geographic location of the project;

d. Duration of the proposed activities;

e. Magnitude/extent of the proposed activities; and,

f. Relationship to past and future management activities.

3. Describe How the Proposed Activity Will Directly Alter Within-Channel Conditions. Address the magnitude and spatial extent of the effects the proposed activity will have on in-channel attributes. Give special attention to changes in features that would affect the oustandingly remarkable and other significant resource values. Describe:

a. The position of the proposed activity relative ot the stream bed and stream banks.

b. Any likely resulting changes in:

(1) Active channel location;

(2) Channel geometry (cross-sectional shape, width/depth characteristics);

(3) Channel slope (rate or nature of vertical drop);

(4) Channel form (straight, meandering, or braided); and,

(5) Relevant water quality parameters (turbidity, temperature, nutrient availability).

4. Describe How the Proposed Activity Will Directly Alter Riparian and/or Floodplain Conditions. Address the magnitude and spatial extent of the effects the proposed activity will have on riparian/floodplain attributes. Give special attention to changes in features that would affect the outstandingly remarkable and other significant resource values. Describe:

a. The position of the proposed activity relative to the riparian area and floodplain.

b. Any likely resulting changes in:

(1) Vegetation composition, age structure, quantity, or vigor.

(2) Relevant soil properties such as compaction or percent bare ground.

(3) Relevant floodplain properties such as width, roughness, bank stability, or susceptibility to erosion.

5. Describe How the Proposed Activity Will Directly Alter Upland Conditions. Address the magnitude and spatial extent of the effects the proposed activity will have on upland attributes. Give special attention to changes in features that would affect the outstandingly remarkable and other significant resource values. Describe:

a. The position of the proposed activity relative to the uplands.

b. Any likely resulting changes in:

(1) Vegetation composition, age structure, quantity, or vigor.

(2) Relevant soil properties such as compaction or percent bare ground.

(3) Relevant hydrologic properties such as drainage patterns or the character of surface and subsurface flows.

c. Potential changes in upland conditions that would influence archeological, cultural, or other identified significant resource values.

6. Evaluate and Describe How Changes in On-Site Conditions Can/Will Alter Existing Hydrologic or Biologic Processes. Evaluate potential changes in hydrologic and biological processes by quantifying, qualifying, and/or modeling the likely effects of the proposed activity on:

a. The ability of the channel to change course, re-occupy former segments, or inundate its floodplain;

b. Streambank erosion potential, sediment routing and deposition, or debris loading;

c. The amount or timing of flow in the channel;

d. Existing flow patterns;

e. Surface and subsurface flow characteristics;

f. Flood storage (detention storage);

g. Aggradation/degradation of the channel; and,

h. Biological processes such as:

(1) Reproduction, vigor, growth and/or succession of streamside vegetation;

(2) Nutrient cycling;

(3) Fish spawning and/or rearing success;

(4) Riparian dependent avian species needs; and,

(5) Amphibian/mollusk needs.

7. Estimate the Magnitude and Spatial extent of Potential Off-Site Changes. Address potential off-site, or indirect effects of the proposed activity, acknowledging any uncertainties.

a. Consider and document:

(1) Changes that influence other parts of the river system;

(2) The range of circumstances under which off-site changes might occur (for example, as may be related to flow frequency); and,

(3) The probability or likelihood that predicted changes will be realized.

b. Specify processes involved, such as water and sediment, and the movement of nutrients.

8. Define the Time Scale Over Which Steps 3-7 are Likely to Occur. Review steps 3-7 looking independently at the element of time. Define and document the time scale over which the effects will occur.

9. Compare Project Analyses to Management Goals. Based on the analysis of steps 3-8, identify and document project effects on achievement, or timing of achievement, of management goals and objectives relative to free-flow, water quality, riparian area and floodplain conditions, and the outstandingly remarkable and other significant resource values.

10. Make Section 7 Determination. Make the Section 7 determination consistent with the policy outlined in FSM 2354.73. Based on the analysis of steps 3-9, document:

a. The effects of the proposed activity on conditions of free-flow, including identification of any proposed measures to minimize those effects;

b. Any direct and adverse effects on the outstandingly remarkable and other significant resource values for which the river was designated or is being studied; and,

c. Any unreasonable diminishing of scenic, recreational, fish and wildlife values associated with project activities above or below the area.

APPENDIX L

Public Response

ARIZONA RIPARIAN COUNCIL
for Environmental Studies
a State University
Box 873211
Tempe AZ 85287-3211

January 22, 2004

Ms. Nora B. Rasure, Forest Supervisor
Attn: Ms. Cecelia Overby
Coconino National Forest
23223 East Greenlaw Lane
Flagstaff, Arizona 86004

Dear Ms. Rasure:

The Arizona Riparian Council (ARC) appreciates the opportunity to comment on the "Native Fish Restoration in Fossil Creek" Draft Environmental Assessment (DEA) which was issued jointly by the U.S. Forest Service (USFS) and U.S. Bureau of Reclamation (BR). The ARC has been involved with the restoration of Fossil Creek since 1992 when relicensing for the Childs/Irving Hydroelectric Project was proposed. We are looking forward to December 2004 when full flows to Fossil Creek will be restored.

General Comments.

The main concern of the ARC is the risk to the native fish community this action potentially poses. In the DEA the USFS and BR are proposing restoration of Fossil Creek's native fish community. All who have worked for the restoration of Fossil Creek flows and those presently involved with its restoration have the same goal in mind – protecting the native fish and the riparian ecosystem of this unique area. However, killing all of the fish (except the natives removed before the renovation) and an the undocumented community of macroinvertebrates is a very drastic measure, an irreversible step. It is one that should be undertaken only as the last resort. During the time the natives are being held in tanks an equipment failure could kill the entire population of native fish to be reintroduced into the stream. This would be disastrous. 1-1

Page 49 states, "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 perhaps is the model for most southwestern streams; however, Fossil Creek's flow is going from 2-5 cubic feet/second (cfs) to 43 cfs. What is the probability that the native fish community living in newly created natural flow regime would be able to out compete the nonnative species? Serious analysis should be given to this scenario. 1-2

Specific Comments.

The number of individuals of each species of native fish needed to be collected to ensure that a sufficient gene pool needs to be determined. Page 23 states, "...capture as many native fish alive as possible." How many is this? 50 or 100 or 2,000 or 11,000 or 210,000 or 456,000, 6,987,000, etc. It is important to have a science-based approach to determine a minimum viable population. Page 86 states that "There is no definitive number of fish that must be salvaged to ensure that genetic viability is preserved for repatriation following chemical renovation (T.E. Dowling, Arizona State University, personal communication)". Because of the importance of knowing the number of individuals needed to ensure a genetically viable population a second opinion on this matter would be prudent. 1-3

Page 23 describe the collection of native fish to be held for reintroduction to the creek subsequent to renovation. Who specifically will be in charge of the salvage operation? Who will be responsible for each subreach? This description needs to contain a complete plan for the collection of the native fish: When will it take place? How many people are needed? Where are these people coming from? What equipment is needed and in what quantity? Will each stream section be broken down into subreaches for collecting? Where will the collection point be for each subreach? Where will the helicopter land? These and all of the "nuts and bolts" of the salvage operation need to be determined well in advance of project implementation. 1-4

Also, the equipment to be used to hold the native fish needs to be identified. How many and the type of holding tanks and aeration systems needs to be determined, where will you get them, when will you set them up and test them, what will be the water testing protocol, what is the contingency plan(s) in case of equipment failure. Who specifically will be in charge of the holding operation and how many people are needed for this phase of the operation?

The concentration of Antimycin A needed to be used to obtain a 100 percent fish kill needs to be decided. Page 24 discusses the concentration of Antimycin A needed to achieve this level. Yellow bullhead is the most difficult to kill and a 100 percent kill was reported using concentrations between 25 to 200 ppb. The lower reach in which yellow bullheads have been documented will be treated with "20 and above ppb" and the upper three reaches will be treated with 20 ppb. First, it would seem to be the prudent thing to do to assume that at least a few yellow bullheads are in the upper three reaches and dose the stream accordingly. Second, the amount of Antimycin A needed to achieve a 100 percent kill in all reaches (more specific that "20 and above ppb") needs to be determined. 1-5

Although the macroinvertebrate community would be expected to recolonize the renovated segment of Fossil Creek, it is unknown because of the lack of in depth surveys. Do any sensitive species exist in the stream? Prior to renovation, this information should be collected and a determination made. 1-6

In light of the fact that the renovation project is a extremely drastic measure which could result in dire consequences for the stream's native fish community, a thorough analysis of this action should be made. Appendix C lists the stream renovations in the Lower Colorado River Basin and notes whether or not the project achieved its purpose. The projects were reported to achieve their purpose in 19 of 21 cases. However, the definition of "achieve it purpose" is not given. Was the purpose to benefit native fish or was the purpose to benefit native fish by removing 100 percent of nonnative fish? Are the projects which were deemed successful still regarded as successful. In other words were they truly successful and for how long? 1-7

Design criteria for the barriers needs to be listed. For example, was it determined that a 4-foot vertical drop was needed with a 20-foot apron downstream of the barrier with a 2 percent slope needed for an effective barrier? Also, under what flood flows (1 in 10 year, 1 in 100 year, etc.) will the barrier be effective? Does the preferred alternative meet these design criteria? 1-8

In summary, the renovation project may be the prudent action to take to save the fish population in Fossil Creek; however, a more thorough analysis is needed to determine if this action is actually needed and what will be its probability for long term success.

Above all, if this project is implemented it must be done so successfully. Time is growing short until December 2004 and all the agencies involved in this operation need to plan--plan--plan.

Failure due to lack of planning is not an option.

Sincerely,

Jeff Inwood, President
Arizona Riparian Council

Response to Letter of Comment from Arizona Riparian Council

1-1 As discussed in section 2.3, *Stream Renovation*, Fossil Creek would be divided into four reaches, each reach being considered as a discrete treatment unit. Once a particular reach has been successfully treated, native fishes removed from that reach would be returned before renovation of the next reach is attempted. At no time would the entire native fish population be removed from the stream

1-2 The new flow regime would not produce a substantial competitive advantage to the native fish community. Other similar streams within the Gila River basin have required human intervention to prevent community dominance by nonnative species and avert partial or complete loss of the native component (also see response 2-8). In the mainstem Verde River, predation and competition from nonnative fishes have greatly reduced the number and distribution of native species, despite flow velocities that are much higher than those in Fossil Creek.

1-3 As discussed in section 3.2.6, *Stream Renovation*, there is no definitive, scientifically defensible number of fish that can be collected to ensure preservation of a "sufficient gene pool." Sampling techniques discussed on pages 22 to 23 will be employed to capture as many native fishes as technically practicable from each reach. As noted in the EA, the native fish community above the Fossil Springs diversion would continue to be a source of genetic variability to downstream populations (also see response 2-13).

1-4 Specific personnel assignments, equipment needs, and operational procedures will be identified in an implementation plan prepared after the NEPA process has been completed and an alternative selected. Stream renovation will be supervised by AGFD.

1-5 Proposed piscicide application rates are discussed on pages 24-25. The final application rates will be determined following completion of field bioassays.

1-6 As discussed on page 71, sampling conducted by Northern Arizona University found no macroinvertebrate species of special concern within proposed treatment areas.

1-7 The fourth column of Table C-1 describes the purpose of each stream renovation project. All sought to remove 100 percent of the nonnative fishes. Projects that list multiple years of treatment clearly were not successful in achieving the project purpose in the initial (and in some cases, subsequent) attempt. Most, but not all, projects are considered successful at the present time.

1-8 Design criteria for the proposed (Wilderness) fish barrier are presented on pages 18 to 22. The minimum vertical drop of the barrier will be 5 feet, as shown in Figure 3 on page 20. Below the barrier, the stream quickly descends an additional 8 to 10 feet in elevation. This configuration will maintain sufficient vertical drop to prevent ingress of nonnative fishes during low-level floods. As noted in the EA, we do not anticipate upstream movements of fishes during peak flooding due to high current velocities and sediment loads.

January 27, 2004

Ms. Nora B. Rasure, Forest Supervisor
Attention: Ms. Cecelia Overby
Coconino National Forest
2323 East Greenlaw Lane
Flagstaff, AZ 86004
Via Email

Re: Comments of American Rivers, Arizona Audubon Society, Center for Biological Diversity, Friends of Arizona Rivers, Sierra Club – Grand Canyon Chapter on the Draft Environmental Assessment for Native Fish Restoration in Fossil Creek, Coconino and Tonto National Forests, December 2003

I. INTRODUCTION

The undersigned organizations have a keen interest in the restoration of Fossil Creek dating back to the beginning of the original relicensing process in 1995. Since that time, many of our staff members and consultants have engaged in various stakeholder processes, intervened in the relicensing process, participated in negotiations, and ultimately signed the settlement in support of surrendering the Childs-Irving Project. We continue to strongly support the efforts of Arizona Public Service (APS) to surrender its hydropower license and retire the Childs Irving Project consistent with the settlement agreement, to restore the natural form and function of Fossil Creek, one of the few remaining intact riparian areas in Central Arizona.

The restoration of flows to Fossil Creek offers one of the best opportunities to provide habitat for native desert fishes in Central Arizona. In order to achieve the full benefits of the decommissioning of the Childs-Irving Project and the return of natural flows to the stream, we have been and remain generally supportive of the restoration actions of the Bureau of Reclamation and the US Forest Service in the proposed construction of a stream barrier and treatment of the stream to remove non-natives.

II. COMMENTS

A. Barrier

As organizations principally dedicated to river protection and restoration, the Conservation Groups are not in the habit of supporting the placement of structures or barriers in rivers or streams. However, that general opposition is overcome by the need to protect native fish species assemblages from predation by non-natives migrating up Fossil Creek from the Verde River. Therefore, the question for us is not whether, but how and where.

Concerns over barrier construction and placement revolve around several issues: a) short-term impacts of construction activities; b) long-term effectiveness; c) impact on fish and wildlife; and d) impact on Wilderness or Wild and Scenic River status.

a) Short-term impacts of construction activities

We have no comments on the impacts of barrier construction beyond concerns about the Wilderness area and the need to minimize impact. Due to the rugged terrain, it appears that carrying the materials and equipment in by mule would cause more negative impacts than the proposal to use a helicopter. We also understand that the use of power drill in this case will minimize the amount of time to establish the barriers and therefore limit the impacts to the area. The explanation in the DEA is reasonably thorough. 2-1

b) Long-term effectiveness of the barrier

This project is only as good as its effectiveness and durability. Our understanding is that this project is being funded by the Central Arizona Project for the purpose of meeting Endangered Species Act requirements for projects elsewhere in the state. While we expect that this project will be successful, in the event that the barrier fails to block non-natives from moving from the Verde up into Fossil Creek, will the Central Arizona Project be held accountable to undertake other native fish restoration projects as a substitute? Would these take place in the Fossil Creek watershed or elsewhere? 2-2

The DEA states on page 12 that the Central Arizona Water Conservation District (CAWCD) will be responsible for the long-term maintenance of the fish barrier. We take this to mean that the CAWCD will ensure that funding is there for proper monitoring and maintenance of the barrier and that if the barrier breaks, then CAWCD would be liable to fix it. We believe that CAWCD should be responsible for paying for construction-related activities, and that while the CAWCD should pay for the maintenance, the USFS should be responsible for overseeing the maintenance activities. Often these fish barriers fail because they are improperly maintained. Considering the remote location of the proposed barrier in the Mazatzal Wilderness, it is essential that the land manager have a long-term commitment to maintaining it in a manner that both affords protection to the native fish and is consistent with the wilderness area. Please address these concerns in the final EA. 2-3

c) Impact on fish and wildlife

There appears to be little short- or long-term impact on fish and wildlife from the construction of the barrier other than its intended purpose of preventing movement of non-native fish from moving up Fossil Creek. 2-4

d) Impact on Wilderness and Wild and Scenic River status.

Several of us stated in our scoping comments that because the proposed barrier would not have an impact on flows, we do not believe that the barrier will affect either Wilderness or Wild and Scenic Rivers status.

The DEA's characterization on page 86 of the future eligibility for Wild or Scenic River classification of the reach where the barrier is constructed in the Wilderness area seems unnecessarily pessimistic. If the project is completed as it is described in the DEA and contemplated by the proponents, we would expect that the barrier would have little if any effect on eligibility for either classification. We strongly believe that the EA should work from such a presumption. Section 16(a) of the Wild and Scenic Rivers Act of 1968, as amended, in defining "Free Flowing," states as follows: 2-5

> The existence, however, of low dams, diversion works, and other minor structures at the time any river is proposed for inclusion in the national wild and scenic rivers system shall not automatically bar its consideration for such inclusion: *Provided,* That this shall not be construed to authorize, intend, or encourage future construction of such structures within components of the national wild and scenic rivers system.

Here we have a hybrid situation, where the river has already been studied and deemed eligible for wild and scenic status, thus perhaps triggering the "proposed for inclusion" language, but the river has not been designated by Congress into the national wild and scenic rivers system. As we read the statute, then, there is no statutory bar to construction of the proposed stream barrier while maintaining eligibility for wild and scenic status, because Fossil Creek is not as yet a "component" of the national system. And one of the "outstandingly remarkable values" ("ORV") assigned for Fossil Creek is "fish." Surely the construction of the stream barrier would both "protect *and enhance*" the "fish" ORV of Fossil Creek, to quote section 10(a) of the Wild and Scenic Rivers Act. In the circumstances, we believe the Forest Service can proceed with the construction of the stream barrier without necessarily jeopardizing the current potentially "wild" classification of that segment. 2-5 (cont.)

The last row in the table on page 33 should be amended to strike the phrase "Minor effect on free-flow" in the second column and "Slightly greater effect on free-flow" in the third column.

Page 83 of the DEA references Forest Service policy (FSM 2354.76) which identifies a 10-step process used when evaluating proposed water resources projects on a river authorized by Congress under Section 5 of the Act, of which Fossil Creek is one. Please include this memo as an attachment to the final EA. 2-6

In the May 2002 comments for the scoping of this DEA, some groups urged the USFS to undertake a formal determination pursuant to Section 7(a) of the Wild and Scenic Rivers Act as to the impact of the project on the designated Verde River, which is only 4.5 miles 2-7

south of the project area. (DEA, p. 84.) The requirement comes from the second sentence of section 7(a) of the Wild and Scenic Rivers Act, as follows:

> Nothing contained in the foregoing sentence, however, shall preclude licensing of, or assistance to, developments below or above a wild, scenic or recreational river area or on any stream tributary thereto which will not invade the area or unreasonably diminish the scenic, recreational and fish and wildlife values present in the area on the date of designation of a river as a component of the national wild and scenic rivers system.

It appears to us that the 10-step process described at pp. 83 – 84 of the DEA was used to determine the project's likely effects on *Fossil Creek*, and did not study the effect of the Fossil Creek stream barrier project on the Wild and Scenic Verde River. The first full paragraph on page 84 of the DEA makes the assertion that the Fossil Creek stream barrier project will not affect the free-flowing character of the Verde Wild and Scenic River or the scenery, recreational or wildlife values thereof, thus paralleling the words of the statute quoted above, but no reference is made to the actual conduct of a detailed study thereof. The Forest Service should give full effect to its statutory obligation and provide an explicit reference to the requirements of the Act and incorporate an appropriate analysis of the impacts of the barrier on the free-flowing character of the Verde River Wild and Scenic River or lack thereof. We do expect that the result of such a consultation would be the finding stated on p. 84, namely, that the project has no adverse effect on the Verde Wild and Scenic River.

2-7 (cont.)

Based upon prior precedence and the intent of the framers of the Wilderness Act it seems clear that fisheries enhancement activities and facilities were contemplated as actions that are accepted within designated areas. (PL 88-577 "A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvement or human habitation, which is protected and managed so as to preserve its natural condition.") We are generally not supportive of

installing concrete structures in wilderness, nor using helicopters or drills in the wilderness area, but believe that in this specific case and based upon the project description in the DEA, the barrier and its construction is consistent with the management requirements of the wilderness area and the Wilderness Act. Having undertaken a site visit to the proposed barrier location and having read the plans to make the structure blend to the greatest degree possible, we believe that it will help restore a more natural fish community and promote protection of the native fishes and will leave "... the imprint of man's work substantially unnoticeable." 2-7 (cont.)

B. Antimycin

Application of a piscicide in a waterbody is a significant and arguably drastic action albeit necessary in specific occasions. Although we support exploring alternatives to using these kinds of chemicals, such as physical collection of non-natives, the Conservation Groups understand that resource managers sometimes need to resort to such measures and this case may support that option. However, we continue to urge BOR and USFS to minimize unintended impacts, especially on macroinvertebrate populations. 2-8

On page 10 and Table C-1, the DEA cites previous treatments of streams with antimycin that have yielded variable results in terms of native fish recovery. Please document the stream lengths of these projects and describe in general how they are similar to the circumstances found in Fossil Creek. Has a stream the size of Fossil Creek ever been treated? Were the other streams warm water fisheries?

Later, on page 25, the DEA states that additional antimycin applications may be needed following the initial doses. How many times might reapplication be tried? Under what circumstances would BOR and USFS decide that enough is enough? Please explain the potential impacts of repeated applications of antimycin. 2-9

On page 49 of the DEA, crayfish are described as likely remaining a chronic problem, even after the application of antimycin. Can restoration resources be applied to address this problem, at least in the short term? Do crayfish pose a significant threat to 2-10

restoration efforts and if so, should they be addressed as we move forward with the barrier and antimycin treatment? While the antimycin application is underway, could crayfish gain a competitive advantage in the basin while the fish are gone? 2-10 (cont.)

One significant concern of the Conservation Groups is whether stream treatment will have a significant impact on macroinvertebrate populations. Several studies identified by the Conservation Groups seem to indicate that treatments with antimycin-A do not have a large effect on macroinvertebrates, but we wish to see more discussion of this in the final EA.[1] Please also further your discussion on the possible effects on other non-target species due to the depletion of the food base. 2-11

Please provide the following information that was lacking in the DEA:

- Amount of antimycin expected to be used to treat the stream 2-12
- Expected biomass of the non-natives estimated to be in the stream 2-13
- Management of natives in the holding tanks during the antimycin application? 2-14
- Impacts of the neutralizing agent, potassium permanganate, on all affected environments. 2-15

C. Miscellaneous

The DEA should reflect a greater expectation that Arizona Game and Fish will be responsible for managing fishermen and their introduction of non-natives into the stream as referenced on page 48. The bait-bucket transfer problem was described several times in the DEA, but little was said about additional actions that AG&FD could take to prevent this problem. Consideration should be given to declaring Fossil Creek off limits to sport fishing except as needed to "catch and remove" the exotics. 2-16

[1] "Short-term effects of antimycin and rotenone on invertebrates in first order, high elevation streams." K.M. Cerreto, R.O. Hall, Jr., and H. Sexauer. Department of Zoology & Physiology, University of Wyoming, Laramie, WY 82070, Wyoming Game & Fish Department, Region 1, Pinedale, WY 82941

"Effects of chemical treatment on benthic macroinvertebrates in Sams Creek, Great Smoky Mountains National Park, North Carolina/Tennessee, USA" C.A. Walker and D.A. Etnier. Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN 37996

Finally, cautionary signage referenced on page 28 of the DEA should be provided in both Spanish and English. 2-16 (cont.)

D. Forest Service Appeal Eligibility

USFS regulations for appeals of decisions based upon an EA (36 CFR 215, June 4, 2003) require interested persons to file substantive comments within the 30-day notice period. Individuals and organizations wishing to appeal must provide the following information: 2-17

1. Name and address;
2. Title of proposed action;
3. Specific substantive comments on the proposed action along with supporting reasons;
4. Signature or other verification of identity;
5. Signature of a representative for each organization wishing to be eligible; and
6. Individual members of organizations must file separately from the organization to be eligible to appeal individually.

The undersigned organizations have met each of these requirements and should be eligible to appeal a Forest Service decision in this matter.

Andrew Fahlund
Senior Program Director
American Rivers
1025 Vermont Avenue, NW
Suite 720
Washington, DC 20005

Sandy Bahr

Sandy Bahr
Conservation Outreach Director

Sierra Club – Grand Canyon Chapter
202 E. McDowell Rd, Suite 277
Phoenix, AZ 85004

Tim Flood

Tim Flood
Conservation Coordinator
Friends of Arizona Rivers
503 E Medlock Dr
Phoenix, AZ 85012

Robin Silver, M.D.
Conservation Chair
Center for Biological Diversity
P.O. Box 39629
Phoenix, AZ 85069

Response to Letter of Comment from American Rivers, Arizona Audubon Society, Center for Biological Diversity, Friends of Arizona Rivers, and Sierra Club

2-1 Your comment is noted.

2-2 Reintroduction of nonnative fishes is addressed on page 27. Under the 2001 CAP biological opinion, nonnative control and removal actions above the barrier are the responsibility of the FWS working in partnership with the AGFD, Forest Service, and Reclamation. Any failure of the barrier in preventing reintroduction of nonnative fishes will be thoroughly assessed by the agencies to determine appropriate management actions.

2-3 The CAWCD will afford the same qualitative standard of inspection and maintenance to the barrier as it utilizes on the CAP. Provisions for Wilderness protection will be included in a special use permit issued by the Forest Service to the CAWCD for activities associated with barrier maintenance. All the cooperating agencies are committed to the long-term protection of Fossil Creek as a refugium for native fishes.

2-4. Your comments are noted.

2-5 The WSR Section 7(a) analysis conducted by the Forest Service concluded that modification of the waterway at either of the alternative barrier sites will have a minor effect on free flow. Table 1 accurately reflects that conclusion.

2-6 This policy statement has been included in the final Environmental Assessment as Appendix K.

2-7 The WSR Section 7(a) analysis conducted by that Forest Service concluded the project will not adversely affect the free-flowing character of the Verde Wild and Scenic River.

2-8 Stream lengths of renovation projects listed in Table C-1 range from very short reaches (<0.5 km) at Bylas Springs, AZ, to approximately 15 km on Mogollon Creek. Since Fossil Creek has been divided into four treatment reaches, none longer than 5 km, the length of stream to be treated there is not unusual. Although most streams listed in Table C-1 are cold water streams, some (Arnett Creek, Bylas Springs, O'Donnell Creek, Sabino Canyon, and West Turkey Creek) are warm water streams like Fossil Creek, with similar discharge rates, pool formation, substrate type, etc.

2-9 As described on page 25, we are planning for a minimum of two, and a maximum of three back-to-back chemical treatments of each of the four reaches of Fossil Creek. Additional applications of antimycin would be needed in the future only if monitoring shows that nonnative fish have been reestablished in the stream. Use of antimycin for stream renovation has a high probably of success when applied correctly (see Appendix C for more information). We recognize that repeated introductions of nonnative fishes by humans would be problematic for the project in the long term.

On pages 52-54 we note that impacts to aquatic biota (other than the target organisms) from chemical treatments are temporary. As long as the reach of Fossil Creek above the Fossil Springs Diversion Dam is not renovated, it will always provide a source for recolonization of macroinvertebrates. We recognize that chemical treatment is a last-choice management alternative, and we intend to minimize the impacts of such actions to the greatest extent possible.

2-10 At present there are no technologies other than trapping that are effective and approved for control of crayfish. And even by trapping, it is questionable if enough effort can be applied to significantly suppress crayfish populations (Momot 1998). The period of time in which treated segments of Fossil Creek will be fishless following renovations will be short (not more than two weeks), and we do not anticipate that crayfish will gain a competitive advantage during this brief absence. As stated on page 53, we do not believe the continued presence of crayfish in Fossil Creek, while undesirable, will preclude the success of native fish restoration efforts. Removal of nonnative fishes will eliminate the primary limiting factor to survival of native fishes in the system. Although the project is not designed to eradicate crayfish, we will keep apprised of crayfish control methodologies and propose new control efforts against them as appropriate.

Momot, W. T. 1998. An example of how exploitation can increase production and yield in a northern crayfish (*Orconectes virilis*) population. Pages 225-233 *in* G. S. Jamieson and A. Campbell, editors. Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management. Canadian Special Publication of Fisheries and Aquatic Sciences.

2-11 We added some additional discussion of references pertinent to this topic on page 53. To our knowledge, there is no direct information available concerning food base effects on non-target species due to depletion of macroinvertebrates following antimycin treatment. However, macroinvertebrate losses due to antimycin treatment would be functionally no different than losses from floods (Bruns and Minckley 1980; Gray 1980, 1981). Native fishes have evolved with and are adapted to withstand such disturbances. We expect rapid recolonization of macroinvertebrate populations following antimycin treatment, and therefore we do not expect significant impacts to non-target organisms.

Bruns, D.A., and W.L. Minckley. 1980. Distribution and abundance of benthic invertebrates in a Sonoran Desert stream. Journal of Arid Environments 3:117-131.

2-12 Although precise dosages of antimycin needed to effect mortality of target fishes will be refined with bioassay and field experiments, if we assume a standard dosage of approximately 20 ppb of antimycin, the total amount of antimycin required to treat all four reaches of Fossil Creek two times will be approximately 60 units, where a unit consists of 960 ml of undiluted antimycin (60 units equals 15 gallons). In the most likely scenario of treating at approximately 20 ppb in the three upper reaches and at approximately 200 ppb in the lowermost reach (to dispatch yellow bullheads), the total amount required for two complete stream treatments will be 137 units, or 131,520 ml (35 gallons). Using a worst-case scenario of three complete stream treatments, with the upper two reaches treated at approximately 20 ppb and the lower two reaches treated at approximately 200 ppb, the total amount of antimycin required will be 777 units, or 745,920 ml (197 gallons). The final application rates will be determined following completion of field

bioassays.

2-13 There are no data available to provide a definitive estimate. Biomass of nonnative fishes does not appear high in upper reaches of the action area. The uppermost ½-mile reach below the Fossil Springs Diversion Dam is protected by a small natural barrier and appears to be devoid of nonnative fishes. Native fish diversity and numbers are quite high in this uppermost reach, and chemical treatment of the reach will not be necessary if surveys confirm the absence of nonnative fishes.

2-14 As described on pages 22-23, native fishes transported to tanks at Irving will be held alive during antimycin treatments and released back into the stream reach where they were taken prior to treatment. Specific operational and contingency procedures will be addressed in the implementation plan.

2-15 Toxicity of potassium permanganate ($KMnO_4$) to fishes was briefly described in Appendix B on pages 124-125. It is more toxic in alkaline water than soft water (Marking and Bills 1975). There is little information available about its effects on other biota; however, Kemp et al. (1966) reported that KMnO4 reacted quickly in natural waters to form a biologically inert residue. 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). Note that the draft EA erroneously reported $KMnO_4$ would be applied at 1 mg/l.

Potassium permanganate will be acquired in a fine granular form and dissolved in water before dispensing to the stream. The dry material is inert, but becomes active when dissolved in water. If the chemical comes in contact with eyes or skin, the area should be flushed with copious amounts of water (Finlayson et al. 2000). Personnel are required to wear protective clothing and breathing apparatus for protection. The implementation plan will include personnel safety and spill contingency procedures.

2-16 Thank you for your suggestion. The agencies will continue to use every management tool available to them to prevent reintroduction of nonnative fishes.

2-17 Your comment is noted.

"Craig Sommers"
<csommers@eroresources.com>

01/31/2004 08:33 AM

To: <comments-southwestern-coconino@fs.fed.us>
cc: "Rob Clarkson (E-mail)" <rclarkson@lc.usbr.gov>, "Dave Roberts (E-mail)" <dcrobert@srpnet.com>, "Rich Siegel (E-mail)" <rssiegel@srpnet.com>
Subject: Draft EA, Native Fish Restoration in Fossil Creek -- Comments by SRP

Attn: Ms. Cecelia Overby, Coconino National Forest
Copy also sent by facsimile.

Dear Ms. Overby,
I am submitting these comments on behalf of the Salt River Project (SRP). If you have questions, please contact me or Dave Roberts, Manager, Water Rights and Contracts, Salt River Project (602-236-2343).

First, we regret missing the January 28 deadline for comments. We were unaware of this Draft EA until we coincidentally found it on the internet the other day during a search for native fish information for the Verde River watershed.

Although the Draft EA is quite comprehensive in its analysis of many types of potential impacts, it is silent on the effects of fish barrier construction on water flows and downstream water rights. We believe that the final EA and related documents must disclose the quantity of water to be lost by construction of either fish barrier alternative, including water used during construction, initial fill of the pond created by the fish barrier, and increased evapotranspiration losses over the life of the project. Similarly, the final documents should disclose the status of resolution of water right issues involving SRP and other downstream water users. 3-1

Discussions of water right issues related to construction of a Fossil Creek fish barrier were initiated with Reclamation in 2003. However, those water right issues have not been resolved to date. Of note, the recently released draft EA for an Apache Trout Enhancement Project by the Apache-Sitgreaves Forests recognizes the water rights issues created by construction of fish barriers, and suggests that if the water right issues are not resolved successfully, alternatives would be considered including backfilling the structure or making the barrier permeable.

In summary, the final EA, FONSI, and ROD must address the water losses and water right impacts if a Fossil Creek fish barrier is to be constructed.

Thank you for you consideration of these comments.

Craig Sommers
President
ERO Resources Corp.
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Response to Letter of Comment from ERO Resources Corporation (Salt River Project)

3-1 Appropriate revisions have been made to the final EA.

"Glen Knowles"
<xyrauchen@hotmail.com>

To: comments-southwestern-coconino@fs.fed.us
cc:
Subject: Comment on Draft EA on Native Fish Restoration in Fossil Creek

01/28/2004 09:24 AM

Ms. Nora B. Rasure
Forest Supervisor
Attention: Cecilia Overby
Coconino National Forest
2323 East Greenlaw Lane
Flagstaff, Arizona 86004

Re: Comment on Draft Environmental Assessment on Native Fish Restoration in Fossil Creek

Dear Ms. Rasure:

I support renovating Fossil Creek to eliminate nonnative fishes and building a barrier in Fossil Creek at the proposed action site in the Mazatzal Wilderness. The existing native fish community in Fossil Creek consists of headwater chub (Gila nigra), roundtail chub (Gila robusta), speckled dace (Rhinichthys osculus), longfin dace (Agosia chrysogaster), Sonora sucker (Catostomus insignis), and desert sucker (Pantosteus clarki). There are only a handful of streams in Arizona left that still support 5 native species. If our native fishes are to survive we will need to use renovation to create refuges for native fishes and barriers to protect them from the nonnative fishes that are the primary cause of their decline. 4-1

The proposed action wilderness alternative barrier will allow for an additional 2.8 miles of stream habitat that will benefit native fishes. Perhaps more importantly, the non-wilderness alternative will allow greater public access to the stream and facilitate potential illegal bait bucket introductions of nonnative fishes that could jeopardize the entire project. Please move forward with the proposed action wilderness alternative and implement this important project for native fishes.

Sincerely,

Glen W. Knowles
35223 N. 9th St.
Phoenix, AZ 85086

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Response to Letter of Comment from Glen Knowles

4-1 Your comments have been noted.

RECEIVED
JAN 2 7 2004
COCONINO N.F.

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January 23, 2004

NORA WW
CE Cdo

Ms. Nora B. Rasure, Forest Supervisor
Attn: Ms. Cecelia Overby
Coconino National Forest
2323 East Greenlaw Lane
Flagstaff, Arizona 86004

Inre: Draft Environmental Assessment (EA) on Native Fish Restoration in Fossil Creek – Opportunity to Comment (Action by January 28, 2004)

Dear Ms. Rasure:

As a conservation biologist with nearly 25 years of research and management experience dealing with native fish issues in the arid Southwest, I am familiar with the fauna of the Gila River basin in general and with that of Fossil Creek in particular. I have worked on the stream and its fishes for many years, and know them well. I have visited the stream and its watershed many times and know the specific sites being considered as part of the subject project. I have carefully read those portions of the EA upon which I feel qualified to comment.

If the Fossil Creek native fish restoration project is successfully implemented as presently scoped it will be a significant and precedent-setting action benefiting our state and regional natural resources. As you know, the project incorporates placing a barrier across the stream to prevent undesirable non-native species from invading (or reinvading) the system, salvage of existing native fishes, reclamation of the stream to remove non-native fishes, and re-establishment of the indigenous fishes. Because of this project there also is potential in the future to establish new populations of critically imperiled species such as loach minnow and spikedace.

The fact of the matter is that native fishes in Arizona are in particularly bad shape. Excluding our two indigenous trouts, there is no native fish species that is in better shape today than it was twenty years ago, and this is startling when considering that many of these species have been federally listed throughout this time. And, additional species are being proposed for protection (roundtail chub, for example). The message is clear that too little is being done to conserve these valuable resources. 5-1

Most scientists agree that non-native fishes pose the most serious threat to the continued survival of our native fish populations, and there is much evidence in support of this view. In most instances, it seems unlikely that native fishes will persist where non-natives become established. Management needs for native fishes are clear: eliminate or reduce non-native populations where native fishes are desired, and keep non-natives out of places from which they have been eliminated (or where they do not yet exist). Fossil Creek represents an almost ideal opportunity to do just this, while at the same time preserving all other resource values (I do not consider a barrier in Forest Service wilderness a compromise to resource values in that reach, especially in context of the overall benefit of the project).

In conclusion, I fully support the Fossil Creek native fish restoration project, and specifically support the proposed action (wilderness alternative). Please contact me at your convenience if you would like additional information or would like to discuss the project further.

Sincerely,

Paul C. Marsh

Paul C. Marsh, PhD

Response to Letter of Comment from Paul Marsh

5-1 Your comments have been noted.

Jerome A. Stefferud
315 East Medlock Drive
Phoenix, Arizona 85012
Voice: 602-274-5544
Email: Stefferud@cox.net

January 28, 2004

Ms. Nora B. Rasure, Forest Supervisor
Attention: Ms. Cecelia Overby
Coconino National Forest
2323 E. Greenlaw Lane
Flagstaff, AZ 86004

Submitted via email to: comments-southwestern-coconino@fs.fed.us.

In re: Draft Environmental Assessment, Native Fish Restoration in Fossil Creek

Dear Ms. Rasure:

Thank you for the opportunity to review the draft "Environmental Assessment, Native Fish Restoration in Fossil Creek". I have looked forward to seeing this document for many years and am not disappointed. It is a finely written document that fully and logically explains the project. Please convey my compliments to those who prepared it.

Before my retirement from the Forest Service (Tonto National Forest) as a fisheries biologist in 2002, I was fully involved with the Childs-Irving Hydroelectric Project that had been ongoing for longer than a decade, and more recently the Fossil Creek native fish restoration project. Because of this involvement, I am extremely familiar with Fossil Creek, the hydroelectric and fisheries projects, and have visited the locations of the proposed fish barriers. I am also familiar with fish barrier construction and fisheries renovation projects in both wilderness and non-wilderness areas for coldwater and warmwater fishes, having planned and participated in more than two dozen efforts during my career.

Throughout the Forest Service's negotiations with Arizona Public Service Company, the Federal Energy Regulatory Commission, and the environmental coalition, the primary goal consistently was to restore the natural ecosystem values in the Fossil Creek watershed. The native fishery was an integral part of that goal. If this project is successfully implemented as per the proposed action, it will be a precedent-setting achievement of regional and national importance to native fish conservation and wilderness management. In addition to conserving the native fishes currently found in Fossil Creek, there also will be significant potential for reestablishing several species that were lost from Fossil Creek during the past century.

Fishes in the southwestern United States, particularly the Gila River basin, are in peril of extinction. Despite efforts stimulated by the Endangered Species Act and other federal and state statutes, these native fishes are in worse shape in terms of distribution and abundance then they were 20 years ago. Native fishes have been lost from a significant proportion of their historical range due to a combination of water manipulations, watershed impacts, and introduction and spread of nonnative fishes. It will be only through efforts such as the proposed Fossil Creek native fish restoration project that this deadly decline can be slowed or reversed. 6-1

I encourage your efforts and strongly urge you to recommend the proposed wilderness alternative to the Regional Forester for his approval.

Of the two action alternatives, the proposed wilderness alternative would provide the greatest extent of protection for native fishes, and the least disturbance to the landscape and natural values. The no action alternative would do nothing to improve the status of native fish in the region, but instead would allow their continued decline and loss from Fossil Creek. Bait-bucket transfers of nonnative fish would likely compromise the non-wilderness alternative soon after

project completion. Once compromised, management agencies would then be forced to perform additional activities to restore the integrity of the project, which would probably lead to even more disturbances. 6-1 (cont.)

Following are more specific comments on the EA:

Page 8, 1st para, 3rd sentence: During the comment period for designation of critical habitat for razorback sucker in 1994, the Forest Service recommended to the U. S. Fish and Wildlife Service that Fossil Creek be included in critical habitat because of its value to recovery of the species. 6-2

Page 10, 1st paragraph, penultimate sentence: Add Sabino Canyon to the list of streams recently renovated to remove green sunfish. 6-3

Page 15, Renovation methods: Alternative means of removing nonnative fishes will also harm native fishes. Nets, angling, and electrofishing do not distinguish between native and nonnative fishes, and reliance on these methods to keep the nonnative species in control would likely injure and/or kill many individual native fishes in the long-term. 6-4

Page 25, 2nd paragraph, 5th sentence and following: The use of a second application of piscicide to determine if the preceding application was successful was pioneered by the Gila Trout Recovery Team in order to determine actual success of the project. Previously in other renovation projects, the stream would have been treated and then electrofishers or other gear used to determine if fish had survived the treatment. This often resulted in a false conclusion that the treatment had been successful, only to find out later that a few individuals had survived and the project was compromised. Unfortunately, the comprehension that target organisms had survived and required a removal project usually was not realized until native fish had been repatriated into the stream. This resulted in wasted effort, dashed expectations, and sometimes public ridicule. The Gila Trout Recovery Team determined that a follow-up application of piscicide was much more likely to reveal any surviving individuals then electrofishing. The team has successfully used this methodology for 15 years and many renovation projects with no failures. 6-5

Page 28, 1st line: Typo: "zix". 6-6

Page 33, last row, 3rd and 4th columns: I don't agree that a barrier that is lower than other natural waterfalls in Fossil Creek will have an effect on free-flow. Both barriers are designed to retain base flow in the natural thalweg of the stream with no artificial widening of the active channel. Nor will they impound any water or have an effect on discharge below the barrier. I recommend they be modified to "no effect on free-flow". 6-7

Page 34, 1st row: Define acronyms "ORV", "VQO". 6-8

Page 41, 2nd paragraph, 4th line: Typo: "5-oot". 6-9

Page 46, 3rd paragraph: Would you add some description of the private inholding, i.e., how many acres, how much stream frontage? Also please note that the housing at Irving is on National Forest System land, not private. 6-10

Page 47, 6th line: Typo: remove comma at end of line. 6-11

Page 49, 3rd paragraph: An excellent citation to document crayfish effects on native fish is: Guan, R.Z., and P.R. Wiles. 1997. *Ecological impact of introduced crayfish on benthic fishes in a British lowland river*. Conservation Biology 11:641-647. They used field and laboratory data and experiments to document the fish responses to crayfish and the mechanisms by which crayfish altered the native fish community. 6-12

Page 53, 3rd paragraph, 2nd sentence: This is a particularly strong statement and could be toned down. Although there may not be any published evidence to support the statement, there are anecdotal accounts that suggest that crayfish could decimate fish populations to the point of no return, particularly if there are nonnative fish predators also present. I observed crayfish nearly eliminate longfin dace in Cave Creek north of Phoenix in the mid-1990's. Although longfin dace remain extant in that stream, their population vigor, and perhaps genetic variation, could have been compromised during that bottleneck. 6-13

Page 55, 1st paragraph: A local example of nonnative fish being moved over a barrier into a renovated stream occurred in Sabino Canyon Creek on Coronado National Forest. There, the barrier was about 8' high, but was in a location with considerable public access and water-play. 6-14

Green sunfish were moved over the barrier within a few years of the renovation project, which then compromised the previously successful project.

Page 61, razorback sucker, last sentence: Should change this statement to read "Razorback suckers were stocked above Irving dam in 1988, where they grew to lengths >15". None have been collected in Fossil Creek since 1992. However, the aquatic habitat there is complex, the fish are secretive, and surveys have not been intense." 6-15

Page 62, spikedace: Rinne, J.N. 1992. *Physical habitat utilization of fish in a Sonoran desert stream, Arizona, southwestern United States*. Ecology of Freshwater Fish 1:35-41 is probably a better citation for habitat of spikedace, and other native fishes. 6-16

Page 62, last paragraph, 3rd line: "several thousand feet" should be changed to "several tens of miles". 6-17

Page 69, Other species of concern, 2nd line: Add: "and elsewhere in their range" after comma. 6-18

Page 86, Classification: It needs to be emphasized that fish barriers do not create impoundments. In Fossil Creek, the height of the barrier will be no more or less than natural waterfalls that currently exist, and sediment moving through the system will rapidly deposit and aggrade the channel behind the barrier, thus displacing any potential for impounding water. Additionally, the proposed fish barrier would be a replacement for a natural barrier that was destroyed during flooding a few years ago. 6-19

Construction of fish barriers in wilderness and/or wild and scenic rivers is a relatively common practice on National Forest lands. I have knowledge of rock masonry and gabion structures constructed in Gila, Aldo Leopold, Golden Trout (Figure 1), and San Pedro Parks wilderness areas, none of which caused any controversy or public comment. Most were constructed to blend in well with the surrounding landscape and were typically placed in areas where there was little human use. Their effect on the landscape or free-flowing aspects of the streams was minimal.

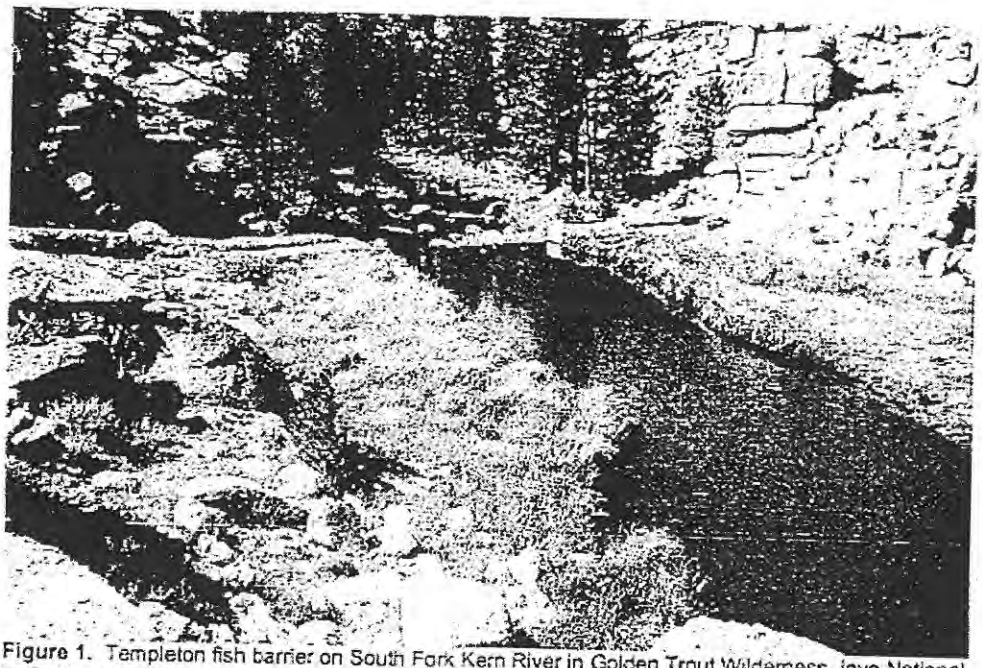

Figure 1. Templeton fish barrier on South Fork Kern River in Golden Trout Wilderness, Inyo National Forest, California. The barrier was about 6' high, but water behind the barrier was only a few inches deep and moved at a velocity of >1 foot per second during base flow. The South Fork Kern River was designated a Wild and Scenic River. Before livestock removal, the grassy areas were barren sand flats. Photo: 8/9/2003, J. Stefferud.

Based on my considerable experience with other barrier construction and fish restoration efforts, I am convinced that the Fossil Creek fish restoration project is technically and physically possible with little to no environmental perturbation. The wilderness alternative would place a structure in a part of Fossil Creek that receives almost no human visitation, thus visual impacts 6-20

and potential for bait-bucket transfers of fish would be minimized. The carefully planned and implemented application of antimycin, as per the EA, would have minimal or no impact on non-target organisms, or downstream effects. Fossil Creek is a linear system that will have untreated areas both up- and downstream of the project area from which macroinvertebrates will be able to recolonize the treated reaches. Based on my experience with antimycin treatments, associated macroinvertebrate monitoring, and knowledge of the literature, I do not believe that there will be any long-term detrimental effects on aquatic macroinvertebrates. Detoxification of antimycin with potassium permanganate will limit downstream effects on fishes to a very short distance. When label instructions are followed, there is no potential for harm to humans, terrestrial wildlife, other aquatic animals, or plants.

Although successful application of piscicide to a stream the length of Fossil Creek appears formidable, the situation has certain advantages:

- There is excellent vehicular access along the middle portion of the stream, and moderately good access to the upper portion.
- Fossil Creek has simple drainage complexity with no tributaries, backwaters, or marshy areas that would be difficult to treat.
- Work can occur nearly yearlong.
- The discharge is controlled and does not change incrementally downstream, which makes calculation of dosages more accurate.
- The area to be treated can be divided into distinct and isolated segments that can be treated individually.

6-20 (cont.)

I have applied piscicide to streams in wilderness areas that were much longer, and with much greater drainage complexity than Fossil Creek. Although Fossil Creek has its own unique problems (e.g., most of the volume of water is in pools), I do not see anything insurmountable to prevent successful completion of the project, other than running out of time before the treatment can be completed.

I support the wilderness alternative and urge its timely implementation. The Fossil Creek native fish restoration project presents a unique opportunity to contribute significantly to the conservation of native fishes in the Gila River basin. Moreover, it fulfills the goals developed during discussions of the Childs-Irving Hydroelectric Project to restore natural ecological values to the Fossil Creek watershed. The time is swiftly approaching when full flows are returned to the stream, and delay in approving this project may preclude its successful completion.

I appreciate your consideration of these comments. Please contact me at your convenience if you would like additional information or would like to discuss the project further.

Sincerely;

Jerome A. Stefferud

Response to Letter of Comment from Jerome Stefferud

6-1 Your comments have been noted.

6-2 Your comment has been noted.

6-3 Appropriate revisions have been made to the final EA.

6-4 Appropriate revisions have been made to the final EA.

6-5 Your comment has been noted.

6-6 This typographic error has been corrected.

6-7 Please see response 2-5.

6-8 The acronyms are spelled out in Table 1 of the final EA. They also are defined on pages 81 and 84.

6-9 This typographic error has been corrected.

6-10 Appropriate revisions have been made to the final EA.

6-11 This typographic error has been corrected.

6-12 Thank you for pointing out this reference. This article discussed how an introduced species, the crayfish *Pacifastacus leniusculus*, native to parts of western North America, affected the abundance of two benthic fishes in the United Kingdom through shelter competition, habitat alteration, and predation.

6-13 See response 2-10.

6-14 Your comment is noted.

6-15 Appropriate revisions have been made to the final EA.

6-16 Thank you for pointing out this reference.

6-17 Appropriate revisions have been made to the final EA.

6-18 Appropriate revisions have been made to the final EA.

6-19 Thank you for your comment. We believe those issues were adequately address on page 41 (*Hydrology*) and page 87 (*Free-flow*).

6-20 Your comments are noted.

SALLY E. STEFFERUD
315 E. Medlock Drive
Phoenix, Arizona 85012
602-274-5544
stefferud@cox.net

January 27, 2004

Nora B. Rasure, Forest Supervisor
Attention Cecelia Overby
Coconino National Forest
2323 East Greenlaw Lane
Flagstaff, Arizona 86004

Dear Ms. Rasure:

Thank you for the opportunity to comment on the draft Environmental Assessment (EA) on Native Fish Restoration in Fossil Creek. I strongly support this very important project for native fish conservation in the Gila River basin. I am a biologist with nearly 30 years experience with fishes of the American southwest. I recently retired from the U.S. Fish and Wildlife Service in Phoenix, where I worked for 13 years on protection and recovery of native fishes. As an independent biologist, I continue to work on native fish conservation in a variety of ways, including field studies and collaborative management efforts. As a Fish and Wildlife Service biologist, I was involved with the Childs/Irving Hydropower and Fossil Creek native fish restoration projects for over 5 years and have a continuing interest in this unique opportunity for significant forward progress in recovery of Gila basin native fishes.

Please convey my compliments to the preparers of this EA. The draft EA is, within the constraints of the form, well organized, readable, well documented, and logically presented. My comments are presented as general comments on the project and then as specific comments on particular items of the document.

General Comments

I support the proposed action (wilderness alternative) and urge you to move forward expeditiously to implement the project. To ensure the maximum probability of success, the nonnative removal portion of the action must take place prior to restoration of full flows. The proposed wilderness alternative will provide for the greatest amount and quality of native fish and aquatic ecosystem restoration. I support the use of the downstream wilderness location for the barrier because of its lesser negative impacts and because, as the EA clearly points out, it will have a significantly higher probability of preventing reinvasion of the stream by nonnative fishes. The short-term, minor impacts to wilderness values are far outweighed by the substantially greater beneficial impacts to the ecosystem. Methods proposed for nonnative fish removal are state-of-the-art and have been successfully used in many other projects. 7-1

Nonnative fishes are the greatest single obstruction to recovery of native fishes in the Gila River basin. The landmark effort to restore flows to Fossil Creek will be a hollow one without removal

of nonnative fish. If not removed, the nonnative fish will continue to reduce and possibly extirpate the remaining native fishes. The proposed project to remove nonnatives and repatriate extirpated natives will make Fossil Creek a showcase in native fish restoration. Fossil Creek is a unique opportunity in Arizona to fully restore a medium-sized stream system and is the only significant opportunity in the Verde River drainage for repatriation of the native fishes. Other tributaries are either unsuitable due to lack of sufficient flow, high gradient, etc., or have substantial areas in private ownership and/or are highly modified by existing and increasing human activities. Fossil Creek, with its substantial flow (post-decommissioning), travertine ecosytem, Federal ownership, and lack of significant adverse human activities, is an ideal stream for native fish and aquatic ecosystem restoration. This proposed project is a key component to reversing the rapid decline of the native fishes of the Verde River drainage. 7-1 (con

Specific Comments

page 6, paragraph 2. Although it is discussed later, it would be helpful to mention here that the proposed barrier is a replacement for a natural barrier that was destroyed by catastrophic flooding. The bullet statements in this paragraph could be improved by adding the fact that Fossil Creek is the only Verde River tributary with the potential for major native fish restoration. The final bullet statement should also add that the project will help avoid decline and listing of additional native fish species. 7-2

page 9, paragraph 4. Yellow bullhead are also in the Santa Cruz River basin. 7-3

page 9, Stream renovation. It may be helpful to add that detoxification of antimycin with potassium permanganate happens immediately upon mixing of the two. 7-4

page 10, Repatriation of native fishes. The second sentence should provide for including advice from academic and independent experts on Fossil Creek and native fish. 7-5

page 15, Renovation methods, paragraph 1. Repeated disturbance of stream channel and banks and handling of fish during frequent mechanical removal attempts on a long-term basis would have significant negative effects to habitat and fish. 7-6

page 15, Renovation methods, paragraph 2. Rotenone also causes higher invertebrate mortality than antimycin. 7-7

page 28, paragraph 1. In the first complete sentence on this page, there is a typo in the word "six." 7-8

page 28, Information and Education. Delete the word "casual" in sentence three. 7-9

page 40, last paragraph. In the third sentence I believe the word "velocity" was omitted between the words "diminish" and "upstream." 7-10

page 49, paragraph 3. Although it is discussed later in the document, it would be helpful to the reader to state here that crayfish control methods are being investigated and an experimental mechanical removal project is underway in Fossil Creek. 7-11

page 52, paragraph 1. Although we have little ability to predict the habitat mix that will result after travertine deposition returns to natural levels, under current conditions lower gradient, finer sediment areas, such as will occur behind the barrier, are rare in Fossil Creek. These types of habitats are desirable for some species, such as longfin dace and spikedace. Thus, the localized effects of the barrier on habitat may benefit some fish species and may beneficially affect the critical habitat of spikedace. 7-12

pages 52 and 53. Regarding effects of the proposed use of antimycin on invertebrates, the statement in the last sentence on page 52 is very important. The fact that the treated area will always have upstream and downstream sources for recolonization is highly significant in mitigating impacts to invertebrates from the project. The discussion of possible impacts to rare invertebrates is excellent. Fossil Creek is a linear system with a high degree of homogeneity except at the source springs. That, along with the high degree of modification of flows and travertine, and the historic interconnection with similar habitats in the Verde River, makes it very unlikely that rare invertebrates exist in localized areas of the system. The staged treatment proposed should provide for the greatest possible avoidance and mitigation of adverse impacts to the aquatic invertebrates of Fossil Creek. 7-13

page 54, paragraph 3. Remove the word "greatly" in the first sentence. Its presence there implies that affects to human uses may be of significance, when in reality they are unlikely to be affected at all, or at the most in very minor ways. 7-14

page 55, paragraph 1. In addition to increasing the probability of the public moving fish across the barrier, the accessibility of the nonwilderness barrier also makes the barrier more susceptible to purposeful or inadvertent damage from the public. People recreating around structures in streams may pile rocks on the apron or top, build ramps, or various other actions that may decrease barrier effectiveness or cause damage to the barriers. 7-15

page 56, paragraph 1. Gila topminnow and desert pupfish may also be affected by the proposed action, if they are repatriated to Fossil Creek. The effect would be beneficial. 7-16

page 61, Razorback sucker. The last sentence in this section says that razorback sucker may no longer occur in Fossil Creek. Although that is possible, the Fish and Wildlife Service asserts, and I agree, there is no basis for a belief that the stocked razorback sucker are extirpated from the system. In fact several razorback sucker were discovered in Stehr Lake just a few years ago. 7-17

pages 61 and 62, Loach minnow. The discussion of where loach minnow still exist is confusing to anyone who has knowledge of that species. It is not clear that you are referring only to populations in Arizona and descriptions for some of the other species are not restricted solely to Arizona. I would recommend that the populations in the San Francisco and Gila Rivers in New Mexico be added to the description. In the second paragraph on page 62, it should be clarified that loach minnow were recorded historically in the Verde River basin. 7-18

page 62, Spikedace. Similar to loach minnow, I recommend that the description of existing populations of spikedace include the Gila River in New Mexico. 7-19

page 62, Colorado pikeminnow. It would be helpful to identify that Colorado pikeminnow is the newer name for the Colorado squawfish. The old common name was used in most earlier Fossil Creek documents, which may lead to confusion. 7-20

page 64, Razorback sucker. It is not a correct statement to say that razorback sucker are not present in Fossil Creek. See my earlier comment for page 61. In addition, this is in contradiction to the statement on page 61 and to the entry on Table 4 on page 75. 7-21

page 65, Spikedace critical habitat. It should be added that the proposed action will beneficially affect spikedace critical habitat. 7-22

page 65, Non-wilderness alternative. The non-wilderness alternative would also not provide the beneficial effects to critical habitat that would accrue from the wilderness alternative. 7-23

page 75, Table 4. Roundtail chub should be noted to include headwater chub. 7-24

page 86, Classification. It is clear that the barrier would have no negative effect on the suitability of Fossil Creek for inclusion in the wild classification of the wild and scenic rivers system. There will be no impounded body of water behind the barrier. I have been involved with installation of fish barriers in several locations throughout the southwest, including those completed by the Bureau of Reclamation on Aravaipa Creek. None have result in impoundment of a body of water behind the barrier. As the EA notes, in a few years this proposed wilderness barrier will be virtually unnoticeable to anyone other than a close and discriminating observer. 7-25

I appreciate your consideration of these comments and commend you on an excellent EA. If you have question, please do not hesitate to contact me.

Sincerely,

Sally E. Stefferud

Response to Letter of Comment from Sally Stefferud

7-1 Your comments are noted.

7-2 We thank you for your recommendation. We believe those issues were adequately addressed in the EA.

7-3 Appropriate revisions have been made to the final EA.

7-4 In Appendix B we noted that potassium permanganate reduces the half life of 7 to 11 minutes in the laboratory. Organic material in the stream would further reduce the half life of antimycin.

7-5 Appropriate changes have been made to the final EA.

7-6 Appropriate changes have been made to the final EA.

7-7 Your comment is noted.

7-8 This typographic error has been corrected.

7-9 Appropriate changes have been made to the final EA.

7-10 The sentence refers to the inverse relationship between distance from the barrier vs. volume of sediment deposition.

7-11 Appropriate changes have made to the final EA.

7-12 We concur. Thank you for your comment.

7-13 Your comment is noted.

7-14 The use of "greatly" in the context of the sentence was meant to infer the effects would be minor.

7-15 Your comment is noted.

7-16 Your comment is noted.

7-17 Appropriate changes have been made to the final EA.

7-18 Appropriate changes have been made to the final EA.

7-19 Appropriate changes have been made to the final EA.

7-20 Appropriate changes have been made to the final EA.

7-21 Appropriate changes have been made to the final EA

7-22 Appropriate changes have been made to the final EA.

7-23 Appropriate changes have been made to the final EA.

7-24 Appropriate changes have been made to the final EA.

7-25 Your comment is noted.

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FS

MS NORA B RASURE FOREST SUPERVISOR 14 JAN 2004
ATTN: CECILIA OVERBY
COCONINO NAT FOREST
2323 E GREEENLAW LANE
FLAGSTAFF, AZ 86004

MS OVERBY,

THIS IS A COMMENT IN REFERENCE TO THE FOSSIL CREEK NATIVE FISH RESTORATION PROJECT.

WE BELIEVE THE MIDDLE SITE IS THE FISH BARRIER SITE THAT SHOULD BE CONSTRUCTED. THIS WOULD NOT ONLY ALLOW MORE HABITAT FOR THE NATIVE FISH SPECIES, BUT IT IS OUR UNDERSTANDING IT IS MORE SUITABLE FOR CONSTRUCTION.

WE WOULD ALSO LIKE TO COMMENT IN GENERAL. WE BELIEVE, WITH NATIVE FISH THE MOST IMPERILED SPECIES IN ARIZONA, THAT THIS PROJECT SHOULD RECEIVE ALL THE RESOURCES & EFFORT NECESSARY. AS CITIZENS WE APPRECIATE THE AGENCIES WILLINGNESS TO DO THIS HUGE EFFORT ON BEHALF OF NATIVE FISH SPECIES. 8-1

WE APPRECIATE THE OPPORTUNITY TO COMMENT ON THIS SIGNIFICANT PROJECT FOR NATIVE FISH SPECIES OF ARIZONA.

SINCERELY,

Tom Taylor for

TOMAS & TOM TAYLOR
C/O 1640 N LINDSAY ROAD
MESA, AZ 85213
480 964 6482

Response to Letter of Comment from Tomas and Tom Taylor

8-1 Your comments have been noted.

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Michael T. Perkinson
P. O. Box 1822
Tempe, AZ 85280-1822
(480) 967-7923
mperk@worldnet.att.net

Ms. Nora B. Rasure, Forest Supervisor
Attn: Ms. Cecelia Overby
Coconino National Forest
2323 East Greenlaw Lane
Flagstaff, Arizona 86004

Re: Draft Environmental Assessment (EA) on Native Fish Restoration in Fossil Creek – Opportunity to Comment (Action by January 28, 2004)

Dear Ms. Rasure:

I want to thank you for the opportunity to comment on this proposed action. I also want to thank the Forest Service staff and planners from the Tonto and Coconino National Forests who worked on the development of the above referenced material. After reviewing the Draft Environmental Assessment (DEA), I can wholeheartedly conclude that these documents have been prepared with the maximum protection of the Fossil Creek fauna and flora in mind while adhering to the doctrine of multiple use.

I have been living in Arizona for over 25 years. Throughout those 25 years I have had concern for the welfare of Arizona's wildlife. Although I am not a professional biologist, I hold a degree in conservation biology with a concentration in fisheries management and frequently volunteer to assist Arizona Game and Fish Department (AGFD) and Forest Service (FS) personnel with assorted projects. Therefore I feel qualified to comment on this DEA.

As stated in the DEA, Fossil Creek is home to a variety of species listed under the Endangered Species Act (ESA), and like many of Arizona's watercourses is unique in many ways. If the proposed project is successfully implemented as presented in the DEA, it will be a significant and precedent-setting action benefiting our state and regional natural resources. This project has the potential to maintain and establish new populations of critically imperiled species such as loach minnow and spikedace.

9-1

We all know that native fishes in Arizona are doing quite poorly and get little of the badly needed attention they deserve. Without protection they will continue to decline. By reclaiming Fossil Creek and constructing the proposed barrier to non-native species the native fish populations will have an opportunity to survive and the FS will demonstrate its commitment to complying with its mandate. Without the barrier, as most scientists will agree, the native populations will surely decline when the non-natives return.

Therefore, I fully support the Fossil Creek native fish restoration project, and specifically support the proposed action (wilderness alternative). Once again, thank you for the opportunity to comment on the proposed action. If you have any questions, please contact me at your convenience

Sincerely,

Michael T. Perkinson

Response to Letter of Comment from Michael Perkinson

9-1 Your comments have been noted.

United States Department of Agriculture | Forest Service | Rocky Mountain Research Station | Southwest Forest Science Complex
2500 South Pine Knoll Drive
Flagstaff, Arizona 86001-6381

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Ref: PXAO-1500, ENV-7.0

To: Ms. Nora B. Rasure, Forest Supervisor
Att: Ms. Cecelia Overby
Coconino National Forest
2323 East Greenlaw Lane
Flagstaff, Arizona 86004

From: Project RMRS-4302: *Sustainability of Riparian Ecological Systems in Southwestern Forests and Woodlands*. Rocky Mountain Research Station, Flagstaff Laboratory

Daniel Neary, Project Leader
John Rinne, Research Fisheries Biologist
Al Medina, Research Riparian Ecologist
Steven Overby, Soil Scientist

Subject: Comments on "Draft Environmental Assessment on Native Fish Restoration in Fossil Creek"

After review of the "Draft Environmental Assessment on Native Fish Restoration in Fossil Creek" we wish to make our comments a part of the public record. The "Proposed Action (Wilderness Alternative)" is by far the most beneficial alternative for potential restoration of native fish in Fossil Creek. By decreasing accessibility to the fish barrier by placing in the Wilderness Area, you mitigate a major threat to the native fish ecosystem decreasing the probability of "bucket biology" reintroduction of non-native fish, and equally important provide an extra 2.8 miles of habitat (20% increase in total restored habitat). After many days spent in Fossil Creek doing research, we feel that Fossil Creek restoration is a rare opportunity to return not only streamflow, but the entire unique biological community that Fossil Creek and the surrounding basin provide. With ever growing populations in Arizona, the pressure to capture and utilize precious water resources will increase. This opportunity provides the National Forest, Bureau of Reclamation, and Arizona Game and Fish an extraordinary chance to establish a native fish community in the Southwest, which continues to be threatened by loss of habitat. We further believe that the short-term intrusion into the Wilderness area is more than offset by the long-term ecological and esthetic benefits a native fishery adds to the Wilderness Area. 10-1

Daniel Neary, Project Leader

John Rinne, Research Fisheries Biologist

Al Medina, Research Riparian Ecologist

Steven Overby, Soil Scientist

Response to Letter of Comment from Rocky Mountain Research Station (USDA Forest Service)

10-1 Your comments have been noted.

Arizona State Parks

"Managing and conserving natural, cultural, and recreational resources"

In reply refer to: SHPO-2002-847
General comments

January 27, 2004

FAXED 1/27/04

Ms. Nora B. Rasure, Forest Supervisor
Coconino National Forest
2323 East Greenlaw Lane
Flagstaff AZ 86004

Re: Draft Environmental Assessment (EA) on Native Fish Restoration in Fossil Creek; BR, CNF; SHPO-2002-847 (18467)

Dear Ms. Rasure:

Thank you for the opportunity to comment on the Draft Environmental Assessment (December 2003) prepared in support of the above referenced federal undertaking. Dr. William Collins, SHPO Historian, and I have reviewed the document and have the following comments:

In consultation with the Coconino National Forest (CNF), archaeological sites within the proposed Wilderness alternative have been identified and determined eligible for inclusion in the National Register of Historic Places. If the Wilderness alternative is chosen, we would support the proposed treatment measures (avoidance and monitoring of Register-eligible sites, and additional surveys of trails) as detailed on pages 78-79 and as described during the telephone conversation today between Sharon Blood, CNF archaeologist, and Jo Anne Medley, SHPO archaeologist. 11-1

No historic properties have been identified within other alternatives.

If you have any questions or concerns, please feel free to contact me at (602) 542-7142.

Sincerely,

Jo Anne Medley
Compliance Specialist/Archaeologist
State Historic Preservation Office

Janet Napolitano
Governor

State Parks Board Members

Chair
Suzanne Pfister
Phoenix

Gabriel Beechum
Casa Grande

John U. Hays
Yarnell

Elizabeth Stewart
Tempe

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Director's Office Fax:
602.542.4188

Response to Letter of Comment from Arizona State Historic Preservation Office

11-1 Your comment is noted.