Habitat Conservation Plan
Horseshoe and Bartlett Reservoirs

Submitted to:
U.S. Fish and Wildlife Service

Submitted by:
Salt River Project

Prepared by:
ERO Resources Corp.
and Salt River Project

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Attachment 1

Habitat Conservation Plan
Horseshoe and Bartlett Reservoirs

SUBMITTED PURSUANT TO
SECTION 10(A)(1)(B) OF THE ENDANGERED SPECIES ACT

MARCH 2008

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Abbreviations and Acronyms

1917 Contract	1917 contract between SRP and the United States
Action Area	See Subchapter I.B.2
AF	acre-feet
AF/year	acre-feet per year
AGFD	Arizona Game and Fish Department
Association	Salt River Valley Water Users' Association
Bartlett	Bartlett Dam and Reservoir
CAP	Central Arizona Project
CBD	Center for Biological Diversity
cfs	cubic feet per second (1 cfs = 449 gallons per minute)
Committee	Fish and Wildlife Committee
covered species	See page ES-1
cuckoo	yellow-billed cuckoo
DFT	Desert Fishes Team
District	Salt River Project Agricultural Improvement and Power District
EIS	environmental impact statement
ESA	Endangered Species Act of 1973, as amended
ERO	ERO Resources Corporation
FEIS	Final Environmental Impact Statement
flycatcher	southwestern willow flycatcher
FMIC	Fort McDowell Indian Community
FMYN	Fort McDowell Yavapai Nation
frog	lowland leopard frog
FWS	U.S. Fish and Wildlife Service
Gartersnakes	Northern Mexican and narrow-headed gartersnakes
HCP	Habitat Conservation Plan
HDMS	Heritage Data Management System
Horseshoe	Horseshoe Dam and Reservoir
M	million
M&I	municipal and industrial
NCS	New Conservation Storage
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
ORV	off-road vehicle
Permit	Incidental Take Permit
Phoenix	City of Phoenix

Reclamation	U.S. Bureau of Reclamation
Roosevelt	Roosevelt Dam and Lake
SRP	Salt River Project
SRPMIC	Salt River Pima-Maricopa Indian Community
SRPMIC Act	Salt River Pima-Maricopa Indian Community Water Rights Settlement Act (1988)
SRPMIC Agreement	Salt River Pima-Maricopa Indian Community Water Rights Settlement Agreement (1988)
USFS	U.S. Forest Service

Habitat Conservation Plan
Horseshoe and Bartlett Reservoirs

Executive Summary

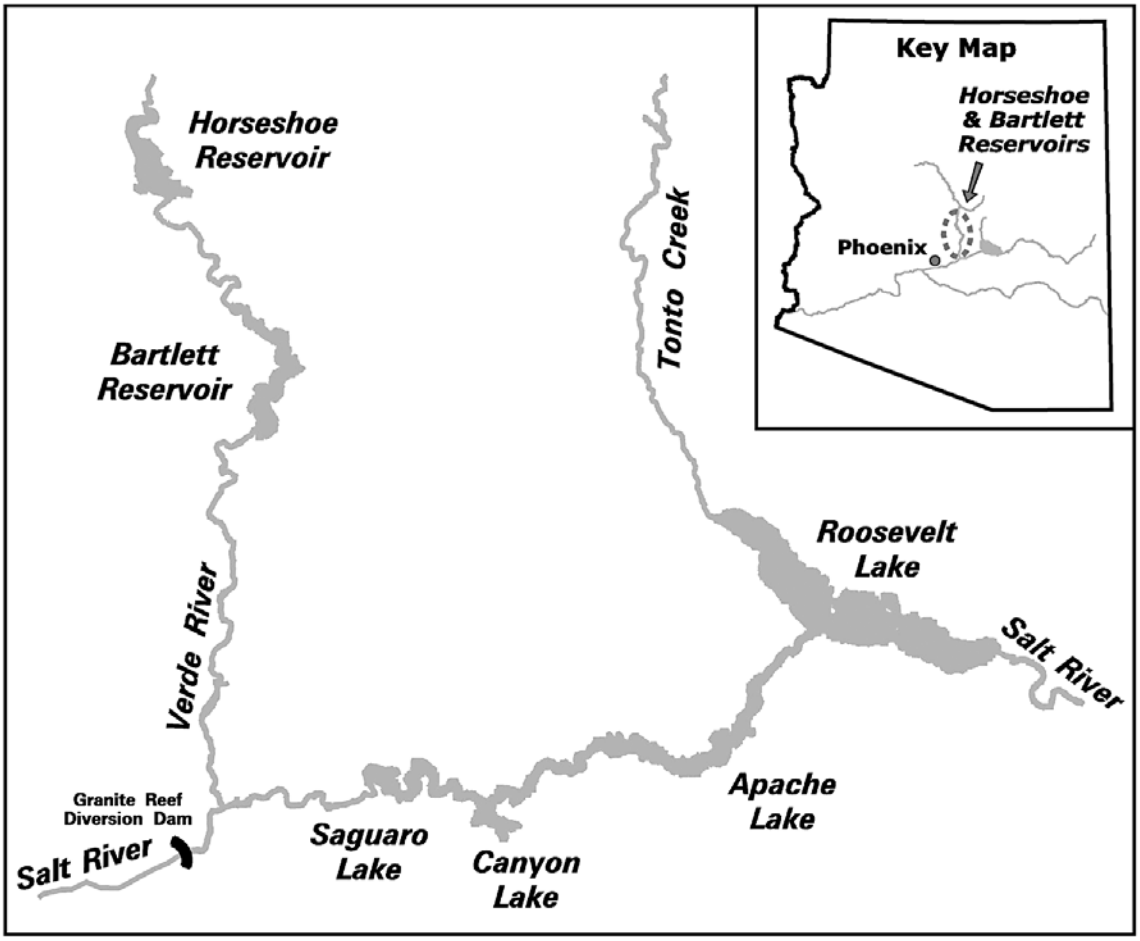
The Salt River Project (SRP) has applied to the U.S. Fish and Wildlife Service (FWS) for a permit pursuant to Section 10(a)(1)(B) of the Endangered Species Act of 1973 (16 U.S.C. §§ 1531-1544, 87 Stat. 884), as amended (ESA). The application is for an incidental take permit (Permit) for the federally listed and other sensitive wildlife species listed below (collectively, covered species).

Covered Species

Scientific Name	Common Name	Federal Listing Status
Empidonax traillii extimus	Southwestern willow flycatcher	Endangered
Haliaeetus leucocephalus	Bald eagle	Threatened (Sonoran Desert Pop.)
Coccyzus americanus	Yellow-billed cuckoo	Candidate
Xyrauchen texanus	Razorback sucker	Endangered
Ptychocheilus lucius	Colorado pikeminnow	Endangered (Experimental Pop.)
Poeciliopsis o. occidentalis	Gila topminnow	Endangered
Meda fulgida	Spikedace	Threatened
Tiaroga cobitis	Loach minnow	Threatened
Gila robusta	Roundtail chub	—
Agosia chrysogaster	Longfin dace	—
Catostomus insignis	Sonora sucker	—
Catostomus clarki	Desert sucker	—
Rhinichthys osculus	Speckled dace	—
Rana yavapaiensis	Lowland leopard frog	—
Thamnophis eques megalops	Northern Mexican gartersnake	—
Thamnophis rufipunctatus	Narrow-headed gartersnake	—

The activity that would be addressed by the Permit is the continued operation by SRP of its two reservoirs on the Verde River in Arizona — Horseshoe Dam and Reservoir (Horseshoe), and Bartlett Dam and Reservoir (Bartlett) (Figure ES-1). These two reservoirs supply water to the Phoenix metropolitan area. The area covered by the Permit would include Horseshoe up to an elevation of 2,026 feet and Bartlett up to an elevation of 1,748 feet, the Salt River from Granite Reef Dam to the Verde River, most of the Verde River upstream from the Salt River, and portions of its tributaries. The requested duration of the Permit is 50 years. To meet the issuance requirements for a permit, SRP has developed and will implement the Horseshoe and Bartlett Habitat Conservation Plan (HCP), which specifies measures to minimize and mitigate incidental take of the covered

Figure ES-1. Vicinity Map, Horseshoe and Bartlett Reservoirs near Phoenix, Arizona.



species to the maximum extent practicable, and which ensures that incidental take will not appreciably reduce the likelihood of the survival and recovery of these species in the wild.

The U.S. Bureau of Reclamation (Reclamation) set aside land along the Verde River in 1903 and 1904 for the purpose of developing irrigation facilities for SRP. Bartlett Dam was constructed in the 1930s and Horseshoe Dam, upstream from Bartlett, was completed in 1945. Pursuant to a 1917 contract between SRP and the United States (1917 contract), the United States turned over to, and vested in, SRP the authority to care for, operate, and maintain all project facilities, of which Horseshoe and Bartlett became integral components. SRP continues to operate these facilities pursuant to the 1917 contract. Since their completion, Horseshoe and Bartlett have continuously provided water for irrigation, municipal, industrial, and other uses. These reservoirs also provide recreation opportunities and wildlife habitat in central Arizona.

SRP delivers an average of 1 million acre-feet (AF) of water each year for use on more than 240,000 acres or 375 square miles of shareholder lands, plus additional contract lands with water rights to the Salt and Verde rivers. Most of SRP's deliveries

are to cities and urban irrigation uses, supplying much of the water for the Phoenix metropolitan population of more than 2.6 million. Annual surface water diversions by SRP average about 900,000 AF, of which approximately 40 percent is provided through the Verde River system. SRP's flexibility in operating Horseshoe and Bartlett is affected by, among other things: 1) SRP's legal obligations to deliver water stored in these reservoirs to its shareholders, cities, irrigation districts, Indian communities, and individual water users pursuant to numerous water rights and contracts; and 2) the capacity of dam outlet works and spillways.

The amount of runoff entering Horseshoe and Bartlett, and subsequent storage and release of that water for downstream delivery, results in fluctuating lake levels and stream flows. Over time, these fluctuations have resulted in the growth of varying amounts of tall woody riparian vegetation along the Verde River where it enters Horseshoe and below Horseshoe and Bartlett. Lake levels, sediment deposition, and occasional scouring floods affect the amount and distribution of vegetation. Following large scouring floods and high lake levels, which occurred frequently in the period between the late 1970s and early 1990s, tall willow habitat has grown at the Horseshoe inlet along the Verde River.

As listed above, this HCP covers the endangered southwestern willow flycatcher (flycatcher), razorback sucker, and a number of other listed and sensitive species. In 2002, flycatchers, a species federally listed as endangered in 1995, were discovered establishing territories in trees on the Horseshoe lakebed and downstream of Horseshoe along the Verde River, which precipitated preparation of this HCP and Permit application. In addition, Horseshoe and Bartlett provide foraging and nesting opportunities for bald eagle, a threatened species for the Sonoran Desert population, and habitat for yellow-billed cuckoo (cuckoo), a candidate species. Horseshoe and the Verde River upstream are designated as critical habitat for the razorback sucker, and other native fish occupy the Verde River and its tributaries above and below the reservoirs. Lowland leopard frog (frog), and northern Mexican and narrow-headed gartersnakes (collectively, gartersnakes) occupy riparian habitat along portions of the Verde River and its tributaries.

Reservoir operations can periodically benefit some of the covered species. A significant amount of willow habitat suitable for the support of flycatchers and cuckoos has grown in Horseshoe and more is expected in the future due to fluctuating water levels. Periodically, Horseshoe also provides spawning and rearing habitat for the razorback sucker. However, a Permit is needed because continued operation of the reservoirs can also adversely affect habitat used by the covered species and, on rare occasions, can result in death or injury of covered individuals. Habitat occupied by flycatchers and cuckoos can be unavailable, modified, or lost due to reservoir operations. Nonnative fish produced in Horseshoe and Bartlett can adversely impact razorback sucker, Colorado pikeminnow, Gila topminnow, spikedace, loach minnow, roundtail chub, longfin dace, Sonora sucker, desert sucker, speckled dace, lowland leopard frog, northern Mexican gartersnake, and narrow-headed gartersnake habitat in and along the Verde River and its tributaries.

Because the cycle of lake levels associated with reservoir operation includes occasions when take of covered species will occur, SRP has applied for a Permit under

Section 10 of the ESA. The application includes this HCP, which is intended to cover SRP's operation of Horseshoe and Bartlett. As discussed below under Satisfaction of Permit Criteria, minimization of impacts with modified reservoir operations and mitigation measures provided by the HCP will fully compensate for the periodic impacts on habitat or loss of individuals caused by the continued operation of Horseshoe and Bartlett. The proposed modified reservoir operation alternative is referred to as "Optimum Operation."

Satisfaction of Policy

FWS has adopted a "five point policy" to improve the habitat conservation planning process. The HCP satisfies the five guidelines outlined in the policy as summarized below.

1. Biological Goals and Objectives. The biological goals of the HCP are to minimize and mitigate incidental take of covered species to the maximum extent practicable, and to not appreciably reduce the likelihood of the survival and recovery of these species in the wild. These goals will be achieved with the following measures: 1) managing water levels in Horseshoe to the extent practicable to benefit or reduce impacts to the covered species; 2) acquiring and managing flycatcher and cuckoo habitat along rivers in central Arizona to provide a diversity of geographic locations with habitat like Horseshoe; and 3) implementing various fish mitigation measures including construction of a fish barrier, funding of additional hatchery and stocking programs, and extensive watershed management efforts, which will also benefit the covered frog and gartersnakes.

2. Monitoring. The HCP, proposed Permit terms and conditions, and implementing agreement (IA) require comprehensive monitoring of habitat and populations of covered species for Permit compliance, impacts, and effectiveness. Long-term biological monitoring is provided at Horseshoe and Bartlett, at mitigation properties, and in the Verde River and its tributaries.

3. Adaptive Management. Adaptive management in the HCP involves ongoing monitoring and evaluation of impacts and management actions with adjustments made as necessary to meet the objectives of the plan. The HCP employs adaptive management measures to address potential changes of circumstances including increased impacts, declines in the quality of mitigation habitat, and ineffective mitigation measures. For example, additional mitigation habitat will be acquired and permanently managed if occupied habitat in Horseshoe that would be impacted by reservoir operations exceeds 200 acres on average for flycatchers and cuckoos. Adaptive management measures for mitigation properties are outlined in the HCP and will be refined as part of the monitoring and management efforts.

4. Permit Duration. The requested Permit term of 50 years is based on the period of time required to provide SRP with sufficient certainty of future water supplies to commit the funding for conservation measures included in the HCP, to implement long-term commitments to habitat conservation, to reflect the long-term benefits of continued reservoir operation on the survival of the listed species, and to reflect long-term fluctuations of habitat as a result of climatic conditions and reservoir operations.

5. Public Participation. SRP and FWS solicited extensive public involvement in development of the HCP through public scoping and input. Comments at two public meetings, comments submitted in writing, and periodic meetings with an advisory group were used to help formulate the HCP.

Satisfaction of Permit Criteria

In order for FWS to issue a Section 10(a)(1)(B) permit, the HCP must meet the criteria set forth in 16 U.S.C. §§ 1539(a)(2)(A) and (B). These criteria, and how the HCP satisfies these criteria, are summarized below.

The HCP Must Specify the Impact That Will Likely Result From Such Taking. The Optimum Operation of Horseshoe and Bartlett is predicted to periodically result in the unavailability, modification, or loss of up to 200 acres of occupied flycatcher and cuckoo habitat on average. The maximum impact on habitat occupied by native fish, frogs, and gartersnakes equates to 34 river miles, which was estimated by evaluating the impacts of reservoir operation relative to impacts from other factors for each reach within the Action Area.

If circumstances change, adaptive management will be implemented to address impacts on: (1) up to 200 acres of additional occupied flycatcher and cuckoo habitat at Horseshoe; (2) additional river miles of native fish, frog, and gartersnake habitat; and (3) bald eagles if they establish nests below the high water mark in the reservoirs.

The HCP Must Specify the Steps That SRP Will Take to Minimize and Mitigate Such Impacts to the Maximum Extent Practicable, and Must Ensure That Funding is Available to Implement Such Steps. The HCP and IA describe measures that will be implemented by SRP to minimize and mitigate, to the maximum extent practicable, incidental take from the Optimum Operation of Horseshoe and Bartlett on covered species and their habitat, and to further the conservation and recovery of these species. Measures to minimize and mitigate for the potential take of these species include:

- Acquisition and permanent management of at least 200 acres of flycatcher and cuckoo habitat in the Verde Valley, Safford Valley, or along the San Pedro or other rivers in central Arizona, and maintenance of riparian habitat in Horseshoe through periodic water management.
- Minimization and mitigation measures for native fish, frogs, and gartersnakes resulting in 81 river miles of mitigation credit involving: (1) early and rapid drawdown of Horseshoe to reduce the recruitment of nonnative fish species; (2) operating and stocking Horseshoe to benefit razorback sucker; (3) providing funding to stock other native fish in the Action Area; (4) installing a fish barrier on Lime Creek; (5) providing funding for construction and operation of additional capacity at the Bubbling Ponds Native Fish Hatchery; and (6) continuing watershed management efforts to maintain or improve stream flows.

As summarized above, up to 200 acres of additional habitat will be acquired and permanently managed if impacts on habitat occupied by flycatchers and cuckoos are greater than anticipated. Additional fish mitigation efforts will be employed if nonnative fish tagged in Horseshoe are found in the uppermost reach of the Action Area.

The HCP and IA provide deadlines to ensure that elements of the HCP are implemented in a timely manner. Funding for implementation of the HCP will be assured by SRP through the establishment of designated accounts and trust funds or other permanent methods. Currently, the estimated cost of implementing the HCP is $6.5 to $9.0 million (M), but SRP commits to ensure that the actual cost of mitigation will be fully funded. Actions to be taken if changed circumstances occur are also described in the HCP.

The HCP Must Specify What Alternative Actions SRP Considered and Why Such Alternatives Are Not Adopted. In addition to the proposed alternative (Optimum Operation), two major alternatives were considered in detail: (1) operation of Horseshoe and Bartlett without a Permit (No Permit); and (2) operation using past practices (Modified Historical Operation). The No Permit Alternative was rejected by SRP because it would not allow Horseshoe and Bartlett to be used for the purposes for which they were built, would have significant socioeconomic impacts through loss of water, and would raise significant legal issues with water rights and water delivery contracts. The Modified Historical Operation Alternative was rejected by SRP because it would not reduce impacts to covered species as much as the Optimum Operation Alternative and would require more mitigation.

SRP also considered many other alternatives that were eliminated from further consideration because they were infeasible, would not have met the purposes of the reservoirs, or were minor variations of the alternatives considered in detail. These alternatives included breaching of the dams, other changes in operation of the reservoirs, and other measures to minimize or mitigate impacts on listed species and water supply.

The HCP Must Specify Such Other Measures That FWS May Require as Necessary or Appropriate, Including Reporting. SRP has worked closely with FWS in developing the HCP and has included all measures required as necessary or appropriate. These measures include the minimization and mitigation actions summarized above, continued management of mitigation activities, monitoring, and adaptive management. SRP will submit an annual report to FWS describing the results of monitoring and compliance with all terms and conditions of the Permit. An annual meeting will be held with FWS and management entities to make any necessary adjustments in implementing the HCP.

The Take of Listed Species Must Be Incidental. The take of covered species will be associated with periodic impacts on their habitat or loss of individuals, which are incidental to SRP's operation of Horseshoe and Bartlett.

The Incidental Take Will Not Appreciably Reduce the Likelihood of the Survival and Recovery of the Species in the Wild. The HCP provides for substantial conservation of habitat for the covered species. SRP believes that these conservation measures will ensure that the incidental take resulting from the covered activities—the Optimum Operation of Horseshoe and Bartlett—will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. In fact, these conservation measures are likely to <u>enhance</u> the long-term survival and recovery of these species.

Habitat Conservation Plan
Horseshoe and Bartlett Reservoirs

SUBMITTED PURSUANT TO
SECTION 10(A)(1)(B) OF THE ENDANGERED SPECIES ACT

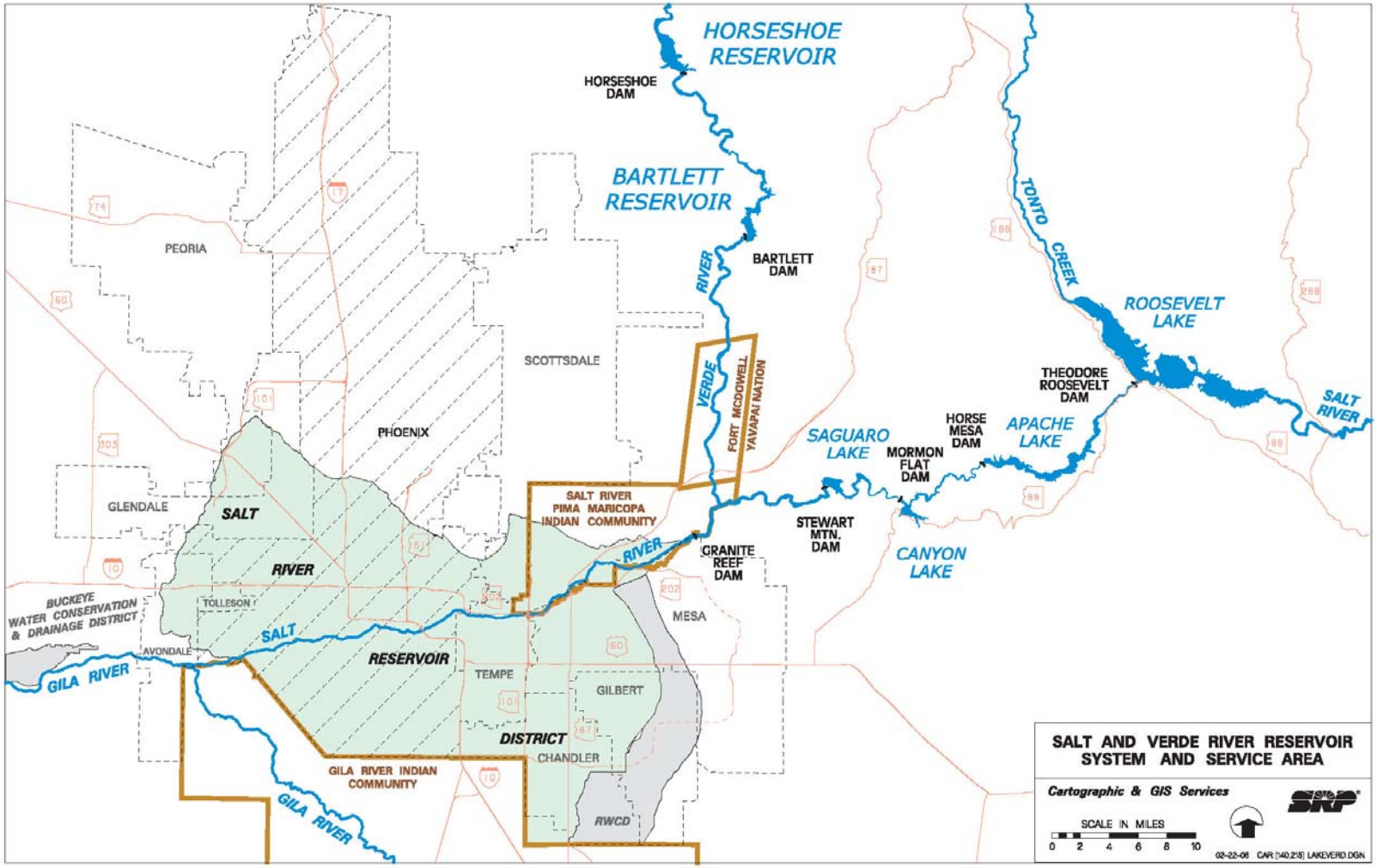
The Salt River Project (SRP) submits this Habitat Conservation Plan (HCP) to the U.S. Fish and Wildlife Service (FWS) as part of the application for an incidental take permit (Permit). The Permit would be issued by FWS under Section 10(a)(1)(B) of the Endangered Species Act (16 U.S.C. § 1539), as amended (ESA). The Permit would address incidental take of federally listed species, and impacts on species of special concern (collectively, "covered species"), associated with SRP's continued full operation of its two reservoirs on the Verde River—Horseshoe Dam and Reservoir (Horseshoe) and Bartlett Dam and Reservoir (Bartlett) (Figure ES-1 and Figure I-1).[1] The HCP provides measures: (1) to minimize and mitigate, to the maximum extent practicable, the impacts of continued reservoir operations on covered species and the habitat they use or occupy; and (2) to ensure that any incidental take of listed species will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. The HCP also addresses potential adverse modification of critical habitat, where such habitat has been designated, or proposed for designation, for listed species or in the event critical habitat is designated in the future for species covered by the HCP. If the Permit is granted, SRP will implement this HCP, as required by Section 10 of the ESA.

I. Background

Chapter I describes the purpose and need for the HCP, including the goals, objectives, and scope of the HCP. SRP (the applicant) and other beneficiaries are identified, as well as the characteristics and history of Horseshoe and Bartlett, including storage operations and the role of these facilities in the SRP reservoir system.

[1] A "listed" species is a species that has been federally listed as threatened or endangered by the FWS (*see* 16 U.S.C. § 1533(a)). "Species of special concern" include "candidate" species, which are "… those species for which the Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species" (50 C.F.R. §§ 17.22 and 17.32); species proposed for listing; and those species that may be listed during the life of the ermit. In the event that an unlisted species covered by an HCP is listed, the permit would authorize incidental take of the species, directly or through habitat modification or degradation.

Figure I-1. SRP Reservoir System and Water Service Area in the vicinity of Phoenix, Arizona.



A. Description of the Action, Purpose, and Need for the HCP

The activity covered by the Permit application is SRP's continued full operation of Horseshoe and Bartlett, which supplies water to the Phoenix metropolitan area. SRP operates these reservoirs to store and release water to meet downstream demands pursuant to various water rights. The area covered by this Permit application includes all of the storage capacity within Horseshoe and Bartlett. Impacts to the Verde River above and below Horseshoe and Bartlett are also addressed.

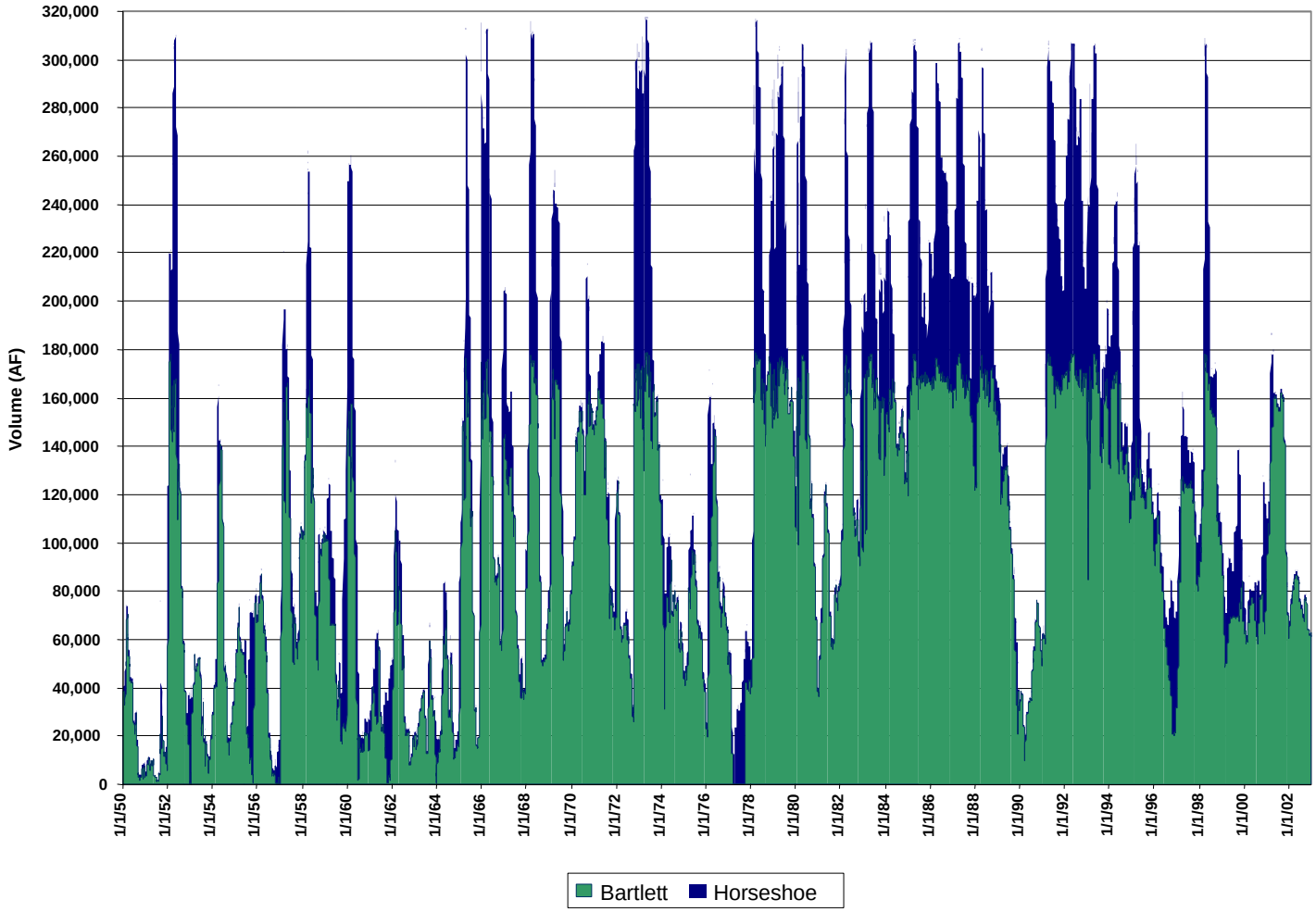
Operation of Horseshoe and Bartlett has resulted in fluctuating lake levels and stream flows since the inception of operations in the 1930s and 1940s, as shown in Figure I-2. Lake levels fluctuate seasonally due to stored winter runoff being gradually used in spring and summer, and from year to year depending on the amount of runoff entering the lake from precipitation on the watershed and reservoir releases to meet water demands. Lake levels depend on the rate of inflow and the amount of water released through the dam outlets and spillways. Stream flows below the reservoirs are primarily the result of dam operations. However, flood flows periodically spill downstream due to the limited capacity of these reservoirs. These fluctuations of lake levels and stream flows are expected to continue in the future.

Over time, the fluctuating lake level at Horseshoe and occasional scouring floods have resulted in varying amounts of riparian vegetation at Horseshoe and along the Verde River. Minimal amounts of riparian vegetation have occurred historically at Bartlett because of its relatively steep, rocky shoreline. Between the late 1970s and early 1990s, a relatively wet period, areas of riparian vegetation expanded at the inlet to Horseshoe and along the Verde River below Bartlett as the result of large scouring floods and high lake levels.[2] Since the mid-1990s, low water levels caused by recent years of drought (Figure I-2) have allowed additional riparian vegetation to become established along the Verde River on the exposed lakebed of Horseshoe.

The fluctuations in lake levels and stream flows affect the amount of riparian and aquatic habitat available at Horseshoe, Bartlett, and along the Verde River. In turn, those fluctuations and effects on habitat are likely to periodically result in take of species listed under the ESA.

[2] Similar expansions of riparian vegetation would be expected during future wet periods.

Figure I-2. Historical combined storage volumes for Horseshoe and Bartlett reservoirs, 1950–2002.



Section 9 of the ESA prohibits take of threatened and endangered species. Under limited circumstances, however, FWS may issue permits to take federally listed species, when such a take is incidental to, and not the purpose of, otherwise lawful activities (50 CFR § 17.3). Regulations governing permits for listed species are codified at 50 CFR §§ 17.22 and 17.32. The term "take" under the ESA means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct (16 U.S.C. § 1531(18)). Harm is further defined to include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing behavioral patterns such as breeding, feeding, or sheltering." Harass is defined as "intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering."

SRP's operation of Horseshoe and Bartlett is anticipated to occasionally result in incidental take of species listed under the ESA. As discussed in depth in Chapter IV, take of listed species due to Horseshoe and Bartlett operations would occur as a result of direct loss of individuals of the covered species or modification of habitat occupied by the covered species. The requested Permit would allow incidental take resulting from SRP's continued operation of Horseshoe and Bartlett, consistent with the purpose of the reservoirs to store and release water.

Section 10(a)(1)(B) of the ESA and regulations at 50 CFR §§ 17.22 and 17.32 contain provisions for issuing permits to nonfederal entities for incidental take of endangered and threatened species, provided the following criteria are met:

1. The take will be incidental;
2. The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such take;
3. The applicant will develop an HCP and ensure that adequate funding for the HCP will be provided;
4. The take will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and
5. Any other measures that FWS may require as being necessary or appropriate for the purposes of the HCP.

This HCP was developed to completely satisfy these criteria.

B. Scope of the Habitat Conservation Plan for Horseshoe and Bartlett

The species, geographical area, environmental baseline, time period, and impacts covered by the HCP are summarized in this section.

1. Species Covered

This HCP covers certain species listed under the ESA as endangered or threatened, candidates for listing, and species of special concern that might be adversely affected by

continued operation of Horseshoe and Bartlett. The species covered by the HCP and their listing status are provided in Table I-1.

Table I-1. Covered species.

Scientific Name	Common Name	ESA	AGFD	Critical Habitat
Empidonax traillii extimus	Southwestern willow flycatcher	LE	WSCA	Yes
Haliaeetus leucocephalus	Bald eagle	LT	WSCA	No-
Coccyzus americanus	Yellow-billed cuckoo	C	WSCA	-
Xyrauchen texanus	Razorback sucker	LE	WSCA	Yes
Ptychocheilus lucius	Colorado pikeminnow	LE, XN	WSCA	Yes (elsewhere)
Poeciliopsis occidentalis occidentalis	Gila topminnow	LE	WSCA	No
Meda fulgida	Spikedace	LT	WSCA	Yes (upstream)
Tiaroga cobitis	Loach minnow	LT	WSCA	Yes (elsewhere)
Gila robusta	Roundtail chub	-	WSCA	-
Agosia chrysogaster	Longfin dace	-	-	-
Catostomus insignis	Sonora sucker	-	-	-
Catostomus clarki	Desert sucker	-	-	-
Rhinichthys osculus	Speckled dace	-	-	-
Rana yavapaiensis	Lowland leopard frog	-	WSCA	-
Thamnophis eques megalops	Northern Mexican gartersnake	-	WSCA	-
Thamnophis rufipunctatus	Narrow-headed gartersnake	-	WSCA	-

KEY: ESA=Endangered Species Act as amended, 1973 (LE=Listed Endangered; LT=Listed Threatened; C=Candidate; XN=Experimental, nonessential population)
AGFD=Arizona Game and Fish Dept (WSCA=Wildlife of Special Concern in Arizona)
Critical Habitat=designated under the ESA (PR=Proposed; WD = Withdrawn)

The listing history, biology, and status of these species are described in Subchapter III.A. Other species for which SRP is not seeking Permit coverage also may benefit from the conservation measures provided in the HCP.

In 2002, flycatchers, a species listed as endangered in 1995, were discovered establishing territories in trees on the Horseshoe lakebed and downstream of Horseshoe along the Verde River. As a result, SRP began discussions with FWS about this HCP, and flycatchers are a primary focus of the HCP.

Horseshoe, Bartlett, and the Verde River provide foraging opportunities for bald eagles and reservoir operations affect eagle foraging. Bald eagles also have historically used cottonwood trees at the upper end of Horseshoe for nesting. Riparian vegetation in and around Horseshoe and along the Verde River below the two reservoirs provides habitat for bald eagles, a recently delisted species, and cuckoos, a candidate species.

Also, Horseshoe has been designated as critical habitat for a native fish, the endangered razorback sucker. SRP is seeking Permit coverage for this species as well. As discussed in Chapter IV, SRP does not anticipate adverse modification of razorback sucker critical habitat from continued reservoir operations. At the time that critical habitat was designated, FWS was aware of the highly variable storage levels in Horseshoe and believed the storage fluctuations were likely to be beneficial to razorback suckers by allowing cover for young razorback suckers to grow on the exposed reservoir bottom and limiting the production of predators in some years (Fitzpatrick, pers. comm. 2003). Storage fluctuations will continue under each of the reservoir operation alternatives. In addition, razorback suckers are known to utilize reservoirs (59 FR 13393, March 21, 1994; FWS 2002b; Robinson 2007).

SRP is also seeking Permit coverage for other native fish species, including two species listed as endangered—Colorado pikeminnow and Gila topminnow, two species listed as threatened—spikedace and loach minnow, and five species that currently are unlisted but may be listed in the future—roundtail chub, longfin dace, speckled dace, Sonora sucker, and desert sucker. The Verde River and its tributaries historically and/or currently provide habitat to these fish species that may be affected by reservoir operations, particularly to the extent that Horseshoe and Bartlett serve as potential sources for nonnative species that predate on or compete with native species or their prey base. In addition, Permit coverage is being sought for lowland leopard frog, and northern Mexican and narrow-headed gartersnakes, which occupy riparian habitat along portions of the Verde River and its tributaries, and would be affected by reservoir operations in the same way as the native fish.

2. Geographical Area Covered

The covered activities would be the operation of Horseshoe up to an elevation of 2,026 feet and Bartlett up to an elevation of 1,798 feet. SRP has authority over and responsibility for operation of the water storage space in Horseshoe pursuant to its contracts with the United States dated 1904, 1917, 1944, 1948, 1988, and 1993 (Subchapter I.E and Appendix 1). SRP has authority over and responsibility for operation of the water storage space in Bartlett pursuant to its contracts with the United States dated 1904, 1917, 1935, 1988, and 1993 (Subchapter I.E and Appendix 1).

Impacts to the Verde River above and below Horseshoe and Bartlett are also addressed (Subchapter IV.B). The HCP encompasses the following Action Area:

- The Salt River and 100-year floodplain between Granite Reef Dam and the confluence with the Verde River;
- The Verde River and the 100-year floodplain between the confluence with the Salt River and the upper end of Horseshoe at full pool;
- The Verde River between the upper end of Horseshoe at full pool and the Allen Ditch Diversion near Peck's Lake;
- The lower 0.125 mile of all intermittent and ephemeral streams and washes tributary to the reaches listed above;
- The lower 6 stream miles of Lime Creek, the lower 8 stream miles of the East Verde River, the lower 3 stream miles of Fossil Creek, the lower 2 stream miles

of West Clear Creek, the lower 12 stream miles of Wet Beaver Creek, the lower 3 stream miles of Oak Creek; and

- Lands acquired for flycatcher mitigation.

Most of the HCP Action Area is in Maricopa and Yavapai counties; however, the upstream ends of some tributaries to the Verde River extend into Gila and Coconino counties, and the mitigation lands will be acquired in Graham and Coconino counties, or other counties in central Arizona.

3. Environmental Baseline

For purposes of Section 7 of the ESA, the environmental baseline includes "the past and present impacts of all federal, state or private actions and other human activities in the Action Area, the anticipated impacts of all proposed federal projects in an Action Area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process" (50 CFR § 402.02). The impacts of activities that form the environmental baseline for the HCP are described in Chapter III and Subchapter IV.B.

4. Time Period Covered

A decision by FWS on the Permit application is anticipated in the spring of 2008. SRP is applying for a Permit for a period of 50 years extending from the date that a Permit is issued based on several considerations. First, a 50-year Permit will provide long-term assurance that Horseshoe and Bartlett can continue to be operated for water storage purposes consistent with the terms of the Permit. As a result, SRP and Phoenix will be provided with greater certainty of future water supplies. This greater certainty makes it possible for SRP to commit to the funding required for the proposed conservation measures in the HCP.[3] This greater certainty in turn benefits the other water users that rely on this stored water, including the two Indian communities with storage entitlements in Horseshoe and Bartlett. Second, the proposed mitigation measures are long-term commitments to protect and preserve habitat for the covered species, including habitat acquisition, management, and monitoring. A 50-year Permit is warranted by these required long-term commitments. Third, the analyses of impacts in the HCP are predicated on the long-term pattern of fill and release for the reservoirs and the effects that continued reservoir operations would have on the habitat available to the listed and candidate species and their long-term survival (Chapter IV). As discussed in Chapter IV, analysis of historical runoff in the Salt and Verde river watersheds indicates that a period of at least 40 years is required to reflect the long-term average pattern and quantity of runoff, and a longer period is required if there are anomalies in climatic conditions within the selected time period.

5. Impacts Covered

SRP's preferred alternative for the HCP is modified operation of Horseshoe and Bartlett, which would involve issuance of a Permit by FWS authorizing continued full

[3] Phoenix is contributing substantial funding for preparation and implementation of the HCP under an agreement with SRP.

operation of Horseshoe and Bartlett consistent with pre-Permit operational objectives for full operation of the reservoirs up to their maximum storage elevations (Subchapter I.F.3), with the addition of two new operating objectives:

- To support stands of tall dense vegetation at the upper end of Horseshoe, and
- To manage Horseshoe water levels to minimize impacts to covered native fish, frog, and gartersnake species and to benefit the razorback sucker.

This Optimum Operation Alternative or Proposed Operation is described in Subchapter II.B. A permit is needed because continued operation of Horseshoe and Bartlett with modified operation objectives will periodically result in inundation or desiccation of occupied habitat at Horseshoe and the associated effects on that habitat may render portions of it unsuitable for use by flycatchers, bald eagles, and cuckoos. On rare occasions, fluctuations in lake levels may result in direct take of eggs, nestlings, or fledglings. In addition, continued operation of Horseshoe and Bartlett may adversely impact covered native fish, frog, and gartersnake species and the habitat they use or occupy along the Verde River above or below the dams within the area covered by the HCP.

The HCP specifies measures to minimize and mitigate impacts of incidental take of covered species from future SRP operations of Horseshoe and Bartlett. These impacts will result from: (1) inundation of covered bird nests with eggs or fledglings, or nestlings falling out of nests and drowning in water at the base of the nest tree; (2) periodic unavailability, modification, or loss of habitat occupied or utilized by covered birds accompanied by loss of productivity; (3) impacts to the habitat of covered fish, frogs, and gartersnakes or their prey base attributable to predation and/or competition by nonnative species spawned or reared in Bartlett or Horseshoe or their progeny; or (4) injury or death of covered fish and frogs from passage through reservoir outflow works or stranding in the reservoir. Impacts will include those to existing occupied or utilized habitat as well as to habitat that may develop and be occupied or utilized in the future. Since future conditions are difficult to predict, the approach in the HCP provides adaptive management to reduce the possibility that take will exceed authorized levels. Detailed information is provided in Chapter IV about the impacts of Horseshoe and Bartlett operations on covered species.

C. Goals and Objectives of the HCP

The goal of the HCP is to provide for the conservation of covered species that inhabit Horseshoe and Bartlett, and the Verde River above and below those dams, while allowing the continued operation of the two reservoirs. The biological goals of the HCP are to minimize and mitigate incidental take of covered species to the maximum extent practicable, and to not appreciably reduce the likelihood of the survival and recovery of covered species due to the continued operation of Horseshoe and Bartlett. If issued, the Permit will become effective for unlisted species upon listing, but the mitigation and minimization measures would be implemented immediately as part of the HCP. The goals of the HCP will be achieved in the following manner:

- Maintaining riparian habitat in Horseshoe;
- Minimizing impacts to flycatchers and cuckoos at Horseshoe;

- Acquiring and managing riparian habitat along the Verde River, Gila River, or elsewhere in central Arizona to provide a diversity of geographic locations;
- Focusing acquisition of riparian land in locations that flycatchers and cuckoos are expected to occupy, i.e., in proximity to existing populations;
- Acquiring mitigation riparian habitat that is similar to Horseshoe habitat in terms of vegetation composition and patch sizes;
- Adaptive management if bald eagles nest in Horseshoe or Bartlett;
- Implementing measures consistent with the August 2002 Southwestern Willow Flycatcher Recovery Plan (FWS 2002a), Razorback Sucker Recovery Plan and Recovery Goals (FWS 1998, 2000), the Spikedace Recovery Plan (FWS 1991a), the Gila Topminnow Recovery Plan (FWS 1984), and the Loach Minnow Recovery Plan (FWS 1991b);
- Early and rapid drawdown of Horseshoe to reduce the recruitment of nonnative species;
- Operating and stocking Horseshoe to benefit razorback sucker;
- Installing a fish barrier on Lime Creek;
- Providing contributions and in-kind support to improve and expand the Bubbling Ponds Native Fish Hatchery, and to assist in stocking native fish; and
- Continuing watershed management efforts to maintain or improve stream flows.

Adaptive management will be employed to address certain changes in circumstances. Detailed information on the minimization, mitigation, and adaptive measures to be implemented as part of the HCP is provided in Chapter V.

D. Public Involvement in the HCP

Public involvement in development of the HCP was initiated with the establishment of an Advisory Group. In early April 2003, invitations to participate in the Advisory Group were sent to representatives of state and federal agencies, Indian tribes, cities, recreational groups, and environmental groups. Meetings of the Advisory Group were held on May 5, September 22, and December 16, 2003; March 16, 2005; and May 4, 2006 to solicit input on all aspects of the HCP. Representatives of the following organizations attended all or some of the Advisory Group meetings and provided input to SRP:

- Arizona Department of Water Resources
- Arizona Game and Fish Department
- Arizona Municipal Water Users Association
- Bureau of Reclamation
- Center for Biological Diversity
- Cities of Phoenix, Mesa, and Tempe
- U.S. Forest Service
- Fort McDowell Yavapai Nation
- Maricopa Audubon Society

- Salt River Pima-Maricopa Indian Community

Public involvement also was solicited in scoping of the HCP, in conjunction with scoping of an environmental impact statement (EIS) on FWS Permit approval, through public notice in the Federal Register (68 FR 36829, June 19, 2003), mailing of approximately 300 scoping announcements in June 2003, and a FWS news release dated June 23, 2003. On June 30, 2003, legal advertisements of the scoping process ran in the Scottsdale Tribune and East Valley Tribune. A public scoping meeting was held on July 15, 2003 from 6:00 p.m. to 8:00 p.m. at the offices of SRP.

Following publication of the draft HCP on July 25, 2007 (72 FR 40892), a public hearing on August 29, 2007, and receipt of written comments, SRP revised the HCP in cooperation with the FWS (Final EIS (FEIS), Section 1.4.4). Copies of the comments that were received and responses to those comments are provided in Attachment 2 to the FEIS.

E. Description of Applicant and Beneficiaries

1. The Applicant

The applicant for the Permit is the Salt River Project Agricultural Improvement and Power District (District). SRP refers to the Salt River Valley Water Users' Association (Association) and the District. SRP was authorized in 1903 under the 1902 Reclamation Act.[4] Formed as an Arizona Territorial Corporation on February 7, 1903, the Association consists of shareholders owning lands within Salt River Reservoir District boundaries.

The District was formed in 1937. Under contract with the Association, the District assumed the obligations of the Association for the overall operation, care, and maintenance of certain SRP facilities including reservoirs; thus, the District is applying for the Permit from FWS. The Association continues to operate the irrigation system as an agent of the District. In addition to operating the reservoirs, the District owns and operates electric and power generation, transmission, and distribution facilities.

SRP shareholder lands that are subscribed to the Association have vested rights to delivery of a share of the water stored behind SRP's reservoirs, including Horseshoe and Bartlett (Appendix 1). In addition to the rights to SRP stored water, many shareholder lands also have individual rights to the normal flow of the Salt and Verde rivers, which pre-date the construction of SRP's reservoirs (Appendix 1).

Water from Horseshoe, Bartlett, and SRP's other reservoirs is provided directly by SRP to shareholder lands for irrigation and other uses, and also is delivered to the cities of Avondale, Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, Scottsdale, Tempe, and Tolleson, for delivery to shareholder lands. In addition to providing water to shareholder lands, SRP is obligated to deliver water to cities, irrigation districts, Indian communities,

[4] March 7, 1903 letter from C.D. Walcott, Director, U.S. Geological Survey to Secretary of the Interior E.A. Hitchcock. Secretarial Approval on March 14, 1903. *In*: U.S. Bureau of Reclamation project feasibilities and authorizations. U.S. Printing Office, Washington, D.C. 1957.

and individual water users having water rights to the Salt and Verde rivers (Appendix 2). The location of SRP shareholder lands and individual water users within the Salt River Reservoir District, as well as cities, irrigation districts, and Indian communities receiving water from SRP, are shown in Figure I-1. Table I-2 lists the entities with independent water rights that are entitled to SRP water deliveries. The settlements, agreements, and water rights that set forth the entitlements of those entities and SRP's delivery obligations are summarized in Appendices 1 and 2. In addition to numerous water delivery contracts, water exchange agreements between a number of entities and SRP are facilitated by stored water.

The purpose of the discussion of settlements, agreements, and water rights in the HCP, including this subchapter, as well as Appendices 1 and 2, is to describe the components of SRP's long-standing obligation to operate the conservation storage space at Horseshoe and Bartlett along with SRP's other reservoirs, and to deliver the water stored in these reservoirs in satisfaction of the water rights of numerous entities and individuals.

2. HCP Beneficiaries

As summarized below and in Appendix 1, beneficiaries of the HCP, in addition to SRP shareholders and contractors, include those entities that have specific entitlements to storage in, and deliveries from, the reservoirs operated by SRP on the Verde River. The Salt River Pima-Maricopa Indian Community (SRPMIC) is entitled to a proportionate share of the water stored in Bartlett. Phoenix has water rights to the upper portion of the storage space behind Horseshoe. The Fort McDowell Yavapai Nation (FMYN) has rights in the combined storage of Horseshoe and Bartlett.

In 1935, SRP and the United States on behalf of SRPMIC contracted to build Bartlett Dam to carry out the provisions of a 1916 federal law mandating delivery of water to allotments on the Salt River Pima-Maricopa Reservation and to provide additional water to SRP. Construction of Bartlett was completed in 1939. As a result of the Bartlett agreement, SRP credits SRPMIC with up to 60,000 AF of storage credits and is required to deliver up to 20,000 AF/year. SRP is required to use the rest of the water stored in Bartlett to meet demands of its shareholders and contractors. In 1988, Congress enacted the Salt River Pima-Maricopa Indian Community Water Rights Settlement Act (SRPMIC Act). Also in 1988, SRP, SRPMIC, the United States, and other parties signed the SRPMIC Water Rights Settlement Agreement (SRPMIC Agreement) pursuant to the SRPMIC Act. With respect to Verde River storage, the SRPMIC Act and SRPMIC Agreement provide to SRPMIC: (1) modifications of Bartlett credit accounting to increase the amount of stored water credits under certain circumstances; (2) a portion of the total water stored in SRP's reservoirs on the Salt and Verde rivers; and (3) stored water credits for various allocations and exchanges.

Table I-2. Entities entitled to SRP surface water deliveries under settlements or agreements.

Entity	Settlement or Agreement*
Buckeye Irrigation Company	Basis of Settlement of Litigation Between Buckeye Irrigation Company and the Salt River Valley Water Users' Association, 1943.
City of Phoenix	**Agreement Between Salt River Valley Water Users' Association and the City of Phoenix, A Municipal Corporation, 1946; Contract Between the United States of America, the City of Phoenix, Arizona, and the Salt River Valley Water Users' Association Providing for the Installation of Spillway Gates at Horseshoe Dam, 1948.**
Cities of Chandler, Glendale, Mesa, Phoenix, Scottsdale, and Tempe	Agreement Among the United States, the Central Arizona Water Conservation District, the Flood Control District of Maricopa County, the Salt River Project Agricultural Improvement and Power District and Salt River Valley Water Users' Association, and the Arizona Cities of Chandler, Glendale, Mesa, Phoenix, Scottsdale and Tempe, the State of Arizona, and the City of Tucson for Funding of Plan Six Facilities of the Central Arizona Project, Arizona and for Other Purposes, April 15, 1986.
Fort McDowell Indian Community (now the Fort McDowell Yavapai Nation)	**Fort McDowell Indian Community Water Rights Settlement Act (104 Stat. 4480, 1990); and Fort McDowell Indian Community Water Settlement Agreement, January 15, 1993.**
Gila River Indian Community	Gila River Indian Community Water Rights Settlement Agreement, 2003, and Settlement Act, 2004, including amended 1936 Maricopa Contract.
Lennox – Lakin	Agreement Between Loring C. Lennox and the Salt River Valley Water Users' Association, 1921.
Maricopa Garden Farms	Agreement Between the Fidelity Savings and Loan Association and the Salt River Valley Water Users' Association, 1924.
New State Irrigation and Drainage District	Agreement Between New State Canal Company, Landowners, and the Salt River Valley Water Users' Association, 1924.
Municipal Delivery Contracts	Water Delivery and Use Agreements between SRP and the cities of Avondale, Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, Scottsdale, Tempe, and Tolleson; Reclamation Act of April 16, 1906, 43 U.S.C. § 567 (34 Stat. 116); Decision and Decree entered by the District Court of the Third Judicial District of the Territory of Arizona, In and For the County of Maricopa in Hurley v. Abbott, No. 4564, March 1, 1910 (Kent Decree).
Peninsula-Horowitz	Agreement Between the Salt River Valley Water Users' Association, Roosevelt Irrigation District, and Valley Bank and Trust Company, N.P. McCallum, George Taylor, T.W. Barker, C.W. and Bertha Boggs, A.B. Vauk, W.A. Thompson, and Maude M. Tanton Grimshaw, 1930.
Phelps Dodge Corporation	**Agreement Between Salt River Valley Water Users' Association, Phelps Dodge Corporation, and Defense Plant Corporation, 1944.**
Roosevelt Water Conservation District	Agreement Between the Salt River Valley Water Users' Association and Roosevelt Water Conservation District, 1924.
Salt River Pima-Maricopa Indian Community	**Agreement between the United States and the Salt River Valley Water Users' Association Verde River Storage Works, 1935; Salt River Pima-Maricopa Indian Community Water Rights Settlement Act (102 Stat. 2549), 1988; and Settlement Agreement, February 12, 1988.**
St. John's Irrigation District	Agreement Between St. John's Irrigation District and the Salt River Valley Water Users' Association, 1924.

*In general, only the initial document is listed. However, many of these settlements or agreements have been supplemented or amended and, where applicable, those modifications are incorporated herein.
NOTE: **Bold text** indicates specific entitlements in Horseshoe or Bartlett.

In 1944, SRP, Phelps Dodge, and the Defense Plant Corporation agreed to construct Horseshoe in order to develop a supply of water for the copper mining operations at Morenci as part of the national defense program and to provide SRP with additional water. Construction of Horseshoe was completed early in 1946 with a storage capacity of 67,900 AF. In exchange for SRP use of water stored in Horseshoe, Phelps Dodge obtained a one-time right to 250,000 AF of water from the reservoir (Appendix 1). Phelps Dodge has used its Horseshoe water at Morenci under an exchange agreement with SRP that allows Phelps Dodge to divert water from the upper Salt River basin.

Later in 1946, SRP and Phoenix entered into an agreement for construction of spillway gates at Horseshoe Dam. After two years of discussion, the 1946 Contract was partially incorporated into the 1948 Contract among the United States, Phoenix, and the Association providing for the installation of spillway gates at Horseshoe Dam. Under these agreements, in consideration for payment of the cost to install gates in the spillway of Horseshoe Dam, Phoenix was authorized to store water behind the spillway gates at Horseshoe. The construction of the spillway gates was completed in the fall of 1951. The spillway gates enable SRP to store additional water behind Horseshoe (thus the commonly used name of "Gatewater" for this entitlement), initially about 76,000 AF, but now less than 68,000 AF due to losses from sediment being deposited behind the dam. Phoenix holds a Certificate of Water Right issued by the State of Arizona for the storage and use of this water.

In 1990, Congress passed the Fort McDowell Indian Community Water Rights Settlement Act (FMIC Act). In 1993, SRP, the Fort McDowell Indian Community (now FMYN), the United States, and other parties, signed the Fort McDowell Indian Community Water Rights Settlement Agreement (FMIC Agreement). Under the FMIC Act and FMIC Agreement, SRP is required to: 1) store up to 3,000 AF/year of water for FMYN for a period of 25 years; 2) provide up to 6,730 AF/year of SRP stored water for use by FMYN; and 3) deliver up to 3,368 AF/year from the Roosevelt Water Conservation District's (RWCD) stored water entitlement (Appendix 1). In addition, SRP is obligated to exchange up to 13,933 AF/year of FMYN's Central Arizona Project (CAP) entitlement for SRP stored water. Finally, SRP is required to release a minimum flow of 100 cubic feet per second (cfs) year-round from Bartlett plus water orders on the Verde River except in situations of emergency, drought, or water quality problems. In the FMIC Act, Congress validated the water storage rights of the United States and the Association for Bartlett and Horseshoe, and the Association's right to deliver water stored at Horseshoe and Bartlett to FMYN as required by the FMIC Agreement, as well as to SRP's shareholders.

F. Description of SRP System, Horseshoe and Bartlett Reservoirs, and Reservoir Operations

SRP delivers an average of 1 million AF of water each year from various sources of surface and ground water for use on more than 240,000 acres spanning 375 square miles (SRP 2001). Most of SRP's deliveries are to cities and urban irrigation uses, which constitute a large portion of the total water supply to the Phoenix metropolitan population of more than 2.6 million (SRP 2002). Annual surface water diversions by SRP average about 900,000 AF, approximately 40 percent of the water supply to the Phoenix Active

Management Area, an area of approximately 5,600 square miles (ADWR 1994).[5] Horseshoe and Bartlett supply about 40 percent of SRP's surface water supplies on average, or about 360,000 AF/year (Ester, pers. comm. 2001).

From 1995 through 2002, Phoenix chose to take delivery of about 15,000 AF/year on average from its storage entitlement in Horseshoe (Appendix 1). FMYN obtains all of its water supplies from the Verde River, including ground water pumped from the alluvial aquifer along the river. As described in Appendix 1, the maximum annual diversion by FMYN could total 31,824 AF at full demand. Recent deliveries to FMYN have averaged about 11,000 AF/year. SRPMIC receives a substantial amount of water from the Verde River, including an average of about 18,000 AF/year from storage developed by Bartlett (Appendix 1).

The SRP system, its history, and a general description of reservoir operations are summarized below in order to provide context for describing the important role of Horseshoe and Bartlett in providing water to a substantial portion of the Phoenix metropolitan area.

1. Overview

The entire storage capacity of Horseshoe and Bartlett is essential to the ability of SRP, Phoenix, the SRPMIC, the FMYN, and other water users to meet their water demand. These two reservoirs are used to directly supply water to meet most of these demands during a portion of each year. In addition, maximum use of these reservoirs allows SRP's largest reservoir, Roosevelt Lake, to accumulate additional storage to supply water during extended droughts. Without Horseshoe and Bartlett operated in combination with all six of SRP's reservoirs and ground water pumping, the Phoenix metropolitan water supply would be in jeopardy. When the SRP surface water supply from the reservoirs shrinks because of prolonged drought conditions, ground water pumping is utilized to supplement the available water supply. However, the Arizona Groundwater Management Act (A.R.S. § 45-401 et seq.) is increasingly restricting the use of ground water.

2. History

Modern irrigation in the Salt River Valley began in the 1860s. Many diversion dams, canals, and laterals were constructed between 1867 and 1902. As the requirements for irrigation water increased and the cycles of extreme flood and drought became problematic, engineers and surveyors began to explore the possibility of large-scale storage structures to control the region's water supply.[6]

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[5] SRP average deliveries of 1 million AF, measured at the delivery point to water users, include surface water, ground water, and any other available supply such as CAP water. SRP diversions from these sources are about 1.1 to 1.2 million AF due to losses in the system, many of which recharge ground water.

[6] The key impetus to construct storage came from the need for a stable water supply in the face of major floods in the late 1880s and early 1890s followed by a severe drought in the late 1890s (Smith 1986, pp. 1-14).

The construction of Roosevelt Dam, the first in the federal Salt River Reclamation Project, began in 1903 and was completed in 1911 by the U.S. Bureau of Reclamation (Reclamation). Roosevelt Lake is located at the confluence of Tonto Creek and the Salt River about 60 miles northeast of Phoenix in Gila and Maricopa counties (Figure I-1). Water was first stored behind the dam in 1910. In this HCP, Roosevelt Dam and Lake are referred to as Roosevelt.

In 1917, by contract with the Association, the United States turned over to and vested in SRP the authority to care for, operate, and maintain all Project facilities.[7] SRP continues to operate these facilities pursuant to that contract.

Three additional dams were built on the Salt River below Roosevelt Dam in the 1920s—Mormon Flat (Canyon Lake), Horse Mesa (Apache Lake), and Stewart Mountain (Saguaro Lake). These dams increased the water supply available to SRP and provided additional hydropower production.

Recently, C.C. Cragin Dam and Reservoir (formerly known as Blue Ridge Dam and Reservoir) was added to the SRP system as the result of the Arizona Water Settlement Act of 2004 (Public Law 108-451). This reservoir on upper East Clear Creek in the Little Colorado River watershed has a capacity of 15,000 AF. Water stored in C.C. Cragin Reservoir is pumped over the Mogollon Rim into the East Verde River.

Reclamation withdrew land from the public domain along the Verde River in 1903 and 1904 for the purpose of construction of irrigation facilities for SRP (Figure I-3).[8] Using this withdrawn land, Bartlett Dam was constructed in the 1930s and Horseshoe Dam, upstream from Bartlett, was completed early in 1946. The withdrawn land surrounding the reservoirs is managed under a three-way agreement among SRP, Reclamation, and the U.S. Forest Service (USFS), with the USFS being responsible for management of recreation and other public land uses.[9]

Since their completion, SRP's reservoirs have continuously provided water for irrigation, municipal and industrial uses, and hydroelectric power generation. These reservoirs also provide a variety of recreational uses in central Arizona.[10] A profile view of the SRP reservoir system is presented in Figure I-4.

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[7] See contract dated September 6, 1917 between the Salt River Valley Water Users' Association and the United States (43 U.S.C. § 499).

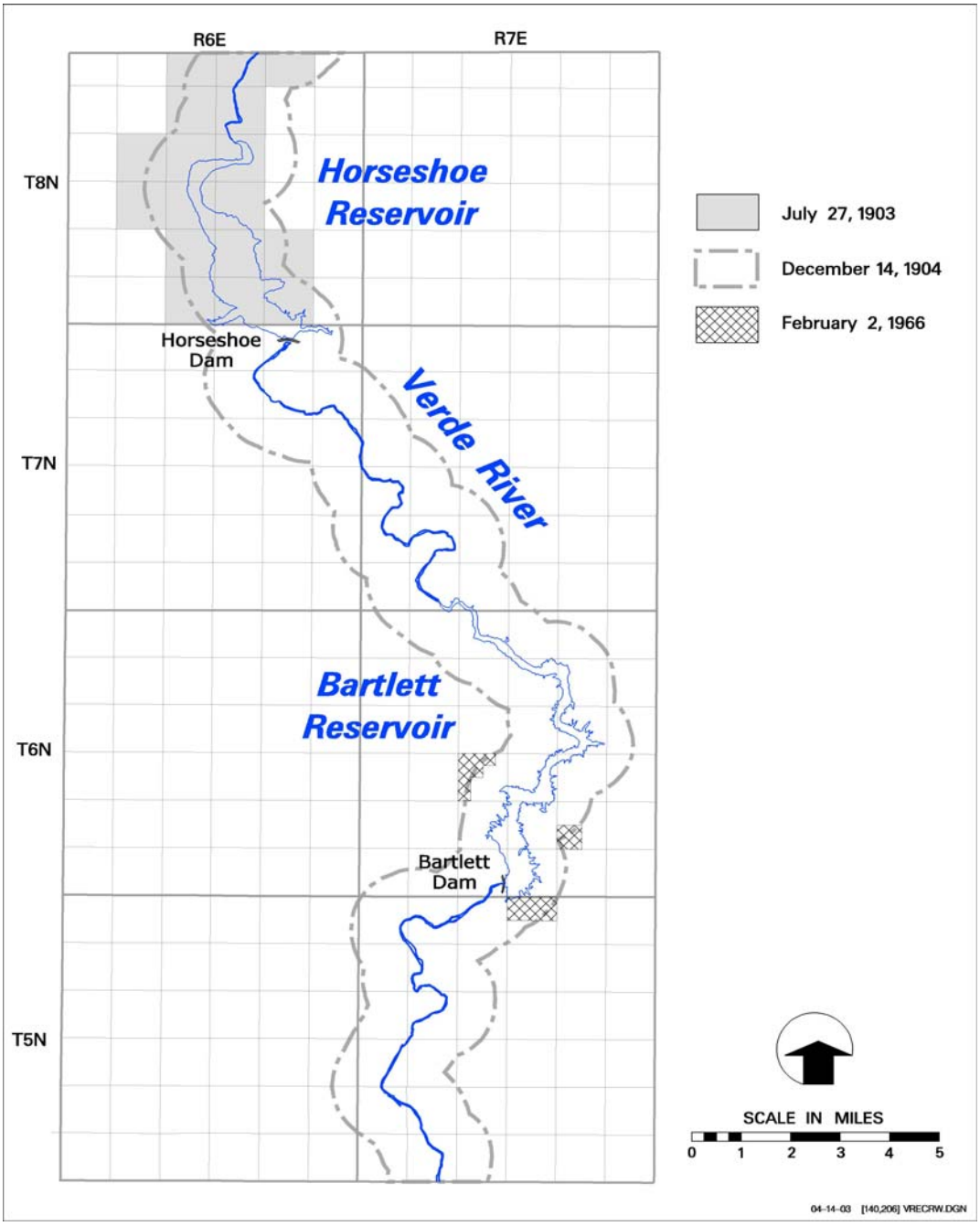
[8] See letter from E.A. Hitchcock, Secretary of Interior to the Commissioner of the General Land Office, December 14, 1903; W.A. Richards, Commissioner, General Land Office, to Register and Receive, Prescott, December 17, 1904.

[9] See Management Memorandum Among the Salt River Project Agricultural Improvement and Power District, United States Department of Agriculture Forest Service, and United States Bureau of Reclamation, April 27, 1979.

[10] Environmental benefits include the creation and maintenance of riparian habitat around the lake, foraging habitat for bald eagles, and generation of energy without emissions or nuclear waste.

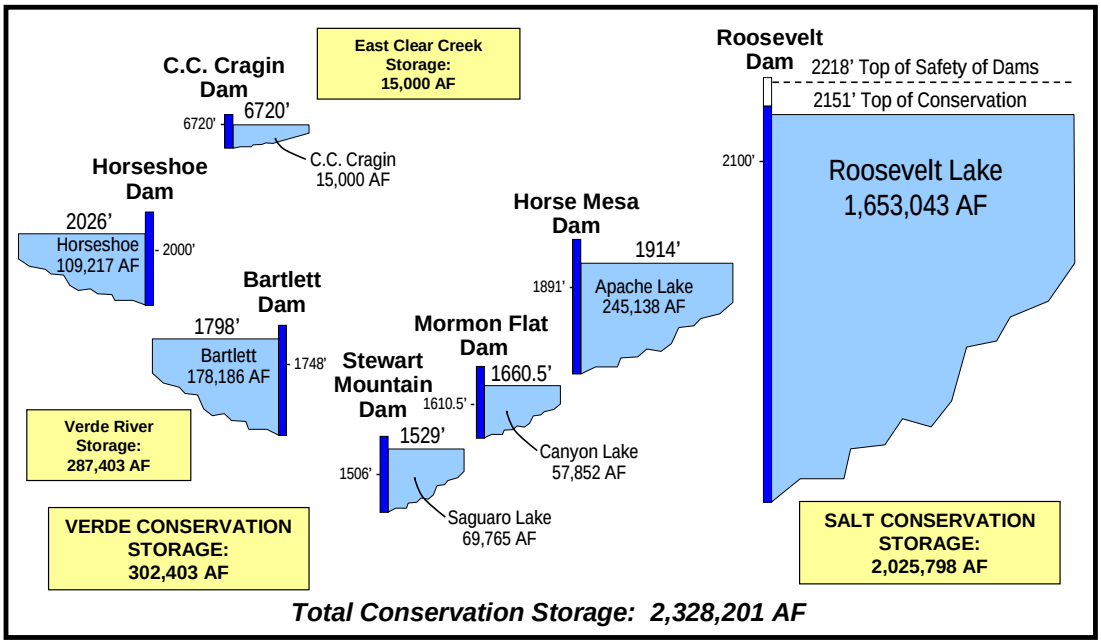
SRP also operates Granite Reef Diversion Dam located on the Salt River just below the confluence with the Verde River, about 250 wells, and an interconnection to the CAP to deliver water through nearly 1,300 miles of canals, lateral ditches, and pipelines.[11]

Figure I-3. Lands withdrawn by Reclamation for the benefit of SRP in the vicinity of Horseshoe and Bartlett. Legend shows date of withdrawal.



[11] See www.srpnet.com/water.

Figure I-4. Profile of SRP Water Storage System.



Note: The maximum conservation storage elevation above mean seal level is shown for each dam, and the maximum flood control elevation (2,218 feet) is also shown for Roosevelt.

3. Overall Reservoir Operations

SRP is responsible for operation of all the conservation storage space at all seven of its reservoirs under the 1917 Contract and the various contracts listed in Appendix 1. SRP manages the SRP reservoir system, including Horseshoe and Bartlett, to minimize releases of water over, around, or downstream of Granite Reef Diversion Dam in accordance with the following SRP conservation storage objectives (in order of priority):

1. "Maintain the safety and integrity of the dams.
2. Maintain sufficient SRP storage to meet SRP water delivery obligations.
3. Optimize reservoir storage for SRP use within the SRP reservoir system.
4. Maintain adequate SRP carryover storage for following years in case of low runoff.
5. Conjunctively manage ground water pumping given reservoir storage and projected runoff and demand.
6. Maximize hydrogeneration.

7. Operate to permit necessary facility maintenance."
(SRP et al. 1993, Modified Roosevelt Operating Agreement)

Surface water is used to meet the SRP allocation and contract deliveries whenever possible because it is a renewable supply and is the least-cost source of water. SRP diverts about 900,000 AF of surface water per year on average, of which about 40 percent is provided through the Verde River system and about 60 percent is supplied by the Salt River system (Ester, pers. comm. 2001). Ground water is used to supplement the available surface water supplies throughout each cycle of drought (compare Figure I-2 and Figure I-5). SRP's ground water resources alone are insufficient to meet its water delivery obligations. SRP's current ground water pumping capacity is about 350,000 AF/year. Also, Arizona law discourages reliance on ground water by mandating strict conservation requirements and other limits on ground water use because ground water has been depleted historically, causing land subsidence and concerns about future water supply. For these reasons, additional ground water pumping is not a feasible source to develop for replacement of surface water supplies. In a further effort to reduce reliance on ground water, SRP has supplemented its surface water supplies during the recent drought years with surplus CAP water rather than relying entirely on additional pumping (Figure I-5). This is a short-term option because SRP does not have a contract for CAP water. This option will no longer be available to SRP once CAP water users fully utilize their allocations, or when Colorado River shortages result from low runoff years or increased use by upper basin states (Subchapter II.C).

4. Horseshoe and Bartlett

Figure I-6 shows the current storage capacities of Horseshoe and Bartlett. Based on a 2001 sediment survey, current storage capacity in Horseshoe is 109,217 AF, divided between 41,515 AF of storage for SRP and 67,702 AF for Phoenix. Current Bartlett storage capacity is 178,186 AF. The lowest 8,909 AF of storage in Bartlett is for SRP and the remaining 169,277 AF is divided 20 percent for SRPMIC and 80 percent for SRP (Appendix 1).

As discussed above, SRP operates Horseshoe and Bartlett on the Verde River in conjunction with the Salt River reservoirs; however, the Verde River reservoirs are operated differently than the Salt River reservoirs. The primary reason for the difference in operations is the relative size of the reservoirs on the two river systems. The Verde River dams have relatively small storage capacity (Figure I-4). Only 12 percent of SRP's total storage capacity exists in the Verde River reservoirs. The Verde River reservoirs' capacity of 287,403 AF (including the space behind the Phoenix spillway gates[12] on Horseshoe Dam) is only about two-thirds of the annual average flow of the Verde River.

[12] Gates in the spillway constructed by the City of Phoenix to increase the storage capacity of Horseshoe Dam (see Appendix 1).

Figure I-5. Annual ground water pumping and CAP water use.

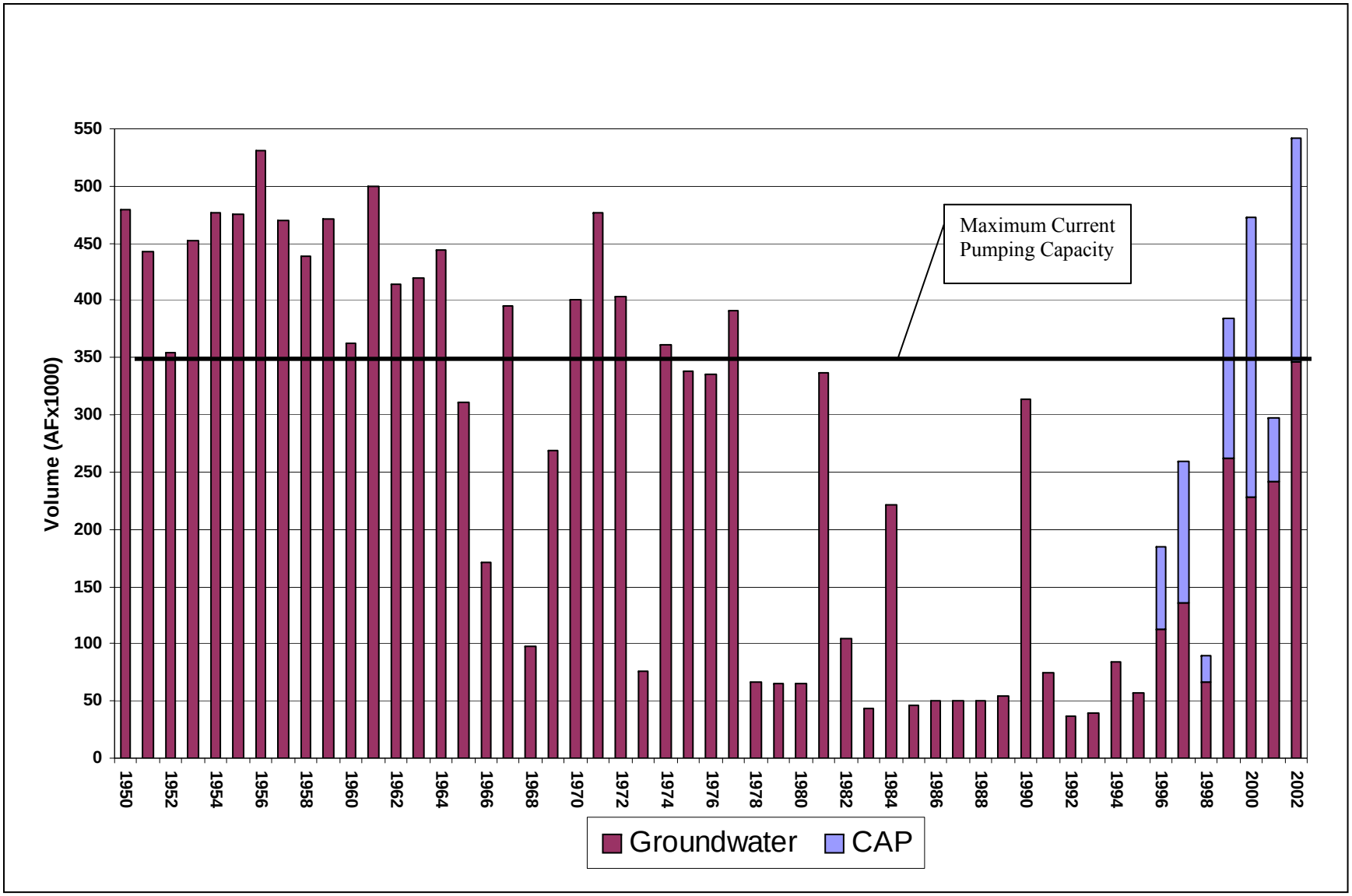
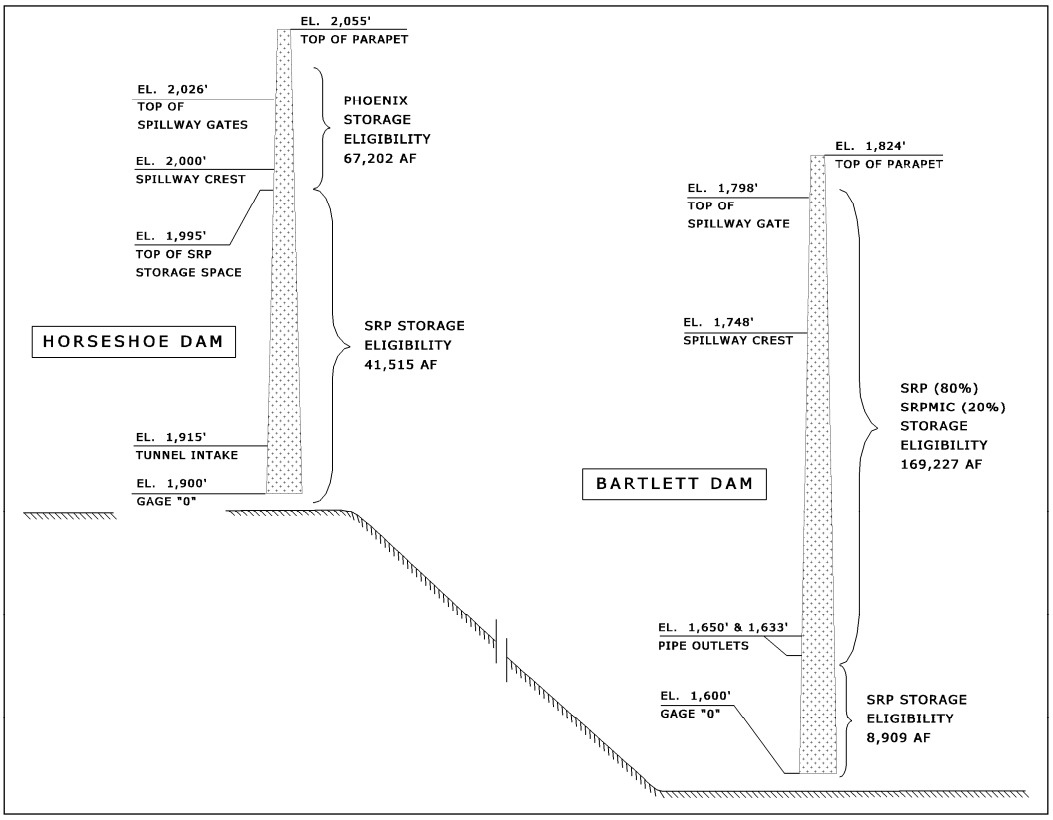


Figure I-6. Horseshoe and Bartlett storage elevations and capacities.



On the Salt River side, the four dams collectively can store more than three times the average annual flow of the river. This imbalance in storage capacity between the Salt and Verde reservoirs creates an annual water supply juggling act at SRP to most effectively and efficiently maximize the conservation of water in storage. Because it is critical to capture as much water as possible to meet the demands of SRP, Phoenix, the two Indian tribes, and the other water users that rely on the SRP system, water stored in Horseshoe is the first to be used out of all of the reservoirs in order to provide space for additional runoff on the Verde. Likewise, a higher percentage of Bartlett stored water is used each year compared to water stored in the reservoirs on the Salt River because that use creates additional storage space to capture Verde runoff. By using Horseshoe and Bartlett stored water to the maximum extent possible, these relatively small reservoirs help ensure that the Verde system provides an average of about 40 percent of the surface water used by SRP and its contractors.

As described in the previous subchapter, SRP constantly strives to operate the entire reservoir system, including Horseshoe and Bartlett, to minimize the risk of spilling water over Granite Reef Dam because any water spilled downstream of Granite Reef Dam is unavailable for meeting water demands. During the winter and spring months (October 1

through April 30), water is typically delivered to meet demands from the Verde River dams in order to keep Verde storage levels low, thereby maximizing the ability to capture runoff and minimizing the risk of spilling water from Bartlett Dam. These months have the lowest demand and the highest potential to produce the greatest amounts of runoff. With the greater storage capacity in the Salt River reservoirs, there is usually sufficient space available to store runoff on that side of the system during the winter and spring, and to provide releases during the summer when water demand is the greatest.

Hydropower generation is another reason for maximizing the use of water from Horseshoe and Bartlett while minimizing releases of Salt River storage during the winter months.[13] SRP has the ability to generate hydroelectricity at each of the Salt River dams but there are no generators on the Verde River dams. During the winter months, SRP generally has ample alternative supplies of power to meet customer needs. In the summer, however, demand for power skyrockets in the hot desert environment of SRP's service area. The hydrogenerators on the Salt River reservoirs provide only about 4 to 5 percent of SRP's annual power production, but represent a low cost, environmentally clean, and renewable energy supply that is readily available to meet peak summer demands. Without this source of power to meet peak demands, SRP would have to generate or purchase expensive fossil fuel-produced energy.

As a result of the considerations described above, water releases to meet orders are progressively shifted from the Verde River reservoirs to the Salt River reservoirs in late April or early May. However, a 1993 agreement between SRP and the FMYN stipulates that a 100 cfs flow will be maintained from Bartlett except in extreme drought or emergency.[14] This minimum flow is to help maintain fish habitat and riparian vegetation along the Verde River below Bartlett.

In summary, Horseshoe and Bartlett play a key role in providing water to the Phoenix metropolitan area. Major components of that role include:

- Providing about 40 percent of the average surface water delivered by SRP to shareholders and contractors (about 360,000 AF).
- Providing specific water supplies to Phoenix, the FMYN, and the SRPMIC under contractual entitlements to storage capacity in these two reservoirs pursuant to state and federal law.
- Providing a minimum flow on the lower Verde River.

[13] SRP releases a minimum of 8 cfs from Stewart Mountain Dam to help sustain native fish populations on the lower Salt River.

[14] The 100 cfs minimum flow is in addition to reservoir releases to meet water orders along the Verde River and is part of the diversion at Granite Reef Dam (see Table I-2). Although storage conditions in 2002 would have allowed SRP to suspend the minimum flow releases, SRP elected to maintain the 100 cfs minimum flow.

II. Alternatives

Chapter II provides a description of SRP's formulation and evaluation of alternatives during the development of the HCP, and a description of the alternatives examined in detail. Alternatives and mitigation measures eliminated from further consideration are also summarized.

Alternatives considered during the development of the HCP involve two components: 1) goals for reservoir operations; and 2) measures to offset biological, environmental, or socioeconomic impacts from each set of reservoir operation goals. With respect to each of the alternatives examined in detail, both components were considered simultaneously because the analysis must address the continued operation of two existing reservoirs (in contrast to evaluation of a new project where alternatives such as build/no build are strong contrasts). Also, the objective of providing habitat conservation for covered species while continuing to operate Horseshoe and Bartlett was determined to be potentially attainable through various combinations of these components.

A. Formulation and Evaluation of Alternatives

SRP considered a wide range of options and alternatives during development of the HCP. A systematic screening process was used to identify alternatives to be evaluated in detail or to be eliminated from further consideration. The primary factors used during formulation, screening, and evaluation were:

- Compliance with the ESA
- Impacts on listed, candidate, and other covered species
- Public input
- Impacts on water rights and deliveries
- Extent and feasibility of minimization and mitigation measures
- FWS guidance

Each of these factors is discussed below.

1. Compliance with the ESA

ESA requirements provided the framework for formulation of alternatives. ESA regulations require applications for a Permit to include: "What alternative actions to such taking the applicant considered and the reasons why such alternatives are not proposed to be utilized" (50 CFR 17.22(b)(1)). As described in the Habitat Conservation Planning Handbook, the analysis of alternatives in a habitat conservation plan is similar to a National Environmental Policy Act (NEPA) evaluation (FWS and National Marine Fisheries Service (NMFS) 1996, pp. 3-25 and 3-36). In other words, a "no action" alternative should be considered along with reasonable alternatives, which are technically and economically feasible, that would reduce the significant adverse effects from the proposed activity (see Subchapter II.B.1 for a description of the "no action," i.e., "no permit" alternative). In this HCP, SRP's alternatives are described in relation to the FWS "action" of issuing a Permit for continued reservoir operations.

2. Impacts on Listed, Candidate, and Other Covered Species

The purpose for preparing the HCP is to address the anticipated impacts of SRP's continued full operation of Horseshoe and Bartlett on currently listed and other covered species, particularly flycatchers. Unlisted covered species are considered in the HCP as if they were already listed; thus, potential take of these species is a primary factor in the development and consideration of alternatives. In particular, SRP evaluated alternatives in light of two Permit issuance criteria: 1) "the applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such takings," and 2) "the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild" (50 CFR § 17.22). Alternatives that would minimize and mitigate the impact of Horseshoe and Bartlett operations on listed species, and that would maintain or improve the likelihood of survival and recovery of those species, were given priority over alternatives that do not satisfy these criteria.

3. Public Input

Public input on alternatives was obtained from the Advisory Group that was established for the HCP and through public notice and scoping (Subchapter I.D). The general list of the alternatives suggested by the Advisory Group and the public is provided below:

- Change Horseshoe and Bartlett operations to benefit riparian habitat along the Verde River
- Do not change Horseshoe and Bartlett operations
- Increase management of livestock grazing
- Acquire and protect off-site riparian habitat
- SRP, the cities, and Indian communities could utilize alternative water supplies

A summary of public input during scoping of the HCP and Draft EIS is provided in Section 1.4 of the FEIS.

4. Impacts on Water Rights and Deliveries

As described in Subchapter I.F, SRP operates Horseshoe and Bartlett in conjunction with other components of its water supply system to provide water to shareholders, cities, Indian communities, and other water users in the Salt River Valley in satisfaction of water rights under state and federal law. SRP water deliveries are made pursuant to numerous water rights and contracts dating back more than a century (Table I-1 and Appendices 1 and 2). SRP does not lease or sell water; it charges for the cost to deliver water pursuant to the various water rights and contracts. The primary purpose of Horseshoe and Bartlett, as well as the other SRP reservoirs, is to maximize the conservation of water — to store water in times of high runoff for use during times of low runoff in order to satisfy obligations to specific water users. Any alternative that does not permit SRP to maximize water storage would result in adverse effects to its water users and creates potential legal liability to SRP. Thus, higher priority was given to alternatives that minimize impacts to water supplies.

5. Extent and Feasibility of Minimization and Mitigation Measures

The ESA requires HCPs to specify, among other things, the measures the applicant is willing to undertake to minimize and mitigate the impacts of nonfederal taking of listed species to the "maximum extent practicable" (50 CFR § 17.22). As part of the evaluation of alternatives, SRP developed a comprehensive list of potential minimization and mitigation measures at Horseshoe and Bartlett, in the Verde watershed, and in nearby watersheds. First, SRP discounted measures on federal lands from further consideration because federal agencies already have a duty to manage these lands for listed species under Sections 7(a)(1) and 7(a)(2) of the ESA. However, measures that SRP could take to conserve listed species in addition to the federal obligation were retained for consideration. Second, the remaining minimization and mitigation alternatives were prioritized, with the highest priority being given to measures at or close to Horseshoe and Bartlett, and diminishing priority further from the reservoirs. Finally, the feasibility of the measures was evaluated and those measures that were found to be impracticable or not cost-effective were eliminated from further consideration. The requirement to minimize and mitigate impacts to the maximum extent practicable was satisfied for each alternative by selecting sufficient measures to fully minimize and mitigate the impacts resulting from the reservoir operation alternatives.

6. FWS Guidance

Regular meetings between FWS and SRP to develop the HCP occurred from March 2003 to 2007. Nine meetings directly involving FWS were held in 2003, eight in 2004, nine in 2005, seven in 2006, and three in the first half of 2007. In addition, fish and watershed technical experts representing FWS, SRP, and the Arizona Game and Fish Department (AGFD) held a number of meetings in 2004 and 2005 to discuss impacts on, and minimization/mitigation measures for, native fish species. During and between these meetings, FWS provided guidance to SRP by responding to questions and proposals. This guidance included input into the development and evaluation of alternatives.

B. Alternatives Examined in Detail

Three primary reservoir operation alternatives were identified for detailed evaluation. Many other alternatives were determined to be infeasible or impracticable, would not meet the project purposes, or were simply minor variations on one of the three primary alternatives. Alternatives that were eliminated from further consideration during the screening process are discussed in Subchapter II.C. The alternatives considered in detail are:

- **No Permit**—No issuance of a Permit by FWS. Under this alternative, SRP would do everything within its control to avoid take of federally listed species associated with its continued operation of Horseshoe and Bartlett. This alternative would result in reduced operation of Horseshoe and, in the future, might result in reduced water storage at Bartlett or implementation of other measures.
- **Modified Historical Operation of Horseshoe and Bartlett**—Issuance of a Permit by FWS allowing SRP's continued full operation of Horseshoe and Bartlett up to their maximum storage elevations consistent with historical storage

operating objectives. This alternative would include implementation of measures to minimize and mitigate the take of covered species.

- **Optimum Operation of Horseshoe and Bartlett (Proposed Action)**—Issuance of a Permit by FWS allowing SRP's continued full operation of Horseshoe and Bartlett up to their maximum storage elevations, with the addition of operating objectives to support stands of tall dense vegetation[15] at the upper end of Horseshoe to minimize impacts to flycatchers and other covered bird species, and to manage Horseshoe levels to minimize impacts to covered native fish, frog, and gartersnake species. This alternative includes implementation of all measures provided in this HCP to minimize and mitigate for take of covered species.

These alternatives are summarized in Table II-1 and are described in more detail below. The effects from the Proposed Action, the Optimum Operation Alternative, and the minimization and mitigation measures to address those effects, are described in Chapters IV and V. The effects of the other two alternatives considered in detail, and actions considered to minimize and mitigate the effects under those alternatives, are discussed in Subchapter IV.C.

[15] "Tall dense vegetation" refers to riparian vegetation mapping units in Horseshoe and along the Verde River that may be used by flycatchers as breeding habitat, and is one component of the total area occupied flycatchers. Definitions of tall dense vegetation and occupied habitat are provided in Subchapters III.A.1 (Flycatcher Breeding Habitat), III.B.4 (Vegetation), and IV.B.1 (Flycatcher Impacts).

Table II-1. Summary of alternatives.

Component	Alternative		
	No Permit	**Modified Historical Operation**	**Optimum Operation (Proposed Action)**
Reservoir Operations	1. Earlier and more rapid Horseshoe drawdown when feasible (early to mid-spring initiation) 2. Minimize Horseshoe summer pool and carryover storage 3. No change in Bartlett operations	1. No change in Horseshoe operations a. Rapid Horseshoe drawdown in mid to late spring b. Minimize Horseshoe summer pool and carryover storage 2. No change in Bartlett operations	1. Earlier and more rapid Horseshoe drawdown when feasible (early to mid-spring initiation) 2. Minimize Horseshoe summer pool and carryover storage 3. Hold water in spring if Horseshoe dry for two years 4. No change in Bartlett operations
Measures for Covered Bird Species	1. Draw down Horseshoe to target elevation in early May to expose stands of tall dense vegetation	1. Acquire and manage offsite riparian habitat (Stands of tall dense vegetation are present at Horseshoe but only intermittently available)	1. Periodic reservoir fills to support stands of tall dense vegetation at the upper end of Horseshoe 2. Acquire and manage offsite riparian habitat and protect its water supply
Measures for Covered Fish, Frog, and Gartersnake Species	1. Minimize reproduction, recruitment, and survival of nonnative fish in Horseshoe 2. Construct Lime Creek fish barrier 3. Work with AGFD and FWS to modify the Verde native fish stocking program to avoid take of stocked listed fish	1. Construct Lime Creek fish barrier 2. Native fish stocking 3. Native fish hatchery funding 4. Watershed management activities 5. Adaptive management if needed	1. Minimize reproduction, recruitment, and survival of nonnative fish in Horseshoe 2. Construct Lime Creek fish barrier 3. Native fish stocking 4. Native fish hatchery funding 5. Watershed management activities 6. Adaptive management if needed

1. No Permit Alternative

SRP is seeking a Permit for continued operation of Horseshoe and Bartlett to meet the ongoing purpose and need for these water storage reservoirs. However, a No Permit Alternative was developed for purposes of analysis as suggested by the Habitat Conservation Planning Handbook and as required by NEPA. Under the No Permit Alternative, FWS would not issue a Permit to SRP for continued operation of Horseshoe and Bartlett. Without a Permit, SRP would do everything within its control to avoid take of federally listed species associated with the continued operation of the reservoirs. To avoid the risk of potential take of flycatchers, Horseshoe would be operated to reduce the water level below the elevation at which flycatchers nested in the previous year before commencement of the nesting season. Specifically, unless a large runoff event occurred that could not be passed through the reservoir immediately, the reservoir elevation would be lowered in April to reach a target elevation in early May to expose the vegetation previously used for flycatcher nesting. The target elevation would be determined each year based on recent flycatcher and riparian habitat conditions at Horseshoe. The maximum target elevation before the nesting season begins, coupled with SRP's practice to draw down Horseshoe before any of the other reservoirs, would ensure that existing nesting trees and shrubs will have leaf canopy available so that previously occupied flycatcher and cuckoo habitat is unlikely to be affected (see Subchapter IV.A.2 for a description of nest height considerations). Although the target elevation might be exceeded in about 3 percent of the years due to uncontrollable high runoff in late spring that exceeds the outlet capacity of the dam, the reservoir level would be lowered to the target elevation as soon as physically feasible (Figure 2 of Appendix 5).

If a bald eagle establishes a nest below the high water mark of the reservoirs, SRP would discuss with AGFD and FWS the need to rescue eggs or chicks threatened by inundation for subsequent reintroduction into the original nest after the water subsides or introduction into a foster nest in another territory if the nest is destroyed. SRP also would coordinate with AGFD and FWS to determine if the construction of an alternative nest structure in the immediate area is appropriate.

To avoid the risk of potential take of currently listed native fish under the No Permit Alternative, SRP would empty Horseshoe as early and rapidly as practicable and keep it empty for as long as possible each year to minimize the production of nonnative fish species (see the description of early and rapid drawdown operations below in Subchapter II.B.3). SRP would also construct a fish barrier on Lime Creek as soon as practicable (estimated to be within two to three years) to prevent nonnative fish from moving up that tributary from Horseshoe. Finally, SRP would work with AGFD and FWS to modify the existing Verde River native fish stocking and management program to avoid the take of stocked razorback sucker, Colorado pikeminnow, or other listed fish from Horseshoe and Bartlett operations.

Currently unlisted native fish, frog, and gartersnake species that occur upstream from Horseshoe or downstream from Bartlett may become federally listed and reservoir operations might result in take. In that event, SRP's options would include seeking a permit, modifying reservoir operations, or implementing other measures such as blocking movement or physically removing nonnative fish from the reservoirs. SRP's decision on

which option to pursue would depend on the circumstances present at the time, e.g., the certainty of the relationship between take and reservoir operations, technological options for preventing nonnative fish from moving out of the reservoirs, the then-existing laws and regulations pertaining to federally listed species, legal liabilities to the water users that SRP serves, and the ability to obtain permits for removal of sport fish. SRP's priority would be to implement the option(s) that are the most cost effective while achieving ESA compliance.

2. Modified Historical Operation Alternative

The Modified Historical Operation Alternative would involve issuance of a permit by FWS allowing the continued full operation of Horseshoe and Bartlett consistent with the historical operating objectives set forth below, along with implementation of minimization and mitigation measures. The intent of this alternative would be to minimize the biological, environmental, and socioeconomic impacts from future reservoir operations, to continue full water storage at these two reservoirs, and to satisfy the criteria of Section 10(a) of the ESA. This alternative also provides a measure of impacts relative to the Optimum Operation Alternative, which is the Proposed Action.

In summary, under the Modified Historical Operation Alternative, Horseshoe and Bartlett would continue to be operated with the same objectives that SRP has used in the past. As discussed in Subchapter I.F, SRP operates the reservoir system to minimize spills of water past Granite Reef Dam with the following objectives:

- Maintain the safety and integrity of the dams
- Maintain sufficient storage to meet water delivery obligations
- Optimize reservoir storage within the reservoir system
- Maintain adequate carryover storage in case of low runoff
- Conjunctively manage ground water pumping given reservoir storage and projected runoff and demand
- Maximize hydrogeneration
- Operate to permit necessary facility maintenance

As part of the Modified Historical Operation Alternative, the primary mitigation and minimization measure for bird species would involve acquisition and management of off-site riparian habitat in the Verde Valley and in the Safford Valley, or elsewhere in central Arizona. Minimization and mitigation measures for impacts of the Modified Historical Operation Alternative on native fish, frog, and gartersnake species would include construction of a fish barrier on Lime Creek, rapid drawdown of Horseshoe during mid to late spring, minimization of summer pool and carryover storage in Horseshoe, assistance with stocking of razorback suckers in Horseshoe and covered native fish species in the Verde watershed, contributions to Bubbling Ponds Native Fish Hatchery, watershed management efforts and, if necessary, other actions deemed appropriate later in time through adaptive management.

3. Optimum Operation Alternative (Proposed Action)

Under the Optimum Operation Alternative, which is the Proposed Action, FWS would issue a permit to SRP authorizing the continued full operation of Horseshoe and Bartlett with the addition of reservoir operating goals to support stands of tall dense riparian vegetation at the upper end of Horseshoe; to manage Horseshoe water levels to minimize impacts to covered native fish, frog, and gartersnake species; and to benefit the razorback sucker.

The reservoirs would be operated consistent with the objectives set forth below. The intent of this alternative is to minimize adverse biological, environmental, and socioeconomic impacts from future reservoir operations, continue water storage at these two reservoirs, and satisfy the criteria of Section 10(a) of the ESA. SRP believes that this alternative best minimizes adverse biological, environmental, and socioeconomic impacts from future reservoir operations and best meets the priorities identified during the process of evaluating alternatives, which are described in Subchapter II.A.

a) Reservoir Operation Objectives

Under the Proposed Action, SRP would continue to operate Horseshoe and Bartlett as part of its reservoir system in a manner consistent with their purpose as water storage facilities. However, two objectives would be added: 1) maintain tall dense vegetation in Horseshoe; and 2) manage Horseshoe water levels to minimize impacts to covered native fish, frog, and gartersnake species, and to benefit the razorback sucker. The addition of those two objectives would result in the following set of objectives for Horseshoe and Bartlett:

- Maintain the safety and integrity of the dams
- Maintain sufficient storage to meet water delivery obligations
- Optimize reservoir storage within the reservoir system
- Maintain adequate carryover storage in case of low runoff
- Conjunctively manage ground water pumping given reservoir storage and projected runoff and demand
- Maximize hydrogeneration
- Permit necessary facility maintenance
- Support stands of tall dense vegetation at the upper end of Horseshoe
- Manage Horseshoe water levels to minimize impacts to covered native fish, frog, and gartersnake species, and to benefit the razorback sucker

b) Reservoir Operations to Support Stands of Tall Dense Vegetation at the Upper End of Horseshoe

In conjunction with the Optimum Operation of Horseshoe and Bartlett, SRP would implement additional measures to minimize and mitigate the take of federally listed bird species. Minimization of take would occur by adding the reservoir operation objective to support stands of tall dense vegetation at the upper end of Horseshoe. Under the Optimum Operation Alternative, after two successive years without storage above an elevation of 1,990 feet, the objective would be to fill Horseshoe in order to saturate the

soil and relieve the drought stress on stands of willow trees. Filling Horseshoe after two dry years would depend on whether adequate water supply is available, consistency with the other reservoir operation objectives, and maintenance of a minimum pool of 50,000 AF in Bartlett to minimize impacts on recreation at that reservoir. As discussed in Chapter IV, the need to manage Horseshoe levels to support stands of tall dense vegetation would occur about once every 13 years on average based on historical runoff patterns.

c) Acquisition of Riparian Habitat

Mitigation measures for impacts to the flycatcher and cuckoo from Horseshoe and Bartlett operations would be acquisition and management of riparian habitat in the Safford Valley and in the Verde Valley, or elsewhere in central Arizona, and protection of the water supply for that habitat. The minimization and mitigation measures for covered bird species are described in more detail in Chapter V.

d) Adaptive Management for Bald Eagles

If a bald eagle establishes a nest below the high water mark of the reservoirs, SRP will discuss with AGFD and FWS the need to rescue eggs or chicks threatened by inundation for subsequent reintroduction into the original nest after the water subsides or introduction into a foster nest in another territory if the nest is destroyed. SRP also would coordinate with AGFD and FWS to determine if the construction of an alternative nest structure in the immediate area is appropriate.

e) Reservoir Operations to Benefit Native Fish, Frogs, and Gartersnakes

Periodically maintaining high reservoir levels to support stands of willow trees at the upper end of Horseshoe would also provide favorable conditions for stocking and subsequent growth of razorback suckers. In all other years, Horseshoe would be emptied as early, rapidly, and completely as feasible to reduce the reproduction and recruitment of nonnative species that prey on or compete with native fish, frogs, and gartersnakes. About one-third of the time, Horseshoe does not fill at all and drawdown objectives are irrelevant. Another one-third of the time, Horseshoe drawdown would begin four to six weeks earlier than historical operations, typically in March or April. It would not be feasible to draw down Horseshoe early and rapidly if additional water would accrue to New Conservation Storage (NCS) in Roosevelt, thereby reducing SRP shareholder and contractor water supplies.[16] Thus, early and rapid drawdown would be delayed in about one in three years on average because of accrual to NCS based on historical runoff. Horseshoe would be completely drained each year, typically by June or July, which also minimizes nonnative fish recruitment and survival, unless: 1) inflow exceeds outlet capacity and the reservoir could not physically be completely drained, or 2) lack of

[16] At times when water is accruing to NCS, SRP is required by law and contracts to release the maximum possible amount of water from the Salt River reservoirs to satisfy water rights that are senior to NCS. Early and rapid drawdown would require that water be released from Horseshoe and Bartlett to meet demand, which would be in direct conflict with the obligation to release the full amount of demand from the Salt River.

storage space in Bartlett means that water released from Horseshoe would be spilled. Based on reservoir operation modeling using historical inflows, the probability of not being able to completely drain Horseshoe in any given year is less than 1 percent (1 in 113 years).

Figure II-1 shows model results for Optimum Operation in comparison to Modified Historical Operation for runoff conditions in 1984 through 2002 (see Appendix 5 for results from 1889 through 2002). As can be seen in this example, Optimum Operation would result in significantly earlier drawdown in years such as 1984, 1986, and 1995. In the other years when fill occurs, drawdown would begin at about the same time or slightly earlier than historical operations but the rate of drawdown would always be rapid.

f) Other Measures to Benefit Native Fish, Frogs, and Gartersnakes

Other minimization and mitigation measures to offset effects to native fish, frogs, and gartersnakes would include construction of a fish barrier on Lime Creek, assistance with stocking of razorback suckers in Horseshoe and other native fish in the Action Area, contributions to Bubbling Ponds Native Fish Hatchery, watershed management activities and, if necessary, other mitigation and minimization actions deemed appropriate later in time through adaptive management. The minimization and mitigation measures for native fish, frog, and gartersnake species are described in more detail in Chapter V.

C. Alternatives Eliminated from Further Consideration

A number of alternatives, including certain measures to minimize or mitigate biological impacts and options to alleviate socioeconomic impacts, were determined to be infeasible, would not meet the project purpose and need, or would have adverse effects on covered species. The alternatives that were rejected and the reasons for elimination are summarized in Table II-2 and described in Appendix 3.

Figure II-1. Comparison of Horseshoe storage, Modified Historical Operation versus Optimum Operation, Model Results for 1984–2002.

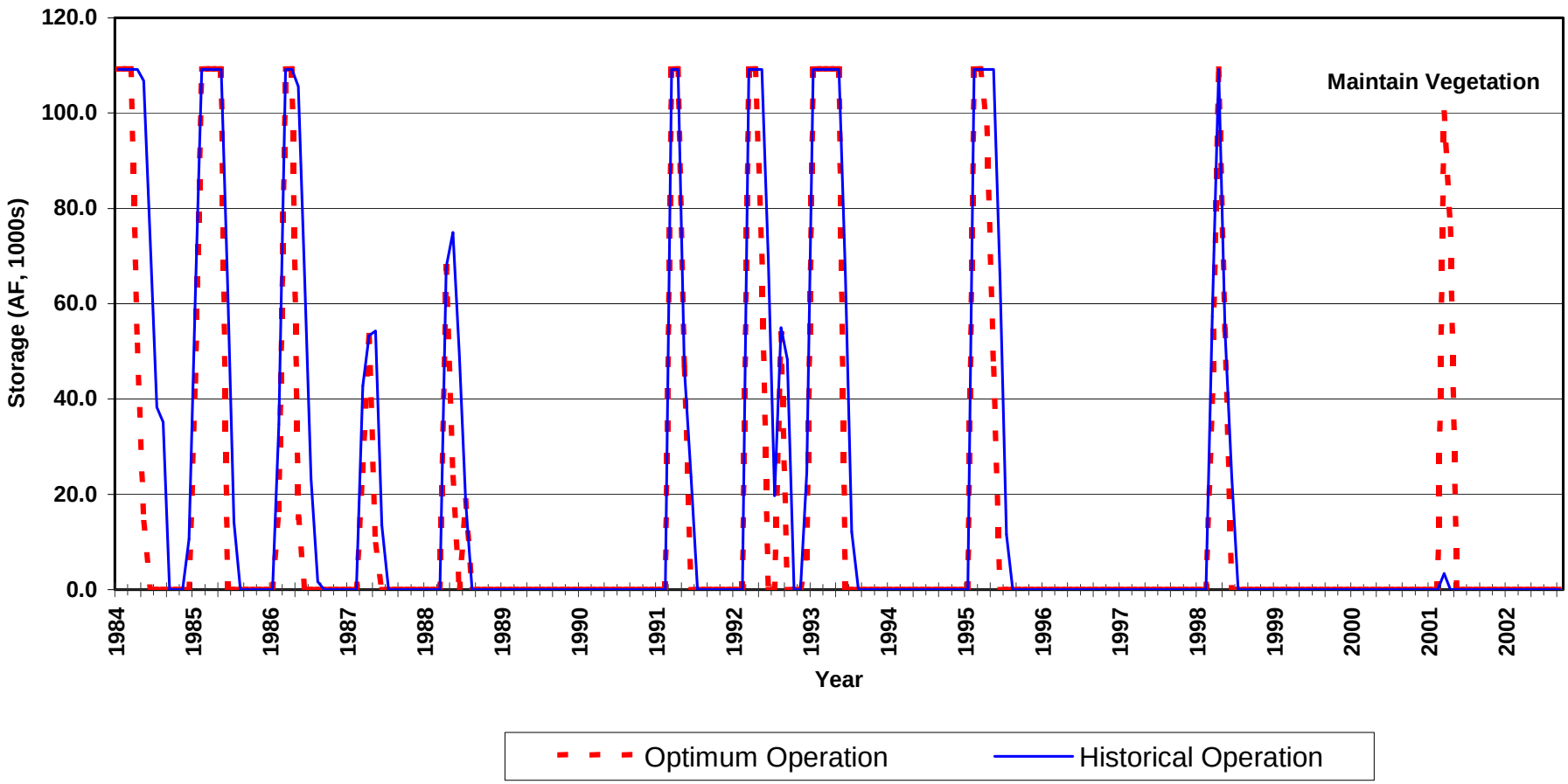


Table II-2. Alternatives eliminated from further consideration.

Alternative or Measure	Primary Reasons for Elimination
Reservoir Operation Alternatives	
Breach Horseshoe and Bartlett	• Entirely defeats the purpose of Horseshoe and Bartlett. • Breach of Horseshoe and Bartlett is infeasible due to Congressional approval of the FMYN, SRPMIC, and Gila River Indian Community water rights settlements. • Breaching is beyond the scope of FWS review of SRP reservoir operations. • Large socioeconomic impacts.
Major changes in Horseshoe and Bartlett Operations (modify reservoir storage criteria, manage Horseshoe vegetation, releases to mimic natural hydrograph, and sediment transport around the dams)	• Modified full operation and vegetation management in Horseshoe is likely to increase nonnative fish production and likely would not provide more flycatcher and cuckoo habitat on average. • Major changes in Horseshoe and Bartlett operations are infeasible because of the effect on the Congressional approval of water rights settlements with the FMYN, SRPMIC, and the Gila River Indian Community. • Releasing water to mimic the natural hydrograph would not allow SRP to meet contractual water delivery demands and would provide limited benefits, if any, to downstream riparian vegetation and native fish populations. • Sediment transport would be very expensive, with uncertain benefits to riparian vegetation and possible adverse impacts to some wildlife. • Large socioeconomic impacts.
Measures to Minimize or Mitigate Impact on Listed Species	
Protect and restore riparian habitat on public land outside of Horseshoe	• Already subject to 7(a)(1) and 7(a)(2) of ESA. • Limited amounts of riparian habitat for flycatchers are available on USFS land due to narrow floodplains and high gradient.
Removal of catch limits on nonnative fish below Horseshoe	• Beyond SRP control.
Chemical removal of nonnative fish in and below Bartlett	• Uncertain effectiveness and high cost in large river system. • Significant concern over the controversy that may arise from the public about impacts to water quality including drinking water supply and impacts to sportfishing opportunities. • AGFD has determined that chemical renovation in the reach would not be feasible or effective.*
Chemical removal of nonnative fish in and above Horseshoe	• Same reasons listed immediately above for chemical removal in and below Bartlett.
Fund gravel-washing research to improve native fish spawning	• Research measures not favored for HCPs. • Uncertain effectiveness.
Salvage of native fish from SRP canals	• Implementation at this time is not appropriate due to golden algae concerns and low abundance of native fish. • Expands the Action Area.
Develop refugia ponds in upper Verde	• Lack of suitable locations.

Alternative or Measure	Primary Reasons for Elimination
Develop quarantine facility	• More suitable for native fish transplant activities. • Higher priority conservation measures are available.
Participate in and support development of state conservation agreement, including funding of AGFD fish biologist position	• Not supported by FWS as a mitigation measure under this HCP.
Fund spikedace-loach minnow surveys	• Research measures not favored for HCPs.
Fund information and education program for native fish	• Uncertain effectiveness. • Other measures would provide more immediate and direct benefit.
Prioritize stocking listed fish species below Bartlett	• Would likely result in concerns by third parties due to increased presence of fish in an area where potential take could occur from existing activities such as water diversions and recreational uses.
Measures to Minimize or Mitigate Water Supply Impacts Resulting from Changes in Reservoir Operations (These Measures Were Suggested During Public Scoping to Offset Impacts from Major Changes in Reservoir Operations)	
Additional ground water pumping	• Severely limited by the 1980 Arizona Groundwater Management Act. The Act passed because ground water is a nonrenewable resource, and because continued depletion would have large socioeconomic and environmental impacts.
Reduction of water use through conservation measures	• Already being implemented as required by sound water management, the Arizona Groundwater Management Act, and sometimes in response to drought.
Recharge of water that cannot be stored at Horseshoe and Bartlett	• Severely limited by legal, institutional, practical, and cost constraints.
Use of CAP water	• Limited by availability and cost.
Use of effluent	• Limited by availability, practical considerations, and cost.
Acquisition of water from other sources or water users	• Limited quantity is available locally; importing large amounts is infeasible due to availability and cost. • Environmental impacts from use or relocation of other water sources.

*AGFD is vested with the authority to manage wildlife and fisheries in Arizona (ARS § 17-102), and thus all mitigation measures that involve removal, introductions, or management of fish and wildlife species must be authorized by AGFD.

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III. Affected Resources

Chapter III identifies the species and other wildlife addressed in the HCP. Water resources, recreation, geology and geomorphology, and vegetation at Horseshoe and Bartlett and along the Verde River above and below the two dams are also described. Impacts to these resources from Horseshoe and Bartlett operations are evaluated in Chapter IV and the conservation plan to address those impacts is provided in Chapter V.

A. Covered Species and Other Wildlife

1. Covered Species

The biology of the covered species is discussed in the following sections. The descriptions provide general background and important attributes of the species discussed in subsequent sections of the HCP.

a) Southwestern Willow Flycatcher

(1) Subspecies and Distribution

The southwestern willow flycatcher (flycatcher) is a riparian obligate species. Flycatchers are considered territorial (or resident within a site) if they were detected between June 15 and July 25, regardless of whether a possible or known mate is observed (Sogge et al. 1997; Smith et al. 2002). The breeding range of this subspecies includes Arizona, southern California, New Mexico, southern Nevada, southern Utah, and southwestern Colorado (Smith et al. 2002).

(2) Listing and Critical Habitat History

The flycatcher was listed as endangered on February 27, 1995 (FWS 1995a). Critical habitat was designated on July 22, 1997 (FWS 1997a) and was corrected on August 20, 1997 (FWS 1997b). On May 11, 2001, the 10th Circuit Court of Appeals found that FWS had failed to properly assess all of the economic and other relevant impacts of the designation of critical habitat for the flycatcher and invalidated the designation. The court remanded the designation to FWS for reassessment of the economic analysis. Critical habitat was again designated on October 19, 2005 including several sections of the Verde River: 1) the middle Verde River Valley from near the Town of Cottonwood to the upstream end of Yavapai-Apache lands; 2) from the downstream boundary of the Yavapai-Apache lands to the Beasley Flat (through the Town of Camp Verde); 3) from the confluence of the East Verde River to the top of the conservation pool of Horseshoe; and 4) from Horseshoe Dam downstream 4.1 miles to a gaging station (70 FR 60886). A final recovery plan for the flycatcher was issued on August 30, 2002 (FWS 2002a). The flycatcher is also listed as a USFS Sensitive Species and as Wildlife of Special Concern by AGFD (AGFD 2002a).

(3) Threats to the Species

Factors that contributed to the decline of the flycatcher include: loss and modification of riparian habitat due to urban and agricultural development, water diversion and impoundment, channelization, ground water pumping, livestock grazing, invasion by nonnative plant species, off-road vehicle (ORV) and other recreational uses, as well as parasitism by the brown-headed cowbird (*Molothrus ater*) (FWS 2002a). The loss of nonnative salt cedar habitat due to fire is another threat. Appendix J of the Southwestern Willow Flycatcher Recovery Plan points out that the creation of dams has altered the amount and timing of flows from rivers in the Southwest,

which has affected habitat (FWS 2002a). Loss of wintering habitat also may play a role in population declines. Unitt (1987) concluded that "probably the steepest decline in the population levels of … *extimus* has occurred in Arizona though the subspecies was always localized and uncommon there… *extimus* has been extirpated from much of the area which it was originally described, the riparian woodlands of southern Arizona."

(4) Prey and Diet of Flycatchers

Flycatchers are generally considered aerial insectivores but flycatchers also glean prey from foliage, or catch them on the ground (Sedgwick 2000; SWCA 2000b; FWS 2002a). At the Camp Verde, Arizona nesting site, flycatchers were found to be "central foragers with most foraging events taking place in mid-air (56 percent) or on foliage (39 percent) at a mean height of 15.2 feet aboveground. Sixty-two (62) percent of the foraging events recorded by observers took place on salt cedar, 30 percent on Goodding willow and 8 percent on other plant species" (SWCA 2000b). Flycatchers eat a variety of insects including wasps, bees, flies, beetles, butterflies, moths, caterpillars, and spittlebugs (Beal 1912; McCabe 1991). Drost et al. (1997) found that flycatchers eat a wide variety of prey: "Major items were small (flying ants) to large (dragonflies) flying insects with Hymenoptera, Diptera, and Hemiptera (true bugs) comprising half of the prey items. Willow flycatchers also took nonflying species, particularly Lepidoptera larvae." Durst (2004) studied potential flycatcher prey base and diet at Roosevelt and found that there was significant interannual variation in prey abundance and diet, possibly due to extreme drought in one year of the study. Arthropod community composition varied among habitat types (native, mixed, and exotic), but flycatchers were able to exploit a diverse array of prey taxa, and there was no indication that habitat type (i.e., abundance of nonnative salt cedar) limited food resources (Id). Owen et al. (2005) also found that salt cedar habitats did not lower individual flycatcher physiological condition (e.g., body mass, stored fat, body condition indices) due to perceived poorer nutritional qualities of exotic habitats compared to native vegetation.

(5) Flycatcher Breeding Biology

Flycatchers are neotropical migrants that can be found on their breeding range at elevations ranging from near sea level to 9,180 feet in elevation (AGFD 2002a). In Arizona, flycatchers have not been reported between about 4,900 and 7,200 feet (Paradzick and Woodward 2003), in part because many of the streams at this zone in Arizona have a high gradient and are in more deeply incised canyons, which limits the establishment and persistence of suitable breeding habitat (Hatten and Paradzick 2003; Paradzick and Woodward 2003). Most flycatchers arrive at their breeding areas from late April to early May and depart in August and September after nesting (FWS 2002a). Peak nesting season in low elevation riparian habitat in Arizona occurs in mid to late June (Rourke et al. 1999).

Nest height can range from 1.6 to 60 feet above the ground. In 2005, mean nest height for flycatchers nesting in cottonwood-willow and tamarisk habitat was about 11 feet aboveground with a mean substrate (tree) height of 22 feet at Roosevelt, and 17 feet aboveground with a mean substrate (tree) height of 28 feet on the San Pedro and Gila rivers (English et al. 2006). Flycatchers lay 3 to 4 eggs from May through July and the young fledge approximately 25 days after the last egg is laid. Flycatchers often re-nest following failed nesting attempts, and four nesting attempts within a breeding season have been documented for some females (Smith et al. 2002). Researchers have also documented flycatchers producing multiple successful broods in one season, which are thought to be in response to superior environmental conditions (Paradzick

et al. 1999, 2000). Subsequent clutches are usually smaller than the first (Holcomb 1974; McCabe 1991). Predation is the leading cause of nest failure in Arizona (English et al. 2006). However, flycatcher productivity also may be negatively impacted by brown-headed cowbird parasitism. Cowbirds parasitize flycatcher nests by laying their eggs in flycatcher nests. Cowbird eggs hatch sooner and often outcompete the flycatcher young, which often results in no flycatcher young fledging from parasitized nests (AGFD 2002a). Cowbird impacts on some populations are large enough to warrant management efforts (FWS 2002a).

(6) Breeding Habitat

Habitat characteristics of areas occupied by flycatchers vary across their range, and some areas that appear similar to occupied breeding areas remain unused (Paradzick et al. 2001). In general, flycatchers breed in tall dense riparian habitat with low gradient streams, wetlands, or saturated soils usually nearby, at least early in the breeding season (Bent 1940; Stafford and Valentine 1985; Harris et al. 1987; Spencer et al. 1996). "Occupied sites always have dense vegetation in the patch interior. These dense patches are often interspersed with small openings, open water, or shorter, sparser vegetation, creating a mosaic that is not uniformly dense" (FWS 2002a, Appendix D). Thin strands of dense vegetation are generally not suitable habitat.

Flycatcher breeding habitat selection in low elevation riparian forest has been assessed at three spatial scales: landscape (Hatten and Paradzick 2003; Brodhead 2005), patch (Paradzick 2005a), and within-patch (Allison et al. 2003). Hatten and Paradzick (2003) used GIS, satellite imagery, and nest and unoccupied sites to examine flycatcher site selection at Roosevelt and at the San Pedro/Gila river confluence area. They found that flycatchers preferred nest sites with high density of vegetation at the nest (0.022 acre), high density and edge within an 11.1-acre neighborhood surrounding the nest, and high amount of floodplain with 100 acres surrounding nest sites. They hypothesized that the 11.1-acre neighborhood was important to the flycatcher because it may provide dispersal, foraging, and buffer habitat. Recently, Brodhead (2005) completed a multi-scaled habitat selection study of flycatcher breeding locations along the Gila River in New Mexico. She found that habitat structure and heterogeneity within 328 feet of territories were more highly correlated with flycatcher presence than characteristics at greater distances—"the degree of sensitivity between all riparian characteristics and flycatcher presence decreased quickly beyond a 100-meter [328-feet] extent" (Brodhead 2005). She also found that the amount and heterogeneity of stands of riparian trees within this area were positively related to site selection and habitat use.

Paradzick (2005a) further quantified abiotic and vegetation structural characteristics at occupied sites within the 11.1-acre neighborhood and patch scale. He found that flycatchers prefer young (less than 10 years old) dense patches dominated by willow and salt cedar located along perennial stream reaches or near standing water. Patch selection was related to stand density of young trees, presence of water, and amount of riparian forest in the 11.1-acre neighborhood surrounding the patch. He also found that canopy density was high (greater than 80 percent) with fewer breaks than unoccupied patches, which was different than the patterns for landscape and nest site scales (see below).

At the nest site scale, canopy density at nests generally ranges from 75 to 90 percent, with a high percentage of vertical cover in all strata aboveground (Allison et al. 2003). Allison et al. (2003) also found that nest site placement was closer to canopy gaps and near water compared to random sites within the patch. Overall, flycatchers may select these conditions because they

provide more favorable microclimate (i.e., cooler temperatures), greater protection and cover from predators, higher food availability and foraging success, and greater amounts of dispersal habitat, which ultimately influence survival and fitness of the flycatcher (Id.).

Flycatchers are found in three basic habitat types of tall woody vegetation: 1) native-dominated, 2) exotic-dominated, and 3) mixed native and exotic (FWS 2002a). Lower to mid-elevation native-dominated areas contain species such as willows (*Salix* spp.), cottonwoods (*Populus* spp.), boxelder (*Acer negundo*), ash (*Fraxinus* spp.), alder (*Alnus* spp.), buttonbush (*Cephalanthus occidentalis*), and nonnative tall, dense salt cedar (*Tamarix* spp.). Nests have also been documented in hackberry (*Celtis reticulata*), mesquite (*Prosopis veluntina*), and graythorn (*Ziziphus obtusifolia*) (English et al. 2006). Canopy height can vary from 13 to 98 feet, often with a distinct overstory canopy and a dense mid- and understory layer, although some areas of dense monotypic willow are also used (Id.). High elevation native-dominated areas consist mainly of a single species of willow (*Salix exigua* or *S. geyeriana*); canopy height is usually only 10 to 23 feet with no distinct vegetation layers (Id.). Exotic species such as salt cedar and Russian olive (*Elaeagnus angustifolia*) often form a dense closed canopy with high vertical foliage and stem density (FWS 2002a).

(7) Site Fidelity, Movement, and Territory Size

Banding studies over several years have shown that most flycatchers return to their former breeding sites; however, they regularly move among sites within and between years (FWS 2002a). From 1997 to 2000, 66 to 78 percent of flycatchers known to have survived from one breeding season to the next returned to the same breeding site (Id.). From studies at Roosevelt, site fidelity, where a site is defined as all patches within a specified area, is higher than patch fidelity—site fidelity ranges up to 92 percent depending on the method of calculation, while patch fidelity ranges up to 54 percent (Newell et al. 2005; Koronkiewicz et al. 2002).

Flycatchers that move to new sites more commonly move within-drainages than between-drainages (Kenwood and Paxton 2001; Newell et al. 2005). However, each year, a few flycatchers from Roosevelt are sighted at other locations, e.g., the San Pedro/Gila River sites, Horseshoe, and Alamo Lake (Paxton and Keim, unpubl. data 2003; Newell et al. 2005). Individual movements of banded flycatchers have been recorded over distances of up to 160 miles from the original banding site, e.g., from the Virgin River to Topock Marsh on the Colorado River or from Roosevelt to Alamo Lake (McKernan and Braden 2001; Newell et al. 2005).

Depending on the vegetation type, quality of the habitat, nesting stage, and population density, territory size can range from 0.25 to 5.7 acres (FWS 2002a). Home range data for the flycatcher have been collected from radio-tracking studies at Roosevelt in recent years (Cardinal 2005; Cardinal and Paxton 2004, 2005). Information from 23 flycatchers that were tracked using radio telemetry indicates a wide variation in range of movement among individuals and before, during, and after nesting. Prior to nesting, home ranges were generally small, with a mean of about 1.4 acres except for one bird with a much larger home range during this period (Cardinal 2005). During nesting, the mean home range was slightly less than 1 acre (Id.). Late in the breeding season, home ranges expanded substantially, ranging from about 10 to 900 acres, but birds often used conspecific territories and habitat, suggesting that not all of the area outside of the tall dense vegetation was essential (Id.). Cardinal (2005) also summarized territory and home range sizes from several studies of other flycatcher subspecies, which range from less than 1 acre

to more than 4 acres. Little is known about the dispersal of flycatcher young after fledging. They appear to remain in the area around the nest for 2 weeks or longer (Sogge et al. 1997). The one fledgling tracked at Roosevelt moved considerable distances, including a roundtrip across the lake, a distance of 15 miles one way (Cardinal and Paxton 2005).

(8) Wintering Habitat

Flycatchers spend winter in Mexico, Central America, and northern South America (Phillips 1948; Gorski 1969; Ridgely and Gwynne 1989; Stiles and Skutch 1989; McCabe 1991; Howell and Webb 1995; Unitt 1997, 1999; Koronkiewicz et al. 1998). They inhabit areas with standing or slow-moving water, seasonally inundated savannas, patches of dense shrubs, patches or stringers of trees (stringers are not used on summer breeding grounds), and open to semiopen areas (Koronkiewicz et al. 1998; Koronkiewicz and Whitfield 1999; FWS 2002a).

(9) Statewide Status of Flycatchers

Between 1993 and 2001, 221 flycatcher breeding sites were identified in California, Nevada, Arizona, Utah, New Mexico, and Colorado, and approximately 986 territories were associated with these breeding sites (FWS 2002a).[17] In Arizona, AGFD reported 883 resident flycatchers, 483 territories and 409 pairs at 42 sites in 2005 (English et al. 2006). In 2004, AGFD reported 940 resident flycatchers, 522 territories, and 430 pairs at 37 sites in Arizona (Munzer et al. 2005). In 2003, AGFD reported 748 resident flycatchers, 410 territories, and 340 pairs at 44 sites in Arizona (Smith et al. 2004). Nests were found in such diverse vegetation as seep willow (*Baccharis glutinosa*), netleaf hackberry (*Celtis reticulate*), Fremont cottonwood (*Populus fremontii*), willow (*Salix exigua* and *S. gooddingii*), and salt cedar (*Tamarix ramosissima*).

(10) Status of Flycatchers at Horseshoe and Bartlett

In 2006, flycatcher surveys within and immediately upstream of Horseshoe identified 30 adult residents, 18 territories, 12 pairs, and 23 nests (Dockens and Ashbeck 2006), which was slightly lower than 2005. Flycatcher surveys at Horseshoe in 2005 identified 35 adult residents, 20 territories, 15 pairs, and 23 nests, including the birds near Ister Flat just upstream of Horseshoe (Dockens and Ashbeck 2005). In 2004, surveys identified 24 adults, 17 territories, and 7 pairs in the Horseshoe lakebed (Munzer et al. 2005). This was an increase over 2003, when 19 adult resident flycatchers, 11 territories, and 8 pairs (including 1 polygynous male) were identified (Smith et al. 2004). In 2002, 8 resident flycatchers, 6 territories, and 2 pairs were located in Horseshoe (Sferra, pers. comm. 2003). Most of the Horseshoe territories have been found at the upper end of the reservoir, with base elevations of trees at approximately 1,980 to 2,000 feet. Through 1997, flycatchers were found just above Horseshoe at Ister Flat (3 resident flycatchers, 1 pair, and 2 territories in 1997); after which the habitat appeared to become degraded and decadent due to prolonged drought until the high runoff year in 2005 (Dockens and Ashbeck 2005; Smith et al. 2003).

In 2005, no flycatchers were observed at the previously occupied Davenport site about 1 mile below Horseshoe because a fire burned through the area in June 2005 (Dockens and Ashbeck 2005; EEC 2005). One migrant flycatcher and no resident flycatchers were at the Davenport site

[17] A "territory," the area selected and defended by a male, is a common unit of measure for flycatchers because it is often difficult to determine whether a particular male is paired with a female (FWS 2002a). One territory generally equals two flycatchers (Id.).

in 2004 (Munzer et al. 2005). In 2003, 3 flycatchers, 2 territories, and 2 failed nesting attempts by 1 pair were documented at the Davenport site (Sferra, pers. comm. 2003; Smith et al. 2004). In 2002, flycatchers were documented at the Davenport site for the first time, and included 9 resident flycatchers, (5 territories and 4 pairs) were located (Smith et al. 2003).

Although surveys were conducted in 2003, 2004, and 2005, flycatchers have not been documented below Bartlett (Willard, pers. comm. 2003, 2004; Dockens and Ashbeck 2005). No suitable flycatcher habitat has been found in or surrounding Bartlett and is unlikely to occur in the future due to the steep, rocky shoreline and reservoir operations.

Nest monitoring was conducted at Horseshoe in 2005 to assess the impacts of inundation on habitat use and reproductive rates (Dockens and Ashbeck 2005). The first pair and nest were documented on May 20. Nesting attempts were documented for all 15 pairs; females were not detected for the remaining 8 territories, and the males in those territories may have been unpaired through the breeding season. Of the 23 nests, 15 were renesting attempts. Twelve nests were successful, 9 were depredated, 1 failed due to weather (strong monsoon storm), and 1 failed due to human disturbance (i.e., nest abandonment presumed to be caused by color banding activities at the nest). There was no incidence of brown-headed cowbird parasitism. Potential predators seen within the habitat patches included snakes, Cooper's hawk, and great-tailed grackles. Of eggs laid, 72 percent hatched (n=54), and 52 percent of all nests were successful (i.e., fledged at least 1 flycatcher young). The Mayfield nest success rate was 62 percent. Overall, nest productivity was 1.41 fledges per nest (n=22, nests with eggs laid). Productivity of successful nests was 2.58 fledges per nest. Nest success and productivity estimates were higher than a number of other sites in 2005 and statewide long-term average.

Short-term inundation had no apparent detrimental impact to habitat quality during the 2005 breeding season and did not affect the timing of breeding activity (Dockens and Ashbeck 2005). Inundated patches were used by the flycatcher throughout the nesting season and nest productivity levels were similar or higher compared to other flycatcher breeding areas (Figure III-1 and Figure III-2). These results are consistent with other studies of flycatcher use and impacts to fitness of short-term partially inundated habitats in Arizona (English et al. 2006) and New Mexico (Moore 2005).

Figure III-1. Flycatcher nest success in 2005 at nest monitoring sites in Arizona (number of nests), and long-term (nine-year) average success.
(Note: stipled bar reflects nests at Horseshoe.)

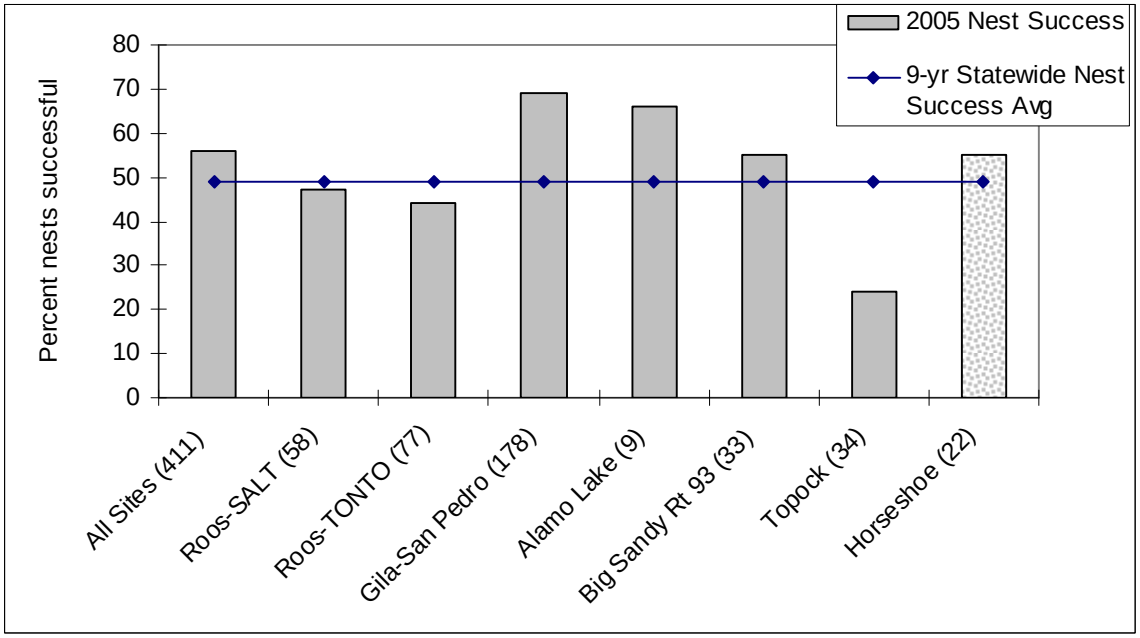
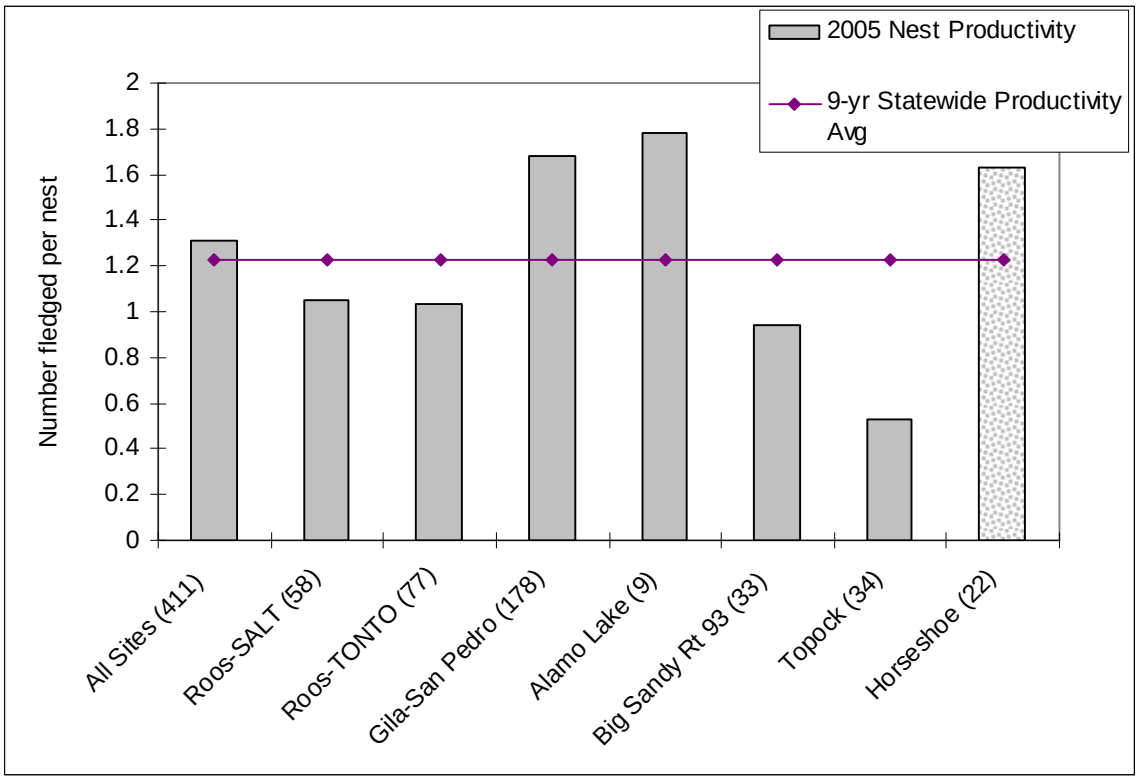


Figure III-2. Flycatcher nest productivity in 2005 at nest monitoring sites in Arizona (number of nests), and long-term (nine-year) average productivity.
(Note: stipled bar reflects nests at Horseshoe.)



b) Bald Eagle

(1) Species Description

The bald eagle is a large bird of prey. Throughout its range, the bald eagle varies in length from 28 to 38 inches with a wingspan of 66 to 96 inches (Stalmaster 1987). The bald eagle usually is found along lakes, rivers, and reservoirs in Arizona (AGFD 2007).

(2) Listing History and Enforcement Policy Pertaining to Bald Eagle

The bald eagle historically ranged and nested throughout North America except extreme northern Alaska and Canada, and central and southern Mexico.

The bald eagle south of the 40th parallel was listed on March 11, 1967 as endangered under the Endangered Species Preservation Act of 1966 (FWS 1967), and was reclassified to threatened status on July 12, 1995 (FWS 1995b). The bald eagle was proposed for delisting on July 6, 1999 (FWS 1999) and was delisted on July 9, 2007 (72 FR 37346). However, on March 5, 2008, the Arizona U.S. District Court enjoined the FWS from delisting the Sonoran Desert bald eagle population pending the outcome of FWS review of whether continued listing of the distinct population segment is warranted. AGFD (in prep. b) lists the bald eagle as Wildlife of Special Concern and the USFS lists the bald eagle as a Sensitive Species (AGFD 2002n).

There is no currently existing mechanism within the Bald and Golden Eagle Protection Act or Migratory Bird Treaty Act to allow for incidental take of bald eagles. However, the FWS believes the measures required to cover the bald eagle under the proposed incidental take permit, its associated implementing agreement, and the Horseshoe and Bartlett HCP are sufficient to protect the species relative to the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act. Thus, take authorized under the proposed incidental take permit is inherently "compatible with the preservation of the bald and golden eagle" as required by the Bald and Golden Eagle Protection Act. The FWS realizes that some birds may be "taken" even if all reasonable measures to protect them are used (take is defined in the Bald and Golden Eagle Protection Act as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb" (16 U.S.C. §§ 668-668) – take is also defined in the Migratory Bird Treaty Act as "to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird" (16 U.S.C. §§ 703)). The FWS Office of Law Enforcement carries out its mission to protect migratory birds through investigations and enforcement, as well as by fostering relationships with individuals, companies, and industries that have enacted programs to minimize their impacts on migratory birds, and by encouraging others to enact such programs. Unless a taking is specifically authorized, it is not possible to absolve individuals, companies, or agencies from liability even if they implement avian mortality avoidance or similar conservation measures. However, the Office of Law Enforcement focuses its resources on investigating and prosecuting individuals and companies that take migratory birds without regard for their actions or without following agreements such as those described above.

(3) Threats to the Species

Historically, the bald eagle experienced rangewide reductions in distribution and abundance due to significant declines in reproductive rates caused by the use of the pesticide DDT (USGS 2005). This contaminant, which is now banned in the United States, persists in the environment and continues to affect local populations. Additionally, as recently as 1952, bounties were being paid for the killing of bald eagles in Alaska (Buehler 2000). Current threats to the species are habitat loss (due to agriculture, housing and recreation development, water diversions and ground water withdrawal, grazing, off-road vehicles, and woodcutting), human encroachment into breeding habitat, entanglement in fishing line, reduction in fish populations, illegal shooting, and heavy metals (Driscoll et al. 2006).

(4) Prey and Diet of Bald Eagles

Bald eagle prey in Arizona consists mainly of fish, but also includes waterfowl, small mammals, and carrion (AGFD 2002n). Fish abundance, availability, and species diversity are important for successful breeding for bald eagles in Arizona (Hunt et al. 1992). Bald eagles in riverine habitats tend to prey upon fish species that are typically bottom feeders and those that utilize shallow water for feeding and breeding (e.g., carp, catfish, and suckers) (Todd et al. 1982; Haywood and Ohmart 1986; BioSystems 1985; Hunt et al. 1992). Hunt et al. (1992) also noted that native suckers are important prey species during the breeding season for bald eagles that forage in lotic systems. In addition, native suckers may be more resistant to drought conditions than some nonnative fish species preyed upon by bald eagles, and may replenish their numbers more quickly following low-flow periods (Rinne and Minckley 1991; AGFD 2007). By contrast, in lakes, reservoirs, and some regulated stream reaches, nonnative fish (e.g., catfish and bass) dominate the bald eagle prey base and supported nesting birds (Hunt et al. 1992).

Stalmaster (1987) described the importance of the quantity, quality, and accessibility (over space and time) of prey to adults and rearing of young. The quantity of food must be sufficient to satisfy the energy requirements of bald eagles. The quality of food, specifically the energy and nutrient content, is closely related to the quantity available; with higher quality, less prey is needed. Food must also be accessible to be of value to bald eagles. In this regard, prey must show a high level of continuity in its distribution, both in time and space, to have the maximum benefit to adults and young. Although adult bald eagles can fast for 4 to 6 days (Driscoll, pers. comm. 2007), disruptions in prey abundance may cause excessive nestling mortality, increase susceptibility to disease, or reduce the general health of the bird. Hunt et al. (1992) noted the importance of temporal sequencing of prey availability in Arizona. From February to late April, Sonora and desert suckers spawn in shallow water, especially in the upstream ends of riffles (pre-riffles) where cleaner substrate and higher oxygen concentrations favor egg survival, whereas other important prey species (e.g., carp and channel catfish) may become available as prey during other times of the bald eagle nesting cycle. Thus, as Hunt et al. (1992) suggested, maintaining a diverse fish community supports prey availability over the entire bald eagle breeding cycle.

Methods by which food sources can be maintained or enhanced are as varied as the bald eagles' diet. Driscoll et al. (2006) recommended a number of management actions to improve bald eagle prey availability and foraging success. Driscoll et al. (2006) suggested identifying important foraging areas in order to manage and minimize impacts of development and recreation. Additionally, fish populations and their diversity should be maintained though 1)

identifying and implementing restoration actions in the lower Gila, and upper Salt and Verde rivers; 2) assessing the impacts of stocking proposals (positive and negative impacts); and 3) monitoring the diversity of fish populations in regulated and unregulated reaches of the Gila, Salt, and Verde rivers. Hunt et al. (1992) suggested that managers should work to support a high abundance of at least two of the following species to maintain bald eagle habitat and a diverse forage base: carp, native suckers, catfish, or perceriforms (in reservoirs).

(5) Bald Eagle Breeding Biology

Arizona bald eagles breed earlier in the year than their northern counterparts. They lay an average of 2 eggs (range: 1 to 3 eggs) between December and March, which take 35 days to hatch (Driscoll et al. 2006). Newly fledged bald eagles can remain in the vicinity of the nest into June (Hunt et al. 1992). The young are dependent upon their parents for food for approximately 45 days after fledging. The bald eagle home range varies in size depending on the water system, food diversity and abundance, and proximity of other breeding areas (Driscoll et al. 2006).

(6) Breeding Habitat

Bald eagles breed in Arizona primarily between 1,080 and 5,640 feet in elevation. Most nesting occurs in central Arizona, in the upper and lower Sonoran life zones, although a few territories are located at higher elevations in coniferous forests (FWS 2003a). Typical vegetation includes Arizona sycamore (*Platanus wrightii*), blue palo verde (*Parkinsonia floridum*), cholla (*Cylindropuntia* spp.), Fremont cottonwood, Goodding willow (*Salix gooddingii*), mesquite (*Prosopis* spp.), saguaro (*Carnegiea gigantea*), and salt cedar, with piñon pine (*Pinus edulis*.) and juniper (*Juniperus* spp.) occurring in the transition areas between life zones (Driscoll and Koloszar 2001). Bald eagles usually place their nests within 1 mile of a creek, lake, or river, although they occasionally have been known to nest farther from water (Id.).

Nests are often built in the crotches of large trees or on rock ledges and typically measure up to 6 feet in diameter and 4 feet in depth (Stalmaster 1987). According to Driscoll et al (2006), bald eagles nest on cliffs, rock pinnacles, in cottonwood trees, and occasionally in junipers, piñon pines, sycamores, willows, ponderosa pines (*Pinus ponderosa*), and snags. In 1980, a bald eagle pair at Horseshoe nested in an artificial structure (Grubb 1980).

(7) Statewide Status at Breeding and Wintering Areas

Little is known of the historical bald eagle breeding or wintering population sizes in Arizona before the 1970s (Beatty, pers. comm. 2002). In 2004, 40 of the 46 known bald eagle breeding areas in Arizona were active (Jacobson et al. 2004). Of these, 39 pairs attempted to breed, and 27 pairs successfully produced 42 fledglings (Jacobson et al. 2004).

Concentrations of wintering bald eagles in Arizona vary both spatially and temporally, most likely in relation to water and food availability. Between 1995 and 2003, researchers documented 324 wintering bald eagles on average along 115 survey routes distributed among major river drainages and lakes (Driscoll et al. 2004). Concentrations of wintering bald eagles have been found in the Gila, Salt, and Verde river drainages (Driscoll et al. 2004).

(8) Status of Bald Eagles upstream of Horseshoe, at Horseshoe, Bartlett, and the Lower Verde

There are 7 bald eagle pairs that nest (or forage) on the Verde River between the Allen Ditch Diversion and Horseshoe (one breeding area, Camp Verde, is vacant and not included in the 7 pairs). One pair of bald eagles has a breeding area at Horseshoe. Ten pairs of bald eagles have

nested in recent years along the Verde River from Horseshoe downstream to its confluence with the Salt River. An eleventh pair forages on the Verde River, but nests and also forages on the Salt River (FWS 2003a). Table III-1 lists nest substrate and primary foraging area for the breeding areas along the Verde River in the Action Area.

Hunt et al. (1992) and AGFD (annual bald eagle nest watch reports) reported bald eagle nest success and productivity data intermittently between 1970 and 2006 for various nests in the Action Area. Mean bald eagle nest success in the Action Area for all active nests that had known outcomes was 61.7 percent (n = 264). Nest success has varied among breeding areas (Figure III-3); generally the nests downstream of Bartlett have had higher success. However, those nests have been in existence for shorter periods of time. Between 1970 and 2006, mean productivity (number of young fledged / occupied breeding area) was 0.98 (± 0.89). Productivity has also varied among breeding areas and years (Figure III-4 through Figure III-8).

Considering all years of data for occupied breeding areas, the Cliff breeding area, located between the reservoirs, has had the lowest rate of success (12 percent) since its discovery in 1983. The bald eagle breeding areas upstream of Horseshoe have had lower rates of overall success compared to some of the breeding areas below Bartlett (Figure III-3 and Figure III-4), but most breeding areas in the reach above Horseshoe have been established for longer periods of time than breeding areas below Bartlett, which may confound direct comparisons between areas. For breeding areas upstream of Horseshoe, there does not appear to be an overall long-term spatial relationship between success and distance to the reservoir; between 1970 and 2006, success rates were similar along the entire reach (Horseshoe to the Allen Ditch Diversion) with the exception that Table Mountain has had slightly lower success: Horseshoe (58 percent), Table Mountain (39 percent), East Verde (61 percent), Coldwater (56 percent), Ladders (60 percent), and Oak Creek (60 percent). Similarly, for these sites over this same time period, breeding area productivity (fledges per breeding area) was not significantly correlated with distance to Horseshoe (Figure III-4). However, over time among breeding areas, there have been differences in productivity and success rates, especially for the breeding areas upstream of Horseshoe, and the Cliff breeding areas just downstream of the reservoir (Figure III-5 through Figure III-8).

Table III-1. Bald eagle nest substrates and foraging areas within the Action Area.

Breeding Area	Nest Substrate	Foraging Area
Towers	Cliff	Nest upstream of Allen Ditch Diversion; foraging area may include mainstem downstream of diversion
Oak Creek	Cliff ledges, cottonwood tree	Verde River (including Oak Creek) downstream of Pecks Lake, specific locations unknown*
Camp Verde	Vacant	Moved into "historical" category after being unoccupied for 10 consecutive years; this site is not on the list of current territories
Beaver Creek	Cottonwood tree	Verde River (and possibly tributaries), specific locations unknown*

Breeding Area	Nest Substrate	Foraging Area
Ladders	Cliff ledges	Verde River – Camp Verde to Bull Run Creek
Coldwater	Cliff ledges	Verde River, approximately Browns Ranch downstream to Fossil Creek*
East Verde	Cliff ledges in recent years, cottonwood trees	Verde, East Verde, Fossil Creek
Table Mountain	Cliff ledges in recent years, willow trees, cottonwood trees	Verde River, specific areas not known
Horseshoe	Cottonwood trees; cliff ledges, willow trees	Verde River upstream of Horseshoe and in Horseshoe
Cliff	Cliff ledges	Verde River downstream of Horseshoe (has not been delineated)*
Yellow Cliffs	Cliff ledges, cottonwood tree	Verde River - middle of Bartlett to unknown point upstream on Verde River*
Bartlett	Cliff ledges	Bartlett and the Verde below Bartlett
Needle Rock, Box Bar, Fort McDowell, Doka, Sycamore, Granite Reef, and Rodeo	Cottonwood or sycamore trees	Verde River below Bartlett, Salt River near Verde Confluence

*Driscoll, pers. comm. 2006, 2007.

In the area upstream of Horseshoe in the last 10 years, nests that were closer to the reservoir had lower success than those further upstream. However, during other time periods, breeding areas closer to the reservoir were more successful (Figure III-6, Figure III-7, and Figure III-8). The Cliff breeding area has had no successful nesting attempts since 1989 and was successful only twice in the 17 years it was occupied (in 11 of the 17 years the female failed to lay eggs). There is not a consistent pattern of interannual success or failure within or among breeding areas (Figure III-9 and Figure III-10). Successful nesting was often punctuated by years with failures, but there was no evidence that suggests all nests within the Horseshoe to Allen Ditch Diversion reach are responding to one specific environmental factor. Two breeding areas, East Verde and Table Mountain, have had low success rates in recent years (2000–2006). However, 6 out of the 16 years, the nest outcomes for the two nests differed, suggesting, as noted above, that more than one factor was influencing individual nest success rates (information regarding these potential environmental factors are summarized for each breeding area below).

To address questions raised by FWS that Horseshoe levels or operations may have influenced success of nests through nonnative fish reproduction and concomitant impacts to native species (i.e., suckers), especially those near Horseshoe, relative winter-spring storage levels and eagle success rates were plotted (Figure III-11, Figure III-12, and Figure III-13). Patterns of negative or positive relationships between storage levels and eagle success or failure for the nests closest to Horseshoe (East Verde, Table Mountain, Horseshoe, and Cliff) were assessed. Overall, there was no consistent pattern of effects within or among breeding areas; nest success varied independently with reservoir storage levels. These results mirror the finding of Hunt et al.

(1992), who conducted a more robust analysis of environmental variables on bald eagle productivity in Arizona. They tested a suite of possible environmental variables that were thought to influence bald eagle reproductive rates including nest elevation above sea level, *normal or peak spring flows*, *reservoir elevations*, maximum and minimum air temperatures, precipitation, and human disturbance factors [*emphasis added*]. They found no significant relationships between bald eagle yearly success rates and these variables including reservoir elevations or flows (i.e., storage and releases). Moreover, they suggest that reservoirs that support warm water fisheries and reservoir inflow areas appear to strongly increase habitat quality. Driscoll et al. (2006) also note that any assessment of the positive or negative impacts of dams on bald eagles is confounded by the lack of pre-dam data and that nonnative fish species may have replaced native species in the bald eagle diet.

Variation in nest success and productivity among breeding areas and among years at individual nests could have been caused by infertility, human disturbance, interactions with other wildlife, climate (e.g., heat, cold, wind, and precipitation), nest parasites, lack of available prey during the nesting season, and other events causing stress or forcing the adults off the nest; however, most causes of nest failure are unknown (Hunt et al. 1992). FWS (2003a) reported that some of the most productive sites in Arizona for bald eagle nesting occur on the lower Verde River at the Fort McDowell breeding area (Figure III-3 and Figure III-4). The higher productivity of some bald eagle breeding areas along the lower Verde compared to other breeding areas was likely the result of several factors, including abundant native suckers and river riffles (Hunt et al. 1992), and possibly stocking of rainbow trout (Driscoll, pers. comm. 2007).

Summary of Data for Specific Breeding Areas and Reaches:

There are various hypotheses concerning how dams and their operations may influence the fish community, and specifically the native sucker population, on the lower Verde River and why suckers are currently abundant. Hunt et al. (1992) suggested that the cool summer water releases from the hypolimnion layer within a reservoir (e.g., Bartlett) may favor the sucker population, whereas warm water (or water temperature near ambient air temperature), such as those released from Horseshoe, would favor nonnative species. Bonar et al. (2004) suggests a combination of factors that could be supporting natives including: 1) the lower Verde River winter-spring flows from Bartlett Dam have mimicked natural flooding, which may trigger spawning by natives and provide more spawning and rearing habitat for natives during the spring and summer (Bryan et al. 2000); 2) warmer temperatures in the lower Verde River may trigger spawning suckers to emigrate from the Salt River to the Verde River; and 3) native fishes may be concentrated in the lower Verde River due to Bartlett Dam, which precludes upstream movement. It is not clear which of these factors is the driving ecological mechanism supporting the sucker population in the lower river – no study has been completed to specifically test or examine these hypotheses and relationships, but sampling by Bonar et al. (2004) suggests that under the current flow regime, reproduction, recruitment, and abundance of native suckers is high in this reach. However, they also found that predation of native fishes by nonnative fish was also high in this reach.

Downstream of Bartlett. It is likely that Bartlett operations both positively and negatively influence the native fish community that resides downstream. In general, the minimum flow requirement ensures that the river remains wetted during the dry and/or storage periods of the

year and therefore provides more habitat. Alternatively, the change in frequency of small and mid-sized flood pulses below Bartlett, and maintenance of a 100 cfs minimum flow,[18] have increased the stability of the hydrograph below Bartlett Dam. Increased stability of hydrographs can favor nonnative species including some of the predatory nonnative fish species (e.g., bass and catfish) occurring in the Verde River (Rinne et al. 1998), but these nonnative species are also utilized and considered important food resources for bald eagles (Hunt et al. 1992). Although the minimum flow releases have been in place for 12 years (instituted in 1994), native suckers are long-lived, and there could be a delayed response to these minimum flows, which may influence sucker abundance in the future. However, the available data (Bonar et al. 2004) and field observations in the fall of 2007 during fish sampling by AGFD (Cantrell, pers. comm. 2007) suggest that there is high abundance, reproduction, and ongoing recruitment of suckers within this reach of the river. The bald eagles appear to have had a positive response to this abundant food resource as new breeding areas have been established and success has been high since 1995. However, the long-term sustainability of suckers below Bartlett, and other native fish species in general in the Verde River below Bartlett and upstream of Horseshoe, is difficult to predict due to long-term native/nonnative fish interactions, future land use changes, recreational uses and impacts, grazing impacts, future tribal policies and actions, and state and tribal sport fisheries management and actions.

Other factors have likely influenced bald eagle nesting success in the past. Trout stocking on USFS and tribal land coincided with the bald eagle egg-laying period, which may have provided greater food availability during critical times early in the nesting cycle. In the 1980s and 1990s, the FMYN, in cooperation with the FWS, annually stocked approximately 12,000 to 17,000 catchable rainbow trout during the winter, which declined to 3,000 to 5,000 stocked fish per year from 1999 to 2003, and ceased after 2003 (White, pers. comm. 2007). Verde River Flycasters (a private fishing club), through a permit from the AGFD, has stocked large catchable rainbow trout above the Fort McDowell Reservation, from about 700 to 1,250 fish during the winter in 2001 to 2003 to about 100 fish in 2005 (Warnecke, pers. comm. 2007). The Fort McDowell tribal government closed the river area to nontribal members and hired their own police in 1997. Nest watchers have also helped protect nesting attempts (FWS 2003a).

Bartlett Breeding Area. The Bartlett breeding area has been used by bald eagles since the 1940s (Hunt et al. 1992). Hunt et al. (1992) describes the bald eagles at the Bartlett breeding area as "dependable nesters, having laid eggs in each of the 24 years data has been collected" and that general trend continued though 2006. Average nest success between 1970 and 2006 was 66 percent. Hunt et al. (1992) reported their foraging territory as including both Bartlett and the river below the dam to Needle Rock. They observed the bald eagles foraging on the 2 native sucker species, 10 different nonnative fish species (e.g., carp, catfish, largemouth and smallmouth bass, sunfish, black crappie), 5 bird species, 5 mammal species, and 2 reptile species. Hunt et al. (1992) does not report that prey quantity, quality, or spatial and temporal availability were an issue to Bartlett bald eagle reproduction, and suggest that the Bartlett flow

[18] See Subchapter I.F.4. The minimum 100 cfs flow was instituted under agreement between SRP and FMIC to maintain fish habitat and riparian vegetation along the Verde River below Bartlett Reservoir. The 100 cfs flow approximates the historic base flow conditions in this reach of the Verde River.

releases support prolonged sucker spawning and riffle foraging habitat within the breeding area. Hunt et al. (1992) report that human disturbance is a significant problem to the pair; AGFD, USFS, and FWS have instituted protection during the breeding season through closures and interagency management coordination.

Cliff Breeding Area. As noted above, the Cliff breeding area between the reservoirs has had low productivity and nest success. FWS questioned whether changes in the fish community were the cause of the lower productivity. The Cliff nest foraging area has been dominated by, and managed for, nonnative sport fish since creation of the reservoirs (AGFD 1954; Committee Report 2006). Thus, since the Cliff bald eagle territory was found (1984), few native suckers have likely been present in this reach. The bald eagles occupying the Cliff breeding area laid eggs in 7 years, successfully raised 4 nestlings in 2 years, was occupied for 13 years, and was not occupied for 2 years (Figure III-3). Hunt et al. (1992) noted that carp were a major prey item for the bald eagle and were available throughout the breeding season. Hunt et al. (1992) does not report that prey quantity, quality, or spatial and temporal availability were an issue to Cliff bald eagle reproduction. Hunt et al. (1992) note that the area receives very high recreational use, which could be the cause of many of the nest failures. Hunt et al. (1992) hypothesizes that the warm water releases favor nonnative fish species but, as described above, no specific research has been conducted to test this or the other confounding factors – such as sport fisheries management and past stocking in both lakes, which maintained high nonnative fish abundance and likely reduced native populations to very low levels.

Horseshoe Breeding Area. The Horseshoe breeding area has had moderate success (Figure III-3). Hunt et al. (1992) reported the bald eagles foraging in the mainstem and reservoir taking nonnative fish and native suckers. While reservoir storage does affect the fish community composition in the lake (Robinson, pers. comm. 2006), and some fish from the lake are likely moving up or downstream (Committee 2006), the changes do not appear to affect the reproductive success of the bald eagle in relation to prey availability. When the reservoir is held high for extended periods, perceriforms and carp become abundant, whereas when the lake is low or storage is minimized, carp dominate the fish community (Committee Report 2006; Robinson 2007). These species were identified as important prey for bald eagles (Hunt et al. 1992; Driscoll et al. 2006). Figure III-13 shows that bald eagle success responded independently to storage elevation – in years when the reservoir was high, the Horseshoe bald eagles were both successful and unsuccessful, and in years when storage was near zero, the bald eagles were successful and unsuccessful.

For the past 17 years, the eagles have not nested in trees within the conservation space of Horseshoe. However, in a few previous years (1982, 1986, and 1991), storage has had direct impacts on bald eagle nest success through nest tree inundation and subsequent tree fall. In these years, the eagles nested on a live tree (willow) or a snag within the conservation space of the reservoir, but prior to inundation, the eagle eggs or nestlings were rescued by agency biologists. The nestlings rescued in 1982 and 1986 were successfully fostered in another pair's nest (Hunt et al. 1992). In 1991, the eggs were removed and transported to the Phoenix Zoo, but did not successfully hatch. In 1979 and 1980, eagle nests were impacted when the artificial nesting structures ("tripods") constructed by resource managers below the high water mark of the reservoir were inundated. In circumstances when an occupied nest is not inundated, but rather surrounded by high water, injuries or fatalities can occur to fledglings. For example, in 1983,

young eagles prefledged, fell into the open water, and were returned to the nest with human intervention (Hunt et al. 1992). Based on observations by AGFD of the Horseshoe bald eagle breeding pair, eagle young generally fledge between mid-May and mid-June.

Upstream of Horseshoe. Operation of Horseshoe influences the fish community at Horseshoe and some fish produced from the reservoir may move up or downstream, but those fish would not be expected to cause widespread measurable shifts in fish community composition in the river. If large-scale movement of nonnative fish from Horseshoe was occurring, higher densities of lake-adapted species should be observed in Reach 4 (Beasley Flat – Horseshoe) compared to Reach 5 (Allen Ditch Diversion – Beasley Flat). However, Bonar et al. (2004) found no significant differences in biomass or density of nonnative fish species between these reaches. The increase of smallmouth bass and flathead catfish in 2006 detected by Gill (2006) is likely unrelated to storage because smallmouth bass are predominantly a riverine species and flathead catfish spawned in the summer when the lake was being drained and near its lowest levels, minimizing possible reproduction. Also, Robinson (2007) found no smallmouth bass, and flathead catfish had very low abundance (<1% relative abundance) during sampling of Horseshoe in the spring of 2005 (when lake levels were high) and fall of 2005, and spring and fall of 2006 (when lake levels were very low). Therefore, the increase of these species is likely due to in-river spawn and not from lake spawning and movements.

Table Mountain Breeding Area. As noted above, the Table Mountain breeding area has had low success in recent years. Hunt et al. (1992) presented little information concerning the foraging ecology of the Table Mountain breeding area located upstream of Horseshoe, and no additional foraging or feeding specific data has been published since their report. No clear relationship between reservoir storage and bald eagle success is evident (Figure III-12). AGFD fish survey data suggests that the Sonora sucker population declined (38 to 6.3 percent relative abundance) between 2001 and 2002 in the reach between Childs and Horseshoe, and relative abundance has remained low since 2002. While this sucker population decline could have contributed to poor bald eagle success, sucker abundance data is lacking for the late 1990s when Table Mountain bald eagle productivity first declined. Therefore, it is unclear if the sucker population was already declining by 2001, which could have caused lower bald eagle success, or if other factors are responsible or interacting to cause bald eagle nest failure (e.g., widespread severe drought began in the late 1990s). Recent fish sampling from Childs to Horseshoe by AGFD (Duffy 2005; Gill 2006) also suggested a significant decline in noncarp species (both native and nonnative species) in 2005, and an increase (or rebound) in overall fish abundance in 2006 to previous levels. Smallmouth bass and flathead catfish showed the greatest increase in this reach. Duffy (2005) and Gill (2006) suggested that a number of factors, such as 2005 flood flows, changes in sampling techniques, or impacts of recent fires in the watershed, could be responsible for the differences observed.

Other Upstream Breeding Areas. The East Verde, Coldwater, Ladders, and other breeding areas are located further upstream from Horseshoe than the Table Mountain breeding area, thus influences of the reservoir on the fish community are expected to be less, as described above. Hunt et al. (1992) reported that East Verde and Ladders nesting pairs utilized native and nonnative fish species, as well as other prey items. No specific foraging data is available for the Coldwater breeding area.

Figure III-3. Number of years bald eagle nests were occupied and successful in the Action Area, 1970–2006.

(Occupied and successful means fledged ≥1 young, failed (laid eggs but no young fledged), or no eggs were laid but breeding area was occupied.)

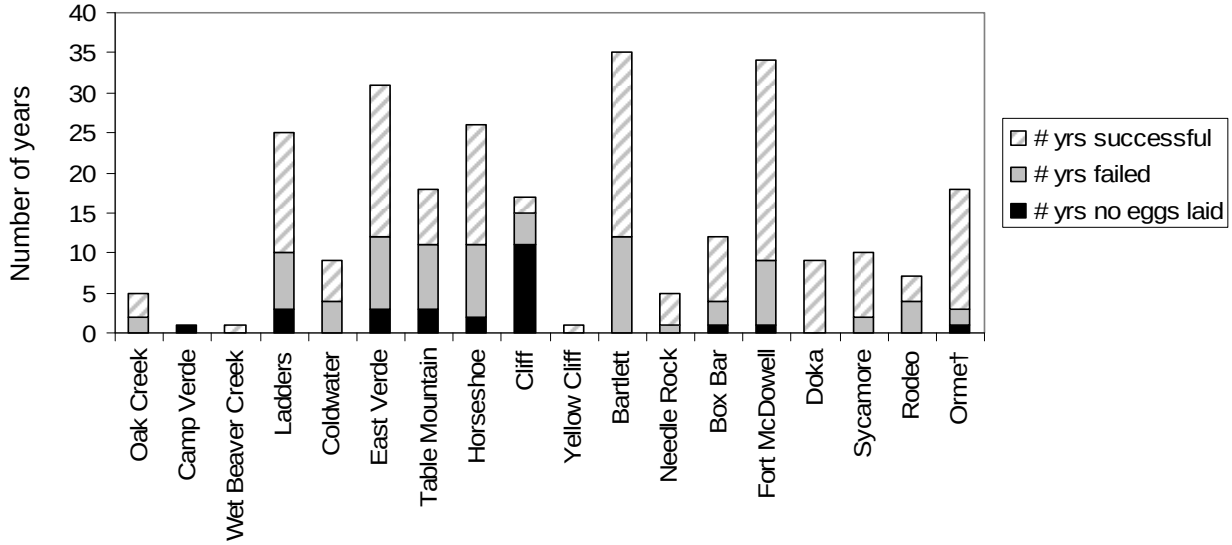


Figure III-4. Mean bald eagle nest success for breeding areas in the Action Area, 1970–2006.

(Nest success = no. young fledged / occupied breeding area; n values indicate number of years breeding area was occupied. Eagles that also forage out of the Action Area (Towers and Granite Reef) are not included.)

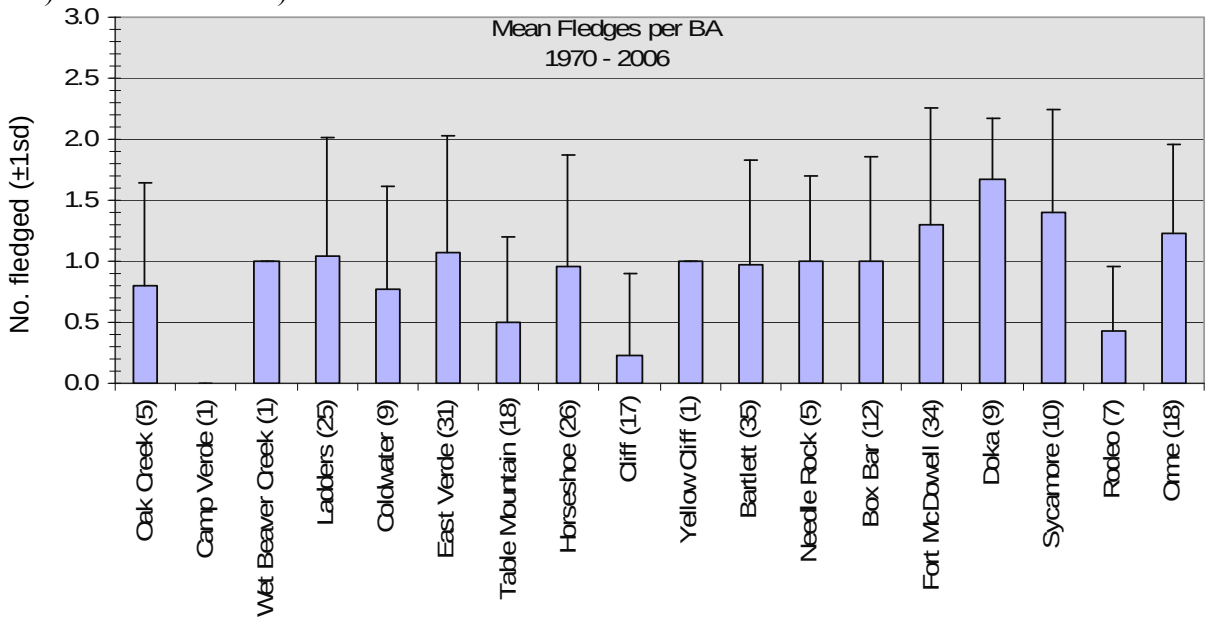


Figure III-5. Mean bald eagle nest success in Action Area, 1998–2006.
(Generally, 1998–2006 was dry with little carryover storage in Horseshoe.)

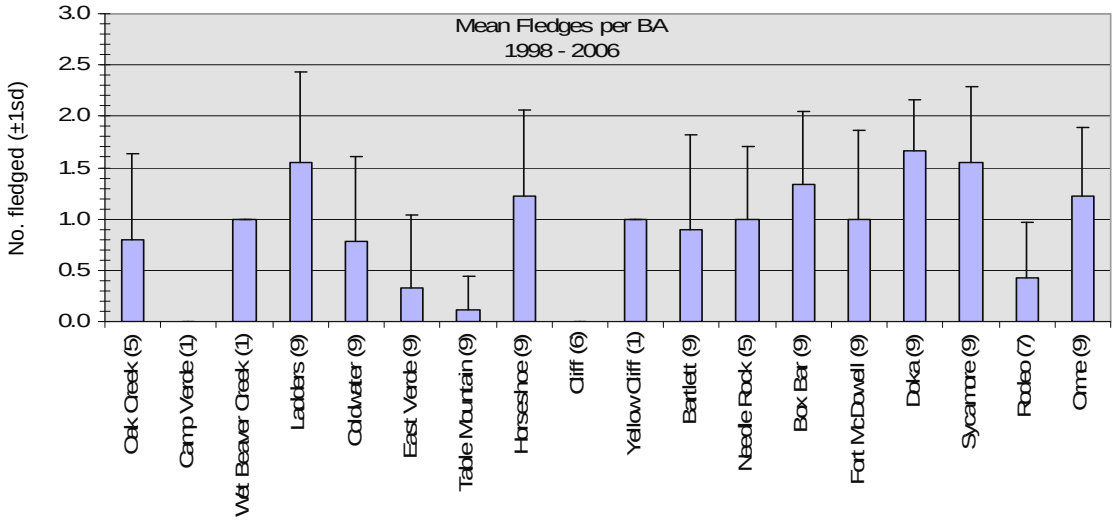


Figure III-6. Mean bald eagle nest success in Action Area, 1991–1996.
(Generally, 1991–1996 was a wetter period with greater frequency of carryover storage in Horseshoe.)

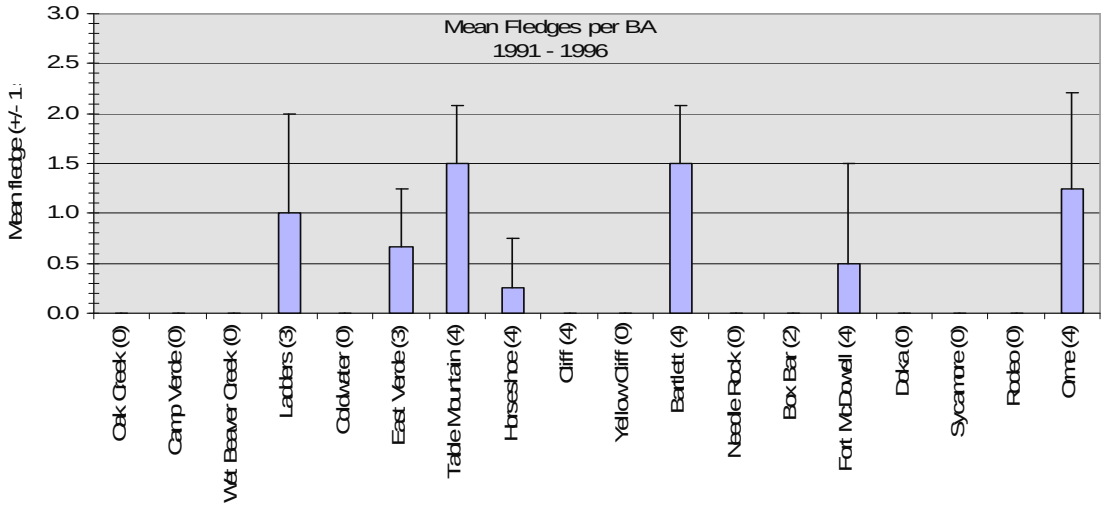


Figure III-7. Mean bald eagle nest success in Action Area, 1983–1989.
(Generally, 1983–1989 was a wetter period with greater frequency of carryover storage in Horseshoe.)

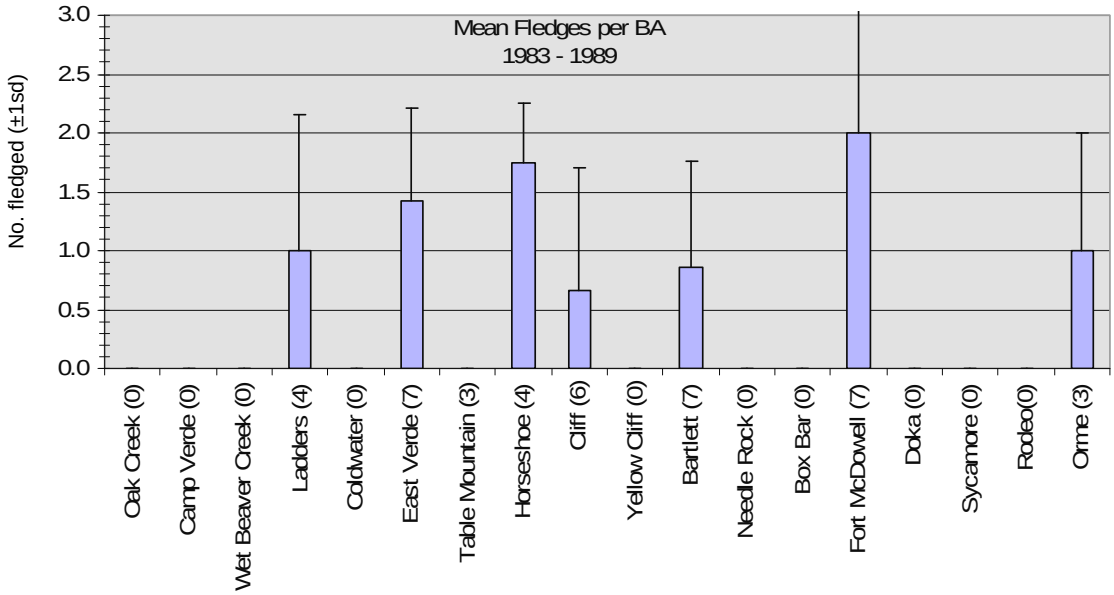


Figure III-8. Mean bald eagle nest success in Action Area, 1970–1982.
(Generally, 1970–1982 was dry with little carryover storage in Horseshoe.)

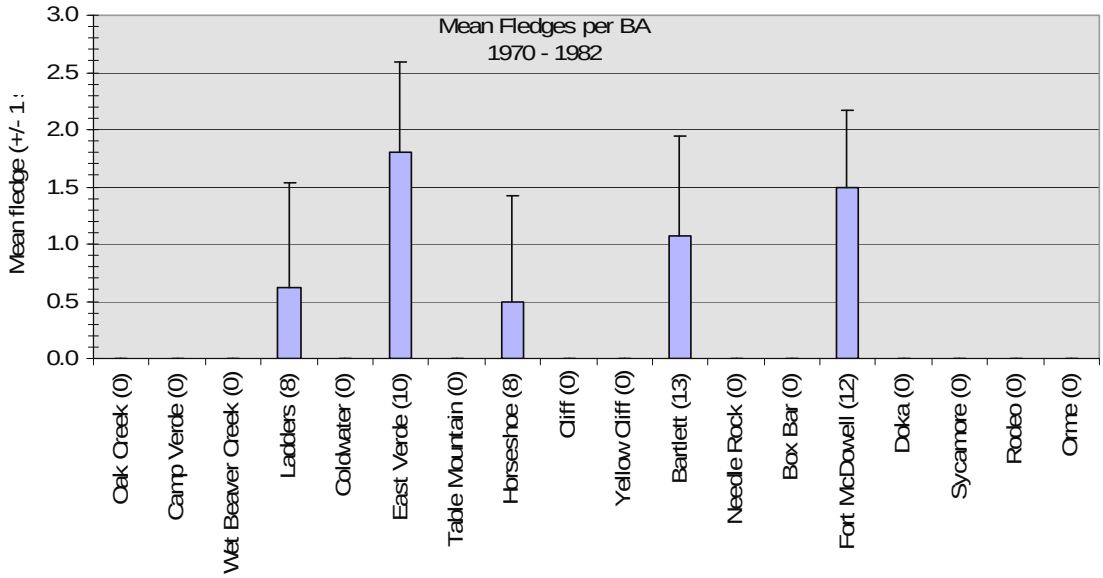


Figure III-9. Annual variation in mean number of young fledged between 1970 and 2006 for selected breeding areas upstream of Horseshoe.

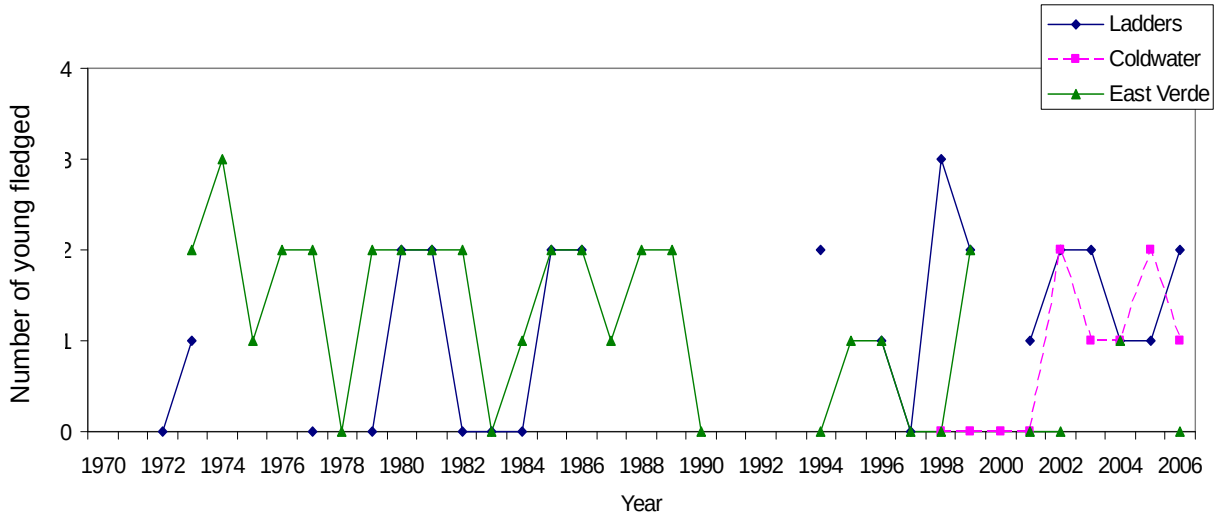


Figure III-10. Annual variation in mean number of young fledged between 1970 and 2006 for the Table Mountain and Horseshoe bald eagle breeding areas.

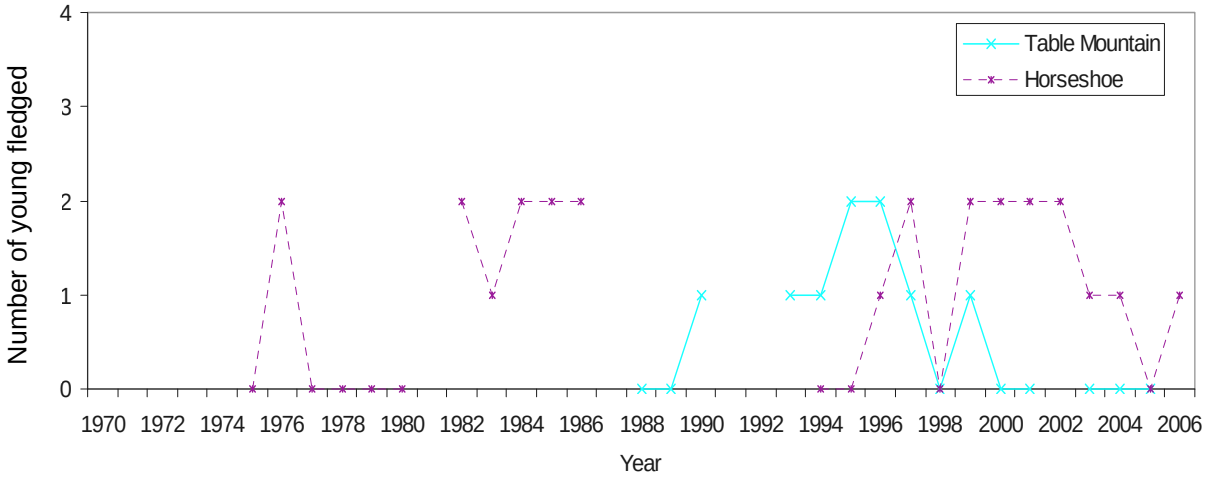


Figure III-11. East Verde bald eagle nest success and relative Horseshoe winter-spring storage, 1975–2006.

(Bald eagle success: "-3" value denotes when the breeding area was occupied but no eggs were laid; a "0.1" value denoted a failed nest; no bar ("0") denotes no data; "1, 2" denoted number bald eagles fledged. Horseshoe relative winter-spring storage values: 0 denotes no storage or pass through storage; 1 = <50,000 AF; 2 = 50,000 - 100,000 AF; 3 = >100,000 AF.)

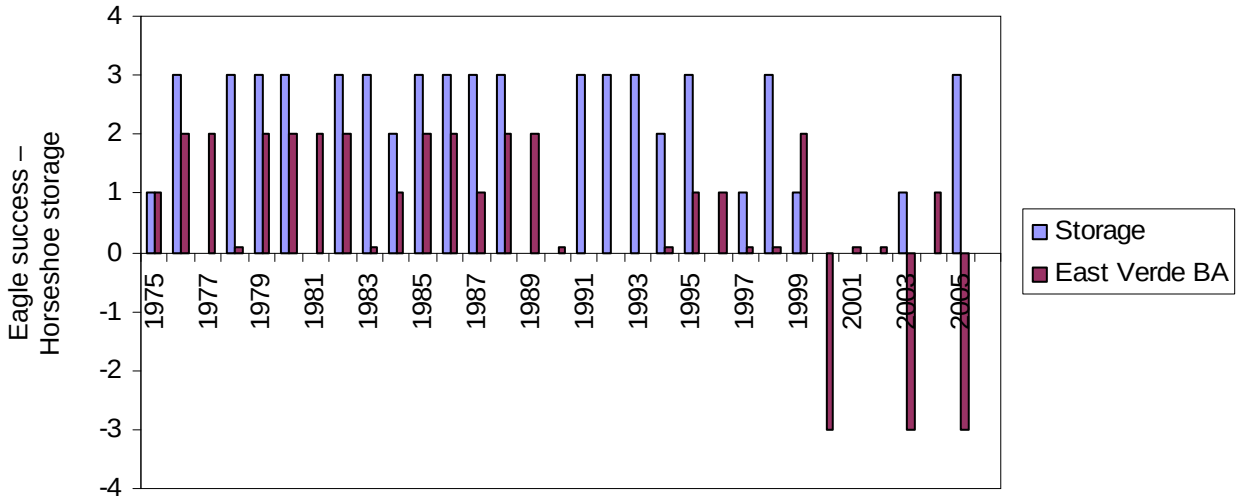


Figure III-12. Table Mountain bald eagle nest success and relative Horseshoe winter-spring storage level, 1975–2006.

(Bald eagle success: "-3" value denotes when the breeding area was occupied but no eggs were laid; a "0.1" value denoted a failed nest; no bar ("0") denotes no data; "1, 2" denoted number bald eagles fledged. Horseshoe relative winter-spring storage values: 0 denotes no storage or pass through storage; 1 = <50,000 AF; 2 = 50,000–100,000 AF; 3 = >100,000 AF.)

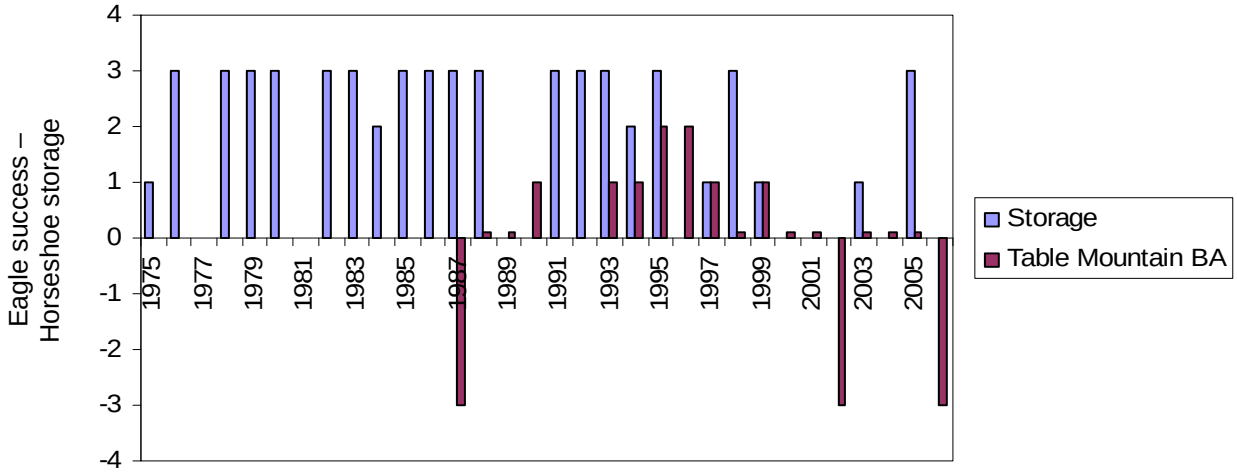


Figure III-13. Horseshoe bald eagle nest success and relative Horseshoe winter-spring storage level, 1975–2006.

(Bald eagle success: "-3" value denotes when the breeding area was occupied but no eggs were laid; a "0.1" value denoted a failed nest; no bar ("0") denotes no data; "1, 2" denoted number bald eagles fledged. Horseshoe relative winter-spring storage values: 0 denotes no storage or pass through storage; 1 = <50,000 AF; 2 = 50,000–100,000 AF; 3 = >100,000 AF.)

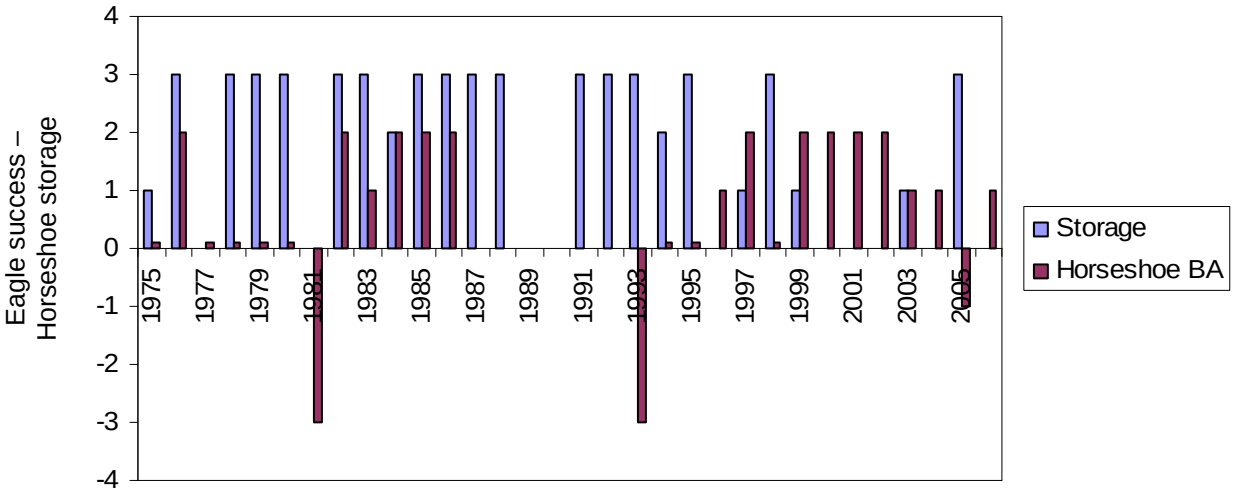
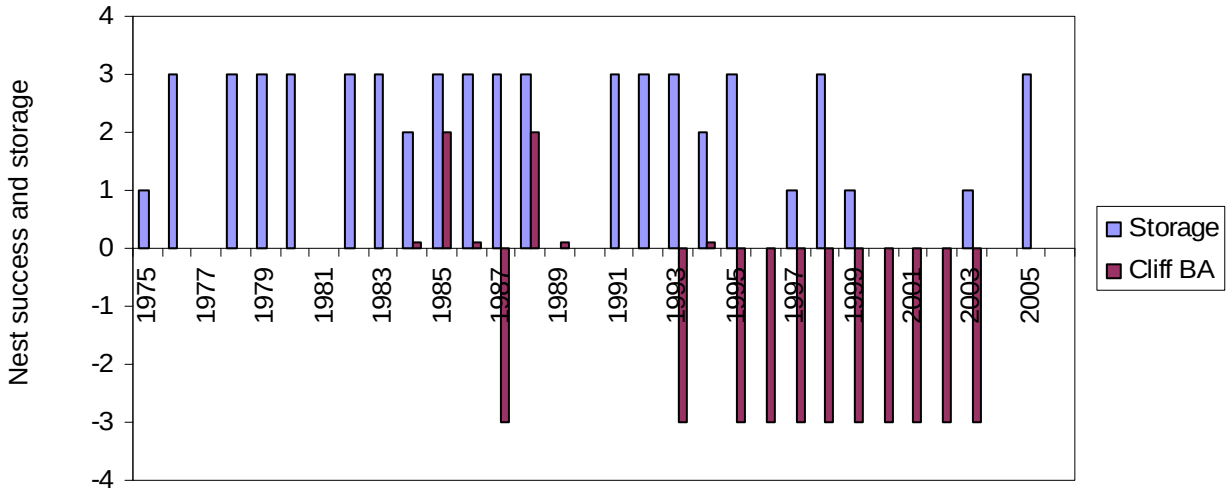


Figure III-14. Cliff bald eagle nest success and relative Horseshoe winter-spring storage level, 1975–2006.

(Bald eagle success: "-3" value denotes when the breeding area was occupied but no eggs were laid; a "0.1" value denoted a failed nest; no bar ("0") denotes no data; "1, 2" denoted number bald eagles fledged. Horseshoe relative winter-spring storage values: 0 denotes no storage or pass through storage; 1 = <50,000 AF; 2 = 50,000–100,000 AF; 3 = >100,000 AF.)



(9) Site Fidelity and Movement

A pair of breeding bald eagles generally uses the same breeding area each year and may add to the same nest or build an alternate nest. In Arizona, breeding pairs tend to stay in their breeding areas year-round, with some movement within the state during the summer (Hunt et al. 1992). Radiotelemetry data indicate that juvenile, two- and possibly three-year old, bald eagles often migrate north (Id.).

c) Yellow-billed Cuckoo

(1) Species Description

The cuckoo is a neotropical migratory bird. It is a summer resident throughout the United States, southern Canada, and northern Mexico, and it winters from Colombia and Venezuela south to northern Argentina (Ehrlich et al. 1988; AOU 1998). During breeding season, mated males give a loud, unmusical "kowlp" call, while unmated males give a series of soft notes "coo-coo-coo-coo." Both males and females may give a harsh, rattling "knocker" call (Hughes 1999).

(2) Listing History

The decline of the western population of the cuckoo due to loss and alteration of riparian habitat has been reported consistently (Tate and Tate 1982; Finch 1992). On July 25, 2001, FWS identified a distinct western population segment of cuckoos and determined that there was substantial information to indicate that the listing was warranted, but precluded by higher priority listing actions (FWS 2001). At this time, the western population of this species has been added to the FWS candidate list, and is listed as a Sensitive Species by the USFS and Wildlife of Special Concern by the AGFD (AGFD 2002b).

(3) Threats to the Species

Factors contributing to the decline of the cuckoo in the western U.S. include: degradation and loss of riparian habitat due to vegetation clearing, stream diversion, water management, agriculture, urbanization, overgrazing, and recreation (AGFD 2002b); modification and fragmentation of habitat (Franzreb 1987; Laymon and Halterman 1989; Hughes 1999); decreased water tables (Phillips et al. 1964); and possibly the use of pesticides (Gaines and Laymon 1984; Laymon and Halterman 1986; Rosenberg et al. 1991; Hughes 1999; Corman and Magill 2000). Estimates of riparian habitat losses range from 90 to 95 percent in Arizona, 90 percent in New Mexico, 90 to 99 percent in California, and more than 70 percent nationwide (FWS 2001).

(4) Prey and Diet of Cuckoos

Cuckoos eat insects, especially hairy caterpillars, grasshoppers, and larvae, as well as small fruits and berries (Ehrlich et al. 1988). They have sometimes been known to eat small frogs, lizards, and occasionally the eggs of other birds (Alsop 2001). It is thought that nesting peaks mid-June through August in response to the abundance of cicadas, katydids, caterpillars, and other large prey that form the bulk of their diet (Hamilton and Hamilton 1965). They forage mainly by gleaning in tree foliage but will fly out to catch insects or pounce quickly after spotting prey from their perch. Cuckoos are often found foraging in cottonwood forests (Laymon 1999).

(5) Cuckoo Breeding Biology

Cuckoos are relatively late nesters in the Southwest, compared to most neotropical migratory songbirds. In Arizona, few cuckoos arrive before the last week in May, with the peak occurring in mid to late June (Corman, pers. comm. 2002). Breeding often coincides with outbreaks of cicadas and tent caterpillars (AGFD 2002b). The earliest cuckoo egg-laying date in Arizona is June 15 and nesting activities continue through August and often into September in the southeast portion of the state (FWS 2001; Corman and Magill 2000).

Cuckoos utilize open woods, thickets, and riparian areas. Both adults build nests in trees or shrubs near drainages. The nests are well hidden and are flimsy platforms usually located between 4 and 10 feet aboveground, but occasionally as high as 35 feet. Nests are built in trees, shrubs, and vines (Preble 1957), and are most commonly found in willow or mesquite thickets. Usually 2 to 3 pale bluish-green eggs are laid (range: 2 to 5 eggs). Incubation lasts for 9 to 11 days and the young develop rapidly, beginning to climb in the trees near their nest in just 7 to 9 days (Corman, pers. comm. 2002). Fledging occurs at approximately 3 weeks of age (Id.). Cuckoos occasionally lay their eggs in the nests of other cuckoos or other bird species (FWS 2001).

(6) Breeding Habitat

Cuckoos breed in large blocks of riparian habitat, particularly in cottonwood and willow stands, which they also use extensively for foraging (Ehrlich et al. 1988). Dense understory vegetation seems to be an important factor in site selection (FWS 2001), as well as high humidity near the nest (Hamilton and Hamilton 1965). They also breed in stands of very tall screwbean-honey mesquite (*Prosopis pubescens-P. glandulosa*) (FWS 2003b) and in a mixture of tamarisk and cottonwood-willow (Corman and Magill 2000). Cuckoos are found mainly below 6,600 feet (FWS 2001). Home ranges on the South Fork of the Kern River, California vary from approximately 42 to 99 acres (Id.). In New Mexico, estimated nesting densities range from 1 to 15 pairs per 99 acres (Id.). In Arizona, reported nesting densities at three sites consisted of 8.2, 19.8, and 26.5 pairs per 99 acres (Id.).

In Arizona, cuckoos prefer desert riparian woodlands with dense stands of willow, Fremont cottonwood, and mesquite, but cuckoos have occasionally been found to nest and forage in stands with up to 50 percent salt cedar (Pima County 2001; Corman and Magill 2000; Halterman, pers. comm. 2002). For nesting, cuckoos prefer very dense vegetation with canopy cover greater than 65 to 70 percent. Poole and Gill (1999) and Laymon (1999) suggest microhabitats, which consist of dense, damp thickets that have relatively high humidity, are necessary for nesting. While other trees may be used for nesting, willows appear to be preferred (Laymon 1998, 1999). The average canopy height in optimal nesting areas is about 20 to 30 feet, and canopy height less than about 10 feet appears to be unsuitable (Laymon 1998, 1999).

In addition to vegetative characteristics, the size and shape of patches of riparian habitat are important in determining their usefulness to cuckoos. Typically, breeding cuckoo pairs require patches of 10 to 100 acres. Habitat patches less than about 10 acres are generally considered unsuitable. However, Laymon (1999) notes that patches on the Colorado River as small as 10 acres have been occupied by breeding pairs. Similarly,

Halterman reports a minimum home range of 10 to 50 acres in Arizona, depending on habitat quality and other factors (Halterman, pers. comm. 2002). The shape of patches is also crucial. Cuckoos are thought to avoid habitat edges because of an increased risk of predation; therefore, the less edge a patch has, the better the habitat (Laymon 1999). Long, narrow areas have more edge in relation to the area of habitat, and are considered less suitable (Id.). In one study, desirable habitat strips were found to be typically greater than 325 feet wide, and 1,950 feet was the most favorable (Id.). However, some populations (i.e., on the Verde River) appear to use much smaller patches provided that the patches are contained within a larger matrix or surrounded by numerous patches of riparian forest (Van Riper, pers. comm. 2005).

(7) Statewide Status

According to the FWS 12-Month Finding on a Petition to List the Yellow-billed Cuckoo in the Western Continental United States, "Arizona probably has the largest remaining cuckoo population among states west of the Rocky Mountains" (FWS 2001, citations omitted). The largest concentration of cuckoos in Arizona during a census in 1998–1999 occurred at the San Pedro Riparian National Conservation Area in the south-central portion of the state (Corman and Magill 2000). Cuckoo distribution is fragmented in Arizona with birds occurring throughout central, east-central, west-central, and southeastern Arizona. Other large numbers of detections of cuckoos have been reported along the lower and middle San Pedro, Verde, and Agua Fria rivers, and Cienega Creek in Pima, Pinal, Cochise, and Yavapai counties, and Sonoita Creek in Santa Cruz County (Corman and Magill 2000).

(8) Status of the Cuckoo at Horseshoe and Bartlett

Five cuckoos were documented during cuckoo surveys at Horseshoe in 2003 (EEC 2005). Five to six individuals were detected during three cuckoo surveys in 2004 (EEC 2004). In 2005, six cuckoos were detected at Horseshoe (EEC 2005).

Riparian cottonwood-willow galleries and mixed riparian stands that may be suitable for cuckoos exist both above and below Horseshoe, although some of these stands occur as narrow strands along the Verde River. There is insufficient tall riparian forest near Bartlett for cuckoo habitat. Cottonwood groves that may be suitable for the species also occur on the Verde River below Bartlett at the Highway 87 crossing on the FMYN (FWS 2003b).

d) Covered Fish Species

There are 10 species of fish proposed for coverage under the Permit. These species are summarized in Table III-2. Critical habitat for the razorback sucker exists at Horseshoe; therefore, this species is discussed in greater detail than the other nine species.

Table III-2. Fish proposed to be covered under the Permit.

Common Name	Listing History	Breeding Biology	Habitat	Status in Action Area
Razorback sucker	Listed, Endangered—1991 Recovery Plan—2002 Critical Habitat—1994	Spawn January through March over coarse substrates	Medium to large rivers, lakes, or reservoirs	Reaches of the Verde river upstream and including Horseshoe is designated as critical habitat. Stocked above Childs since the 1980s. Stocked individuals survive <5 years. No known reproduction. A few individuals were found in Horseshoe in 2005 and 2006.
Gila topminnow	Listed, Endangered—1967, 1973	Spawn March through August; live-bearers	Headwaters and springs	Stocked and persist in Lime Creek.
Colorado pikeminnow	Listed, Endangered—1967, 1969, 1973 Section 10(j) experimental nonessential population—1985	Spawn in spring over coarse substrates	Warm, swift, large rivers	Stocked in Verde River above Childs since the 1980s. Found in the Verde Valley in 2004. A few individuals were found in Horseshoe in 2006.
Spikedace	Listed, Threatened—1986 Critical Habitat—1994 (vacated 1998); 2000 (vacated 2004); designated 2007	Spawn from March through May	Moderate to large streams and small rivers with coarse substrate	Most recently found in 1999 by the AGFD in the upper Verde (upstream of the Action Area) near Paulden. May be stocked into upper Verde and selected tributaries within the Action Area in the future; designated critical habitat upstream of the Action Area.
Loach minnow	Listed, Threatened—1986 Recovery Plan—1991 Critical Habitat—same as spikedace	Spawn from March through May	Shallow, swift water with gravel, cobble, and rubble substrates	Populations in the Verde basin have been extirpated. May be stocked in the future in upper Verde and selected tributaries in the Action Area; no designated critical habitat in the Verde River watershed.
Roundtail chub	Not listed	Spawn February through June	Small streams to rivers; often in pools and eddies	Roundtail chub observed by Bonar et al. (2004) in all sections of the Verde River (except between the reservoirs), and known to occur in some larger perennial tributaries and Lime Creek.
Longfin dace	Not listed	Spawn December to August, peak in April	Shallow water in cool, small streams	Likely present in most perennial tributaries in the upper portion of the Action Area, in Lime Creek, and in the Verde River below Bartlett.
Sonoran sucker	Not listed	Spawn late winter through mid-summer	Wide range of temperature tolerance; prefer gravelly or rocky pools	Found by Bonar et al. (2004) in all reaches of the Verde River, except between the reservoirs.
Desert sucker	Not listed	Spawn late winter and early spring	Streams and rivers, mainly over bottoms of gravel-rubble with sandy silt	Found by Bonar et al. (2004) in all reaches of the Verde River, except between the reservoirs; may occupy perennial tributaries; considered to be the most abundant native species.
Speckled dace	Not listed	Two spawning periods: spring and late fall	Headwaters, creeks, and small to medium rivers	Found in upper end of the Action Area and in some tributaries.

(1) Razorback Sucker

Species Description

The razorback sucker is a large river-dwelling fish that can reach lengths of 3.3 feet and weights of 13.2 pounds (Rinne and Minckley 1991). The prominent predorsal keel distinguishes the adult razorback sucker. The young lack a keel and may be difficult to distinguish from other suckers (*Catostomus* sp.) (AGFD 2002i). The razorback sucker is long-lived, with some individuals surviving 40 years (Id.). Some hybridization with flannel-mouth suckers has been documented historically (Hubbs and Miller 1953).

Listing History

The species was listed as endangered in 1991 by FWS. Recovery goals published in 2002 supplemented the 1998 Razorback Sucker Recovery Plan (FWS 2002b). Critical habitat was designated in 1994 (FWS 1994a). In the last 40 to 50 years, wild populations (Lake Mohave and Lake Mead) have been composed mainly of aging adults, with steep declines in numbers. Reproduction occurs, but very few juveniles are found (FWS 2002b). This species is also listed as a Sensitive Species by the USFS and as Wildlife of Special Concern by AGFD (AGFD 2002i). Threats include stream flow regulation, habitat modification, predation by nonnative fish species, and pesticides and pollutants (FWS 2002b).

Breeding Biology

"Spring migrations of adult razorback sucker were associated with spawning in historic accounts and a variety of local and long-distance movements and habitat-use patterns have been documented" (FWS 2002b). Spawning occurs mainly in January through March when water temperatures of 50˚F to 70˚F and river flows are high during spring runoff (Minckley 1973; Sublette et al. 1990; Moyle 2002). Spawning takes place in broad alluvial, flat-water regions over bars of cobble, gravel, and coarse sand substrates or in reservoirs over rocky shoals and inundated shorelines (Minckley 1973; Sublette et al. 1990; Moyle 2002). Wick (1997) found that eggs deposited on substrates with moderate to high sediment have lower survival because of suffocation. Young razorback (fry) are thought to require quiet, warm, shallow water, such as backwaters, inundated floodplain habitats in rivers, coves or inundated shorelines in reservoirs, or tributary mouths downstream of spawning bars. The young of the year appear to stay in these sheltered habitats for several weeks after hatching, and then disperse to deeper water (Rinne and Minckley 1991). In lakeside rearing ponds, juvenile razorback suckers hide during the day in dense aquatic vegetation, under debris, and in rock cavities (FWS 2002b). During the nonbreeding (summer to winter) season, adults have been found in deeper eddies, slow runs, backwaters, and other pool-type habitats with silt or sand substrate, at depths ranging from approximately 1 to 19 feet, with velocities of approximately 1 foot/second (Minckley 1973; Sublette et al. 1990; Moyle 2002). Razorback suckers are known to hybridize with other catostomid species, but according to the Razorback Sucker Recovery Goals (FWS 2002b), hybridization is not considered to be a threat to the species.

Habitat

In general, razorback suckers are found at elevations up to about 5,000 feet in slow backwaters of medium and large streams and rivers, sometimes around cover. In

impoundments, they prefer depths of 3 feet or greater over sand, mud, or gravel substrates. A wide range of temperatures is tolerated by razorback suckers, ranging from near freezing to 89.6˚F (AGFD 2002i). Adult razorback suckers tend to occupy different habitats seasonally (Osmundson et al. 1995). According to the recovery plan (FWS 2002b), habitat requirements for adults in rivers include: deep runs, eddies, backwaters, and flooded off-channel environments in spring; runs and pools often in shallow water associated with submerged sandbars in summer; and low-velocity runs, pools, and eddies in winter.

Statewide Status

Historically, razorback suckers inhabited the Colorado, Gila, Salt, Verde, and San Pedro rivers. Present adult populations exist only in Lake Mohave, Lake Mead, and in the lower Colorado River from Lake Havasu to Davis Dam. Due to low recruitment, these populations remain small. Most individuals are older adults. This species has been stocked in the Verde River and the Salt River (Jahrke and Clark 1999), mostly near Childs about 20 miles upstream of Horseshoe. Between 1981 and 1990 (before the species was listed as endangered), more than 10 million hatchery-produced fry and fingerling razorback suckers were released into historical habitat in the Verde and Salt rivers in Arizona, where the status of the natural population was uncertain but believed to be extirpated. No long-term survival of the stocked fish has been reported (FWS 2002b). In 1993, due to low survival, managers began stocking subadult and adult (12-inch) razorback suckers into the Verde River. Between 1994 and 2003, 19,745 razorback suckers were stocked (Weedman 2003). Survival of up to two years has been documented, but no evidence of successful reproduction or recruitment has been found (FWS 2002b). Razorback suckers collected in Horseshoe in early 2005 were in spawning condition, but no recruitment was documented in follow-up surveys in the fall of 2005 or in 2006 (Robinson 2007).

Status at Horseshoe and Bartlett

Horseshoe is included in the designation for critical habitat for this species (FWS 1994a), along with the area on the Verde River upstream to the Tonto National Forest - Prescott National Forest boundary. Occasionally, a few stocked razorback suckers have been documented in or just upstream of Horseshoe—at Sheep Bridge, approximately 4 to 5 miles above Horseshoe; one in Horseshoe in 2002; seven in Horseshoe in April 2005; two in the spring of 2006; and one in the fall of 2006 (Willard, pers. comm. 2003; Robinson 2005, 2007). Bartlett is not considered suitable habitat for razorback sucker recruitment because of the lack of dense aquatic vegetation and the abundance of nonnative fish. Coverage for razorback sucker is being sought in the HCP because of critical habitat in Horseshoe and the possible future persistence and reproduction of stocked razorback suckers in the Verde River in and above Horseshoe. As described above, AGFD has funded a stocking program in the mainstem Verde River to establish, maintain, and periodically augment an adult razorback sucker population. Such a program is consistent with AGFD's Wildlife 2006 plan (AGFD 2001h) and Recovery Plan goals to augment and reestablish razorback sucker populations in suitable habitat to meet conservation goals.

(2) Gila Topminnow

The Gila topminnow inhabits headwater springs, vegetated margins, and backwater areas of intermittent and perennial streams and rivers. They occur at elevations ranging from 1,320 to 7,510 feet, but prefer elevations below 5,000 feet (AGFD 2001e). This species prefers warm water in a moderate current with dense aquatic vegetation and algae mats, where it feeds on aquatic insects, mosquito larvae, crustaceans, and detritus (Id.). Gila topminnow are live-bearers that give birth to 1 to 31 young per brood that mature a few months after birth (Schoenherr 1974). They breed primarily from March to August, but a few females may become pregnant during other times of the year (Id.).

The Gila topminnow was listed as endangered by FWS in 1967. Critical habitat has not been designated for this species. Threats to the species include habitat loss, predation and competition by nonnative fishes (especially the mosquitofish, *Gambusia affinis*), aquifer pumping, drought, and development of springs.

The Gila topminnow was historically considered the most abundant fish in the Gila River Basin, particularly in low to mid-elevation streams (AGFD in prep.). It is now thought to occur in 11 natural sites in southern Arizona (Id.). The Gila topminnow was stocked in Horse Creek in the 1980s but that population no longer exists; currently it is not found at Horseshoe or Bartlett (Willard, pers. comm. 2003; Robinson 2007). A reproducing, stocked population has persisted in Lime Creek, a tributary to Horseshoe, through the summer of 2005 (Weedman 1998; Voeltz, pers. comm. 2005) when a large wildfire burned the watershed. It is unknown if the population survived, but Gila topminnow were salvaged prior to the fire and managers intend to restock this reach if the population was extirpated. Gila topminnow no longer has extant, naturally occurring populations in the Verde River basin (Voeltz and Bettaso 2003).

Coverage for the Gila topminnow in the HCP is being sought because of the Lime Creek population (Weedman 1998) and potential future critical habitat designation.

(3) Colorado Pikeminnow

The Colorado pikeminnow occupies warm, swift, turbid mainstem rivers, preferring eddies and pools (AGFD 2001c). Spawning occurs in the spring over clean cobbles and rubble in relatively swift water with temperatures of 68˚F to 78.8˚F. Juveniles use slow-moving water, backwater, and side channel areas with a silt-sand substrate. Larger Colorado pikeminnow (greater than 7.9 inches in length) occupy turbid, deep, and strongly flowing waters (Id.). Colorado pikeminnow is North America's largest minnow with records of lengths reaching up to 6 feet and weights of up to 100 pounds (AGFD 2001c).

The Colorado pikeminnow was listed as endangered in 1967 by FWS. Recovery goals were published in 2002, which supplemented the 1978 Colorado Squawfish Recovery Plan (FWS 2002c). Critical habitat is designated in the upper Colorado River Basin, but none is designated in Arizona (FWS 1994a). Recovery actions have focused on the upper Colorado River basin. Threats include stream diversions, impoundments, reservoir operations, and predation by and competition with nonnative fishes (AGFD 2001c).

Historically, this species occurred in large rivers such as the Salt, Gila, Verde, and Colorado rivers but was extirpated before the mid-1960s, probably due to habitat alteration (especially dam construction), competition and predation by nonnative fish species, and possibly overharvest (AGFD 2001c). AGFD has funded a stocking program in the mainstem Verde River to establish, maintain, and periodically augment an adult pikeminnow population since 1985. The Colorado pikeminnow is stocked as an experimental, nonessential population[19] in the Verde River above Horseshoe near Beasley Flat or Childs (Jahrke and Clark 1999). A few adult Colorado pikeminnow have been recaptured (by AGFD or anglers) in the mainstem Verde River downstream of the stocking location. One Colorado pikeminnow was found dead on the shore in Horseshoe in the spring of 2006, it was likely killed by a bird of prey (Robinson, pers. comm. 2006). Three recently stocked fish were found in Horseshoe in the fall of 2006 (Id.).

Coverage for the Colorado pikeminnow is being sought in the HCP because of continued efforts to reintroduce the species to the Verde River system.

(4) Spikedace

Spikedace are found in moderate to large perennial streams with gravel, cobble, and sand substrates having moderate to swift currents at elevations ranging from 1,620 to 4,500 feet (AGFD 2002g; Propst et al. 1986; Rinne and Kroeger 1988). Recurrent flooding are important components of spikedace habitat (FWS 2003b). Spikedace feed on aquatic and terrestrial insects, and occasionally the fry of other fish during certain seasons (AGFD 2002g). Spikedace spawning occurs from March through May with some yearly and geographic variation (Barber et al. 1970; Anderson 1978; Propst et al. 1986).

The spikedace was federally listed as threatened in 1986 (FWS 2000). A recovery plan was issued in 1991 (FWS 1991a). Threats include stream flow depletion, diversion, competition with nonnative crayfishes, and predation by and competition with nonnative fishes, especially the red shiner (AGFD 2002g). Critical habitat was originally designated in 1994 (FWS 1994c), removed in March 1998, but re-proposed in December 1999, and finalized in April 2000 (FWS 2000). As the result of additional litigation, the designation was vacated and remanded to FWS for revisions to the economic analysis. Critical habitat was re-proposed for designation on December 20, 2005 (70 FR 75546), including the portion of the Verde River from Sullivan Dam at the headwaters downstream to Fossil Creek. In the proposed rule, the FWS found that these areas contain all or a portion of the primary constituent elements (PCEs) necessary for the survival and recovery of the spikedace (and loach minnow). Five PCEs were listed in the 2005 proposed designation including areas "devoid of nonnative species, or habitat in which detrimental nonnative species are at levels that allow persistence of the spikedace." The final rule designated critical habitat for spikedace in the upper Verde River, from Sullivan Lake downstream to the southern boundary of the Prescott and Coconino National Forests, upstream of the Action Area (72 FR 13356; March 21, 2007)

[19] Under Section 10(j) of the ESA, listed species may be transplanted to new locations to promote conservation and recovery efforts. Special rules regarding take of Colorado pikeminnow in the Verde River are found at 50 CFR 17.84(b)(2).

The current range for spikedace in Arizona and New Mexico is reported to be a 15-mile stretch of Aravaipa Creek, a tributary of the San Pedro River; Eagle Creek; 35 miles of the upper Verde River; and the upper Gila River system in New Mexico (AGFD 2002g). The most recent confirmed presence of spikedace near the Action Area was from 1999 surveys by the AGFD in the upper Verde River near Paulden (upstream of the Action Area).

Coverage for spikedace in the HCP is being sought because the species may be reintroduced to selected tributaries in or near the Action Area and critical habitat is proposed for designation in the Action Area.

(5) Loach Minnow

Habitat for the loach minnow consists of shallow water with moderate to swift currents and gravel, cobble, or rubble substrates. Some studies have indicated that the presence of dense, filamentous green algae may be an important component of loach minnow habitat (Barber and Minckley 1966). Loach minnow is a bottom-dwelling inhabitant at elevations ranging from 2,325 to 8,240 feet (Rinne 1989; Propst and Bestgen 1991; AGFD 2001f). Loach minnow use the spaces between, and in the lee of, larger substrate for resting and spawning (Propst et al. 1988; Rinne 1989). It is rare or absent from habitats where fine sediments fill the interstitial spaces (Propst and Bestgen 1991). Loach minnows feed exclusively on aquatic insects (Schrieber 1978; Abarca 1987). Spawning generally occurs in March through May (Britt 1982; Propst et al. 1988); however, under certain circumstances, loach minnow may also spawn in the fall (Vives and Minckley 1990).

The loach minnow was federally listed as threatened in 1986 (FWS 2000), and the Loach Minnow Recovery Plan was published in 1991 (FWS 1991b). Threats include sedimentation and embedding of riffle habitats, diversion, channelization, and predation by and competition with nonnative fishes (Propst et al. 1988). Critical habitat was designated for the loach minnow in 1994 (FWS 1994b), was removed in March 1998, re-proposed in December 1999, and finalized in April 2000 (FWS 2000). As the result of litigation, the final designation has been vacated and remanded to FWS for revisions to the economic analysis. Critical habitat was re-designated on March 21, 2007, but the Verde River and its tributaries are not included (72 FR 13356).

The loach minnow is considered extirpated from the entire Verde River watershed, with the last confirmed observations occurring in 1938 above Camp Verde (Girmendock and Young 1997). Although the loach minnow is reported by the AGFD Heritage Data Management System (HDMS) as being in the reach of the Verde River considered in the HCP, recent surveys have not confirmed its presence (AGFD HDMS 2003).

Coverage for the loach minnow is being sought because the species may be reintroduced to selected tributaries in or near the Action Area or critical habitat may be designated in the Action Area.

(6) Roundtail Chub

The roundtail chub can be found in Arizona waterways that range from small streams to rivers. Roundtail chub can be found in cool to warm water, mid-elevation streams (from 1,210 to 7,200 feet), and often prefer open areas of deeper pools and eddies of mid-

sized to large streams (Voeltz 2002; AGFD 2002c). Roundtail chub spawn during spring and early summer when flow begins to decline after spring runoff (February through June) (Sublette et al. 1990; AGFD 2002c). Diet consists mainly of aquatic and terrestrial insects, filamentous algae, and sometime other fishes (AGFD 2002c). Roundtail chub is now rare in most of the large river portions of the Salt, Verde, and Gila rivers (Id.). It is reported by AGFD HDMS (2003) as occurring in the Action Area. Although not abundant, roundtail chub are found in all sections of the Verde River, except for the reach between Horseshoe and Bartlett (Bonar et al. 2004).

On April 2, 2003, the Center for Biological Diversity (CBD) petitioned the Secretary of Interior to list the roundtail and headwater chubs under the ESA as endangered (CBD 2003). The petitioner requested the roundtail chub be listed as a distinct population segment (DPS) in the Colorado River Basin, below Glen Canyon Dam. The CBD filed suit in 2004 to require FWS to respond to the petition. FWS published a Federal Register notice on July 12, 2005 concluding that listing may be warranted and initiating a status review (70 FR 39981). As a result of that status review, the FWS found that listing the species as threatened or endangered was not warranted (71 FR 26007; May 3, 2006). Threats include aquifer pumping, stream diversion, reduction in stream flows, and predation by and competition from nonnative fishes. The roundtail chub is currently considered a sportfish by the AGFD as a management tool;[20] however, limited harvest of roundtail chub is not considered to impede conservation of the species or limit persistence (Brouder et al. 2000; Voeltz 2002). In 2004, AGFD and the other basin states within the species' range signed a rangewide conservation agreement to protect the roundtail chub. AGFD has developed and is implementing a Statewide Conservation Agreement and strategy for roundtail chub and five other native fish species (AGFD 2007). A number of state, federal, tribal, and nongovernmental parties, including SRP, have agreed to assist in the implementation of the statewide program.

Coverage for the roundtail chub is being sought in the HCP because the populations in Arizona were petitioned for listing, the species is on AGFD's sensitive species list, it is a species covered under the Statewide Conservation Agreement (AGFD 2007), it faces the same threats as the covered fish species that are already listed, and it would be impacted similarly to other covered fish species.

(7) Longfin Dace

The longfin dace is found in cool upland streams to low desert streams (Rinne and Minckley 1991). This species occurs at elevations ranging from 1,360 to 6,740 feet, but is usually found at elevations less than 4,900 feet. This species is generally found in shallow water with moderate velocities, and in small streams with temperatures less than 75˚F (AGFD HDMS 2003). The longfin dace has a "remarkable capacity to disperse to new habitats, appearing in a few hours or days after a storm in formerly dry streambeds" (Rinne and Minckley 1991). "In response to a flood event, the fish will move directly into the margins of the current and move back into the channel as the discharge declines…[and] are rarely caught in flood pools or back waters" (AGFD 2002f). Adults generally become sexually mature by one year of age and spawning occurs over a long,

[20] http://www.gf.state.az.us/h_f/sport_fish.html; accessed April 28, 2003.

6-month period beginning in December and continuing through July (and possibly September in low elevations) with a surge in spawning activity occurring in April (Minckley 1973; AGFD 2003c; Sublette et al. 1990).

Distribution of longfin dace has increased in mountainous areas of Arizona, probably due to climatic trends (AGFD 2002f). The longfin dace is reported by AGFD HDMS (2003) as occurring or potentially occurring throughout the Action Area. The longfin dace is not currently listed by FWS. Threats include human activities that alter the quality or flow of water, particularly flood control and irrigation, as well as predation from and competition with nonnative fishes (AGFD 2002f).

Coverage for the longfin dace is being sought in the HCP because this species has been recommended for listing as threatened by the Desert Fishes Team (DFT 2004), it faces the same threats as the covered fish species that are already listed, and it would be impacted similarly to other covered fish species.

(8) Sonora Sucker

The Sonora sucker occurs in a wide range of habitats, from warm water rivers to cool trout streams, preferring gravelly or rocky pools, or quiet waters, while the young inhabit runs and quiet eddies. This species is found at elevations ranging from 1,210 to 8,730 feet. The Sonora sucker is omnivorous (AGFD 2002d). Similar to other members of its genus, the Sonora sucker is very sedentary and greatly resists downstream displacement, with very little seasonal movement observed (Sublette et al. 1990). Spawning behavior is observed from late winter through mid-summer (AGFD 2002d). The act of spawning is similar to that of other members of its genus characterized by the tendency of larger groups to move into shallower tributaries or onto riffles of larger streams with gravelly substrates where fertilized eggs are deposited, incubated, and developed (AGFD 2002d; Sublette et al. 1990; Minckley 1973). Bonar et al. (2004) found Sonora sucker in all reaches of the Verde River during their sampling effort from March 2002 through January 2003, which also documented large numbers of recently hatched larval suckers in the reach below Bartlett Dam. However, the reach between Horseshoe and Bartlett was not sampled, and these fish are not likely present.

The Sonora sucker is not currently listed by FWS. Threats include reduced available habitat due to alteration of historical flow regimes, construction of reservoirs, and predation and competition by nonnative fishes. Coverage for the Sonora sucker is being sought in the HCP because this species has been recommended for listing as threatened by the DFT (2004), it faces the same threats as the covered fish species that are already listed, and it would be impacted similarly to other covered fish species.

(9) Desert Sucker

The desert sucker occupies rapids and flowing pools of streams and rivers, mainly over bottoms of gravel-rubble with sandy silt. Adults live in pools, moving to swift riffles and runs to feed on vegetation, diatoms, and algae at night. According to Minckley (1973), the desert sucker appears to be intolerant of lake conditions. The young inhabit riffles during the day, feeding on midge larvae. This species is found at elevations below 8,840 feet (AGFD 2002e). Desert suckers are not known to move great distances within the average river system, depending upon the distribution of preferred

habitat, and they resist downstream displacement during flood events (Sublette et al. 1990; AGFD 2002e; Lucas and Baras 2001). The species prefers flowing pools and rapids with a substrate comprised of gravel-rubble with interstitial silt within a wide elevational range (480 to 8,840 feet) (AGFD 2002e).

Desert suckers spawn in late winter and early spring when adults gather in large numbers over riffle substrates where eggs are laid. The eggs adhere to gravel substrates within shallow depressions on the stream bottom (Sublette et al. 1990; AGFD 2002e). Bonar et al. (2004) found that desert suckers were the most abundant species observed throughout the entire length of the Verde River in both riffle and run habitats, and documented large numbers of recently hatched larval suckers in the reach below Bartlett Dam. However, the reach between Horseshoe and Bartlett was not sampled, and these fish are not likely present.

The desert sucker is not currently listed by FWS. Threats include reduced available habitat due to alteration of historical flow regimes, construction of reservoirs, and competition with and predation by nonnative fishes. Nonnative fish have also increased competition and introduced hybridization (AGFD 2002e). Coverage for the desert sucker is being sought in the HCP because this species has been recommended for listing as threatened by the DFT (2004), it faces the same threats as the covered fish species that are already listed, and it would be impacted similarly to other covered fish species.

(10) Speckled Dace

The speckled dace occurs in small- to medium-sized rivers, normally at elevations greater than 5,000 feet. It feeds along the stream bottom on algae, small crustaceans, insect larvae, and small snails. The speckled dace is found in Arizona in the Colorado, Bill Williams, and Gila River drainages (AGFD and FWS 2002). Speckled dace spawn during two defined periods: spring and late fall where the former is dictated by photoperiod and water temperature, and the latter is influenced by flow regimes (Sublette et al. 1990; Minckley 1973; AGFD 2002h). Swift water is sought by breeding adults where the female enters an area with gravelly substrate that has been cleared by courting males and she releases her eggs into the substrate, which is then showered by sperm from several males (Sublette et al. 1990).

The speckled dace is not currently listed by FWS. Threats include nonnative predatory fish and land uses that damage aquatic habitat (AGFD and FWS 2002). This species is reported by AGFD HDMS (2003) as occurring below Bartlett. They are universally recognized to have been widespread in both the Verde mainstem and its tributaries, and have one of the most extensive distributions of all western cyprinids occurring in virtually every western state and a multitude of habitats (Minckley 1973; Bettaso and Paradzick, pers. comm. 2005).

Coverage in the HCP is being sought for the speckled dace because this species has been recommended for listing as threatened by the DFT (2004) and may occur in the Action Area, it faces the same threats as the covered fish species that are already listed, and it would be impacted similarly to other covered fish species.

e) Frog and Gartersnake Species

The lowland leopard frog, northern Mexican gartersnake, and narrow-headed gartersnake are proposed for coverage under the Permit. Pertinent characteristics for these species are summarized below.

(1) Lowland Leopard Frog

Lowland leopard frog is one of six native (and one introduced) species of leopard frog in Arizona. The frog has been described as a habitat generalist and breeds in a variety of natural (e.g., rivers, streams, cienegas) and man-made (e.g., cattle tanks and backyard ponds) aquatic systems (AGFD 2001b). It is found in Arizona at elevations from 480 to 8,200 feet, but generally occurs at elevations less than 6,400 feet. This species is found in riparian areas within the Sonoran Desert to oak and pine–oak woodlands (AGFD 2001b). The species reproduces primarily from January to May, with additional reproduction occurring in some populations in summer and early fall after the onset of summer monsoon rains. Reproduction occurs with females depositing egg masses in shallow water, which attach to submerged vegetation, bedrock, or gravel. Egg masses have been observed between January to late April and in October. Adult lowland leopard frogs feed on arthropods and other invertebrates, and larvae are herbivorous and likely eat algae, organic debris, and plant tissue.

The species has not been proposed for listing under the ESA. Although more data is needed to determine its status in Arizona, populations in central Arizona were thought to be stable in 1997 (Sredl et al. 1997), but no comprehensive surveys have been completed since that time. The species is declining in southeastern Arizona and is extirpated in southwestern Arizona (AGFD 2001b). The species is uncommon but widely distributed in the Action Area with recent records in the Lime, Fossil, Houston/Squaw, and Tangle creek drainages (AGFD 2001b). Threats to the species include habitat alteration and fragmentation, introduction of predatory and competitive nonnative fishes, crayfishes, bullfrogs, and the Rio Grande leopard frog.

Coverage in the HCP is being sought for the lowland leopard frog because it is a sensitive aquatic species with threats similar to native fishes and it is listed by AGFD as a Species of Special Concern (AGFD in prep.).

(2) Northern Mexican Gartersnake

Northern Mexican gartersnake is the most widely distributed of the 10 subspecies of *Thamnophis eques,* and it is the only subspecies that occurs in the United States (FWS 2006a). The species is strongly aquatic, occurring mainly in densely vegetated permanent marshes and streams at middle elevations in central, south central, and southeastern Arizona. It feeds primarily on native fish (e.g., Gila topminnow and roundtail chub) and amphibians (e.g., leopard frog). To a much lesser extent, it forages on nonnative species, including juvenile fish, larval and juvenile bullfrogs, and mosquitofish (FWS 2006a). Threats include predation by nonnative aquatic species such as bullfrogs, habitat degradation and destruction of cienegas and other preferred wetland habitats, and a decline in its prey base due to habitat degradation and increase in nonnative species (AGFD 2001d). The northern Mexican gartersnake is reported as occurring in the Action Area on the Verde River from Fossil Creek upstream to Clarkdale (FWS 2006a), and above the Action Area in lower Oak Creek within the vicinity of Page

Springs. The northern Mexican gartersnake is on AGFD's list of Wildlife of Special Concern (AGFD in prep.). The subspecies was petitioned for listing as threatened or endangered with critical habitat on December 15, 2003. In response to that petition, the FWS initiated a 90-day finding and status review on January 4, 2006 (71 Fed Reg. 315), and completed a 12 month finding on September 26, 2006 (71 Fed Reg. 186), which found that the subspecies was not warranted for listing as threatened or endangered due to limited knowledge of its status in Mexico. Within the United States, the distribution of this species has decreased by 90 percent and it has likely been extirpated from New Mexico (FWS 2006a). In a large-scale, two-year sampling effort, Holycross et al. (2006) found this species in only three of 33 targeted sites (9 percent) in central and east-central Arizona.

Coverage in the HCP is being sought for the northern Mexican gartersnake because it is a sensitive aquatic species with threats similar to native fishes, it is listed on AGFD's list of Wildlife of Special Concern, and it was petitioned for listing as threatened or endangered.

(3) Narrow-headed Gartersnake

The narrow-headed gartersnake is one of 21 species in the genus *Thamnophis*. The species is highly aquatic, occurring in or near clear, cool, permanently flowing rocky streams in the mountains of central and eastern Arizona and west-central New Mexico (AGFD 2002m). The elevation range for this species is about 2,300 to 8,080 feet, and its habitat setting generally includes montane forests with piñon-juniper, oak-pine, or ponderosa pine with cover from cottonwood-willow. Important vegetative components include shrub and sapling Arizona alder, velvet ash, willows, and canyon grape. It feeds primarily on native fish (e.g., longfin dace, and desert and Sonora sucker), but may also take nonnative fish (e.g., green sunfish, rainbow and brown trout, fathead minnow, red shiner), and occasionally amphibians (frogs and toads) (Degenhardt et al. 1996; Rossman et al. 1996; AGFD 2002m). Threats include predation by nonnative aquatic species such as bullfrogs, crayfish, and some fishes; lowered water table; diminishing prey base; sedimentation of streams and substrates; and habitat degradation and fragmentation due to grazing and recreation (AGFD 2002m).

The most recent narrow-headed gartersnake records are from Oak Creek in Oak Creek Canyon (Nowak and Santana-Bendix 2003), and from the Verde River near Fossil Creek in the Action Area (Holycross et al. 2006). This species may also occur along the mainstem or in tributaries of the Verde River upstream of Fossil Creek. Holycross et al. (2006) found this species in only five of 42 targeted sites (11 percent) in central and east-central Arizona. The species is on AGFD's list of Wildlife of Special Concern (AGFD in prep.).

Coverage in the HCP is being sought for the narrow-headed gartersnake because it is a sensitive aquatic species with threats similar to native fishes, and it is on AGFD's list of Wildlife of Special Concern.

2. Other Listed and Rare Species

a) Other Listed Wildlife and Species of Concern

AGFD's HDMS was used to identify wildlife species listed by FWS under the ESA or by another federal or state agency as needing protection (Table III-6). The species were listed by AGFD as having occurred between 2 miles upstream of Horseshoe and 2 miles downstream to the confluence of the Verde and Salt rivers (AGFD HDMS 2003). For the reasons stated in each of the following subsections, SRP is not seeking coverage under the HCP for these other listed and rare species.

Table III-3. Other listed wildlife and species of concern near Horseshoe and Bartlett.

Scientific Name	Common Name	ESA	USFS	AGFD	Critical Habitat Designated	Upland, Riparian, or Aquatic
Glaucidium brasilianum cactorum	Cactus ferruginous pygmy-owl	-	-	WSCA	-	Upland
Rallus longirostris yumanensis	Yuma clapper rail	LE	-	WSCA	-	Riparian
Gila intermedia	Gila chub	LE	S	WSCA	Yes (upstream)	Aquatic
Gila nigra	Headwater chub	C	-	-	-	Aquatic
Oncorhynchus gilae	Gila trout	LT	S	WSCA	-	Aquatic
Gopherus agassizii (Sonoran population)	Sonoran desert tortoise	-	-	WSCA	-	Upland
Ictinia mississippiensis	Mississippi kite	-	-	WSCA	-	Upland

KEY: ESA=Endangered Species Act as amended, 1973 (LE=Listed Endangered; LT = Listed Threatened; C = Candidate)
USFS=United States Forest Service (S=Sensitive Species)
AGFD=Arizona Game and Fish Dept (WSCA=Wildlife of Special Concern)
Critical Habitat=designated under the ESA (relationship to Action Area)

(1) Cactus Ferruginous Pygmy-Owl

The cactus ferruginous pygmy-owl is an upland species that occupies Sonoran desert scrub, cottonwood-willow riparian or dense mesquite woodlands, or semidesert grasslands, usually adjacent to saguaros or other columnar cacti more than 8 feet tall, or trees in association with at least some shrub cover (AGFD 2001g; AGFD and FWS 2002). This species generally nests from April to June. The young fledge anywhere from 21 to 30 days after hatching and disperse from the nesting area at approximately 8 weeks after fledging (AGFD and FWS 2002). The cactus ferruginous pygmy-owl is a food generalist that eats insects, birds, small mammals, and reptiles (Id.).

The cactus ferruginous pygmy-owl was listed as endangered in the state of Arizona as a distinct population segment (DPS) on March 10, 1997 but delisted on May 15, 2006 (71 FR 19452; April 14, 2006). Threats include loss of habitat degradation and loss of habitat and urban development in saguaro-ironwood forests (AGFD in prep.).

Historically, the northern edge of the range for this species extended to the confluence of the Salt and Verde rivers. This species is reported as occurring or potentially occurring below Bartlett by the AGFD HDMS (2003).

Coverage for the cactus ferruginous pygmy-owl is not sought under the HCP for the following reasons:

- The cactus ferruginous pygmy-owl is an upland species that is unlikely to be affected by any of the reservoir operation alternatives considered in the HCP.
- The historical range does not extend into the Verde watershed.
- The cactus ferruginous pygmy-owl is not currently listed under the ESA.

(2) Yuma Clapper Rail

The Yuma clapper rail breeds in fresh water marshes, brackish water marshes, and side waters. It is usually found in tall, dense cattail (*Typhas domingensis*) and giant bulrush (*Scirpus californicus*) marshes at elevations below 1,700 feet (AGFD 2001a). Common reed (*Phragmites australis*) marshes are mainly used when associated with cattail. Salt cedar, as a minor associate of cattail, forms part of the cover used by the territorial Yuma clapper rail in some areas. Water at least 11.8 inches deep; vegetation equal to or greater than 15.8 inches tall; and an interface between water, soil, and vegetation appears to be more important than plant species in determining habitat suitability (Id.). Prior to 1985, Yuma clapper rails were periodically sighted on the Salt River near Granite Reef Dam. While there is potential habitat for the Yuma clapper rail along the Verde River, including areas below the dams, there have been no records of this species along the Verde River since 1985, other than 1 audible detection of what was identified as a Yuma clapper rail near Red Creek in 2001 (Burger 2003).

The Yuma clapper rail was listed as endangered in 1967 (FWS 1967). No critical habitat has been designated (FWS 1997c). A recovery plan was completed in 1983. It is on Arizona's list of Wildlife of Special Concern (AGFD in prep.). Threats to the Yuma clapper rail include loss of marsh habitat from river management activities such as channelization, dredging, bank stabilization, and fluctuating reservoir levels, which have reduced its habitat. However, impoundments along the lower Colorado River and mitigation efforts in that area have increased the extent of backwater marshes in the reach between Davis and Laguna dams (FWS 1997c).

Coverage for the Yuma clapper rail is not being sought under the HCP for the following reasons:

- Yuma clapper rails are not thought to utilize areas along the Salt or Verde rivers northeast of Phoenix on more than an intermittent basis.
- Reservoir operations are unlikely to impact habitat downstream of Granite Reef, where Yuma clapper rails may be found.

(3) Gila Chub

The Gila chub is a small minnow (about 6 to 10 inches in length) that inhabits pools in small streams, cienegas, and impoundments at elevations of 2,000 to 5,400 feet

(AGFD 2002j). It generally is found where cover is abundant. The Gila chub is omnivorous, feeding on insects, small fish, and algae. In the Verde River basin, the Gila chub is known to occur only in headwater creeks above the Action Area for native fish species covered in the HCP (AGFD HDMS 2003). No Gila chub were found during studies conducted on the Verde River in 2002–2003 (Bonar et al. 2004).

The Gila chub was listed as endangered on November 2, 2005 with critical habitat (70 FR 66664). The designation of critical habitat in the Verde River watershed includes Walker Creek, Red Tank Draw (tributaries of Wet Beaver Creek), Spring Creek (a tributary of Oak Creek), and Williamson Valley Wash (a tributary at the headwaters of the Verde River). Threats include habitat degradation from grazing, recreation, and mining; predation and competition by nonnative fishes; aquifer pumping; and drought.

The Gila chub is not being considered for inclusion in the HCP for the following reasons:

- It occupies small headwater streams.
- Reservoir operation alternatives are unlikely to impact existing populations or adversely modify critical habitat.

(4) Headwater Chub

The headwater chub is a recently described species formerly thought to be a subspecies of either the Gila chub or the roundtail chub (Minckley and DeMarais 2000). The historical range of the headwater chub included the tributaries of the middle Verde River above Fossil Creek draining from the Mogollon Rim, e.g., Fossil, West Clear, Wet Beaver, and Oak creeks (Minckley and DeMarais 2000; AGFD 2003c). Water temperature may limit distribution to a narrow range of elevation between about 4,300 to 6,600 feet (CBD 2003). No headwater chub were found during studies conducted on the Verde River in 2002–2003 (Bonar et al. 2004). The headwater chub is not listed as occurring within the Action Area (AGFD HDMS 2003). The CBD petitioned the Secretary of Interior to list the entire population of the headwater chub under the ESA as endangered (CBD 2003) (see roundtail chub discussion). The CBD filed suit in 2004 to require FWS to respond to the petition. Based on the petition and resulting status review, the FWS found that listing the headwater chub was warranted as threatened or endangered but was precluded by other higher priority listing actions (71 FR 26007). Threats include aquifer pumping, stream diversion, reduction in stream flows, channelization and irrigation, mining, roads and logging, development activities, predation by and competition from nonnative fishes, disease, and livestock grazing (71 FR 26007, AGFD 2002c).

This species is not being considered for coverage in the HCP for the following reasons:

- There is no known evidence that it historically occupied habitat in the Action Area.
- It prefers smaller headwater streams, and reservoir operation alternatives are unlikely to impact the existing populations.

- The closest known population of headwater chub is located more than 40 miles upstream, outside of the Action Area.

(5) Gila Trout

The Gila trout is a salmonid that historically inhabited small headwater streams in Arizona. Oak Creek and West Clear Creek, tributaries to the Verde River, may have supported populations of Gila trout. Habitat for this species is small mountain headwater streams, which generally are shallow, narrow, and cold (normally less than 70°F). Gila trout require high water quality including high dissolved oxygen concentration, low turbidity and conductivity, low levels of total dissolved solids, near-neutral pH, and low conductivity (Hanson 1971). In New Mexico, the known elevation range for this species is 5,446 to 9,220 feet.

Between 1974 and 1992, a population of Gila trout persisted in Gap Creek, a headwater tributary of the Verde River in Prescott National Forest outside of the Action Area for native fish. Surveys of Gap Creek in 1993 revealed no Gila trout. (AGFD 2002k). In 1999, Gila trout were stocked in Dude Creek, a tributary of the East Verde River near Payson (Gila Trout and Chihuahua Chub Recovery Team 2000). Gila trout may occupy approximately 2 miles of stream in Dude Creek (Gila Trout and Chihuahua Chub Recovery Team 2000), although this population is no longer considered viable (FWS 2006b).

This species is not being considered for coverage in the HCP because:

- There is no known evidence that it historically occupied habitat close to Horseshoe or Bartlett.
- It prefers cold, small headwater streams.
- Where Gila trout have been reintroduced, a fish barrier protects reaches from nonnative fish invasion, thus reservoir operation alternatives are unlikely to impact the existing habitat.
- Future introductions of Gila trout for sportfishing or urban fishing may occur in many areas of Arizona including within or adjacent to the Action Area, but survival of these introduced fish would be of seasonal duration in the Action Area due to lethal summer water temperatures. Thus, the introduced fish occurring in the Action Area would not be targeted for species recovery (see 71 FR 40657; July 18, 2006).

(6) Sonoran Desert Tortoise

The Sonoran desert tortoise is on AGFD's list of Wildlife of Special Concern and occurs across southwestern Arizona's Sonoran Desert and is mainly found in rocky foothills and less often on lower bajadas (coalesced alluvial fans) and in semidesert grassland (AGFD in prep.). Threats include habitat fragmentation, habitat loss and degradation from urban and agricultural development and roads, wildfires, illegal collecting, ORV use and other recreation, and genetic contamination of wild populations by escaped or released captives. This species' decline is also associated with the invasion

of nonnative annual grasses and forbs (AGFD in prep.). The Sonoran desert tortoise is reported by AGFD HDMS (2003) as occurring or potentially occurring below Horseshoe.

Coverage of the Sonoran desert tortoise under the HCP is not being sought because:

- It is currently not a candidate for listing.
- It is an upland species unlikely to be impacted by any of the reservoir operation alternatives.

(7) Mississippi Kite

The Mississippi kite is found in open woodlands, wooded streams, and swamps. This falcon-shaped kite is found in the southern Great Plains, the Mississippi Valley, the Southeast, and more recently, the Southwest. This species is a neotropical migrant that nests in trees near waterways in forests, open woodlands, or semiarid rangelands. In Arizona, the Mississippi kite nests at elevations ranging from 1,400 to 3,040 feet. The Mississippi kite begins nest building in early to mid-May but may add to old nests during June and early July. Eggs are laid from March to June. The young fledge on average at 34 days, but depend on their parents for several weeks after fledging (AGFD 2003b). The main prey item of this species is insects, which are captured in flight, although occasionally bats, amphibians, and lizards are taken. The Mississippi kite is social, often breeding in small colonies of up to 20 pairs and hunting in small flocks.

The Mississippi kite is not listed by FWS. The Mississippi kite is on AGFD's list of Wildlife of Special Concern and is reported as occurring or potentially occurring on the Verde River near Cottonwood and below Bartlett (AGFD HDMS 2003). Its habitat is threatened by destruction of riparian deciduous forests and woodlands.

Coverage for the Mississippi kite is not being sought under the HCP because:

- It is not listed, nor is it a candidate species for listing at this time.
- Reservoir operation alternatives are unlikely to impact the existing populations because operations will not impact habitat conditions near Cottonwood or downstream of Bartlett dam.

b) Listed and Rare Plants

Three plant species listed by FWS under the ESA or by a federal agency as needing protection may occur from 1 mile above Horseshoe to 1 mile below Bartlett (AGFD HDMS 2003). These plants and their status are listed in Table III-4.

Table III-4. Listed and rare plants near Horseshoe and Bartlett.

Scientific Name	Common Name	ESA	USFS	BLM	NPL	Riparian or Upland
Purshia subintegra	Arizona cliffrose	LE	-	-	HS	Upland limestone lakebed deposits
Agave murpheyi	Hohokam agave		S	S	HS	Upland
Eriogonum ripleyi	Ripley wild buckwheat		S	-	SR	Upland

KEY: ESA=Endangered Species Act as amended, 1973 (LE=Endangered)
USFS=United States Forest Service (S=Sensitive Species)
BLM=United States Bureau of Land Management (S=Sensitive Species)
NPL=Arizona Native Plant Law (A.R.S. § 3-901 et seq.) (HS=Highly Safeguarded, no collection; SR=Salvage Restricted, collection with permit)

(1) Arizona Cliffrose

The Arizona cliffrose is found at 2,500 to 4,000 feet in elevation in rolling limestone hills with Sonoran desert scrub usually on white Tertiary limestone lakebed deposits high in lithium nitrates and magnesium (Arizona Rare Plant Committee 2002). This species occurs near Horseshoe on Chalk Mountain and near Lime Creek on the southwest side of Horseshoe, but does not occur within the lakebed (Willard, pers. comm. 2003). The Arizona cliffrose is listed by FWS as an endangered species. AGFD reported it as occurring or potentially occurring throughout the area considered in the HCP (AGFD HDMS 2003).

Coverage for Arizona cliffrose under the HCP is not being sought because the known locations and all potential locations for this species occur in upland areas surrounding Horseshoe that are unlikely to be impacted by any of the reservoir operation alternatives.

(2) Hohokam Agave

The Hohokam agave is typically located near major drainage systems on open hilly slopes or alluvial terraces in desert scrub at elevations of 1,350 to 2,950 feet. According to the Arizona Rare Plant Committee's *Arizona Rare Plant Field Guide* (2002), the range includes Paradise Valley, New River Mountains, Castle Creek River, Agua Fria River, Roosevelt, the Mazatzal Mountains, Tonto Basin, and Queen Creek near Superior. This species is reported by AGFD as occurring below Bartlett (AGFD HDMS 2003).

Coverage for Hohokam agave under the HCP is not being sought because this is an upland species that is unlikely to be impacted by any of the reservoir operation alternatives considered in the HCP.

(3) Ripley Wild Buckwheat

Ripley wild buckwheat is found on well-drained, powdery soils derived from Tertiary lakebeds and limestone, sandstone, or volcanic tuffs and ashes at elevations ranging from 2,000 to 6,000 feet. This species is reported by AGFD as occurring or potentially

occurring from above Horseshoe to between Horseshoe and Bartlett (AGFD HDMS 2003).

Coverage for Ripley wild buckwheat under the HCP is not being sought because this is an upland species that is unlikely to be impacted by any of the reservoir operation alternatives considered in the HCP.

B. Other Affected Resources

This subchapter describes the affected resources along the Verde River from above Horseshoe to just below the confluence of the Verde and Salt rivers. In addition to covered species, major resources that may be affected by alternative reservoir operations considered in the HCP are water, recreation, geology and geomorphology, and vegetation. These resources along this reach of the Verde River are described below.

The Action Area also includes the Verde River and portions of its tributaries upstream of Horseshoe in locations where nonnative fish produced by reservoir operations may affect covered native fish species (Subchapter IV.B.2). Although a number of environmental resource issues affect fish populations in those stream reaches (e.g., water quality, recreation, and water diversions), reservoir operations do not affect those resources upstream of the dams. Thus, those resource issues are considered part of the analysis of the effects of alternatives on covered fish species in Chapter IV, but are not addressed below.

1. Water Resources

This section provides hydrological information for the Verde River above and below Horseshoe and Bartlett. Additional information on flood hydrology is provided in Appendices 3 and 4.

a) Overview

The Verde River is a perennial stream with a contributing drainage area of approximately 6,250 square miles (USGS 1991). Water quality is generally good (ADWR 2000). High elevations in the north-central part of the watershed receive an average of about 24 inches of precipitation per year with lower elevations receiving 12 inches or less annually (Id.).

Verde River flows are composed of baseflow from ground water discharge and runoff due to winter precipitation and monsoon storm events (Id.). Baseflow into Horseshoe is estimated to be 185,000 AF/year (Id.). Key statistics for selected gaging stations along the mainstem and major tributaries are provided in Table III-5. The Verde River gaging station below Tangle Creek is just above the inflow to Horseshoe.

b) Period of Record

In the arid Southwest, the selection of the period of record for analysis of hydrologic statistics is important because long-term cycles of precipitation result in highly variable runoff between years and decades (Shepard et al. 2002; Jarrett 1991; Meko and Graybill 1995). A well-known example of the peril of using an unrepresentative period of record for drawing conclusions is the Colorado River Compact, which allocated one-half of the apparent runoff at Lee Ferry to the Lower Basin States. The Compact is based on the

period of record of 1896 through 1930, when the average annual discharge of the river was 17 million AF (Jarrett 1991). However, during the following 35 years, the average annual discharge of the river was only about 13 million AF, slightly less than the estimated long-term average flow of 13.5 million AF (Id.).

Table III-5. Selected Verde River basin gaging station statistics, 1934–1996.

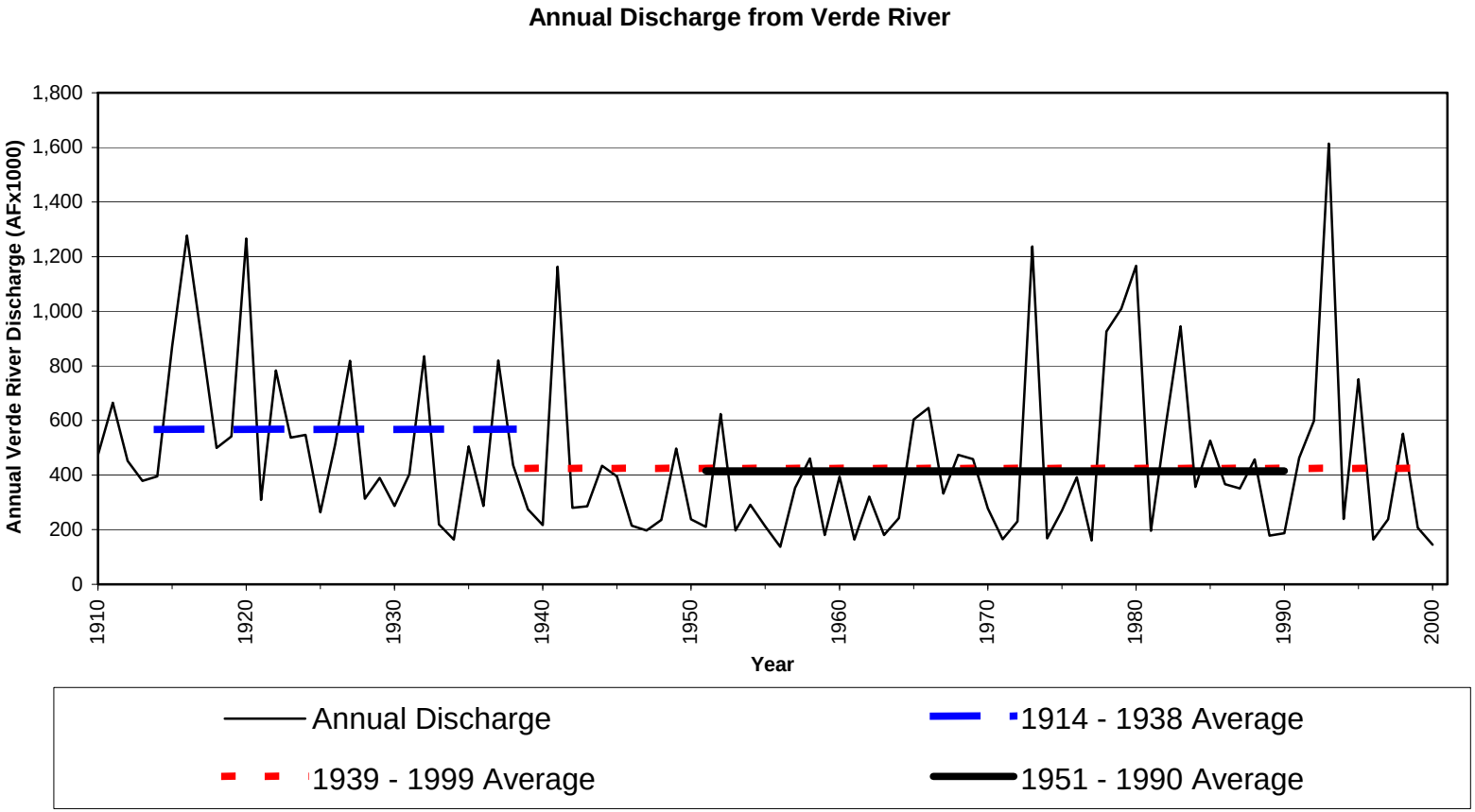
Gaging Station (#)	Period of Record	Minimum Flow (cfs)	Maximum Flow (cfs)	Average Flow (AF)
Tributaries				
Oak Creek near Cornville (64500)	1940-1996	6	26,400	65,200
Wet Beaver Creek near Rimrock (05200)	1961-1996	5	16,000	N/A
Dry Beaver Creek near Rimrock (05350)	1960-1996	0	26,600	N/A
West Clear Creek near Camp Verde (05800)	1964-1996	11	24,800	N/A
East Verde near Childs (07980)	1961-1996	0	23,500	N/A
Wet Bottom Creek near Childs (68300)	1967-1996	0	7,380	N/A
Sycamore Creek near Fort McDowell (10200)	1960-1996	0	24,200	N/A
Mainstem				
Verde near Paulden (03700)	1963-1996	15	23,200	32,600
Verde near Clarkdale (04000)	1965-1996	55	53,200	142,600
Verde near Camp Verde (06000)	1934-1996*	40	119,000	336,700
Verde below Tangle Creek (08500)	1945-1996	31	145,000	427,900

*Discontinuous.
Source: Pope et al. 1998.

As in the Colorado River basin, the early decades of the 1900s were relatively wet in the Verde River watershed. The 1904–1938 "pre-dam" period of record has average annual flows that are 30 percent greater than the 1939–1999 "post-dam" period (Figure III-15). Thus, comparison of the pre-dam data to post-dam data would attribute some of the hydrologic changes to the construction of dams that are actually attributable to differences in the period of record.[21] Comparison of flows above and below the dams for the same period of record eliminates questions regarding differences caused by use of different periods of record. Below, under *Operation of Horseshoe and Bartlett—Changes in Flow*, the effect of the dams on the magnitude and frequency of flows are summarized using a consistent period of record.

[21] For this reason, caution should be used in relying on Graf's analysis (1999) of Verde River flow changes because several of his conclusions rely on the 1904-1938 "pre-dam" period of record.

Figure III-15. Unregulated annual flow of the Verde River near Bartlett and Horseshoe dams.



Source: USGS data on file at SRP; Stockton 1996 (1910–1995); Reigle, pers. comm. 2002 (1996–2000).

Even when using the post-dam data for hydrological analysis, the period of record is not necessarily representative of long-term conditions, and portions of the record can be skewed due to unusually wet or dry decades. Stockton (1996) determined that the period 1951–1990 is representative of the average runoff during the past four centuries (1580–1995) for the Salt and Verde watersheds based on tree-ring and other data. As shown in Figure III-15, the 1951–1990 period and the 1939–1999 post-Bartlett Dam period have similar average annual flow. Thus, either period can be used to assess the long-term hydrology above and below the dams. Although Stockton's work has not been updated to reflect the period of record since 1995, which includes the extended drought of 1996–2004, the periods of 1951–1990 or 1939–1999 would still be expected to represent long-term runoff conditions (extremely dry recent years would be at least partially offset by the very wet years of 1993, 1995, and 2005). The period 1951–1990 is used whenever applicable to evaluate the effect of reservoir operations in this HCP.

c) Operation of Horseshoe and Bartlett

Horseshoe and Bartlett are at the lower end of the Verde River, below nearly all of the major tributaries. Dam operations alter flow parameters such as the magnitude, frequency, duration, timing, and rate of change. Differences in flow parameters above and below Horseshoe and Bartlett dams are discussed below.

The extent of flow alteration by dams and reservoirs is related to their storage and outlet capacities. Horseshoe and Bartlett are relatively small in proportion to average runoff, which means that they fill quickly and large inflows pass through with relatively little change in flow characteristics. The outlet valves at the dams have low capacities. The maximum capacity of the Horseshoe Dam outlet valve is 1,800 cfs at full reservoir levels. The maximum release at full reservoir levels through Bartlett Dam's two outlet valves is 2,400 cfs. Thus, unless the spillway gates are being used to pass flood flows or the reservoirs are spilling, the maximum flows below Horseshoe are 1,800 cfs and the maximum flows below Bartlett are 2,400 cfs.

(1) Minimum Flow

Following closure of Bartlett (1939) and Horseshoe (1945), the minimum flow of the Verde River below Bartlett was reduced—"most years experienced low flows below 50 cfs, with many years recording some days with zero flow" (Graf 1999, p. 9). However, in 1993, SRP and the Fort McDowell Indian Community (now known as the FMYN) entered into a permanent agreement that stipulates that a 100 cfs flow will be released from Bartlett Dam year-round except in extreme drought or an emergency (Appendix 2).[22] This minimum flow will help maintain fish habitat and riparian vegetation along the Verde River below Bartlett. The minimum flow of 100 cfs is larger than the historical minimum inflows above Horseshoe. Above Horseshoe, the minimum flow drops below

[22] The minimum flow releases became effective on February 7, 1994 and have been continuous since that time except for brief interruptions in 1994 and early 1995 due to dam construction and maintenance activities. The 100 cfs minimum flow is in addition to reservoir releases to meet water orders along the Verde River and is part of the diversion at Granite Reef Dam. Water stored in Horseshoe and Bartlett supports the minimum flow unless extended drought depletes the reservoir, which may trigger reduced releases.

100 cfs for more than 7 consecutive days in one-half of the years (Pope et al. 1998; reporting flow statistics for the USGS gage on the Verde River below Tangle Creek, 1947–1996).

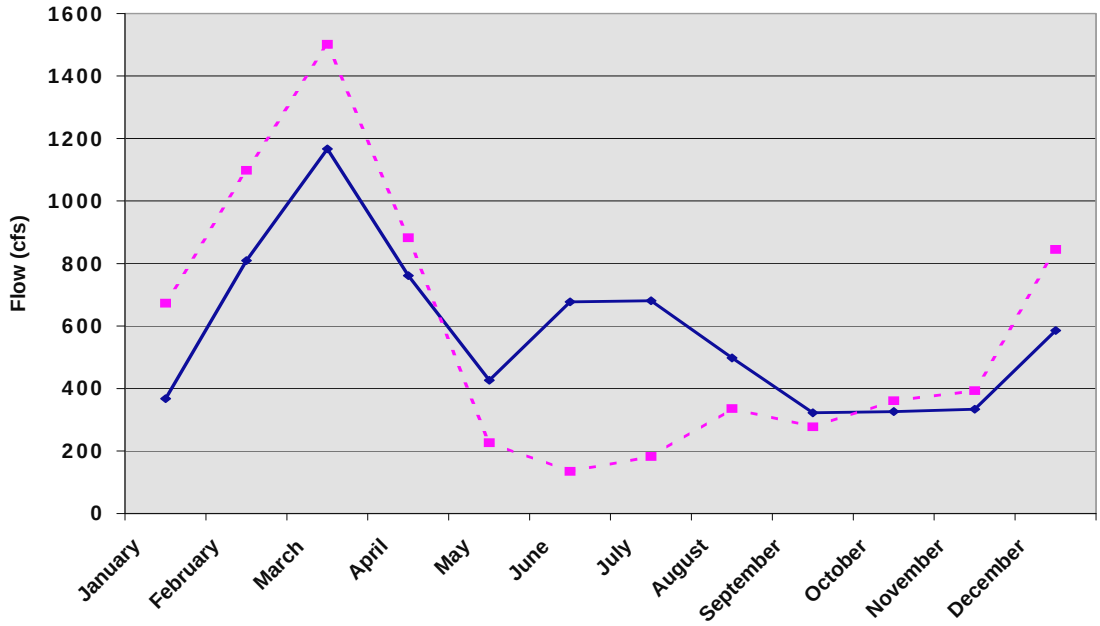
(2) Changes in Flow

The average monthly flow downstream of Bartlett is lower than the inflow to Horseshoe in winter and higher in summer, a pattern typical of reservoirs in the western United States (Figure III-16). Horseshoe and Bartlett also have changed other flow patterns downstream of the reservoirs:

- Mean annual peak flow is decreased
- Annual peak flows are more variable
- Mean annual low flows are increased (Graf 1999)

Because Horseshoe and Bartlett have small storage volumes relative to the runoff of the Verde River, the effect of these dams on the overall magnitude and frequency of downstream flows is attenuated. The cumulative frequency of flows above and below Horseshoe and Bartlett for each month can be used to describe the historical effect of dam operations. Below, the cumulative frequency of flows for March and July are discussed. A complete set of monthly cumulative frequency graphs is provided in Appendix 4 for the representative period of 1951–1990 as well as the period of 1996–2005 after the minimum flow was established.

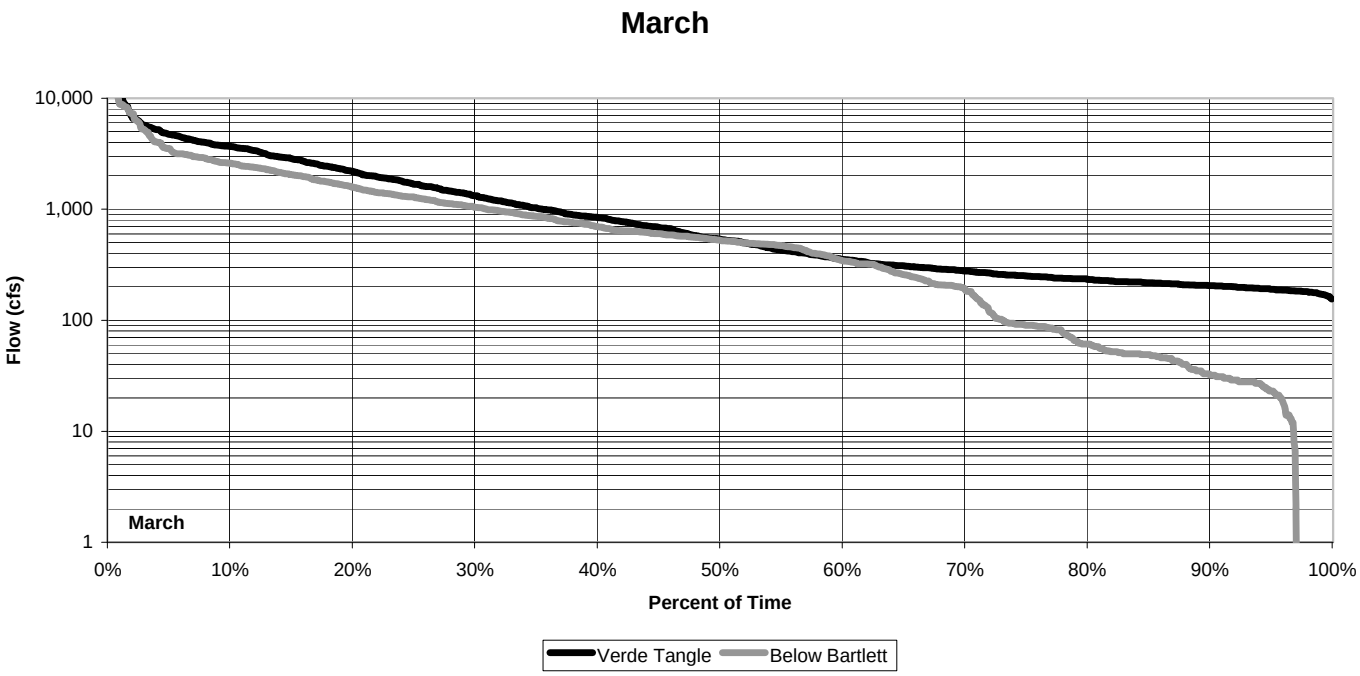
Figure III-16. Mean monthly flow above and below Verde reservoirs, 1951–1990.



Dashed line = above Horseshoe; solid line = below Bartlett.

Spring runoff provides the highest average monthly flow during the year (Figure III-16). Figure III-17 shows that the cumulative frequency distributions of flows above and below Horseshoe and Bartlett are very similar in March. In the future, the minimum releases from Bartlett, which were instituted in 1994, will largely eliminate the historical difference in frequency of flow values below 100 cfs. The cumulative frequency distribution of flows above and below the reservoirs is similar during the period from September through April (Appendix 4).

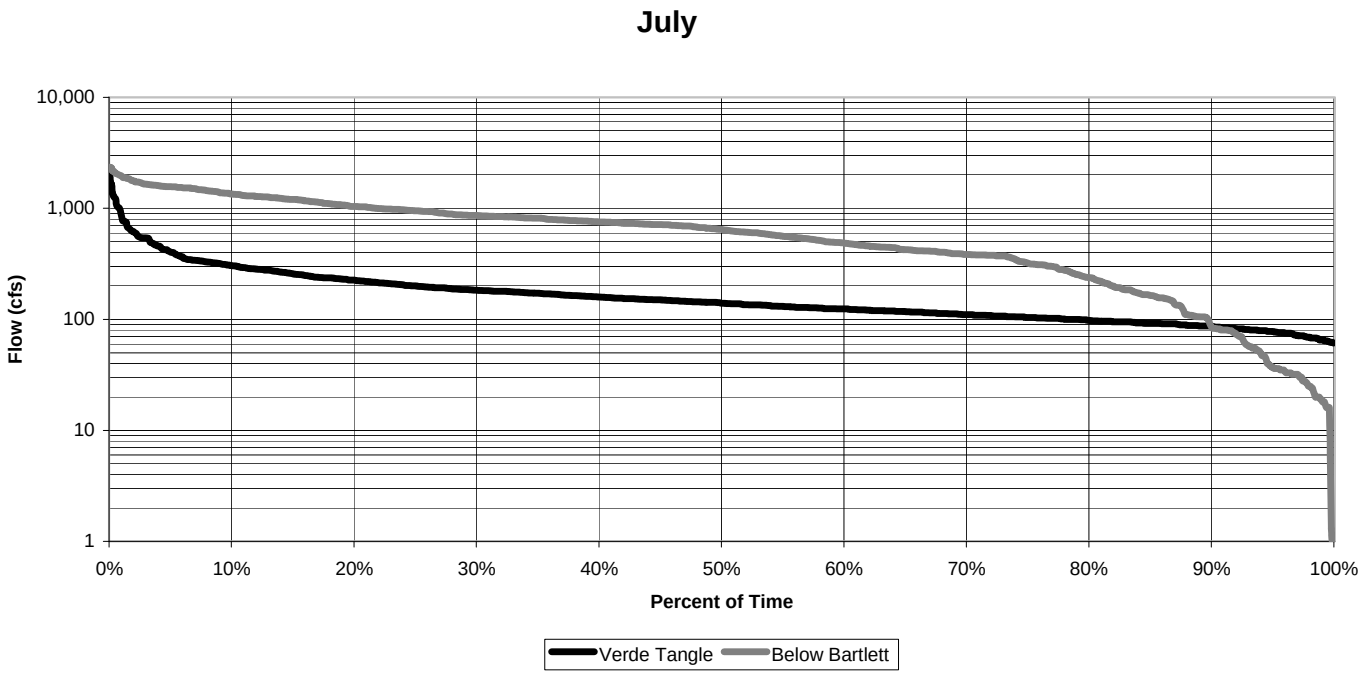
Figure III-17. March cumulative frequency diagram of Verde River flow above and below SRP's dams, 1951–1990.



Dashed line = above Horseshoe; solid line = below Bartlett; shown as frequency (%) of flows less than or equal to the flow value on the x-axis.
Source: USGS data on file at SRP.

Above Horseshoe, June and July have the lowest average monthly flow. Figure III-18 shows that, in July, releases of water from Bartlett to meet downstream diversion demands create a divergence in the frequency of flows over the range of about 100 to 1,000 cfs. On average, June and July flows are substantially greater downstream of Bartlett in comparison to inflow to Horseshoe. A similar pattern occurs in May, June, and August (Appendix 4).

Figure III-18. July cumulative frequency diagram of Verde River flow above and below SRP's dams, 1951–1990.



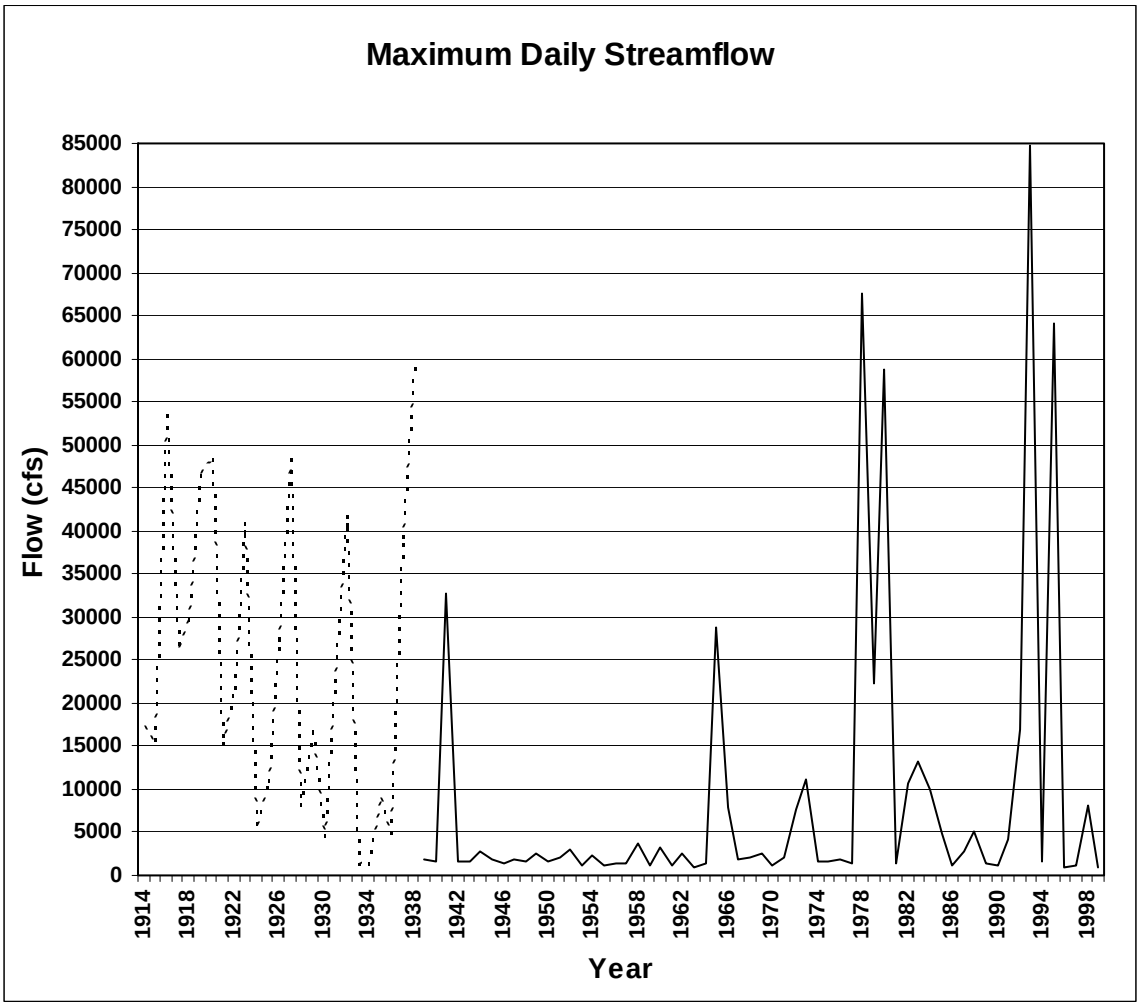
Dashed line = above Horseshoe; solid line = below Bartlett; shown as frequency (%) of flows less than or equal to the flow value on the x-axis.

Source: USGS data on file at SRP.

(3) Flood Flows

One of the most significant flow patterns affecting the river channel and floodplain along the Verde River are periodic large flood flows. Figure III-19 shows the maximum daily flow at the gage below Bartlett Dam for the period 1914–2000. Figure 2 in Appendix 4 shows the return period and exceedance probability for flows above and below the reservoirs. Except for the extended drought from the mid-1940s through the 1960s, peak flows exceeding 30,000 cfs occur regularly below Bartlett, even though the dams attenuate flood peaks (Figure III-19; Figure 2 in Appendix 4). More frequent flood peaks in the early years of record reflect a relatively wet period as well as the absence of dams.

Figure III-19. Maximum annual daily flow, Verde River below Bartlett Dam, 1914–2000.



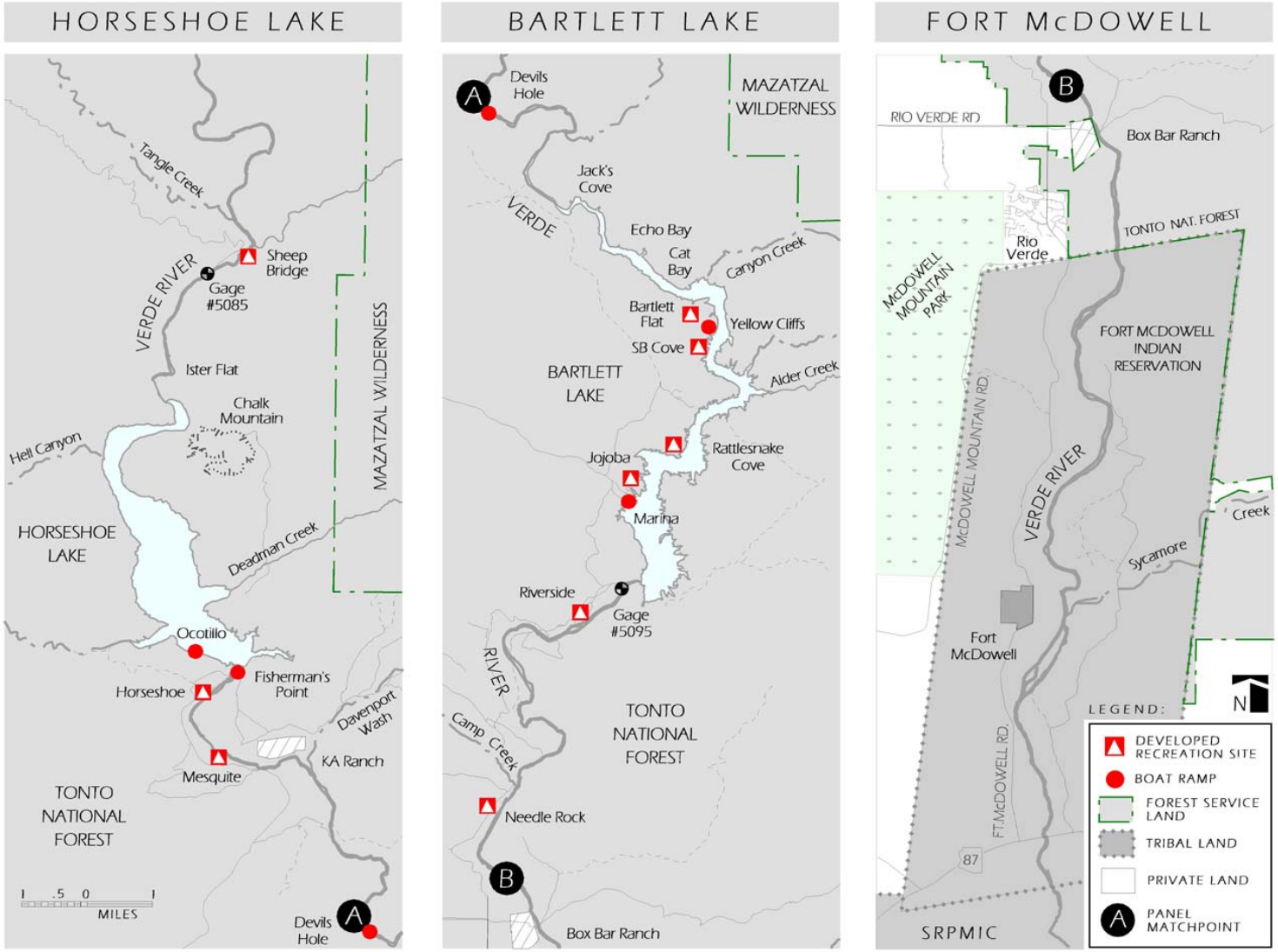
Dashed line = pre-Bartlett; solid line = post-Bartlett.

2. Recreation

Horseshoe, Bartlett, and nearby lands along the lower Verde River provide a wide range of water- and land-based recreation opportunities including boating, angling, personal watercraft use, camping, and ORV use. Water-based recreation at Horseshoe is limited by its size and frequent drawdown of lake levels. About 50 percent of visitation in this area occurs at Bartlett, which is larger than Horseshoe, because Bartlett experiences more stable lake levels, and is closer to metropolitan Phoenix (Jardin, pers. comm. 2005).

Public recreation use also occurs along a 12-mile segment of the Verde River between the two reservoirs and another 11-mile segment that extends from Bartlett to the Fort McDowell Indian Reservation (Figure III-20). The Verde River includes popular areas for river rafting, kayaking, angling, and camping. The river-running season along

Figure III-20. Horseshoe, Bartlett, and lower Verde River recreation sites.



the Verde River primarily spans between March and April, depending on the amount of spring runoff. The peak recreation season for the study area is April 1 to October 1, although usage is year-round (Jardin, pers. comm. 2003).

Estimated annual recreation use levels at Horseshoe, Bartlett, and portions of the Verde River between Horseshoe Dam and the Salt River confluence totaled about 318,000 visitors in 2004 (Table III-6). Recreation facilities in this area have a total daily capacity for 10,700 people (Table III-7).

Table III-6. Recreation visitation at Horseshoe, Bartlett, and the lower Verde River.

Location	Total Visitation*
Horseshoe and Verde River (from Horseshoe Dam to Bartlett)	63,600
Bartlett	159,000
Lower Verde River	95,400
Total Visitation	318,000

*Visit estimates were calculated by the Cave Creek Ranger District based on revenue generated from the sale of 24-hour overnight use permits and assuming three passengers per vehicle.
Source: Jardin, pers. comm. 2005.

The following sections provide a more detailed description of recreation opportunities at Horseshoe, Bartlett, and along the lower Verde River.

a) Reservoir Recreation

Horseshoe. Boating and angling are the primary recreation activities on Horseshoe, and are dependent on seasonal water levels, which fluctuate by as much as 75 feet annually and rarely are at full capacity due to runoff fluctuations and SRP water delivery obligations.[23] For this reason, water skiing and the use of personal watercraft are prohibited. Horseshoe's only developed recreation facility is the Ocotillo boating site, which includes a boat launch for small boats (Table III-7; Figure III-20).

Angling opportunities at Horseshoe have long been recognized as poor due to frequent water level fluctuations or seasonal closures associated with fire risks, which limit sportfish recruitment and survival (Warnecke 1988). When lake levels remain high, primary sportfish species include flathead catfish, crappie, bluegill, and largemouth bass. No developed campground facilities are available at Horseshoe. Most camping is dispersed and occurs along the reservoir shoreline.

Bartlett. Boating and angling are the primary recreation activities at Bartlett. Sportfish species at Bartlett include flathead catfish, crappie, bluegill, and largemouth and smallmouth bass. One or two angling tournaments are held during the winter. Motorized and nonmotorized boating, water skiing, and personal watercraft use are popular throughout much of the year (USFS 2002).

[23] Horseshoe is the first of the SRP lakes to be drawn when irrigation, municipal, and industrial water requirements dictate.

Table III-7. Bartlett, Horseshoe, and Verde River recreation capacities.

Site Name	Type	Parking Spaces or Units	Capacity (persons)	Maximum use (persons/day)
Horseshoe				
Ocotillo Boating Site	Developed boat launch	50 dispersed sites	280	560
Bartlett				
Bartlett Flat	Dispersed camping and boat launching	60 dispersed sites	300	600
Yellow Cliffs Boating Site	Developed boat launch	85 paved parking spaces	425	850
SB Cove	Developed campground	56 paved parking spaces	280	280
Rattlesnake Recreation Site	Developed picnic area	90 paved parking spaces	450	1,800
Jojoba Boating Site	Developed boat launch	220 paved parking spaces	1,100	2,200
Bartlett Lake Marina	Full service marina	Large unpaved parking area and dispersed use beach area	600	1,800
Verde River (Horseshoe Dam to Bartlett)				
Fisherman's Point	Angler access and boat launching	Dispersed parking for 25 vehicles	100	400
Horseshoe Campground	Developed campground	10 sites	100	100
Mesquite Campground	Developed campground	20 sites	200	200
Devils Hole	Dispersed camping	Parking for 10 camps	50	50
Verde River (Bartlett Dam to Fort McDowell Indian Reservation)				
Riverside Campground	Developed campground	12 sites	60	60
Needle Rock Campground	Developed campground	40 sites and dispersed shoreline access	600	1,800
TOTAL			4,545	10,700

Source: Jardin, pers. comm. 2003, 2005.

Six developed recreation sites are available at Bartlett, including three boat launches, a picnic area, and a full service marina (Table III-7; Figure III-20). Camping and picnicking are primarily available at dispersed sites along the west side of Bartlett.

b) River Recreation

The lower Verde River offers a variety of boating and tubing, angling, camping, and scenic viewing opportunities. Recreation along the Verde River in the area of primary interest includes two segments:

- Segment One – between Horseshoe and Bartlett
- Segment Two – below Bartlett Dam to the Fort McDowell Reservation boundary

The Fort McDowell Indian Reservation is 4 miles south of Needlerock and the SRPMIC encompasses the mouth of the Verde River downstream to Granite Reef Dam. Recreation use along this stretch of river is more limited than upstream areas because access is generally restricted to tribal members.

Between December 1 and June 30, land access is prohibited for a ½-mile portion of Segment One just above Devil's Hole and portions of Segment Two between Riverside and Box Bar Ranch (excluding Riverside and Needlerock campgrounds) due to the presence of nesting bald eagles. Visitors traveling these areas by boat are not allowed to stop or disembark during this time (USFS 2002; Jardin, pers. comm. 2005). River Access Points (RAP) located in Segment One include: Fisherman's Point (Catfish Point), Horseshoe, Mesquite, and Devils Hole (Table III-7; Figure III-20). Segment Two includes the Riverside and Needlerock campgrounds.

c) Other Recreation

ORV use has become increasingly popular in designated areas at each reservoir, along 4-wheel drive roads dispersed along the Verde River, and in undesignated locations such as desert washes. ORV use contributes to an increase in fire starts, nonnative species dispersal, accelerated rates of erosion, and other impacts in the watershed. In an effort to more effectively manage and direct ORV use, the Cave Creek Ranger District plans to develop a Transportation Management Plan pending approval of additional staff and funding (Jardin, pers. comm. 2005).

3. Geology and Geomorphology

The primary geologic and geomorphic resource of concern is the effect of Horseshoe and Bartlett operations on stream and floodplain morphology below the dams, especially as it might affect riparian vegetation or stream habitat for covered species.

The fluvial geomorphology[24] of the Verde River and its floodplain through the study area reflects the physical setting of the stream as it cuts through the mountains in central

[24] Fluvial geomorphology is the study of how flowing water affects the surface of the earth. Fluvial: Pertaining to streams or rivers or produced by stream action (www.hyperdictionary.com); "Geomorphology: That branch of both physiography and geology that deals with the form of the earth, the general configuration of its surface, and the changes that take place in the evolution of land forms" (SCSA 1976).

Arizona (Pearthree 1996). About 2 to 2.5 million years ago, the Verde River began rapidly downcutting like other major rivers draining central Arizona (Id.). Thin terrace deposits on the mountain slopes adjacent to the Verde River trace the successive entrenchment of the drainage (Id.).

> "Because the geology of the central mountain area is reasonably complex and variable, the Verde River flows through a number of different types of rock units with varying susceptibility to erosion. In areas where the Verde River flows through resistant bedrock, the river valley is steep and narrow, and alluvial deposits and the floodplain are limited in extent. This situation typifies nearly all of the Verde River between Paulden and the northern Verde Valley, and most of the river between southern Verde Valley and Bartlett Dam. There is little potential for substantial changes in channel position or character in these reaches. Where lithologies are less resistant to erosion, such as most of the Verde Valley and downstream from Bartlett Dam, the river valley is broad, the flood plain is relatively wide, and the potential for significant changes in channel position is much greater" (Id., figure references omitted).

The recent alluvium along the Verde River channel is dominated by coarse gravel and cobble material, with pockets of sand and silt deposited in slackwater and overbank flood areas (Id.; MEI 2004).[25]

> "The young alluvium that forms the channel bed and low banks of the Verde River is generally composed of coarse gravelly deposits and much finer sandy overbank or slackwater deposits. This young sediment does not have much cohesion and is susceptible to scour and bank erosion during large flow events. Older river deposits typically are coarse, and underlying rock units are indurated to a greater or lesser degree. These units are much more resistant to lateral bank erosion than young stream deposits. Thus, the potential for changes in channel morphology and shifts in channel position during large floods is greatest in areas where young terraces are extensive. However, young terraces commonly have relatively dense and large vegetation, which tends to stabilize these deposits" (Pearthree 1996).

The gradient of the Verde River above Horseshoe to Beasley Flat, between the reservoirs, and below Bartlett to Needle Rock is relatively steep, with the channel constrained by bedrock and resistant alluvium to a braided channel about 600 to 4,000 feet in width (MEI 2004). The main channel of the lower Verde has a capacity of about 16,000 to 20,000 cfs. The active floodplain is shaped by large floods with a recurrence interval of about 10 years (Id.). Although Horseshoe dam captures about 620 AF of sediment per year (SRP 2002), the channel slope limits sediment deposition below the

[25] MEI (2004) is a primary support document for this analysis, and can be found online at <http://www.fws.gov/southwest/es/arizona/HCPs.htm>.

reservoirs (Id.). Significant sediment mobilization occurs when flow is near channel capacity. As flow approaches channel capacity, secondary chute channels that are common in the lower Verde become inundated (Id.). The similarity of geomorphic characteristics above and below the Verde reservoirs indicates that there has been little or no modification of the Verde River channel and floodplain due to the operation of the dams (Id.).

4. Vegetation

Vegetation information forms the foundation for the analysis of impacts on covered bird species in Chapter IV. Historical riparian vegetation at Horseshoe, Bartlett, and along the lower Verde River is described in addition to recent vegetation mapping, categorization, and trends.

a) Historical Vegetation

For the purposes of this discussion of pre-dam vegetation, "historical" refers to the period of time prior to dam construction on the Verde River. Most information for historical vegetation was derived from aerial photography taken in January and February of 1934, photos taken during construction of Bartlett Dam (1936–1939), and photos taken during construction of Horseshoe Dam (1941–1945).

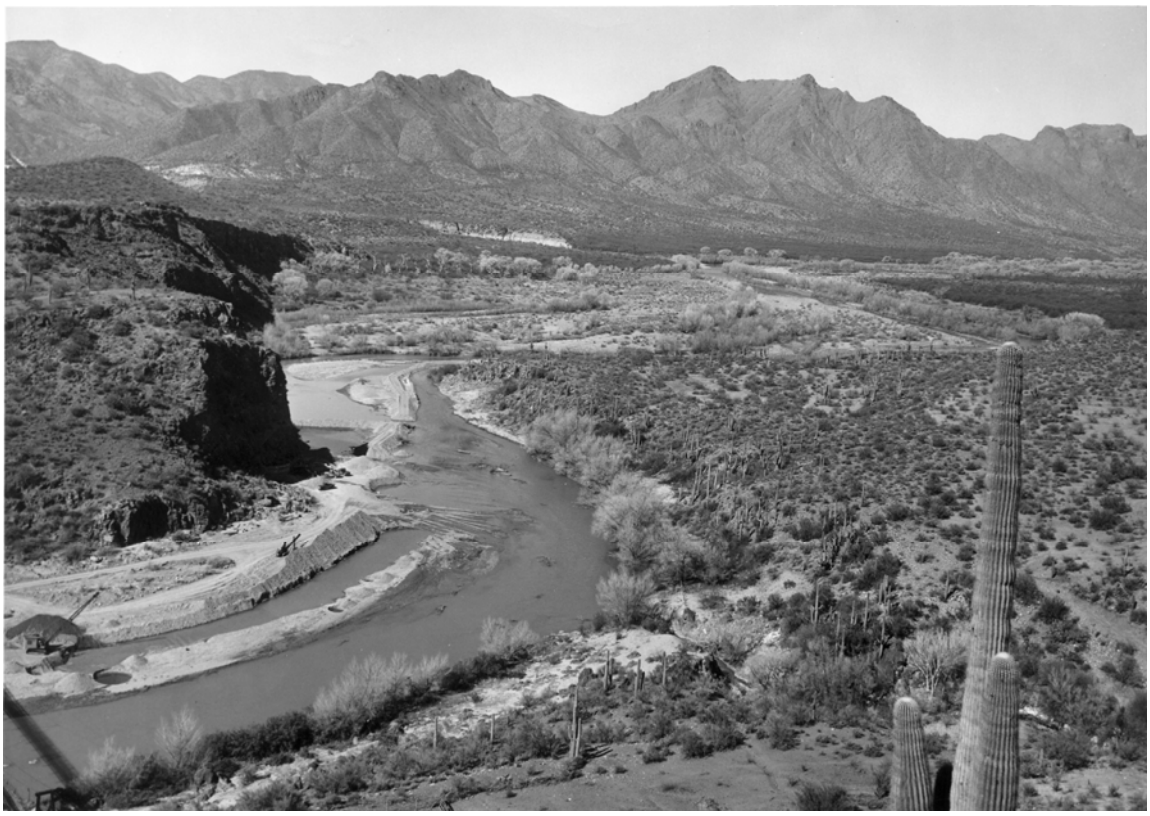
The Verde River experiences periods of drought interspersed with extreme flood events. Historically, flood events scoured the floodplain—removing most vegetation—and redistributed sediment and raised the water table, allowing establishment of tall woody vegetation. This natural cycle favors establishment of woody vegetation along the main river channel and in backwater areas where shallow water tables persist and provide supportive hydrology.

Prior to the construction of Horseshoe and Bartlett dams, the major human factors that influenced riparian vegetation included grazing and irrigation. Ranchers along the Verde River grazed livestock in the watershed and along the riverbanks, and diverted water from the stream for irrigation purposes. Livestock can have many impacts on natural riparian systems including: increasing erosion by trampling river banks; trampling or consuming stabilizing vegetation; and preventing or reducing establishment of woody vegetation by consuming or trampling seedlings, saplings, and young trees (FWS 2002a; Appendix G). The historical amount of riparian vegetation prior to heavy grazing is unknown but may have been greater than what is shown on or estimated from historical photos. Historically, other human activities, such as vehicle travel within the floodplain, likely had low effects on riparian vegetation because recreation and other use of the area were limited.

(1) Horseshoe

Before completion of Horseshoe Dam in 1945, tall woody vegetation was present in limited amounts along the channel of the Verde River within the reservoir area (Figure III-21; 1934 photos on file at SRP). Based on review of historical photographs, topography, and hydrology, this tall woody vegetation was concentrated in relatively small areas and narrow bands along the Verde River channel. Overstory riparian species included Fremont cottonwood-Goodding willow galleries and tamarisk or salt cedar stands near the river at low elevations, and mesquite stands on higher benches. The

Figure III-21. Horseshoe dam site in 1944, looking upstream from the east dam abutment.



largest areas of vegetation historically occurred at the north end of the reservoir at the mouth of several small, unnamed washes including drainages through Ister Flat and Hell's Canyon. Other large inlets near the southern end of the present reservoir (including unnamed drainages, Mullen Wash, Deadman Creek, and Lime Creek) were mostly bare historically, consisting of sand and cobble washes. Livestock grazing on USFS grazing allotments predate Horseshoe, and historically may have limited the establishment of new stands of woody vegetation (FWS 2002a; Appendix G).

(2) Horseshoe to Bartlett Inflow

Historically, tall woody vegetation along the Verde River between the Horseshoe dam site and present Bartlett inflow (approximately 12 miles) was similar to the vegetation for the Horseshoe area. Prior to the construction of Horseshoe, this area would have experienced more sediment deposition, which is conducive to cottonwood/willow establishment. However, the stream gradient, cobbly alluvium, and steep banks in most locations restricted the growth of woody riparian vegetation. Photos from this era indicate that willow and mesquite formed occasional narrow bands of vegetation along the riverbank (Reclamation 1982). The upper stretch of the river floodplain downstream of Horseshoe is slightly wider, but the coarse cobbly alluvium apparently inhibited growth of dense woody vegetation. In addition, livestock grazing in this area predates the dam, and likely limited the establishment of riparian vegetation in some locations.

Figure III-22. 1934 aerial photo of Verde below Bartlett (white arc shows location of Bartlett Dam; north is to the top of the photo).

(3) Bartlett

Historically, the river reach where the Verde River now flows into and through Bartlett was scoured, rocky, and steep, with small patches and strips of riparian vegetation. A small amount of riparian vegetation was present at the current reservoir inlet.

(4) Downstream of Bartlett

Immediately below Bartlett, the floodplain is narrow and was frequently scoured (Figure III-22). About 6 miles downstream of Bartlett, below Needle Rock near Box Bar Ranch (Figure III-23), the Verde Valley changes character from a relatively high-gradient, bedrock-restricted, steep-sided channel with a narrow floodplain to a lower gradient, more braided channel with a broader floodplain. Topographically, there is more opportunity for riparian vegetation to establish and develop from this point to the mouth of the river. Historically, the river floodplain in this reach was periodically scoured bare, and did not support extensive stands of woody riparian vegetation. From 1934 aerial photographs, it appears that most areas of woody vegetation were relatively sparse (less than 50 percent vegetation cover). Human impacts, such as livestock grazing and irrigation diversions, pre-date the dam and likely impacted vegetation cover and establishment in some areas.

Figure III-23. 1934 aerial photo near Box Bar Ranch (north is at the top of the photo).

b) Vegetation Mapping

Field mapping of current vegetation, and mapping using aerial photography between dam construction and the present, were completed for areas with substantial amounts of woody riparian vegetation or potential for woody riparian vegetation, including the Verde River just above Horseshoe, the Horseshoe inlet, a study location below Horseshoe, and a study area below Bartlett. The objective of vegetation mapping was to provide the basis for the analysis of impacts to existing vegetation as a result of the future operation of the Horseshoe and Bartlett and to identify patterns of vegetation change over time so that the effects of varying lake levels and stream flows could be assessed (ERO 2004). As part of the effort along the Verde River, detailed topographic information was incorporated into the analysis (MEI 2004). Vegetation map units were developed to reflect wildlife habitat. Categories of vegetation favored by the covered bird species were emphasized, i.e., tall dense woody vegetation.

In the fall of 2002, ERO Resources Corporation (ERO) conducted fieldwork to map vegetation along the Verde River at the four locations described above. SRP contracted aerial photography that was flown in August and December 2002. ERO mapped vegetation characteristics directly onto aerial photo base maps (ERO 2004).

The ERO vegetation study identified the following vegetation types in the study area: cottonwood/willow, mixed riparian, salt cedar, mesquite, strand, shrub, sparsely vegetated, and nonwoody. Several of the vegetation classes were further divided into subcategories based on height characteristics and density to better identify potential flycatcher habitat areas. ERO's riparian vegetation classification types for the 2002 study are shown in Table III-8 (ERO 2004).[26]

Additional vegetation mapping for years prior to 2002 was completed using aerial photography. Using vegetation signatures identified in 2002, vegetation patches were delineated for other years from black and white, color-infrared, and true-color aerial photography. Patches of similar vegetation signature were delineated and assigned to a vegetation class based on vegetation types and signatures confirmed during 2002 field verification surveys (ERO 2004).

c) Vegetation Types

Most vegetation delineated along the reach of the Verde River included in the 2002 survey fits into the following categories, and includes the species described below (Id.).

(1) Cottonwood

In dense stands, there is more than 80 percent relative cover of Fremont cottonwood. Because overstory and mid-canopy cover are quite dense (canopy cover ranges up to 100 percent), vegetation in the understory often is sparse. In sparse cottonwood stands, canopy cover ranges from 40 to 50 percent. Vegetation in the understory includes Goodding willow, salt cedar, and mesquite.

[26] ERO (2004) provides an analysis of the historical effects of reservoir operations on riparian vegetation downstream of Bartlett Dam, and can be found online at <http://www.fws.gov/southwest/es/arizona/HCPs.htm>.

Table III-8. Vegetation classification types for the Verde River.

Type	Definition
Tall Woody Vegetation	
Cottonwood	More than 80%* cottonwood in either dense or sparse stands
Willow >15 feet	More than 80% willow in dense stands
Mixed riparian >15 feet	No single species (cottonwood/willow/tamarisk) comprises more than 80%*, trees generally more than 15 feet in height
Mixed riparian >15 feet, low density	No single species (cottonwood/willow/tamarisk) comprises more than 80%*, trees generally more than 15 feet in height, but noticeably more open with more spacing between trees
Salt cedar >15 feet	More than 80%* salt cedar in dense stands
Other Vegetation	
Mixed riparian <15 feet	No single species (cottonwood/willow/tamarisk) comprises more than 80%*, trees generally less than 15 feet in height
Mixed riparian <15 feet, low density	No single species (cottonwood/willow/tamarisk) comprises more than 80%*, trees generally less than 15 feet in height, but noticeably more open with more spacing between trees
Mesquite	More than 80%* mesquite
Strand	Thin strands of dense or sparse vegetation including woody and nonwoody plants directly adjacent to stream channels and in gravel bars
Shrub	Densely vegetated but few tall woody plants; mostly burro brush less than about 10 feet in height
Sparsely vegetated	Areas with less than 30%* vegetative cover, including bare sandbars
Salt cedar <15 feet	More than 80%* salt cedar, trees generally less than 15 feet in height
Nonwoody	Densely vegetated but few woody plants; mostly cocklebur

*Cover relative to other woody species.

(2) Willow Stands Greater Than 15 Feet Tall

Goodding willow stands greater than 15 feet tall occur in portions of the floodplain that are flooded infrequently. Having reached a height of 15 feet, willow trees quickly grow to 25 feet or more. Mature Goodding willow generally dominate these stands. Some salt cedar and mesquite occur in the middle layers, and sparse herbaceous vegetation occurs in the understory. Understory vegetation is similar to that described below for mixed riparian stands less than 15 feet in height. Canopy cover is high, ranging from 80 to 100 percent, and structural diversity is high. Shrubs are common in the middle layer of the canopy (between 5 and 10 feet), and deadfall, standing dead, and snags are common.

(3) Mixed Riparian Stands Greater Than 15 Feet Tall

Mixed riparian communities greater than 15 feet in height generally have a dense overstory composed of Fremont cottonwood, Goodding willow, salt cedar, and mesquite. Because overstory and mid-canopy cover is quite dense (canopy cover typically ranges from 70 to 100 percent), vegetation in the understory often is sparse. The same species are common in the understory of mixed riparian stands greater than 15 feet in height as

those that are common in mixed riparian stands less than 15 feet in height (see below), but cover of understory species is more sparse. In high density stands, canopy cover is generally high, ranging from 80 to 100 percent, and structural diversity is high. Shrubs are common in the middle layer of the canopy (between 5 and 10 feet), and deadfall, standing dead, and snags are common. In low density stands, canopy cover is less than 80 percent and the understory is similar to mixed riparian stands less than 15 feet in height (see description below).

(4) Salt Cedar

Salt cedar (tamarisk) stands occur in areas that are periodically flooded or seasonally subirrigated. In general, salt cedar stands are monospecific, with little or no vegetation in the understory. Canopy cover is typically high, ranging from 80 to 100 percent, and structural diversity is low. Salt cedar stands along this reach of the Verde River are generally less than 15 feet in height except in the bed of Horseshoe.

(5) Mixed Riparian Stands Less Than 15 Feet Tall

Mixed riparian stands with canopies less than 15 feet in height include young riparian stands along the Verde River streambank and in backwater channels.

Along the Verde River and in side channels where the water table is near the soil surface, mixed riparian stands contain many hydrophytic species. Dominant species include Fremont cottonwood, Goodding willow, seep willow (*Baccharis salicifolia*), giant reed (*Arundo donax*), narrow and broad-leaved cattail (*Typha latifolia* and *T. angustifolia),* salt cedar, arrowweed (*Pluchea purpurascens*), spikerush (*Eleocharis* spp.), barnyard grass (*Echinochloa crus-galli*), cocklebur (*Xanthium strumarium*), Bermuda grass (*Cynodon dactylon*), wood sorrel (*Oxalis corniculata*), and beggarsticks (*Bidens cernua*). Canopy cover ranges from about 30 to 70 percent. Structural diversity is high, with species in the understory (less than 3 feet tall), middle layers (3 to 8 feet tall), and the overstory (8 to 15 feet tall). These stands are characterized by openings between tree crowns in areas that are frequently inundated.

Some mixed riparian stands occur in areas where soils are drier, and infrequently saturated. Common species in drier mixed riparian areas are Fremont cottonwood, Goodding willow, salt cedar, some mesquite, Bermuda grass, lovegrass (*Eragrostis* spp.), sand dropseed (*Sporobolus cryptandrus*), Jimson weed (*Datura meteloides*), blue grama (*Bouteloua gracilis*), and desert brome (*Baccharis sarothroides*). Canopy cover ranges from 20 to 70 percent, and structural diversity is moderate.

(6) Sparsely Vegetated

The sparsely vegetated stand type includes gravel bars and coarse sediment deposits in the Verde River floodplain. Some areas of gravel bars are nearly devoid of vegetation (less than 10 percent canopy cover); and some are dominated by forbs such as buckwheat (*Eriogonum inflatum*), rattlesnake weed (*Euphorbia albomarginata*), desert marigold (*Baileya multiradiata*), groundsel (*Senecio* spp.), Parry's dalea (*Dalea parryi*), skeleton weed (*Lygodesmia* spp.), ground cherry (*Chamaesaracha coronopus*), wild cucumber (*Marah gilensis*), desert straw (*Stephanomeria pauciflora*), desert milkweed (*Asclepias subulata*), and canyon ragweed (*Ambrosia ambrosendes*).

Gravel bars that are flooded less frequently are dominated by desert brome, burro brush (*Hymenoclea salsola*), and scattered mesquite (*Prosopis glandulosa*). Other species include sand sage (*Artemisia filifolia*) and many of the same forbs mentioned above. Canopy cover ranges from 10 to 20 percent, and there is little structural diversity, as most shrubs are between 2 and 4 feet in height.

(7) Tall Dense Vegetation in Horseshoe

Vegetation types in the study areas have been grouped into two categories: 1) existing tall dense vegetation, some of which is currently used as nesting habitat by flycatchers; and 2) other vegetation types. Existing tall dense vegetation is composed of three vegetation types: cottonwood/willow, mixed riparian greater than 15 feet in height, and willow greater than 15 feet in height.

Within the bed of Horseshoe, approximately 120 acres of tall dense vegetation were present in 2002 (Table III-9). The distribution of that vegetation is shown in Figure III-24.

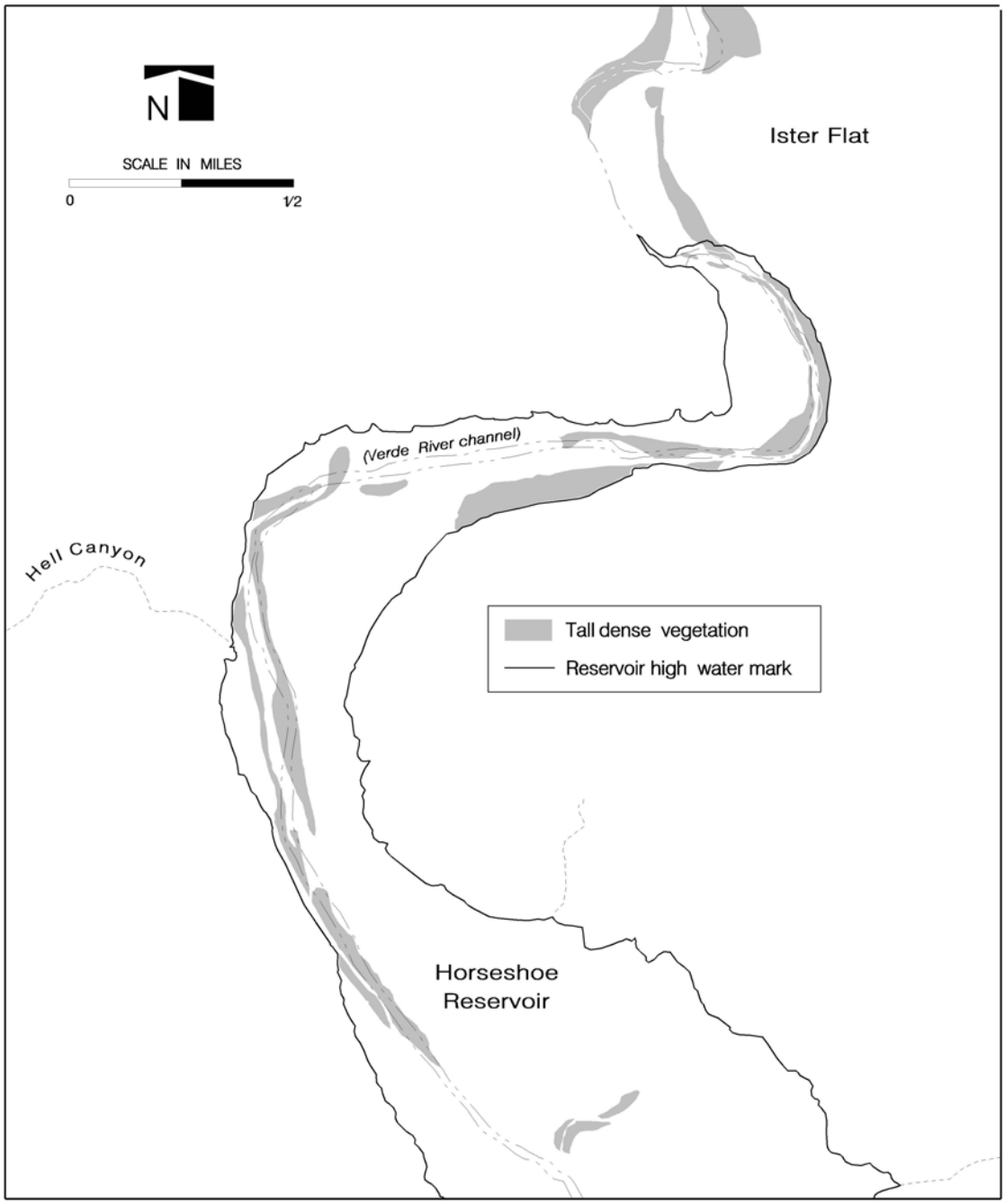
Table III-9. Cumulative acres of 2002 tall dense vegetation in Horseshoe inlet by elevation.

Elevation	Tall Dense Vegetation (Acres)
<1,980	5.71
1,980–1,985	18.96
1,985–1,990	29.12
1,990–1,995	40.99
1,995–2,000	47.88
2,000–2,005	53.56
2,005–2,010	63.69
2,010–2,015	72.83
2,015–2,020	88.91
2,020–2,025	112.88
2,025+	120.16

(8) Other Woody Vegetation in Horseshoe

Other woody vegetation currently occupying the reservoir bed is composed of salt cedar or mixed riparian vegetation that is relatively sparse or occurs in narrow strands and is unsuitable as flycatcher nesting habitat. These areas consist primarily of salt cedar with some willow, which lack the density and height to be flycatcher nesting habitat.

Figure III-24. 2002 tall dense vegetation, Horseshoe inlet.



d) Changes in Horseshoe Vegetation

The recent drought reduced stream flows and resulted in low reservoir levels throughout the West. Typically, this resulted in the growth of vegetation at lower elevations of affected reservoirs. In the Verde River system, the most dramatic vegetation changes of this type have occurred at the Horseshoe inflow. New vegetation now occurs on the Horseshoe bed. Some of this new vegetation has developed into patches of tall dense willow nesting habitat that flycatchers occupy, but most of the new vegetation remains relatively short or sparse.

SRP contracted with researchers at Arizona State University to evaluate the effects of up to 6 months inundation of tall dense vegetation in Horseshoe that occurred during the winter and spring of 2005 (Paradzick 2007). Researchers also evaluated if management of reservoir drawdown timing and rate at Horseshoe could facilitate desirable woody vegetation seedling establishment above elevation 2,010, primarily to promote the creation of habitat for southwestern willow flycatcher.

The inundation study found that patches of vegetation at the lowest elevations in the reservoir, which were inundated for the longest period of time, had the highest mortality, especially among tamarisk trees and shrubs. Willow trees had relatively low mortality (less than 5 percent) regardless of the duration of inundation. The overall results of the study were:

- Tamarisk was disproportionably affected by inundation compared to willow.
- Willow trees above elevations of 1,976 feet showed little impact of inundation.
- Tall tamarisk at middle and lower elevations (<1,991 feet) and short-shrub tamarisk (not suitable flycatcher nesting habitat) were significantly impacted by inundation.
- Tree mortality and canopy loss was likely related to the species and height of trees, inundation duration, and elevation of the patch within the reservoir.
- Inundation had moderate impacts to tall dense willow patches located in the portion of the reservoir at the lowest elevation studied. Willow and willow-tamarisk patches located at middle and upper reservoir elevations showed zero to negligible impacts of inundation. Drought stress, which would have greater impacts on willow compared to tamarisk, could cause mortality and canopy loss in low water years.

Results of the germination study suggest that reservoir drawdown levels can be used to promote riparian woody tree establishment, but the species composition and survival of those seedlings will depend on timing to coincide with seed production and rate of drawdown. Although not documented for Horseshoe, results from other sites in Arizona found that generally cottonwood produces seeds in the spring (~late April to early June), followed by willow (~March to early June), and then tamarisk, which produces seeds for a longer period throughout the summer (~mid-April to September). Seedling survivorship is dependent on slow water table declines of approximately 1 inch per day to maintain root contact with the alluvial aquifer and to promote vertical root growth, which

can be achieved in Horseshoe. Also, winter moisture may be an important factor in seedling survivorship, which is not well studied.

e) Human-induced Vegetation Changes

As discussed previously in Subchapter II.B.6.a, livestock grazing since the late 1800s likely has influenced the pattern of riparian vegetation development along the Verde River. Livestock grazing has little effect on established trees, but can prevent regeneration of riparian forests by trampling or eating young trees and seedlings (FWS 2002a; Appendix G).

Dam operations (1939 to present), which change flow and sediment patterns, have had little effect on tall woody vegetation except new stands have been created on the Horseshoe inflow delta (ERO 2004; Beauchamp and Stromberg 2004). Horseshoe and Bartlett have relatively small storage capacities allowing large runoff events to pass through the reservoirs. Capture of sediment by Horseshoe and Bartlett operations slightly affects the distribution of fine sediment along the Verde River below the dams (MEI 2004). In an undammed system, sediment deposition provides seed beds for establishing vegetation. In the current system, slightly less fine sediment is available to support vegetation establishment, particularly in areas directly downstream of the two dams. However, flows that pass the dams and inflows from tributaries below the dams continue to provide sediment to the lower Verde (Id.).

Stromberg et al. (2007) summarizes how Horseshoe and Bartlett dams and their operations have influenced the woody riparian vegetation on the lower Verde River:

> "The degree of change in *Populus* [cottonwood] and *Salix* [willow] abundance and age structure parallels the degree of change in the flood hydrograph, as exemplified by a case study of the Verde River in central Arizona. The two major dams and reservoirs on the Verde River are managed to supply water to downstream Phoenix metropolitan area. The total flow volume is not altered, but typical of many rivers (Richter et al. 1996) dam operation has decreased average peak flow rate, flood frequency, and variability of some flow components, and shifted the timing of flow maxima and minima. Compared to some western rivers, the Verde reservoirs have a low storage to runoff ratio. Although small floods are captured in the reservoirs, large floods still occur in very wet years in which the reservoir capacity is exceeded, allowing for periodic channel movement, sediment redistribution, and *Populus* and *Salix* regeneration. During the wet winter of 1995, for example, reservoir spills during March and April were largely unmodified (i.e., larger run-of-the-river), and *Populus* and *Salix* established at about equal densities above and below the dam (Beauchamp and Stromberg, [*in review*] 2007). Tree recruitment during wet years also has been observed on other regulated rivers in the regions (Zamaro-Arroyo et al. 2001). Smaller-scale recruitment events, associated with smaller floods, are likely to be pre-empted [*or occur less frequently, see Appendix 4*] along such rivers."

The findings of Stromberg et al. (2007) relative to the similar abundance of cottonwood-willow forest above and below dams are not unique to the Verde River.

Lytle and Merritt (2004) found that cottonwood forest was most abundant when floods were slightly less frequent than the natural flood regime due to dams because flood scour of seedlings is reduced and mortality caused by drought may be minimized though elevated base flows.

Recently, recreation activities along the Verde River, predominantly from Bartlett downstream to the Salt River confluence, have had a significant impact on vegetation patterns. Use of vehicles on cobble and sand bars inhibits colonization by vegetation.

f) Future Vegetation Dynamics and Relationship to Effects on Flycatcher Habitat

To the extent that drought conditions and low lake levels occur in the future, the trends described in Sections III.B.4.d and III.B.4.e indicate that new tall dense vegetation may periodically develop at mid-elevations in Horseshoe. Existing tall dense vegetation in the upper elevations of the reservoir will mature, losing the structural characteristics for optimum flycatcher nesting habitat. Future floods are expected to scour some vegetation along the river channel near the Horseshoe inflow and along the Verde River below the dams. Because scouring flows and fluctuations in lake levels are caused primarily by fluctuations in precipitation in the Verde watershed, disturbance regimes and concomitant changes in riparian vegetation mimic those in undammed river systems, which provide the long-term persistence of suitable flycatcher breeding habitat (Paradzick, pers. comm. 2005b). The Southwestern Willow Flycatcher Recovery Plan (FWS 2002a) also emphasizes the relationship between flycatcher habitat and natural processes:[27]

> "The flycatchers' riparian habitats are dependent on hydrological events such as scouring floods, sediment deposition, periodic inundation, and ground water recharge for them to become established, develop, be maintained, and ultimately to be recycled through disturbance" (FWS 2002a, p. 18).
>
> "Historically [flycatcher] habitats have always been dynamic and unstable in place and time, due to natural disturbance and regeneration events such as floods, fire, and drought" (FWS 2002a, pp. 33, 34).

[27] See Subchapter V.A for further discussion of the Southwestern Willow Flycatcher Recovery Plan.

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IV. Impact Analysis

Chapter IV begins with a description of the area and other tools used in the impact analysis. Subchapter IV.B provides an analysis of the direct, indirect, and cumulative impacts of the Proposed Action, the Optimum Operation Alternative, to the covered species, and other resources. The chapter concludes with an evaluation of impacts for the No Permit and Modified Historical Operation alternatives.

A. Area of Analysis and Tools Used in the Analysis

The analysis of the impacts of future reservoir operations at Horseshoe and Bartlett involves three primary components: 1) impacts on flycatchers and cuckoos within the conservation pool of Horseshoe and habitat for the species downstream of both dams; 2) impacts on bald eagle nesting habitat within the conservation pool of Horseshoe and downstream of the dams, and bald eagle native fish forage resources in the Action Area; 3) impacts on habitat occupied by covered native fish, frog, and gartersnake species in, above, and below Horseshoe and Bartlett (Subchapter IV.B.4.a); and 4) impacts on water resources, recreation, geology and geomorphology, and vegetation below the dams. The area of analysis for birds and habitat extends from the top of the conservation pool at Horseshoe downstream to Granite Reef Dam, where water is diverted into the SRP canals. The area of analysis for native fish, frog, and gartersnake species extends from Allen Ditch Diversion near Clarkdale on the Verde River downstream (including portions of some tributaries) to Granite Reef Dam. The Action Area does not extend into the canals below Granite Reef Dam because: (1) the operation of Horseshoe and Bartlett does not dictate water flow rates or volumes in the canals, which is the result of water demands and supplies from other sources, primarily the Salt River, CAP, and ground water; (2) the canals are an artificial, highly managed system strongly affected by activities unrelated to reservoir operations, such as diversions, structures, recreation, and water quality impacts; and (3) the canals do not currently provide habitat for listed species.

Because of the complex variation in runoff and lake levels over time, models were used to estimate the future impacts of reservoir operations on bird habitat, fish, frog, and gartersnake habitat, and water supplies. As discussed below, the models and relationships between hydrologic conditions and habitat or water supply are based on reservoir operations, ecological principles, historical data, and empirical evidence.

1. Reservoir Operation Model

SRP uses a long-term planning model to evaluate reservoir operation alternatives. This model, called SRPSIM (SRP SIMulation model), simulates reservoir operations using a monthly time step based on stream flows, reservoir and outlet capacities, operational logic, and water demands. The program was originally written in 1979 by Reclamation and has been periodically refined by SRP to better reflect current and future operations, recent demands, and reductions in reservoir capacity from sediment. The 2002 version of the model used in the evaluation of impacts in this HCP is an update of the 1995 version of the model that was used in the analysis for the Roosevelt HCP and its alternatives (SRP 2002). The update reflects gaged inflows to the reservoirs through

September 2002 and the 2001 sediment survey of Horseshoe. The parameters of SRPSIM and summaries of the output from model runs used in the analysis of impacts in this chapter are provided in Appendix 5. The SRPSIM results, especially Horseshoe water levels, were used as inputs to the flycatcher habitat model described below.

2. Flycatcher Habitat Model

The flycatcher habitat model developed for the Roosevelt HCP (SRP 2002) was adapted to Horseshoe. Recently published biological information and studies were reviewed, evaluated, and data were incorporated into the model (e.g., Cardinal 2005; Paradzick 2005a; Brodhead 2005). The model was used to evaluate the long-term probability of impacts to occupied flycatcher habitat from inundation under the Optimum Operation and Modified Historical Operation alternatives (Subchapters IV.B.1 and IV.C.2). In the model, Horseshoe reservoir elevation is examined at the beginning of the flycatcher breeding season to determine the minimum amount of flycatcher habitat that is likely to be available for breeding in a particular year. As explained below, flycatcher habitat is considered to be available if tall dense vegetation is not inundated by more than 10 feet on May 1.

a) Definitions

The following terms for flycatcher habitat are used in this HCP:

- **A flycatcher** is a resident Southwestern willow flycatcher that is territorial (actively defending space) during the breeding season. Flycatchers may arrive as early as late April, but for determining resident status the accepted FWS protocol defines a flycatcher as being detected between June 15 to July 20, or where an active nest is found within the territory before or after those dates (Sogge et al. 1997).
- **Occupied habitat** or **flycatcher habitat** is the essential habitat (for breeding, feeding, and sheltering) for a resident flycatcher, which is composed of a mosaic of riparian vegetation within an 11.1-acre neighborhood surrounding known nest and territory locations. Within the 11.1-acre neighborhood, tall dense vegetation for nest placement, shelter, and foraging is always present, but the area may contain other vegetation communities that provide insect populations, foraging areas, shelter, and dispersal habitat (see Subchapter IV.A.3 for a description of how the 11.1-acre neighborhood was generated). Various habitat components outside of the 11.1-acre neighborhood may be used by the flycatcher during its lifecycle, but for estimating impacts of dam operations, the 11.1 acres represents the best available method to quantify <u>essential</u> flycatcher habitat.
- **Tall dense vegetation** is a component of the overall habitat occupied by breeding flycatchers. The trees and shrubs provide the tall dense vegetation structure necessary for nest placement, which are primarily willows greater than 25 feet in height under current conditions at Horseshoe. However, tall dense vegetation is expected to vary in distribution, abundance, and flycatcher occupancy over the term of the 50-year Permit, i.e., sometimes contain no resident flycatchers due to natural successional process of riparian habitat, the preference by flycatchers for specific structural characteristics (young, dense

forest), and flycatcher population dynamics. Additionally, the composition of the tall dense vegetation patches may shift to other tree species (e.g., cottonwood, tamarisk), and this potential shift was incorporated into the impact analysis.

- **Riparian habitat** refers to those habitats that are not, in any one flycatcher season, essential habitat for flycatcher breeding, feeding, or sheltering, yet through the dynamics of habitat development, may become occupied for breeding, feeding, or sheltering over time.

These terms are defined more fully in the description of existing Horseshoe flycatcher habitat in Subchapter IV.B.1.a.

b) Assumptions

The flycatcher habitat model incorporates the following major assumptions (see Subchapter IV.B.1 for definitions of terms):

- **Operations will only impact occupied habitat in Horseshoe—**Flycatchers and cuckoos utilize a variety of habitats during various life stages: dispersing, breeding, migrating, and wintering habitats. Dam operations are expected to periodically impact habitat in Horseshoe and cause incidental take. However, impacts are not expected to occur at a level that would cause take of flycatchers, bald eagles, or cuckoos based on impacts to habitat downstream of the dams based on fluvial geomorphology and vegetation studies (Appendix 3, Section II.A.2).
- **Future inflows will reflect historical runoff—**Monthly reservoir elevation data from reservoir simulation using river flows into Horseshoe from October 1889 through September 2002 are used as inputs. These historical inflows are used in SRPSIM with dam operational rules to model reservoir levels (Appendix 5). Although the pattern of future flows (and thus, reservoir levels) will not be the same as historical flows and resulting reservoir levels, the future probability of reservoir levels at Horseshoe is expected to be similar to long-term average percentages based on historical flows.
- **Existing reservoir topography was used to define reservoir storage capacity—**Although future sediment deposition will significantly reduce the capacity of Horseshoe, the current storage volume and topographic profile was used in the evaluation of impacts to avoid underestimates of storage capacity. Use of existing reservoir topography results in a conservative definition of reservoir capacity because impacts on flycatchers are largely in direct proportion to the depth of water in Horseshoe during the spring and early summer (Subchapter IV.B.1). Over time, sediment deposition in Horseshoe will result in shallower depths of water, and earlier and more frequent drawdown of the reservoir, and thus less impact.

- **Amount and distribution of future occupied flycatcher habitat was estimated based on tall dense vegetation to determine impacts—**
  - Because the exact number and distribution of flycatcher territories cannot be reliably predicted, the amount of tall dense vegetation was used as a surrogate to estimate the amount of flycatcher habitat in the future.
  - Tall dense vegetation was used instead of a mosaic of habitat or a combination of habitat types because these other components vary widely among occupied habitats (Paradzick 2005a) and their direct effect on flycatcher fitness (breeding, feeding, sheltering) is unknown. Tall dense vegetation abundance and growth could be estimated using current reservoir and hydrological information, and tall dense vegetation must be present for flycatchers to establish a territory and nest.
  - The future amount and distribution of tall dense vegetation was estimated based on 2002 mapping at Horseshoe, trends observed at Horseshoe and Roosevelt, estimates of future soil moisture conditions, hydrological conditions, topography, sedimentation, and proposed reservoir operations.
  - For each modeled alternative, the tall dense vegetation was distributed by 5-foot elevation intervals for use as input to the model.
  - Monitoring take of flycatchers due to impacts on occupied habitat once the HCP is implemented will be based on known flycatcher territories buffered by an 11.1-acre neighborhood that are unavailable due to inundation by lake levels. However, SRP will also monitor tall dense vegetation annually as needed to estimate the likelihood of potential take before it occurs, i.e., estimate tall dense vegetation that develops in the reservoir, which could become occupied in the future and be impacted by reservoir operations.
- **Tall dense vegetation is available for flycatcher use to establish territories and nests if trees are inundated by 10 feet or less on April 30**—It is assumed if trees are inundated by less than 10 feet by April 30, the occupied habitat is unlikely to be significantly impacted and would remain functional as flycatcher habitat (i.e., breeding, feeding, sheltering would not be significantly impacted) (SRP 2002; Appendix 4; Dockens and Ashbeck 2005). The 10-foot maximum level of inundation on April 30 is a conservative estimate based on the following considerations:
  - If the reservoir has filled during the winter, Horseshoe levels typically begin to drop rapidly in April or early May, which is when flycatchers begin to arrive and establish territories, and usually are lower by 30 feet or more in early to mid-June when most nesting occurs (Figure I-2). Thus, more tall dense vegetation is usually available as the season progresses.
  - After May, significant summer refill has never occurred, so inundation of established nests is very unlikely.
  - Flycatchers typically breed where "slow-moving or still water and/or saturated soil is present in wet or normal precipitation years" (Sogge and Marshall 2000). Research studies at Horseshoe in 2005 show that nest

success and productivity was not affected by partial inundation (Dockens and Ashbeck 2005). Studies at Roosevelt and Alamo Lake show both positive and negative effects of partial inundation on nest success (English et al. 2006). However, because Horseshoe operations usually result in declining reservoir levels as the breeding season progresses, compared to Roosevelt where levels may be kept high for long periods of time, it is assumed that nesting impacts due to partial inundation are not likely at Horseshoe (e.g., partial inundation for a few weeks or months will not cause high tree mortality or affect canopy cover and density—Balluff and Green 2007; Green and Balluff 2007).

- Based on observations during the 2005 surveys, current flycatcher nest height at Horseshoe appears to differ somewhat from nest height at Roosevelt as the willows are much taller at Horseshoe. At Roosevelt, nest height is typically 10 to 20 feet above the root crown of vegetation that is 16 to 30 feet tall (Sferra et al. 1995, 1997; Spencer et al. 1996; McCarthey et al. 1998; Paradzick et al. 1999–2001; Smith et al. 2002). The mean nest height at Roosevelt is about 13 feet with a standard deviation of 3 feet. The average tree and shrub height is approximately 21 feet with a standard deviation of 5 feet. At Horseshoe, existing tall dense vegetation occupied by flycatchers ranges up to 80 feet in height. However, the height is predicted to be approximately 20 to 25 feet over the term of the Permit in order to be conservative, based on the average height of tall dense vegetation at Roosevelt, which is relatively young and short. Over the next 50 years, it is likely that the current tall dense vegetation at the upper end of Horseshoe will eventually be replaced by shorter vegetation for a period of time. If the tall dense vegetation is inundated by no more than 10 feet, at least 10 to 15 feet of tree canopy would be above water and available at the outset of the breeding season, and more canopy and subcanopy would become available as the season progresses.

- **The amount of tall dense vegetation that is occupied is likely to be 50 percent of the total available tall dense vegetation within the conservation pool**—Based on Figures II-4 and III-6 from the Roosevelt HCP (SRP 2002) and 2002 to 2005 data from Horseshoe, the maximum amount of tall dense vegetation occupied at any one time at a given elevation is estimated to be about 50 percent of the total amount of tall dense vegetation that is available.
- **The habitat occupied by flycatchers is estimated to be composed of about 50 percent tall dense vegetation and about 50 percent other vegetation community types**—Based on Table III-1 in the Roosevelt HCP, observations at Horseshoe (Table IV-1), and data analysis on the San Pedro and Gila rivers (Paradzick 2005a), the amount of tall dense vegetation within occupied habitat over the long term is estimated to be about 50 percent of the total occupied habitat using the 11.1-acre neighborhood surrounding territories (see discussion of AGFD model results below for the basis of the 11.1-acre neighborhood). The other 50 percent, which extends beyond the tall dense vegetation, is composed of various floodplain communities (e.g., short dense saplings and riparian tree

stands, open space, water, and riparian strand). The portions of the occupied habitat patches outside of tall dense vegetation are important to other flycatcher life cycle needs (e.g., song perches, foraging, insect production, and dispersal). Extensive areas of these other floodplain communities occur adjacent to patches of tall dense vegetation in Horseshoe.

- **The effect of the previous two assumptions is offsetting—**In other words, the total amount of tall dense vegetation at Horseshoe is equivalent to occupied habitat. As an example, if there are 100 acres of tall dense vegetation at Horseshoe, the assumption is that 50 percent (or 50 acres) are occupied. However, the tall dense vegetation only constitutes 50 percent of the total amount of occupied flycatcher habitat at Horseshoe, with the other 50 percent (or 50 acres) being composed of other vegetation community types, for a total of 100 acres. Therefore, the total amount of tall dense vegetation at Horseshoe is used to estimate the amount of occupied habitat for the purposes of the HCP.

As discussed in Subchapter V.C.4.a, adaptive management will be used to modify the impact estimates in the future if these assumptions are not accurate.

c) Input Data

Monthly reservoir elevation data from SRPSIM output for runoff from 1889 to 2002 are used as inputs to the flycatcher habitat model. Topographic contours of Horseshoe at 5-foot intervals were obtained from the 2001 sediment survey. Future tall dense vegetation, which is suitable as the core of flycatcher habitat, was estimated as described in the previous section. Vegetation for each 1-foot elevation increment was determined using straight-line interpolation within each 5-foot interval. ArcView and ArcInfo software programs were used to manage the map data.

d) Model Operation

The flycatcher habitat model compares the modeled end-of-month reservoir level of Horseshoe with tall densely vegetated acres for each 1-foot elevation interval. The model calculates available tall dense vegetation for the entire year, but the primary breeding season is May through July although it may extend into August or later. May is the focus of the habitat model because June and July reservoir levels are never higher than May levels and, therefore, if habitat is available in May, it is available in June and July or later as well. The reservoir level at the end of April, which will be available in May, is used as a conservative analysis of impacts.

e) Period of Record

Two periods of record, 1889–2002 and 1951–1990, were evaluated for each modeled reservoir operation alternative to ensure that a range of runoff conditions is considered. The period 1951–1990 is the most representative of the average runoff during the past four centuries (since about 1580) for the Salt and Verde watershed (Subchapter III.B.1). The slightly greater availability of tall dense vegetation that occurs during simulations of the period 1951–1990 reflects that the water level in Horseshoe is lower on average during that period of years than during the longer modeling period of 1889–2002. Thus, the period 1889–2002 reflects a larger quantity and frequency of inflow and higher

reservoir levels than the shorter representative period of record. The analysis of impacts primarily relies on the 1889–2002 period as a conservative estimate of impacts because the extent and duration of tall dense vegetation inundation may be underestimated by the 1951–1990 period of record.

3. AGFD Model – 11.1-acre Neighborhood as Essential Habitat

AGFD developed a multiscaled model to map and rank potential flycatcher breeding habitat in Arizona in order to prioritize surveys and to detect changes in habitat over time (Hatten and Paradzick 2003). The model uses a Geographic Information System (GIS) along with satellite images, digital elevation models, and field data on the presence of flycatchers, GIS variables, and multiple logistic regression analysis to predict the likelihood of breeding sites. The AGFD model was developed and tested using 1999 satellite imagery of Roosevelt, the San Pedro/Gila river confluence, and Alamo Lake (Dockens et al. 2004). The best combination of variables in the model explains 54 percent of the variance in the occurrence of flycatcher breeding sites. In the model, the habitat components most highly correlated with breeding activity are: 1) the vegetation density within the 0.22-acre site associated with an observed nest or territory; 2) the vegetation density and variability within the 11.1-acre neighborhood of an observed nest or territory; and 3) the amount of floodplain within an area of about 100 acres surrounding the site. The 11.1-acre neighborhood equates to a radius of about 394 feet around a breeding site. Although the model was not developed to quantify occupied habitat, flycatcher biologists with AGFD believe this area is the best available estimate of the average amount of habitat needed by adult and juvenile flycatchers for refuge, dispersal, and foraging in the vicinity of nests and territories (Hatten and Paradzick 2003; McCarthey et al., pers. comm. 2002).

Three other habitat studies support the use of the 11.1-acre neighborhood as the best available estimate of occupied habitat. Paradzick (2005a) built on the results of the AGFD habitat model and found that the amount of tall dense riparian vegetation within the 11.1-acre neighborhood, which averaged 46 percent in cottonwood-willow occupied patches, was a key variable in habitat selection by the flycatcher at the patch scale. He also found no significant patterns of preference for other vegetation community types (i.e., shrubs, forbs, riparian strand) within the 11.1-acre neighborhood. Recently, a multiscaled study of flycatcher breeding locations in relation to riparian vegetation cover and structure along the Gila River in New Mexico (in vegetation communities similar to Horseshoe) found that habitat characteristics within a territory radius of 328 feet were more highly correlated with flycatcher presence than characteristics at greater distances—"the degree of sensitivity between all riparian characteristics and flycatcher presence decreased quickly beyond a 100-meter [328-feet] extent" (Brodhead 2005). Brodhead also found that the amount and heterogeneity of stands of riparian trees within this area were positively related to site selection and habitat use. Cardinal (2005) found that flycatcher home range during much of the breeding season was less than 11.1 acres. While flycatcher movements were greatest during the post-nesting stage (greater than 394 feet), flycatcher habitat use remained consistent. Birds used primarily mature (tall) dense vegetation and often used areas with conspecific territories; thus, buffering all known nests and territories by 11.1 acres in the Horseshoe conservation pool would likely capture important post-nesting habitat. These results support use of the AGFD model's

11.1-acre, 394-foot radius neighborhood buffering known territories and nests to define occupied habitat.

B. Impacts of the Optimum Operation Alternative (Proposed Action)

As discussed in Chapter I, the emphasis in this HCP is on flycatchers because of the endangered status of this species and because their presence in Horseshoe triggered the application for a Permit. The impacts of the Optimum Operation Alternative on covered species are described in subsequent sections. Impacts on water resources, recreation, geology and geomorphology, and vegetation are also analyzed below.

1. Impacts on Flycatchers

This subchapter begins with the approach used for the analysis of impacts from the Optimum Operation Alternative for Horseshoe and Bartlett on flycatchers. Background on existing flycatcher habitat (the environmental baseline) is provided before evaluating the impact of the Optimum Operation Alternative on the estimated maximum future occupied habitat of this species.

a) Approach and Background

The analysis of the impact of future reservoir operations focuses on the availability of habitat occupied by flycatchers. Future operation of Horseshoe and Bartlett by SRP involves the periodic inundation and potential modification of habitat occupied by flycatchers in Horseshoe. The analysis focuses on Horseshoe because no flycatcher habitat currently exists in Bartlett and it is not likely to become established in that reservoir because the reservoir does not fluctuate as much as Horseshoe and substrate conditions are not favorable for riparian habitat germination and growth. Optimum reservoir operations would not have significant adverse impacts on riparian habitat that is used or may be used by flycatchers along the Verde River below Bartlett and Horseshoe (Subchapter III.B.4.e; Section II.A.2 in Appendix 3).

The periodic inundation of occupied flycatcher habitat at Horseshoe would result in habitat being unavailable, modified, or lost in some future years, which is expected to result in an incidental take of flycatchers through harm and harassment. To reiterate, take under the ESA means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct [ESA § 3(19)]. Harm is further defined to include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing behavioral patterns such as breeding, feeding, or sheltering" (50 CFR § 17.3). Harassment is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Id.).

Assessment of impacts on flycatcher habitat from the continued operation of Horseshoe and Bartlett under the Optimum Operation Alternative differs from a typical biological impact analysis because impacts do not occur as a single, permanent event and the amount of impact cannot be precisely predicted for any specific future year. Direct impacts to flycatchers, their nests or eggs are not expected unless a nest tree with eggs or nestlings in it falls due to inundation or drying, or a fledgling falls out of a nest over

water and drowns.[28] Horseshoe levels typically peak in March or April and are steadily drawn down during the flycatcher breeding season. Thus, impacts are primarily expected through periodic inundation of occupied habitat (which precludes its use), habitat modification or loss caused by periodic inundation or drying, or habitat unavailability that may impact reproduction. These periodic impacts will vary over time. In many years, the Optimum Operation Alternative would not be expected to adversely impact any occupied flycatcher habitat at all or would benefit the habitat by stimulating the growth of riparian vegetation (Subchapter III.B.4). Under current and future reservoir operation, the average amount of flycatcher habitat in Horseshoe is expected to gradually increase, but is likely to ebb and flow over time similar to many natural southwestern riparian ecosystems. As described in the Southwestern Willow Flycatcher Recovery Plan, such periodic disturbance and flooding within riparian systems is essential for long-term maintenance of flycatcher habitat (FWS 2002a). However, in some years, operation of Horseshoe and Bartlett will result in the unavailability, and possible degradation or modification, of portions of the flycatcher habitat in Horseshoe, which is anticipated to result in take as defined by the ESA, although disturbance and flooding are necessary to maintain the habitat over the long term.

To reflect the biological processes required to create and sustain suitable breeding habitat over time while meeting the requirements for mitigation of impacts under Section 10(a)(1)(B) of the ESA, the impact analysis predicts both the long-term average and maximum amount of occupied breeding habitat that could occur in Horseshoe, but might be periodically unavailable due to reservoir operations. The proposed mitigation (average acres impacted) and adaptive management (to account for underestimates of average impacts up to the maximum predicted acres impacted) reflects both biological and legal considerations (Section V.C).

Approach to Quantification of Incidental Take. The quantity of take of individual flycatchers from future Horseshoe and Bartlett operations is difficult to estimate for several reasons:

- Direct take of adult flycatchers at Horseshoe is unlikely because the birds are mobile.
- Take of flycatcher eggs or unfledged young from direct inundation is unlikely because an increase in reservoir levels during the breeding season has never occurred in the past and is not likely to occur in the future. Prior inundation might occasionally result in tree fall during the breeding season causing direct take, and fledglings may die occasionally from drowning if standing water remains under nest trees when the young are learning to fly.

[28] Direct take may also occur from recreation use at high lake levels (e.g., boat disturbance to nesting flycatchers). However, recreation use at Horseshoe is subject to Forest Service and AGFD management, which is outside SRP control. Forest Service authorization of recreation use is a federal action; thus, recreation impacts on flycatchers and other listed species are addressed as a cumulative impact under NEPA in the FEIS.

- Take of flycatchers primarily would result from impacts on reproductive rates (productivity and nesting success) or other indirect impacts from not being able to occupy habitat that would otherwise be available at Horseshoe in the absence of refilling the reservoir. However, the amount and frequency of occupied habitat affected by future reservoir fills is difficult to predict precisely; thus, the magnitude and results of these indirect impacts on individual flycatchers, flycatcher numbers, and flycatcher productivity will change over time.
- Future changes in population size are difficult to estimate because population dynamics, and the relationship between population size and area of available habitat, are not well understood (FWS 2002a). For example, the density of flycatchers at Horseshoe may increase or decrease depending on a variety of factors not related to operation of Horseshoe and Bartlett. Flycatchers are subject to substantial stresses during migration and in their wintering range, which lead to mortality independent of habitat availability at breeding areas such as Horseshoe (FWS 2002a). Conversely, losses of habitat in other locations could cause increased habitat use at Horseshoe.

Given that periodic unavailability, modification, or loss of habitat is the primary impact that would result in the anticipated incidental take of flycatchers at Horseshoe and the precise quantity of that take is difficult to estimate, incidental take is quantified in terms of impacts on acreage of occupied habitat in this analysis (FWS 1996). The impact analysis is based on an approach that estimates the maximum amount of occupied habitat in the future, and correspondingly predicts the maximum and long-term average amount of habitat that could be unavailable in the future. As described above, Horseshoe reservoir levels are expected to continue to fluctuate as they have for the past 60 years, only with a slightly different seasonal distribution in Horseshoe and Bartlett because of the modified reservoir operating goals under the Optimum Operation Alternative. Over the long term, the amount of future flycatcher habitat within the reservoir is expected to increase; correspondingly, the amount of future habitat periodically affected by reservoir operations is likewise expected to increase. However, severe natural events such as large flood flows could destroy riparian vegetation and reduce impacts from reservoir operations until the vegetation regrows.

The approach used to prepare this impact analysis is to evaluate the long-term dynamics of riparian vegetation and reservoir operations related to occupied flycatcher habitat and productivity in Horseshoe. The first step was to conduct fieldwork to map the vegetation and observe current conditions (Subchapter III.B.4). Then, the trend of habitat occupied by flycatchers was developed. Finally, the flycatcher habitat model incorporating relationships of hydrologic conditions, and occupied habitat was applied, which is based on reservoir operations, ecological principles, historical data, and empirical evidence in order to estimate future impacts to flycatcher habitat (Subchapter IV.A).

Existing Horseshoe Flycatcher Habitat. The development of habitat at Horseshoe, some of which is occupied by flycatchers, is described in Subchapter III.B.4. Cottonwoods and willows were present in relatively small stands and narrow bands along

the Verde River channel prior to the construction of Horseshoe and Bartlett in the late 1930s and mid-1940s (Figure III-21 and Figure III-22). Wet years from the late 1970s through the early 1990s deposited sediment on the inflow delta at Horseshoe and frequently maintained high lake levels, creating favorable conditions for the growth of tall dense vegetation, primarily willow.

No comprehensive model that defines flycatcher habitat in all locations has been developed; because flycatcher habitat varies widely across its range, and it is difficult to produce a precise habitat characterization or model (FWS 2002a). In general, habitat occupied by flycatchers consists of nest trees, male-defended territory space, and adjacent areas used for feeding and other activities (see Appendix D in FWS 2002a; Paradzick 2005a; Brodhead 2005). At nearby Roosevelt, flycatchers primarily occupy the mature riparian vegetation used throughout the breeding season although younger habitat types were also used (Cardinal 2005). However, Paradzick (2005a) found no indication of habitat selection due to presence or abundance of young (sapling) riparian trees. Also, because recruitment events for cottonwood and willow occur on average every decade in natural systems, young trees would not be expected to be available annually at all occupied flycatcher sites. These habitats, where they occur, could be important as potential future nesting habitat (and may be explored by flycatchers during the breeding season), but the function and link to flycatcher fitness is currently unknown. Despite uncertainty over precise characterization of occupied habitat, field observations indicate that most flycatchers at Horseshoe nest in tall dense patches of willow over or relatively close to water (Subchapter III.A.1.a.10).

Home range data for the flycatcher have been collected from radio-tracking studies at Roosevelt in two recent years (Cardinal 2005; Cardinal and Paxton 2004, 2005). Information from 23 flycatchers indicates a wide variation in range of movement among individuals and before, during, and after nesting. Prior to nesting, home ranges were generally small, with a mean of about 1.4 acres except for one bird with a much larger home range during this period (Cardinal 2005). During nesting, the mean home range was slightly less than 1 acre (Id.). Late in the breeding season, home ranges expanded substantially, ranging from about 10 to 900 acres, but birds often used conspecific territories and habitat, suggesting that not all of the area outside of the tall dense vegetation was essential (Id.). Cardinal (2005) also summarizes territory and home range sizes from several studies of other flycatcher subspecies, which range from less than 1 acre to more than 4 acres. Home range data were not used to define occupied habitat for purposes of this HCP because the amount of habitat required to support flycatchers is not clear from this data. However, the majority of home range estimates are significantly less than the 11.1-acre neighborhood used for occupied habitat in this analysis.

The method used to estimate the amount of habitat occupied by flycatchers at Horseshoe was adapted from the Roosevelt HCP (SRP 2002).[29] That approach was derived from meetings held with Arizona biologists active in flycatcher research and management to discuss methods to quantify future occupied habitat (Id.). The method used for the Roosevelt HCP was selected because it is based on peer-reviewed science, objective, accurately reproducible, easy to measure, and correlated to the number and distribution of flycatchers. The consensus was that the 11.1-acre neighborhood of flycatcher territory used for breeding, feeding, and other activities, which was a significant factor in the AGFD breeding habitat model, is a reasonable estimate of occupied (essential) habitat (Id). The 11.1-acre neighborhood and the AGFD model are described in more detail in Subchapter IV.A.3. Figure IV-1 illustrates the estimated occupied habitat at Horseshoe in 2004 and 2005 using this method where "territory buffer" equals the 11.1-acre neighborhood.

The 11.1-acre neighborhood is equivalent to a 394-foot radius around a nest or the center of a territory. The locations of nests and territories from 2002 to 2005 were mapped with the 394-foot radius using GIS analysis. Overlapping neighborhoods around nests and territories were joined into one polygon. Occupied habitat measured by this method has expanded from about 55 acres in 2002 to about 167 acres in 2005.

The categories of vegetation types within the areas delineated as occupied habitat for the years 2002 through 2005 are listed in Table IV-1. Currently, all of the occupied tall dense vegetation is dominated by dense willow greater than 25 feet in height (Figure IV-1). Other mapping units within the occupied areas consist of salt cedar, sparse vegetation including stream channels and gravel bars, or nonwoody vegetation. In recent years, the average percentage of tall dense vegetation in relation to the total of all mapping units within the occupied habitat is about 29 percent. This percentage is expected to increase to about 50 percent as the amount of tall dense vegetation increases in Horseshoe (Subchapter IV.A.2.b), which is also used to develop the minimum criteria for mitigation land (Subchapter V.C.1).

[29] Common to the regulatory definitions of both harm and harassment is a focus on effects to individuals of the species present in *occupied habitat*. Harm, as defined by the regulations, "may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing behavioral patterns including breeding, feeding, or sheltering" 50 C.F.R. § 17.3 (see Babbitt v. Sweet Home Chapter of Communities for a Great Oregon, 115 S.Ct. 2407). The focus on effects to behavior patterns of species present in occupied habitat is also integral to the definition of harassment, which addresses actions or omissions creating "the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering" 50 C.F.R. §17.3.

Figure IV-1. 2004 and 2005 estimated occupied habitat at Horseshoe (north is to the top of the figure).

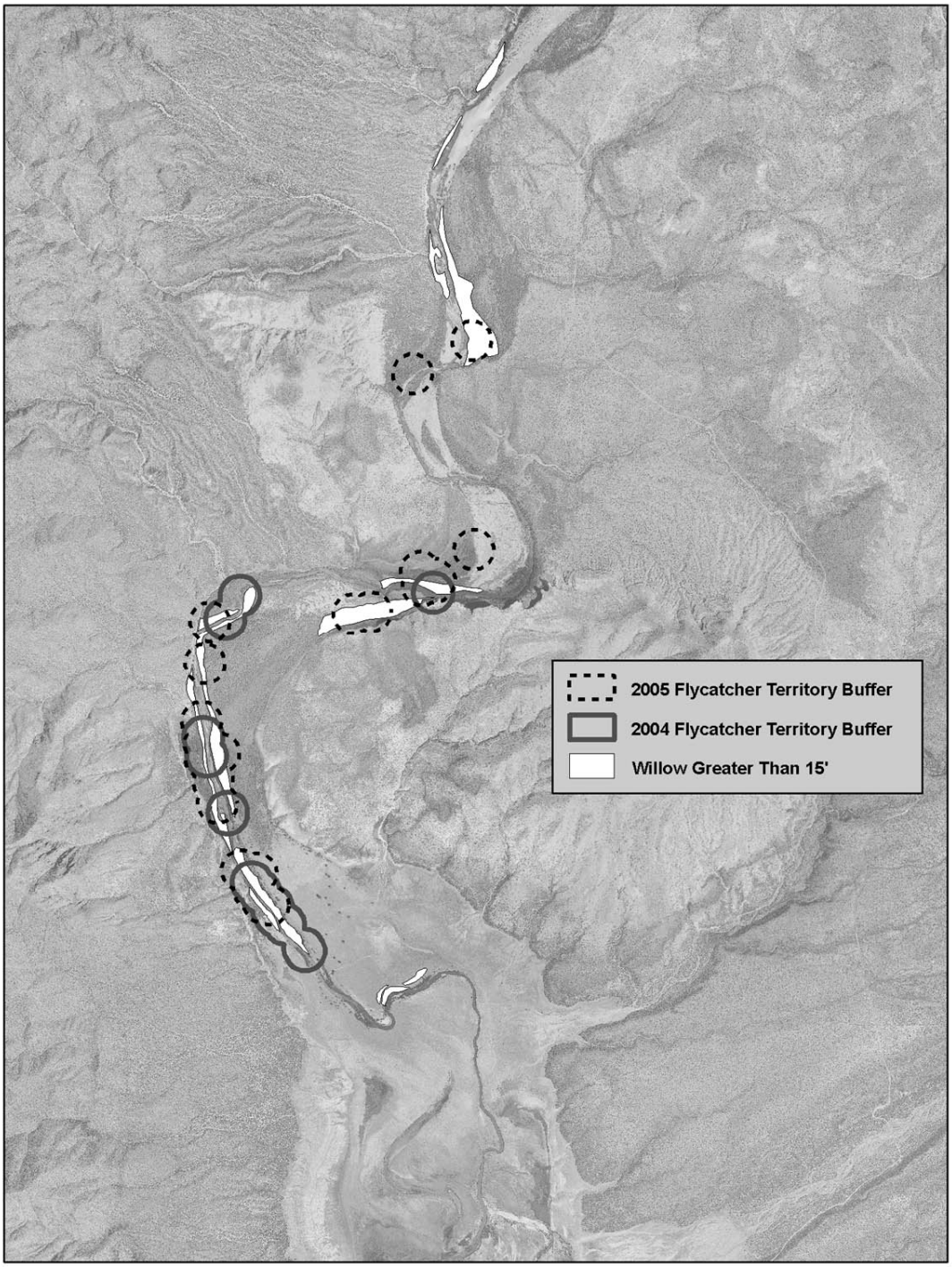


Table IV-1. Categories of vegetation mapping units within habitat occupied by flycatchers at Horseshoe, 2002–2005.

Year	Occupied Acres of Tall Dense Vegetation (% of Total)	Occupied Acres of Other Mapping Units (e.g., Channels, Salt Cedar, or Short and Sparse Vegetation)	Total Occupied Acres
2002	15.7 (28%)	39.7	55.4
2003	20.3 (31%)	45.8	66.1
2004	27.8 (27%)	74.5	102.3
2005	45.9 (28%)	120.8	166.7
Average %	(29%)	(71%)	—

In 2005 and 2006, during and after a period of high flows, the effects of inundation on flycatcher breeding habitat were evaluated (Paradzick 2007). Horseshoe was maintained completely full until mid-May 2005, then was lowered 15 feet by June 8, and held approximately at that level for nearly a month. Flycatchers continued to occupy most of the same patches of tall dense vegetation for nesting used in 2003 and 2004, and also used some additional habitat at higher elevations near the inflow to Horseshoe in 2005, probably because of the high water levels. Given the depth of water early in the breeding season in 2005, flycatchers placed their nests in the upper portion of the canopy of partially inundated trees, with average canopy heights above the water of about 12 feet (Dockens and Ashbeck 2005). Average canopy height of nest trees after the reservoir receded was about 39 feet (Id.). Research studies at Horseshoe in 2005 and 2006 show that nest success and productivity was not significantly affected by partial inundation (Paradzick 2007). Reproductive rates were similar to or higher than other nest monitoring sites in central-Arizona (Id.).

Future Flycatcher Habitat. Under the Optimum Operation Alternative, it is estimated that additional habitat suitable for flycatcher breeding will develop in Horseshoe in the future (compared to Modified Historical Operation and No Permit Operations). In 2005, 167 acres of occupied flycatcher habitat occurred in Horseshoe. Based on impact analysis modeling (Subchapter IV.B.1.b), 260 acres are expected to be available for flycatcher nesting on average over the life of the Permit. While it is unknown if and at what densities flycatchers will occupy habitat at Horseshoe in the future, based on the amount of tall dense vegetation estimated to be available at the lake, Optimum Operations could provide habitat for a significant portion of the territories (50) identified in the Recovery Plan for the Verde River Management Unit. Most of this additional habitat will occur at the middle elevations of the reservoir given vegetation trends observed at Horseshoe and Roosevelt, sediment deposition, hydrology, morphology, and proposed reservoir operations.

Tall dense vegetation in 2002 occupied by flycatchers or potentially occupied by flycatchers is provided in Table IV-2. Over the 50-year Permit term, the predicted maximum amount of tall dense vegetation likely to develop at the middle and lower elevations of Horseshoe is estimated to be 20 percent of the area based on vegetation

development on the upper Salt arm of Roosevelt (see Figure II-2 in the Roosevelt HCP; SRP 2002), which has similar morphology and hydrology. Above elevations of 1,990 feet, a smaller increase in the percentage of tall dense vegetation is likely because of scouring and a relatively narrow floodplain bounded by high terraces of sediment. Below elevations of 1,960 feet, a lower percentage of tall dense vegetation is likely to develop because of frequent and extended inundation. Maximum predicted tall dense vegetation is shown in Table IV-2.

Table IV-2. Tall dense vegetation by reservoir elevation increment, 2002 and maximum predicted.

Upper End of Elevation Increment (feet)	Incremental Reservoir Area (acres)	2002 Tall Dense Vegetation (acres)	2002 Tall Dense Vegetation (% of area)	Maximum Predicted Tall Dense Vegetation (% of area)	Maximum Predicted Tall Dense Vegetation (acres)	Maximum Cumulative Predicted Tall Dense Vegetation (acres)
1,950	25.1	0.0	0%	10%	2.5	2.5
1,955	187.3	0.0	0%	15%	28.1	30.6
1,960	124.8	0.0	0%	20%	25.0	55.6
1,965	273.8	0.0	0%	20%	54.8	110.4
1,970	288.3	0.0	0%	20%	57.7	168.0
1,975	169.6	0.6	0%	20%	33.9	202.0
1,980	199.5	8.0	4%	20%	39.9	241.9
1,985	168.2	7.9	5%	20%	33.6	275.5
1,990	149.4	8.7	6%	20%	29.9	305.4
1,995	135.2	16.4	12%	15%	20.3	325.7
2,000	121.5	9.8	8%	15%	18.2	343.9
2,005	126.0	6.0	5%	10%	12.6	356.5
2,010	178.7	15.0	8%	10%	17.9	374.3
2,015	205.2	13.2	6%	10%	20.5	394.9
2,020	157.2	16.1	10%	10%	16.1	411.0
2,025	174.2	24.6	14%	14%	24.6	435.6
2,030	178.0	7.0	4%	4%	7.2	442.8
2,035	199.7	3.8	2%	2%	3.8	446.5
2,040	173.1	1.2	1%	1%	1.2	447.8

b) Impacts on Flycatcher Habitat and Productivity

As discussed in the approach to the flycatcher impact analysis (Subchapter IV.B.1.a), periodic unavailability, modification, or loss of occupied habitat is the primary anticipated impact of future reservoir operations under the Optimum Operation Alternative. Thus, incidental take is quantified by estimating the long-term average and maximum acreage of anticipated occupied habitat that would periodically be unavailable due to the Optimum Operation of Horseshoe. Below, impacts on flycatcher productivity based on the average and maximum amount of unavailable habitat are also estimated.

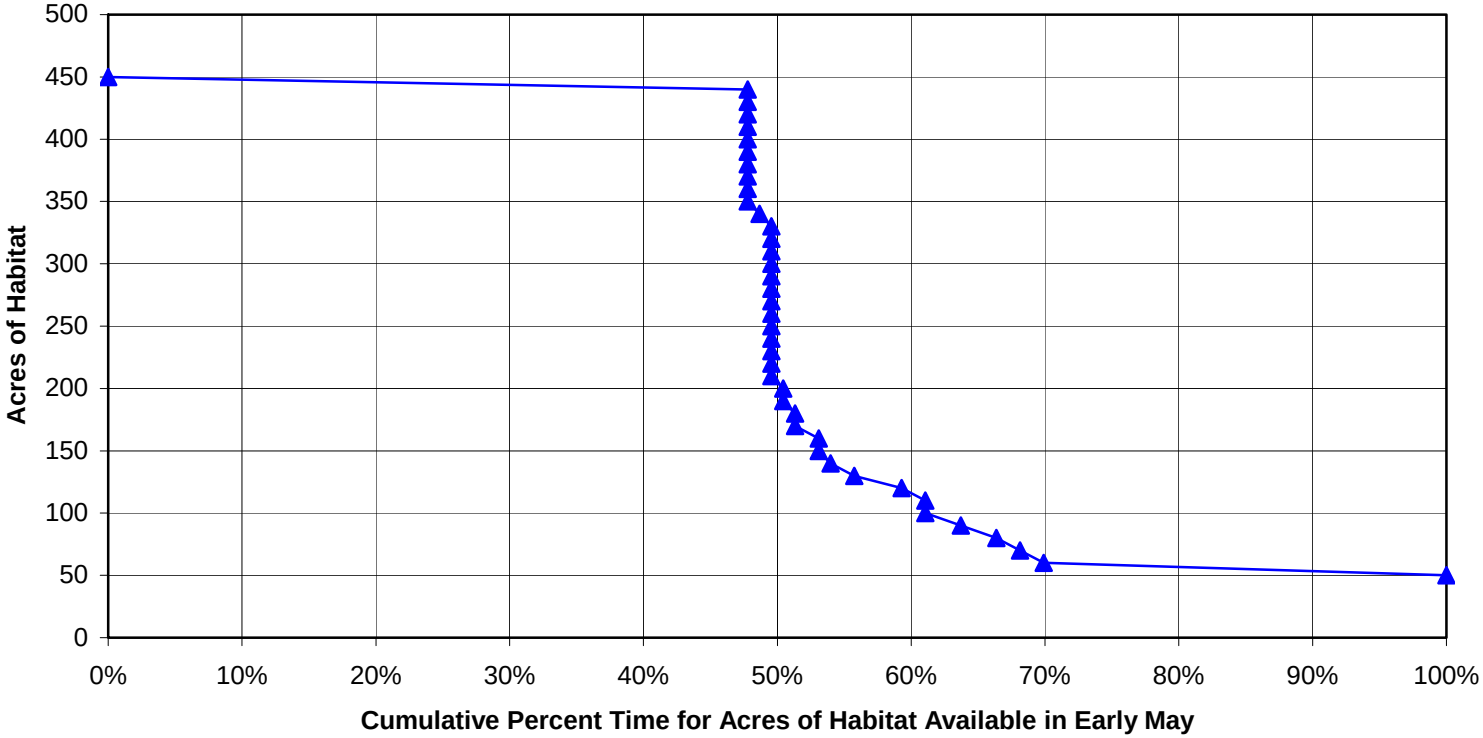
Impacts on Flycatcher Habitat at Horseshoe. The amount of occupied habitat affected by the Optimum Operation Alternative would vary over time in Horseshoe as existing tall dense vegetation matures and is replaced, as sediment is deposited, and as new riparian habitat becomes established lower in the reservoir. In the long term, operation of the reservoir is likely to promote the growth of greater amounts of flycatcher habitat within Horseshoe, compared to No Permit or Modified Historical operations. Operation of Horseshoe under the Optimum Operation Alternative would help maintain habitat, which would be available for flycatcher occupancy except during years of high runoff. As described in Chapter II, under the Optimum Operation Alternative, after two successive dry years (which based on runoff projections occurs once every 13 years on average), the objective would be to fill Horseshoe at the earliest opportunity in order to relieve the drought stress on willow trees at higher elevations in the reservoir. It is also likely that at least some suitable habitat would be available for flycatchers at the upper end of the reservoir in all years, and the amount of habitat that is always available is likely to increase as sediment accumulates over the next 50 years. By helping maintain vegetation useful as flycatcher habitat, the Optimum Operation Alternative minimizes the long-term effects of periodic inundation by supporting greater average levels of flycatcher production in the Horseshoe reservoir footprint than would occur if the reservoirs were not so operated.

In the next 5 to 10 years, no significant adverse impacts on flycatcher habitat availability are anticipated from operating the reservoirs. Based on 2005 observations at Horseshoe when the reservoir was full in late spring, it is likely that the flycatcher population at Horseshoe will continue to increase and there is sufficient habitat when the reservoir is full to support a larger population. This habitat is likely to remain viable for at least the next 5 to 10 years.

In the long term, the habitat model was used to evaluate the impacts of the Optimum Operation Alternative. Figure IV-2 reflects the estimate of the maximum amount of future occupied habitat determined with the habitat model that could be affected by periodic filling of Horseshoe during the 50-year Permit duration. As shown in Figure IV-2, the maximum amount of flycatcher habitat (450 acres) would be available almost 50 percent of the time, available flycatcher habitat would range from 60 to 450 acres about 20 percent of the time, and the minimum of 59 acres would be available about 30 percent of the time. The average annual amount of flycatcher habitat available would be 260 acres.[30] Conversely, about 190 acres would <u>not</u> be available on average and the maximum amount of unavailable habitat would be about 390 acres. Note that under the Optimum Operation Alternative, the effects of the losses in some years would be significantly minimized by the growth and maintenance of this habitat, in amounts larger than the average under the No Permit Alternative (Subchapter IV.C.1.a).

[30] The "average available (and unavailable) habitat" was calculated as a weighted average amount of predicted flycatcher habitat available over the 113 years of modeling.

Figure IV-2. Average percent time that the predicted maximum amount of habitat is available in early May, Optimum Operation Alternative.



Current tall dense vegetation (138 acres, the sum of 2002 tall dense vegetation acres in Table IV-2) is less than one-third of the maximum predicted at Horseshoe and all of it occurs at the upper elevations of the reservoir bed. It is anticipated to take at least 15 to 20 years for the additional two-thirds of the maximum predicted tall dense vegetation (about 310 acres) to grow at lower elevations in Horseshoe and become occupied by flycatchers, and for the tall mature willows at the upper end of Horseshoe to be replaced with shorter trees. In the meantime, greater amounts of tall dense vegetation will be available in all years and the amount and frequency of unavailable habitat will be less than shown in Figure IV-2.

Summary of Impacts on Flycatcher Habitat. In summary, the Optimum Operation Alternative will result in additional vegetation growth and flycatcher population growth over the long term, with periodic unavailability, modification, or losses of flycatcher habitat occurring over the life of the Permit. As much as 450 acres of flycatcher habitat would be present 50 percent of the time; however, in particular years when the reservoir fills (about 40 percent of the time), up to 390 acres of occupied habitat are anticipated to be unavailable for flycatchers. Given the widely variable levels of estimated impacts from year to year, the beneficial effects of reservoir operations on flycatcher habitat over the life of the Permit, and the need for periodic disturbance to create and sustain suitable flycatcher breeding habitat over the long term, the impacts of the Proposed Action have been quantified in terms of the average annual amount of occupied habitat that would be unavailable at Horseshoe over the life of the Permit. This amount is predicted to be 190 acres, which is rounded up to 200 acres for purposes of this analysis. SRP will implement a number of conservation measures as part of the HCP in order to minimize and mitigate that impact. As part of the minimization and mitigation measures, SRP will acquire 200 acres of off-site riparian habitat to mitigate for the average periodic unavailability of 200 acres at Horseshoe. These measures are described in detail in Subchapter V.C.

It is unlikely that more than an annual average of 200 acres of occupied habitat would be impacted by periodically filling the reservoir over the next 50 years at Horseshoe. However, this is an estimate, and uncertainty remains regarding the actual annual average future impact. Future hydrological conditions, changes in vegetation or population dynamics, or other factors could possibly combine to result in greater average unavailability, modification, or loss of occupied habitat at Horseshoe. Because it is not feasible to accurately estimate the amount of additional occupied habitat that might be impacted above the predicted annual average of 200 acres, adaptive management (discussed further in Subchapter V.C.4) would be employed to address such increases if they occur. However, the additional occupied habitat that would be addressed through adaptive management would be capped at an additional 200 acres in order to provide a finite estimate of maximum incidental take resulting from habitat inundation.[31] Thus, the

[31] Additional occupied habitat would be determined using the same methods used to estimate the maximum predicted impact on habitat, which is based on estimates of the future amount and distribution of occupied tall dense vegetation and frequency of reservoir fills. The estimate of 200 acres of additional occupied habitat is based on twice the maximum predicted average of unavailable habitat.

upper limit of annual average unavailable flycatcher habitat addressed by the HCP is 400 acres (200+200). If the annual average unavailable flycatcher habitat were to exceed 400 acres, a Permit amendment would be necessary.

Flycatchers have occupied habitat along the Verde River below Horseshoe in recent years and riparian habitat below Bartlett may become occupied in the future. However, the Optimum Operation Alternative would not significantly change downstream flows or have significant adverse impacts on the riparian habitat based on studies of the historical effect of the two dams on downstream tall dense vegetation (Section II.A.2 in Appendix 3).

Impacts on Flycatcher Productivity. Over the long term, the Optimum Operation Alternative is expected to result in greater average flycatcher productivity than the No Permit Alternative because flycatcher habitat is predicted to always be present at Horseshoe, more flycatcher habitat would be available on average at Horseshoe, and more habitat would be available at off-site mitigation sites in the short term than is needed for mitigation (see discussion of No Permit Alternative impacts in Subchapter IV.C.1). Periodic reservoir fills are anticipated to reduce flycatcher productivity in years when occupied habitat is inundated, but these impacts will be mitigated through acquisition of riparian habitat at off-site mitigation sites.

Flycatchers depend on riparian areas for carrying out their life cycle. Riparian areas are dynamic systems subject to periodic catastrophic floods and fires that can eliminate significant amounts of habitat. The flycatcher has adapted to these dynamics and flycatcher habitat ultimately requires periodic disturbance and destruction followed by new growth to maintain availability of young trees and the mosaic of floodplain patches. However, periodic unavailability of occupied habitat is anticipated to reduce the productivity of flycatchers at Horseshoe in those years when occupied habitat is inundated. The temporary unavailability of occupied habitat is likely to result in site abandonment or delayed breeding by some flycatchers, or reduced productivity (if birds are displaced from nest sites). Some flycatchers may successfully relocate to other areas of suitable breeding habitat, but some flycatchers are likely to be harassed or harmed because searching for alternative nesting sites can lead to a loss of breeding opportunities or reduced productivity and places individuals at increased risk of mortality from competition, starvation, or predation. Also, the degree to which Horseshoe flycatchers would disperse to other areas on the Verde, Gila, San Pedro, or other rivers is difficult to predict, although banding studies have documented movement among these sites (FWS 2002a; Newell et al. 2005). The result would be reduced recruitment and reproduction in some years.

Summary of Impacts on Flycatcher Productivity. In summary, periodic inundation of Horseshoe flycatcher habitat, resulting in habitat unavailability, modification, or loss, would likely result in delayed or lost breeding attempts, decreased productivity and survivorship of dispersing adults in search of suitable breeding habitat, decreased productivity of adults that attempt to breed at Horseshoe, and the loss of eggs or nestlings. However, future variability in reservoir hydrology, extent of habitat availability, breeding site density, and reproductive success after dispersal result in an uncertain amount of take of individual flycatchers from a particular refill event and the

multiple refill events during the life of the Permit. For this reason, conservative estimates of impacts on occupied flycatcher habitat were used for purposes of this HCP.

If the density at Horseshoe increased to levels observed at Roosevelt, which were about 1 bird per 2 acres (SRP 2002), about 195 birds could occupy the 390 acres of maximum predicted occupied habitat at Horseshoe that would be unavailable due to a complete fill of the reservoir. More likely, the number of birds occupying a given amount of tall dense vegetation will vary over time and on average be less than the high density recently observed at Roosevelt because the habitat will likely be dominated by willow in narrow linear patches in Horseshoe rather than the extensive stands of tamarisk at Roosevelt, which have supported exponential growth of flycatchers and high peak densities. Similarly, the amount of occupied habitat affected by higher reservoir levels would vary from a few acres to most of the occupied acres depending on the extent of riparian habitat that has developed and is occupied, the height and elevation within the reservoir of the occupied habitat, and the degree and duration of fill in a particular year. Based on historical hydrology, the predicted frequency of inundation resulting in effects to some amount of occupied flycatcher habitat and flycatcher productivity in the long term would average about one out of every two years.[32] In the short term, predicted effects during the initial Permit period of 10 to 15 years are expected to be lower than the maximum possible levels because reservoir operations are not likely to significantly impact flycatcher productivity at Horseshoe (i.e., impact existing tall dense vegetation). As observed in 2005, partial inundation of occupied habitat would have negligible impacts to flycatcher habitat and reproductive success (Dockens and Ashbeck 2005). It is expected that in many years, as trees establish, grow, and become occupied, depending on location in the reservoir, partial inundation would not impact habitat or nesting birds. If circumstances change and occupied habitat doubles, up to another 195 birds (390 total) could be present at a density of 1 bird per 2 acres of habitat.

Minimization and Mitigation. The impacts of the Optimum Operation Alternative on flycatcher productivity described above will be offset by the minimization and mitigation measures set forth in Subchapter V.C. Acquisition of off-site mitigation habitat may provide sites for Horseshoe flycatcher relocation during periods of full reservoir levels. However, the primary purpose of off-site mitigation is to provide additional habitat for flycatcher populations to expand to offset any take of the species from Horseshoe and Bartlett operations.

c) Impacts on Flycatcher Critical Habitat

Critical habitat for the flycatcher was recently designated along several segments of the Verde River in the vicinity of Horseshoe and Bartlett (70 FR 60886; October 19, 2005). One segment is a 4-mile reach located immediately below Horseshoe. Another segment is a 23-mile reach from the upper end of Horseshoe upstream to the confluence with the East Verde River. Two other segments are located farther upstream in the Verde Valley.

[32] The average frequency of complete and partial fills is based on historical inflows with the current reservoir system and demand (see Figure I-2; and Figure 3 in Appendix 5).

The Optimum Operation Alternative will not adversely impact any of the designated critical habitat along the Verde River. Horseshoe operations do not affect riparian habitat upstream of the reservoir. With respect to the segment of critical habitat below Horseshoe, reservoir operations are not expected to significantly impact riparian habitat downstream from the dams (Subchapter III.B.4.e; Section II.A.2 of Appendix 3). Specifically, the Optimum Operation Alternative would not significantly impact the physical and biological features essential to the conservation of the flycatcher (i.e., primary constituent elements or PCEs). The PCEs protected in the critical habitat designation rule (FR 70: 60912; October 19, 2005) include: 1) riparian habitat in a dynamic successional riverine environment with suitable woody plant species composition, foliage density, canopy cover, and surrounding habitat mosaic with water or short stature vegetation; and 2) a variety of insect prey populations. The Modified Historical Operation and proposed Optimum Operation alternatives are anticipated to have an insignificant impact on the duration of inundation and sediment mobilization on the floodplain (Appendix 3, Section II.A.2.b, citing MEI 2003, Section B.3). Thus, there would not be significant adverse impacts to the flooding/disturbance regime, which is key to supporting a "dynamic successional riverine environment" that in turn creates and maintains the essential habitat characteristics to conserve flycatchers. This conclusion is supported by the research results of Stromberg et al. (2007; summarized in Subchapter III.B.4.e) who found that the floodplain and riparian habitat is dynamic below the dams, and woody plant species composition and structure was similar above and below the dams (willow, cottonwood, and tamarisk were recruiting and forming new patches over time). Thus, no significant impacts to woody plant species composition, vegetation density, canopy cover and vegetation structure, or patch mosaic are anticipated due to future operations. This dynamism, and the associated vegetation community and flows, also supports the insect food base essential to the conservation of the flycatcher; thus, no measurable impacts to the insect community is anticipated.

In the future, if additional critical habitat is designated in Horseshoe or below the dams, the HCP's minimization and mitigation measures will have addressed the effects of Horseshoe and Bartlett operations on that habitat, if any.

2. Impacts on Bald Eagles

This subchapter begins with the approach used for the impact analysis of the Optimum Operation Alternative for Horseshoe and Bartlett on bald eagles. Background for the analysis of impacts on bald eagles is provided and the potential impacts of reservoir operations on bald eagles and their habitat are described.

a) Approach and Background

The analysis of the impact of future reservoir operations on bald eagles at Horseshoe and Bartlett focuses on nesting and perching habitat, and also addresses the impacts on the forage base. Continued operation of Horseshoe and Bartlett by SRP might involve inundation of nesting habitat used by bald eagles because inundation of bald eagle nests occurred at Horseshoe in 1979, 1980, 1982, 1986, and 1991 (FWS 2003a), and may occur in the future due to large inflow events or efforts to fill the reservoir to maintain riparian habitat. Although, these specific nest trees and artificial nesting structures may no longer be present in the reservoir (Id.), bald eagles could nest in trees that develop in the future.

As discussed below, the small impact of future operations on native fish community composition, abundance, and distribution is not expected to alter the available forage base for the bald eagles.

Bald eagle breeding areas, wintering areas, and foraging areas (both winter and summer) might vary with environmental conditions such as prey availability, nest site suitability, interspecific competition, human disturbance, and other factors. These environmental conditions may vary in the Action Area regardless of lake levels and operation. A key factor to bald eagle nest success and productivity is prey quantity, quality, and availability. Native and nonnative fish are a large component of the bald eagle forage base in the Action Area. Hunt et al. (1992) noted the importance of temporal sequencing of prey availability – abundant and accessible prey needs to be available throughout the breeding season to sustain adults and nestlings. From February to late April, Sonora and desert suckers spawn in shallow water, especially in the upstream ends of riffles, and are an important resource for some bald eagles especially those foraging along rivers, whereas other important prey species (e.g., carp and channel catfish) may become available as prey during other times of the bald eagle nesting cycle. Thus, Hunt et al. (1992) suggested maintaining a diverse fish community to support prey availability over the entire bald eagle breeding cycle. They recommended that managers work to support a high abundance of at least two of the following species to maintain bald eagle habitat and a diverse forage base: carp, native suckers, catfish, or perciforms (in reservoirs).

The primary change in reservoir fluctuations due to the Optimum Operation Alternative that might impact bald eagles will be a higher elevation of Horseshoe reservoir level in the winter and early spring in a few years (Figure 3 in Appendix 5). The fluctuation of reservoir levels over the past 60 years, during the period of time in which all of the SRP reservoirs on the Salt and Verde rivers have been in use, is shown in Figure I-2. The best available data (Hunt et al. 1992; Driscoll et al. 2006, and data presented and summarized in Subchapter III.A.1.b) do not indicate a clear, definitive relationship between bald eagle nest success for breeding areas near Bartlett and Horseshoe with reservoir water levels or that storage levels influence the fish community composition to the degree that would significantly impact their forage base.

The Optimum Operation Alternative at Horseshoe will impact carp reproduction the least due to the timing of their spawn, bass and sunfish reproduction and recruitment will be reduced due to fluctuating reservoir levels, and catfish that spawn in summer will be reduced because the reservoir will be at its lowest levels (Committee Report 2006; Robinson 2007). Overall, minimizing carry-over storage between years will reduce recruitment of all species at Horseshoe. However, all species have self-sustaining populations in the river and fish can freely enter or exit Horseshoe or pass downstream. During winter and spring, carp will continue to be available at Horseshoe, some nonnative species (e.g., bass, sunfish, catfish) will likely be reduced due to future operations, while native species will benefit (less predation and competition by nonnative fish and increased stocking); therefore, overall prey availability for eagles will not be adversely impacted. No change in fish community composition is expected between the reservoirs – the density and composition of fish that have been available in the past are

expected to be available in the future. No operational change will be made at Bartlett. Bartlett is managed as a sportfishery by AGFD and bald eagles have successfully nested and utilized those fish species in the past (Subchapter III.A.1.b). The influences of Bartlett and releases on the downstream fish community are described in detail below, but in general, as noted in Chapter III, releases have had both positive and negative influences on the downstream fish community, and those influences are expected to continue. The current populations of native suckers, as well as other prey species, are high in this reach; the bald eagle population has expanded in recent years, and have had high success. The Optimum Operation Alternative maintains the flow regime that supports these conditions (see "Impacts on Prey Availability due to Bartlett Releases" below). The impacts of nonnative fish produced in Bartlett that could move downstream and prey or compete with individual covered fish, or the future influence of the flow regime (either positive or negative) will be small and is not expected to significantly impact the current amount, or spatial and temporal availability of important bald eagle prey species (e.g., native suckers, catfish, and carp).

Although individual bald eagle breeding areas, wintering areas, and foraging areas may change seasonally and annually depending on a complex variety of environmental and ecological influences including fluctuating reservoir levels, the overall health and fitness of bald eagles near Horseshoe and Bartlett are not expected to be significantly impacted by the proposed operation of the reservoirs (see discussion below). No bald eagles currently nest in trees in the conservation pool of either reservoir, thus no bald eagle nests will be directly impacted (i.e., inundation) by operations. Provisions under adaptive management (Subchapter V.C.4) address potential impacts to bald eagles if a nest is built in trees within either reservoir.

The discussion of the approach used in the analysis of impacts from reservoir operations begins with an analysis of the existing habitat used by bald eagles at and near Horseshoe and Bartlett, and along the Verde River. The approach relies on information with respect to direct impacts on bald eagles and the future availability of nesting and perching habitat in Horseshoe. Finally, as described below, the impact of future operations on available prey for bald eagles was analyzed, including an assessment of the current conditions in the Action Area, use of various prey types by bald eagles, importance of native fish as prey, and the expected impacts of future operations on the fish community (both native and nonnative).

Existing Bald Eagle Habitat. Currently, and for the past 17 years, bald eagles have not nested in riparian trees or snags in Horseshoe or Bartlett conservation pools (Subchapter III.A.1.b). The bald eagles in the Horseshoe, Yellow Cliffs, and Bartlett breeding areas utilize the two reservoirs for foraging, and occasionally perch in cottonwood and willow trees at the upper end of Horseshoe and along the Verde River below Horseshoe and Bartlett. The breeding areas along the lower Verde River have nests in mature cottonwood or sycamore trees.

Recent vegetation mapping and changes in vegetation are described in Subchapter III.B.4. The most important vegetation types for bald eagles along the lower Verde River are cottonwood, willow, and mixed riparian because mature cottonwood and willow trees are used as nesting and perching sites by bald eagles. The mature willows at the upper

end of Horseshoe, which are occasionally used by bald eagles for perching, have a base elevation of about 1,995 to 2,025 feet (Table IV-2 and Figure III-24). These trees have been growing in Horseshoe for more than a decade and high lake levels do not appear to adversely impact their suitability for use by bald eagles. As noted above, for the past 17 years, no bald eagles have nested in trees in the conservation pool of either reservoir, thus no bald eagle nests will be directly impacted (i.e., inundation) by operations. Provisions under adaptive management (Subchapter V.C.4) address potential impacts to the bald eagle if a nest is built in trees within either reservoir. Because no nesting has occurred within the reservoir in nearly two decades, the likelihood of future nesting is difficult to predict. Under the Optimum Operation Alternative, possibly up to 5 nests may be built below the high water mark over the term of the 50-year permit and be impacted by the proposed operations based on the following data:

- The frequency of past nest inundation not including inundation of artificial nest structures (i.e., 3 in 30 years; Subchapter III.A.1.b.8);
- The rapid drawdown that would lower water levels on average prior to the bald eagle fledging period;
- The low frequency of periodically holding water higher in the spring to wet flycatcher and cuckoo habitat in the upper portions of Horseshoe (1:13 years) followed by rapid drawdown after such wetting, which minimizes the likelihood that an eagle nest would be inundated by water during the fledging period; and
- The success rate of past rescue attempts (Subchapter III.A.1.b.8).

Thus, inundation due to the proposed operation and subsequent implementation of the adaptive management measures to rescue and foster eggs or nestlings (Subchapter IV.C.4.d) could impact up to 10 eggs, nestlings, or fledges associated with 5 bald eagle nests.

As discussed in Subchapter III.B.4 and Appendix 3, Horseshoe, Bartlett, and the Verde River below the dams continue to be dynamic systems characterized by cycles of high and low flows that periodically inundate and deposit sediment on the floodplain, scour vegetation along the stream, and maintain relatively high ground water levels. As a result, these flow cycles create and maintain riparian vegetation, including cottonwood and willow trees, some of which are used as nesting and perching habitat by bald eagles.

Impacts Due to Production of Nonnative Fish. Hunt et al. (1992) specifically studied the influence of reservoirs and regulated flows produced by the construction and operation of water projects on nesting bald eagles in Arizona. They concluded, "[O]verall, reservoirs, dams, or regulated river reaches do not appear to have a negative affect on bald eagle reproduction." They found that the difference in reproductive rates between altered and unaltered habitats was not statistically significant. They also specifically tested if reservoir levels (i.e., operations) influenced bald eagle productivity and found no significant statistical relationships (Subchapter III.A.1.b). They further suggested that management strategies to support bald eagle habitat should include "two or more of the following fish taxa occurring in substantial numbers: carp, suckers, catfish, and perciforms (in reservoirs)." Driscoll et al. (2006) notes that prey availability strongly

influences bald eagle productivity and points to data collected from the upper Salt River where a sharp decline of native fish (suckers and roundtail chub), likely caused by a sharp increase of predatory flathead catfish, which overlapped a steep decline in bald eagle productivity. The Conservation Assessment and Strategy for the Bald Eagle in Arizona (Driscoll et al. 2006), which summarizes the best available and most current conservation information, concluded that maintaining a diversity of fish species (native and/or nonnative) benefits bald eagle productivity and enhances survivorship. They also explained that nonnative fish in some river and reservoir systems may have replaced native fish in the diet of bald eagles (Driscoll et al. 2006). The influence of Horseshoe and Bartlett operations on specific bald eagle breeding areas is described below.

As discussed in Subchapter III.A.1.b, the success of the East Verde, Coldwater, Ladders, and other breeding areas located upstream of Horseshoe do not show a relationship with past Horseshoe storage levels. Any influence on the fish community due to reservoir operations is small relative to the self-sustaining nonnative fish populations in the river. The Optimum Operation Alternative will reduce the nonnative fish produced in the reservoir as compared to the Modified Historical Operation Alternative, and thus reduce potential predation and competition on native fish including suckers. Hunt et al. (1992) reported that East Verde and Ladders nesting pairs utilized native and nonnative fish species, as well as other prey items. No specific foraging data is available for the Coldwater breeding area, but the pair likely utilized both native and nonnative species. Based on these data, shifts in the fish community (native vs. nonnative species) due to future operations of the reservoir and mitigation efforts (stocking of native species) are not expected to adversely impact (i.e., reduce) the overall prey abundance for bald eagles in the Action Area.

Hunt et al. (1992) presented little information concerning the foraging ecology of the Table Mountain breeding area located upstream of Horseshoe, and no additional foraging or feeding specific data has been published since their report. It is assumed that these bald eagles utilized both native and nonnative fish species. The Table Mountain breeding area has had low success in recent years, but the cause of the low success is not known (Subchapter III.A.1.b.8); declines in the native sucker population or other confounding factors (e.g., drought) may be responsible. No clear relationship between Horseshoe storage and bald eagle success is evident based on historical data (Subchapter III.A.1.b.8). Hunt et al. (1992) concluded that water levels were not related to bald eagle productivity and fish sampling also showed that populations in the river responded independently of reservoir operations (Subchapter III.A.1.b). AGFD (Duffy 2005; Gill 2006) suggested that a number of factors, such as 2005 flood flows, changes in sampling techniques, or impacts of recent fires in the watershed, could be responsible for the variation in species composition or relative abundances. The fish sampling data show that the nonnative and native species have populations in the river, which are sustained by in-river spawning and recruitment, and are not significantly influenced by lake spawning species that move from the reservoir (Subchapter III.A.1.b). Operations of Horseshoe influence the fish community at the reservoir, some fish produced in the reservoir may move up or downstream, and the fish that leave the reservoir can compete or prey on native fish species, such as sucker, that are important to bald eagles. The Optimum Operation Alternative reduces the nonnative fish produced, which minimizes

future impacts to native fish and allows for improved reproduction and recruitment of covered fish. Loss of nonnative fish that could be utilized by bald eagles as forage would be small relative to the overall large self-sustaining populations in the river. The nonnative fish produced in the reservoir (especially carp) that do emigrate from the reservoir, and compete and prey on individual native fish, may replace those natives that would otherwise be available for foraging bald eagles (Driscoll et al. 2006). For these reasons, no significant impacts to the Table Mountain breeding pair are expected.

The Horseshoe breeding area has had moderate success since it was discovered. Hunt et al. (1992) reported the bald eagles foraging in the mainstem and reservoir were taking nonnative fish and native suckers. While reservoir storage does influence the fish community composition in the reservoir (Robinson 2007), and some fish from the reservoir are likely moving up or downstream (Committee 2006), the changes do not measurably impact the reproductive success of bald eagle in relation to prey availability (see above discussion of Table Mountain breeding area). When the reservoir is held high for extended periods, perciforms and carp become abundant, whereas when the lake is low or storage is minimized, carp dominate the fish community (Committee 2006). Figure III-13 shows that bald eagle success varied independently of storage elevation in the past – in years when the reservoir was high, the Horseshoe bald eagles were both successful and unsuccessful, and in other years when storage was near zero, the bald eagles were both successful and unsuccessful. Thus, local changes to the fish community due to future operations are not expected to significantly limit prey availability for the Horseshoe bald eagle pair; a diverse and abundant fish community will continue to be present in the future, as recommended by Hunt et al. (1992) and Driscoll et al. (2006). Thus, prey-related impacts to bald eagles due to operations are expected to be insignificant. However, in past years, storage has had direct impacts on bald eagle nest success through nest tree inundation and subsequent tree fall; these impacts were discussed above (see "Existing Bald Eagle Habitat").

The Cliff breeding area between the reservoirs has had low productivity and nest success since it was discovered in the 1980s. FWS questioned whether changes in the fish community were the cause of the lower productivity. The Cliff nest foraging area has been dominated by, and managed by, the AGFD for nonnative sport fish since creation of the reservoirs (AGFD 1954; Committee Report 2006). Thus, since the bald eagle territory was found (1984), few native suckers have likely been present in this reach and their low abundance is part of the environmental baseline conditions. Hunt et al. (1992) noted that carp were a major prey item for the bald eagle and were available throughout the breeding season in this reach. Based on their research and the research of others, Hunt et al. (1992) concluded that prey quantity, quality, or spatial or temporal availability did not appear to be a limiting factor in Cliff bald eagle reproduction. Instead, they noted that the area receives very high recreational use, which could be the cause of many of the nest failures. Hunt et al. (1992) hypothesized that the warm water releases favor nonnative fish species, but no specific research has been conducted to test this or the other confounding factors – such sport fisheries management and past stocking in both lakes, which maintain high nonnative fish abundance and likely reduced native populations to very low levels since the reservoirs were constructed. Because of the current predominance of nonnative species in the river below Horseshoe, and the

management emphasis of AGFD to maintain sportfish in Bartlett and in this reach of the river, future operations are expected to have little impact on the fish community composition (Committee 2006). Based on the expected very low impact of future operations on the downstream fish community and the Hunt et al. (1992) summary of reported causes of failure at the Cliff breeding area, no impacts to the forage base for bald eagles are anticipated.

Similarly, the Yellow Cliffs breeding area, which utilizes a portion of the river between the reservoirs, will not be impacted for the same reasons as described above for the Cliff breeding area. Because the Bartlett bald eagle pair has had relatively high success (Subchapter III.A.1.b.8), prey availability does not appear to be a factor limiting nest success. Thus, no changes will be made to Bartlett operations and no impact on the bald eagle forage base is expected.

Impacts on Prey Availability Due to Bartlett Releases. The relationship between the influence of Bartlett releases (i.e., downstream hydrograph) and future native/nonnative fish abundance and distribution is unclear (Committee 2006). FWS (1980) found that habitat carrying capacity for both native and nonnative fish would be enhanced by maintaining a minimum continuous flow below Bartlett, but the abundance of some nonnative fish (e.g., carp and red shiner) could be reduced with minimum flows below 150 cfs. Hunt et al. (1992) hypothesized that relationships among temperature of water releases, periods of low or no flow, and sucker spawning habits and physiology could influence prey species availability for bald eagles and recommended further study. Hunt et al. (1992) suggested that the cool summer water releases from the hypolimnion layer within a reservoir (e.g., Bartlett) may favor the sucker population, whereas warm water (or water temperature near ambient air temperature), such as those released from Horseshoe, would favor nonnative species. More recent studies by Bonar et al. (2004) found a high abundance of adult and larval Sonora and desert suckers below Bartlett, and they suggested that the hydrological mechanisms (e.g., flood flow magnitude, timing, and duration) supported recruitment and population maintenance of these two native fish. However, these same studies also hypothesized, based on research by Bryan and Robinson (2000), that warm water temperatures in the lower reach caused some native species (e.g., native suckers and roundtail chub) to emigrate from the Salt River and concentrate in the reach below the dam. Bonar et al. (2004) also found the highest densities of carp in this reach compared to the other three reaches studied, suggesting that the FWS (1980) conclusions for the species may not be accurate. Bonar et al. (2004) further concluded that managers should focus on controlling nonnative predatory fish (e.g., largemouth bass) in the reach because they observed the highest amount of nonnative predation on native species in this reach, and they recommended the continued study of hydrology-species relationships.

The most recent research by Bryan and Hyatt (2004) showed a declining population of roundtail chub below Bartlett and suggested that lack of flood flows may be the cause. However, Bryan and Robinson (2000) and Brouder (2001) found similar age-class structure of roundtail chub in the upper Verde River compared to the lower Verde River. Similarity in population structure would suggest that both upper and lower Verde River roundtail chub populations are responding to a common environmental condition

(possibly large-scale flood events). As Bonar et al. (2004) noted, "the lower Verde River winter-spring flows from Bartlett have mimicked natural flooding, which may trigger spawning by native fishes and provide more spawning and rearing habitat for native fishes during the spring and summer (Bryan et al. 2000)." This conclusion, explained by low storage-to-runoff ratio for these reservoirs, was also reached by Stromberg et al. (2007) in their study of vegetation responses to flow alteration on the lower Verde River. This suggests that flow alteration below Bartlett has not significantly reduced the frequency of roundtail chub recruitment events, and that the recent population decline below Bartlett may reflect a broader Verde River basin (e.g., there were no large-scale flooding events in the few years prior to the fish studies) or statewide trend, which is exacerbated in some areas by other stressors (i.e., high abundance of nonnative fish). Evidence of high native sucker recruitment by Bonar et al. (2004) and Cantrell (pers. comm. 2007) in the lower Verde River also suggests that current releases and flood frequencies are not negatively impacting the sucker populations.

Low flows are also important and can influence the fish community. Current data suggest that native sucker populations are abundant below Bartlett and recruitment events continue to occur. Rinne et al. (1998) concluded that nonnative fish have responded favorably to a further stabilized hydrograph. However, these nonnative species are also utilized and considered important food resources and part of the diverse prey base for eagles (Hunt et al. 1992; Driscoll et al. 2006). Although the minimum flow releases have been in place for 12 years (instituted in 1994)[33] and native suckers are long-lived, a delayed response by suckers to this flow regime could occur in the future. The best available data (Bonar et al. 2004) suggests that there is high abundance, reproduction, and recruitment of suckers within this reach of the river, and the eagles seemed to have had a positive response to this abundant food resource as new breeding areas have been established and success has been high since 1995, thus no significant impacts to eagle prey base are anticipated due to Optimum Operations.

Based on these data, the proposed operations (Optimum Operation Alternative) of Bartlett (i.e., no change from recent historical operations) are expected to continue to support the current fish community composition and prey base for bald eagles in the future. There is a small increase in predation and competition on covered native fish by nonnative fish produced in the reservoirs that move downstream, but no measurable impacts on bald eagle forage base or productivity are expected because these impacts will not appreciably change community composition (i.e., diversity of the fish population) or the spatial and temporal abundance or distribution of individual species (e.g., Sonora and desert suckers). As Driscoll et al. (2006) explained, nonnative fish in some river and reservoir systems have replaced native fish in the diet of bald eagles. Further, there are indirect benefits to bald eagles and their prey base due to the implementation of covered fish proposed conservation measures, which include rearing and stocking native fish and

[33] See Subchapter I.F.4. The minimum 100 cfs flow was instituted under agreement between SRP and Fort McDowell Indian Community to maintain fish habitat and riparian vegetation along the Verde River below Bartlett Reservoir. The 100 cfs flow approximates the historic base flow conditions in this reach of the Verde River.

watershed improvement in the Action Area (Subchapter V.D). Although the native fish population in this reach is still strong, it also has the highest amount of nonnative predation. Also, given the multiple factors influencing this fish community (e.g., sportfish management, development, grazing, recreation impacts, and tribal fishery and land use policies), predicting the long-term sustainability of the populations is difficult. However, the impact on the fishery in the future due to the Optimum Operation Alternative, independent of the other land uses and policies, is not anticipated to significantly impact the forage base for bald eagles.

Overall, bald eagles in the Action Area utilize a variety of prey, including native fish (primarily native suckers), nonnative fish (primarily carp, catfish, and bass), and small mammals and birds (Hunt et al. 1992). The proposed Optimum Operation Alternative will reduce the recruitment of nonnative fish produced in Horseshoe, which could prey on or compete with native fishes (including existing populations of native suckers) in the Action Area. The abundance and distribution of carp and catfish (important prey items for bald eagles) is not expected to appreciably change due to reservoir operations because the species have self-sustaining populations throughout the Action Area (Committee 2006). The existing self-sustaining fish populations, coupled with the proposed conservation measures, will maintain or increase the diversity of fish species, which will maintain or improve SRP's portion of the impacts (i.e., the influence of future operation of the reservoirs) on the fish community in the Action Area. Thus, the fish component of the forage base for bald eagles within the Action Area will not be significantly impacted by the nonnative fish produced in the reservoirs due to future operations, and prey availability could be improved through the expected increase of native fishes that would be available in the future due to the conservation measures. Fish monitoring will be conducted to assess the effectiveness of the native fish minimization and mitigation measures (Subchapter V.D). Through this monitoring, native fish and nonnative fish populations will be assessed in the Action Area (including upstream of Horseshoe and downstream of Bartlett), and this data can be used by FWS and AGFD to guide native fish stocking efforts and adaptive management measures, and/or fisheries management decisions outside of the scope of this HCP.

b) Summary of Impacts on Bald Eagles

As mentioned above, the anticipated impact of continued reservoir operations under the Optimum Operation Alternative is unlikely to involve direct take of bald eagles, loss of available nesting and perching habitat, or significant change in the forage base for bald eagles. Bald eagles may receive indirect benefits from implementation of covered native fish conservation measures, which include rearing and stocking native fish (including Sonora and desert sucker, if necessary), and improved watershed conditions in the Action Area, as determined by monitoring and adaptive management.

However, if one or more pairs of bald eagles moved their nests into the active conservation space of the reservoirs below the high water mark, inundation of the nests could occur. If circumstances change and there is potential impact on bald eagle habitat and resulting take of bald eagles from Horseshoe and Bartlett operations, SRP will implement the adaptive management measures described in Subchapter V.C.4. Based on the information described above, up to 10 bald eagle eggs, nestlings, or fledges associated

with 5 nests may be taken due to inundation and subsequent rescue efforts. The minimization and mitigation measures for native fish in the HCP provide indirect benefits to the bald eagle forage base (Subchapter V.D.2). As part of those native fish measures, and in coordination with AGFD and SRP, FWS may prioritize species for hatchery production and the location for stocking at the annual HCP implementation meeting. FWS may identify that HCP funding be used for Sonora and desert sucker propagation at the Bubbling Ponds Hatchery and that those fish be stocked within the Action Area consistent with Subchapter V.D.2.

Critical habitat is not currently proposed or designated for bald eagles. If such habitat is designated in the future, SRP believes that the HCP will have fully mitigated any impacts of Horseshoe and Bartlett operations on this habitat because the Optimum Operation Alternative increases and maintains the amount of tall dense vegetation available for bald eagle nesting and perching, and minimizes and mitigates impacts to covered fish species, which are potential prey for the bald eagle.

3. Impacts on Cuckoos

This subchapter describes the approach used for the impact analysis, followed by the effect of the Optimum Operation Alternative on cuckoos and their habitat.

a) Approach and Background

As with flycatchers, the method of quantifying impacts solely in terms of effects on habitat is being used in this analysis because reservoir operations modify habitat and the direct loss of cuckoos at Horseshoe and Bartlett is difficult to estimate (FWS 1996).

Little information is available that specifically defines use of Horseshoe and Bartlett riparian habitat by cuckoos (Subchapter III.A.1.c). However, cuckoos have been consistently observed in the same patches of tall dense vegetation at Horseshoe as flycatchers (EEC 2004; Spencer 2003 unpublished data). Therefore, the same estimates of habitat in Horseshoe currently occupied by flycatchers are used for cuckoos to estimate the impacts of reservoir operations. As with flycatchers and bald eagles, the Optimum Operation Alternative is not expected to significantly adversely affect cuckoo habitat along the Verde River between Horseshoe and Bartlett or below.

b) Summary of Impacts on Cuckoos

As with flycatchers (Subchapter IV.B.1.b), the amount of incidental take of cuckoos likely to result from the Optimum Operation Alternative is uncertain. Thus, the potential incidental take that could occur is addressed below in terms of unavailability, modification, or loss of occupied habitat.

As described in Subchapter IV.B.1.b, the average annual amount of flycatcher habitat impacted by reservoir operations is expected to be 200 acres. Variations in hydrological conditions, uncertainties in the current and future quantity of occupied habitat, and changes in population and vegetation dynamics could combine to result in greater quantities of occupied habitat at Horseshoe and Bartlett than the predicted average level of 200 acres (Subchapter IV.B.1.b). Because it is not possible to estimate the amount of occupied habitat that might be impacted above the predicted average level, adaptive management (discussed further in Chapter V.C.4) will be employed to address such

increases if they occur. The additional occupied habitat to be addressed through adaptive management is 200 acres based on the average annual amount of tall dense vegetation that may be impacted by Horseshoe operations over the duration of the Permit (Subchapter IV.B.1.b). In total, the upper limit of occupied cuckoo habitat at Horseshoe and Bartlett addressed by the HCP is 400 acres (200+200). If future occupied habitat that is periodically impacted by reservoir operations exceeds 400 acres, a Permit amendment would be required.

Minimization and mitigation measures for cuckoo habitat are described in Subchapter V.C.

Impacts on Cuckoo Productivity. As discussed for flycatchers in Subchapter IV.B.1.b, periodic unavailability, modification, or loss of cuckoo habitat from inundation likely would result in delayed or lost breeding attempts, decreased productivity and survivorship of adults that disperse, and decreased productivity at Horseshoe. Estimates of periodic lost productivity for cuckoos at Horseshoe are difficult to derive because little is known about the population. However, for purposes of the HCP, assuming an average territory size of about 50 acres based on the reported range of 10 to 100 acres in the literature (Subchapter III.A.1.c), about 4 pairs could occupy the average predicted occupied habitat of 200 acres affected by inundation. If occupied habitat increased to 400 acres and the territory size is 50 acres, about 8 pairs could be impacted.

Impacts of Future Critical Habitat. Critical habitat is not currently proposed or designated for cuckoos. In SRP's view, if such habitat is designated in the future, the HCP will have addressed any impacts of Horseshoe and Bartlett operations on this habitat because of the habitat-based approach used in this HCP.

4. Impacts on Native Fish

a) Approach and Background

The effects of future operations of Horseshoe and Bartlett on native fish populations over the proposed 50-year Permit period require analysis of numerous complex and interacting ecological factors. The analysis is confounded by anthropogenic influences on the Verde River such as past and current land uses, water uses, intentional and accidental introduction of nonnative fish species, past and current AGFD fisheries management, reservoir construction and operations, and other activities in the watershed. A Fish and Watershed Committee (Committee) was established to cooperatively conduct the analysis. The Committee was comprised of biologists and scientists representing FWS, AGFD, Arizona Department of Water Resources, and SRP. The information in the Committee's report was obtained from an extensive review of existing literature, agency reports, state and federal databases, and discussions with local and nationally recognized experts (Committee 2006).[34] This Subchapter IV.B.4 reflects a summary of the Committee's approach, methods, and findings of impacts.

Action Area. To identify anticipated impacts, the Action Area for native fish was defined to include all areas potentially impacted directly or indirectly by the operations of

[34] The Committee (2006) report is a primary support document for this analysis, and can be found online at <http://www.fws.gov/southwest/es/arizona/HCPs.htm>.

Horseshoe and Bartlett reservoirs. The limits of effects from reservoir operations were defined by physical impediments to fish movement (dams, diversions, ephemeral reaches of streams), the relative suitability of the habitat for warm water reservoir species, and movement data for the nonnative fish and their progeny likely to be enhanced by continued reservoir operations. The Action Area was determined to be the mainstem Verde River from Granite Reef Dam just below the confluence with the Salt River upstream to the Allen Ditch Diversion/Tunnel at Peck's Lake near Clarkdale (Figure IV-3). Granite Reef was considered the lower boundary because the entire river is normally diverted at that point and because of the factors described in Subchapter IV.A.1. The Allen Ditch Diversion was the upper boundary because it is a semipermanent diversion across the river that serves as a barrier to upstream fish movement. The lower 0.125 mile of all intermittent and ephemeral streams and washes tributary to the mainstem reach of the Verde River also is included in the impact analysis. Portions of six Verde River tributaries are included in the Action Area: Lime Creek, East Verde River, Fossil Creek, West Clear Creek, Wet Beaver Creek, and Oak Creek (Figure IV-3). The Verde River and its tributaries in the Action Area was subdivided into reaches for analysis as shown on Figure IV-3 and listed in Table IV-3.

Figure IV-3. Action Area for consideration of fish impacts.

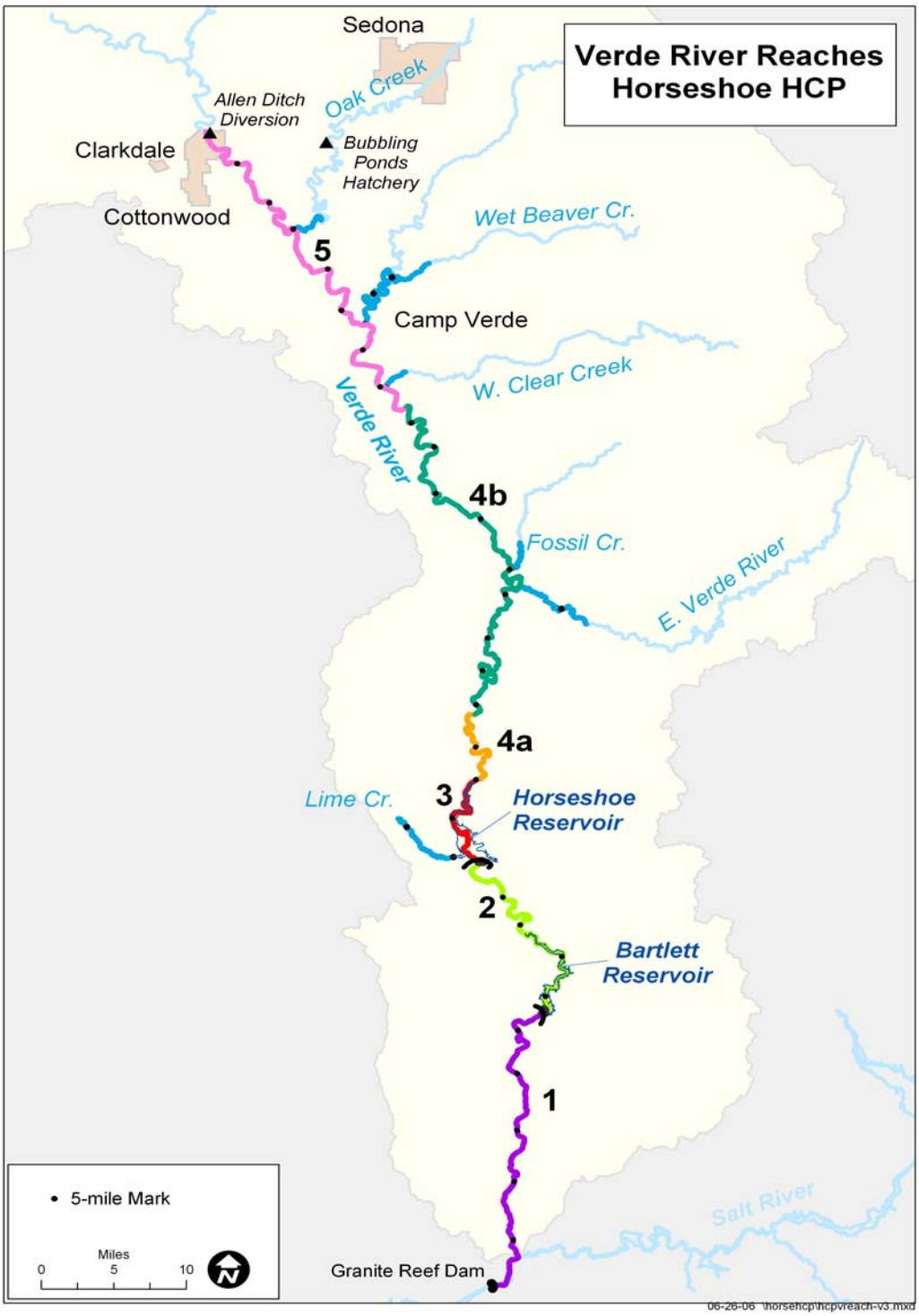


Table IV-3. Stream reaches in the Action Area.

Reach	Endpoints	Distance (River Miles)
Reach 1	Granite Reef to Bartlett Dam	28 miles
Reach 2	Bartlett Dam to Horseshoe Dam	21 miles
Reach 3	Horseshoe Dam to the top elevation of Horseshoe	10 miles
	Lime Creek	6 miles
Reach 4a	Top elevation of Horseshoe to 8 miles upstream	8 miles
Reach 4b	8 miles upstream of Horseshoe to the upstream end of Wild and Scenic River section (near Beasley Flats)	44 miles
	East Verde River	8 miles
	Fossil Creek	3 miles
Reach 5	Upstream end of Wild and Scenic River section to the Allen Ditch Diversion at Clarkdale	38 miles
	West Clear Creek	2 miles
	Wet Beaver Creek	12 miles
	Oak Creek	3 miles

Covered Fish Species. Covered species and their potential habitat by river reach are summarized in Table IV-4. The Committee determined that the impacts of reservoir operations would be similar among all covered native fish species based on life history information; thus, the Committee lumped all native species together to determine the impacts of reservoir operations.

Table IV-4. Native fish species and associated potential habitat in the Action Area.

Species	Reach 1	Reach 2	Reach 3	Reach 4a	Reach 4b	Reach 5	Trib. (Lime)	Trib. (Others)
Razorback sucker	X	X	CH*	CH*	CH*	X		X
Colorado pikeminnow	X	X	X	X	X	X		X
Spikedace				X	X	X		X
Loach minnow				X	X	X		X
Gila topminnow							X	
Roundtail chub	X	X		X	X	X		X
Desert and Sonora sucker	X	X		X	X	X		X
Speckled dace					X	X		X
Longfin dace	X	X		X	X	X	X	X

*CH = critical habitat is designated.

Environmental Baseline. Native fish populations in the Action Area have been and will continue to be impacted by human activities other than SRP dam operations, including:

- Introduction of large numbers of nonnative fish that prey upon and compete with native fish
- Historical construction of physical barriers such as dams and diversion structures
- Diversions and well pumping resulting in stream flow changes
- Livestock grazing including indirect impacts on water quality, riparian vegetation and soils, and stream channel morphology
- Fires, urbanization, development, and roads resulting in water quality degradation
- Sand and gravel mining resulting in water quality and habitat degradation
- Intensive recreation uses of the river and riparian areas, including fishing

Except in proximity to the reservoirs, these and other contributing impacts have more significant combined impacts on native fish than the effects of the Optimum Operation Alternative.

Types of Impacts From Reservoir Operations. Impacts to native fish from operation of Horseshoe and Bartlett under the Optimum Operation Alternative would occur from two sources: 1) direct impacts due to future reservoir operations (stranding in pools or passage through outlet works); and 2) indirect impacts (predation and competition) from small increases of nonnative fish produced by future reservoir operations and their progeny. As with the bird species considered in the HCP, fish are mobile, have varying life histories, life spans, and reproductive strategies and, therefore, direct impacts are difficult to quantify. Measuring impacts to native fish from small increases of nonnative fish is difficult. In addition to nonnative fish already in the reservoir, there are large self-sustaining nonnative fish populations that currently exist throughout the Action Area. In addition, fish populations are dynamic over time due to floods, fires, disease, and other factors.

Methods. To assess impacts to native fish, the Committee used methods that are scientifically based, objective, and correlated to the species likely to benefit from reservoir operations. Given that increased predation and competition pressure are the primary indirect impacts that could eventually result in the anticipated incidental take of native fish in the Verde River from operations at Horseshoe and Bartlett, and that the precise levels of impacts are difficult to estimate and measure, the consensus was to use the accepted method of quantifying incidental take in terms of the quantity of impacted river miles of occupied habitat (FWS 1996).

The Committee's approach to estimate impacts, and subsequently take, of native fish species followed the conceptual framework of Habitat Equivalency Analysis (NOAA 2000). This approach evaluates all natural and anthropogenic impacts that contribute to the existing and future condition of native fish habitat. The approach is based on two

concepts: 1) all contributing impacts or "factors" on native fish habitat can total no more than 100 percent; and 2) estimates of the severity, spatial extent, and duration of the impacts are developed by consensus of technical experts. Application of this approach to the Action Area involved the following steps:

1. Comprehensively review all available baseline information.
2. Reach scientific consensus for evaluating each contributing impact by reach.
3. Evaluate the impact of each factor on native fish within each mainstem reach and connected tributaries of the Verde River in the Action Area.
4. Assign a relative percent contribution of impact from future reservoir operations on the impacts to native fish habitat by reach. For example, the relative percent of impact on native fish habitat in the Verde Valley (Reach 5) from reservoir operation was agreed to be 5 percent based on the fact that it is more than 50 miles upstream of Horseshoe; most riparian land in the Verde Valley is privately owned and heavily populated; the river is impacted by numerous water diversions, extensive grazing, and mining; the river has self-sustaining populations of nonnative fish; and AGFD seasonally stocks the area with large numbers of nonnative rainbow trout.
5. Multiply the percent contribution within each reach by the total river miles within the reach to calculate the river miles impacted by reservoir operations.

Assumptions. As mentioned previously, information in the Committee's report was obtained from an extensive review of existing literature, agency reports, state and federal databases, and discussions with local and nationally recognized experts (Committee 2006). The following information and assumptions have been extracted from the Committee's report.

The Committee identified that impacts to native fish habitat were related to a set of biological and management assumptions based on best available science. The primary biological and management assumptions concerning nonnative and native fish in the Verde River used to provide context to analyze the effects of reservoir operation were:

1. Nonnative fish species of primary concern are those that are reasonably certain to occur in Horseshoe over the life of the Permit and those that breed early and in mid-spring when reservoir water temperatures may be cooler or levels may be stable due to dam operations. Nonnative species of secondary concern are those that breed later in the season or at higher water temperatures, but may benefit in some years when water levels remain stable later in the breeding season.
2. A stable water level during breeding periods benefits nonnative fish because it allows uninterrupted spawning. Conversely, fluctuating reservoir levels negatively impact nonnative fish that use nests to spawn (bass, sunfish) or have adhesive eggs (red shiner, carp) because of impacts on environmental conditions (e.g., oxygen and temperature), desiccation of eggs may occur, and/or adults may be unable to guard the nest against predators.

3. Timing of nonnative fish spawn may vary annually due to local weather conditions, lake water temperature and stratification, conditions in the watershed (rain on snow events) that affect stream and lake water temperatures, local aquatic habitat conditions and substrates, and/or other environmental factors. Because data were lacking to quantify many of the existing variables (i.e., temperature, substrates), and some variations in environmental conditions (e.g., temperature) cannot be reliably predicted in the future, the Committee assumed that the entire reservoir area was potential spawning habitat, and used conservative spawning periods for each nonnative fish species based on published records and expert observations for similar habitat conditions.
4. Fish in the Centrarchid family (largemouth bass and sunfish) are territorial and generally do not move far (less than 8 miles). Carp data also suggest limited movements. Thus, the majority of nonnative fish produced in the reservoir are not expected to disperse long distances from the reservoir and the magnitude of impacts is greatest near the reservoirs. Individual long distance movements, dispersal of future progeny, and fitness also were considered at a lesser magnitude.
5. Large self-sustaining populations of nonnative fish are present in the Action Area, which confounds the ability to discriminate between fish spawned in Horseshoe and Bartlett due to operations, and those individuals spawned or present in the mainstem Verde River or tributaries that are presently impacting native fish.
6. Future stocking of razorback sucker and Colorado pikeminnow adults in the Verde River mainstem will continue independent of the HCP based on the past 20 years of efforts and current AGFD management plans.
7. Reasonably foreseeable native fish conservation efforts within the next 50 years (i.e., barriers, renovations, and restocking of native fishes for conservation and recovery) will likely be focused on Verde River tributaries and the upper Verde River before addressing nonnative fish in the Verde River mainstem downstream of the Allen Ditch Diversion dam. Such efforts are based on past and present conservation actions; past, present, and expected future AGFD fisheries management policy; and the need to successfully manage or control nonnative species in the tributaries prior to initiating removal efforts in the mainstem.
8. Based on past and currently planned statewide fish conservation efforts, large-scale conservation efforts such as chemical renovations on Verde River tributaries will likely include barriers to preclude nonnative fish from immigrating into conservation areas and causing harm to native fish species.
9. Reservoir operations and fisheries management of Bartlett are not expected to change appreciably from historical or current conditions; therefore, there is little, if any, expected modification from baseline of fish habitat or populations between Bartlett and Horseshoe under any alternative.

10. Bartlett operations that indirectly benefit nonnative fish, which pass through or over the dam, will have the greatest impact near the dam and will gradually decrease downstream with increased distance from the dam and as the fish community shifts from a more native composition near the dam outlet works to primarily nonnative species near the downstream terminus of the Action Area at Granite Reef Dam.

b) Impacts to Native Fish

Over the term of the Permit, reservoir operations are anticipated to result in an increment of incidental take of native fish due to stranding in isolated pools, passage through outlet works, increased predation and competition by nonnative fish, or other mortality caused by reservoir operations in the Action Area.

Since construction in the late 1940s, water level fluctuations at Horseshoe have had both a positive and negative impact on the reproduction and recruitment of nonnative fish (Committee 2006). The causes for the historically poor nonnative fish recruitment and survivorship in Horseshoe are likely driven by a number of factors including: 1) fluctuating reservoir levels during spring in many years, which can negatively impact spawning success and recruitment, alter forage abundance and availability, and influence movement and foraging behavior of some fish species; and 2) the low water levels historically maintained during the summer at Horseshoe, which limits the habitat available for late season spawning, decreases nonnative fish survivorship and growth of adults and progeny, and minimizes adult and young-of-year carry over to the next spawning season.

As summarized in the previous subchapter, a number of activities, other than the operation of Horseshoe and Bartlett, directly or indirectly affect the aquatic ecosystem of the Verde River and its watershed. These activities include the presence of nonnative fish, dams and other stream barriers, surface water diversions and ground water pumping, changes in land use including urbanization and development, population growth, recreation, agricultural runoff, sand and gravel mining, other mining activities, roads and trails, livestock grazing, and wildfire. For the analysis of impacts from the Optimum Operation Alternative, the Committee first evaluated the potential of activities other than dam operations to cumulatively impact the quality of stream habitat in each of the five reaches. These activities can result in modification of water quantity, water quality, watershed condition, hydrology, stream channel characteristics, riparian and aquatic vegetation, bank stability, and other aquatic habitat characteristics.

Impacts to the river from human activities are expected to continue as the human population grows along the river corridor and within the watershed. In the past 50 years, the human population within the Verde River watershed has grown substantially, with ranches and farms being converted into residential and commercial areas. The population in the Verde Valley (Reach 5) has doubled in each of the past 2 decades. These changes have had, and will continue to have, a significant impact on the river system, including increased demand for water, increased runoff, shortened return intervals for flood events, water quality degradation, and increased recreation use.

Growth in the Verde River basin, both within the Action Area and beyond the boundaries of the Action Area, will place added pressure on limited water resources. Increased underground water pumping along the river and at source locations (springs, aquifers) may ultimately affect the amount of base flow available in the river. In addition to dewatering, diversions for irrigation ditches have a number of impacts on the stream channel including: a reduction in the quantity and quality of aquatic resources for native fish; fragmentation and loss of connectivity of habitats; changes in stream channel morphology; changes in water temperature, chemistry and flow pattern; and reduction in riparian area width and vegetation type. Return flows from agricultural fields have the potential to introduce pesticides and fertilizers into the river. Unused water or "tail water" eventually returns to the river; however, the majority of the ditches are unlined so that large amounts of water are lost to seepage, resulting in redistribution of surface water to generally shallow water tables near the Verde River and its tributaries.

Optimum Operation Alternative. The Optimum Operation Alternative was selected to balance: 1) the need to provide suitable flycatcher and cuckoo habitat for longer durations over the term of the Permit at the upper end of Horseshoe; and 2) the need to address effects of Horseshoe operations on covered fish species and critical habitat, while meeting SRP's other operational goals and delivery objectives. The Optimum Operation Alternative would entail initiation of rapid drawdown 4 to 6 weeks earlier on average than historical operations except when SRP would permanently lose water supplies as the result of the drawdown (Subchapter II.B.3). Lowering water levels earlier in the spring would maintain availability of flycatcher and cuckoo habitat, and reduce the amount of successful nonnative spawning and recruitment. The reservoir would be kept at minimum pool June through November unless large inflows occur, in which case the reservoir would be drained as quickly as feasible (Subchapter II.B.3). This would further reduce reproductive potential for later-season, higher-temperature spawners, such as channel and flathead catfish, by reducing the amount of suitable spawning and nursery habitat resulting from dam operations. Minimizing carry-over storage would also minimize adult and juvenile survivorship, which in turn reduces the abundance of nonnative fish in the reservoir the following year. Reducing the reproduction and recruitment of nonnative fish also might benefit the recruitment and survival of razorback sucker within the reservoir. However, less floodplain/inundated lake bottom, both in area and duration, would be available during the spring for razorback sucker spawning, grow-out, and cover from predators compared to other reservoir operation alternatives where water is held in storage later in the year.

In most below normal runoff years, Horseshoe does not store water. Lack of stored water could impact riparian habitat occupied by flycatchers or cuckoos. To minimize the effects of these low runoff years on riparian habitat, following two successive years without storage, SRP would have the goal to fill Horseshoe before Bartlett, and hold water to sustain and saturate existing flycatcher and cuckoo habitat. Based on historical runoff patterns, the need to manage Horseshoe levels to maintain tall dense riparian vegetation would occur about once every 13 years on average. After saturating habitat at the upper end of the lake, SRP would rapidly draw down the reservoir. Typically, storage would occur between November and March, and drawdown would begin in April. During these low runoff mitigation events, water level fluctuations would be similar to

the Modified Historical Operation Alternative. Thus, some small increase of nonnative fish reproduction would be expected to occur, but the amount would be less than impacts from other reservoir operation alternatives. These periodic impacts would be partially offset by stocking adult or subadult razorbacks in the lake, which are expected to grow, and then disperse when water levels fall. The stocked razorbacks would benefit from increased habitat and forage, and lower predator densities during these periodic high reservoir levels.

Impacts. In order to estimate impacts on native fish habitat from the Optimum Operation Alternative, each reach in the Action Area was assigned a relative contribution of impact from reservoir operations (as a percentage; ranging from about 2 to 72 percent). The balance of 28 to 98 percent of impacts to native fish habitat is the result of baseline levels of anthropogenic impacts to the stream, including the presence of nonnative fish species, grazing, agriculture, water use, residual effects of past reservoir operations, and other causes. The impacts on fish habitat from the Optimum Operation Alternative total 33.9 river miles of habitat as summarized in Table IV-5. Detailed information on estimated reservoir impacts is provided in Appendix 6.

Table IV-5. Estimate of reservoir operation impacts on covered native fish species.

Reach	River Miles (Including Tributaries)	Proportion of Reservoir Impact	River Miles Affected (Miles x % Impact)
1	28	20%	5.6
2	21	5%	1.1
3	16	72%	11.5
4a	8	55%	4.4
4b	55	18%*	9.1
5	55	5%*	2.2
Total	183	—	33.9

*The percent impact in the mainstem reach is shown; the percent impact is less in the tributaries to this reach, ranging down to an average of 1.7 percent.

The adverse impacts of the Optimum Operation Alternative would be minimized by reservoir operations to rapidly draw down Horseshoe and keep it empty whenever possible. The remaining impacts would be more than offset through the mitigation actions described in Subchapter V.D.2., resulting in a net conservation benefit for covered native fish.

c) Impacts to Critical Habitat

In addition to consideration of take, the impact of the Optimum Operation Alternative on existing and potential designations of critical habitat for native fish was evaluated. Razorback sucker critical habitat occurs from Horseshoe Dam about 46 miles upstream on the Verde River to the Prescott National Forest boundary, which corresponds to Reaches 3, 4a, and part of 4b. In the future, critical habitat could be designated in the Action Area for other covered fish species.

In Horseshoe, future reservoir operations are not likely to adversely modify critical habitat for razorback sucker because “the affected critical habitat would remain

functional (or retain the current ability for the PCEs [primary constituent elements] to be functionally established) to serve the intended conservation role for the species" [FR 5515, 5527 (February 1, 2006); see 50 CFR 424.12(b); see also December 2004 FWS Guidance (FWS 2004b)]; i.e., space; necessary nutritional and physiological elements (e.g., water); cover or shelter; breeding and reproduction sites; and appropriate habitats [59 FR 13374 (March 21, 1994)]. More specifically, the PCEs for razorback sucker critical habitat included water (quantity, quality, hydrologic regime), physical habitat (habitats for all life stages and needs), and biological environment (food supply, predation, competition). As noted in the Federal Register (Id.), predation and competition are natural components of the razorback sucker's environment, but these components are out of balance in some systems due to nonnative fish. The increase in reproduction of nonnative fish would not appreciably diminish PCEs because of: 1) the current contribution to the environmental baseline due to the already saturated and self-sustaining populations of nonnative fish currently distributed throughout the Verde River critical habitat for the razorback sucker; and 2) the mitigation measures proposed to address effects associated with the Proposed Action (Subchapter V.D.2; Table IV-5) (Committee 2006). Additionally, the FWS considered reservoir operations and state water law when designating critical habitat for the razorback sucker, and found that no changes in reservoir operations were contemplated as a result of recovery efforts, and maintenance of particular reservoir elevations were not implied by the designation (Id.).

Similarly, future reservoir operations are not likely to modify future designations of critical habitat for covered native fish species upstream of Horseshoe. For example, recently proposed PCEs for spikedace encompassed: 1) permanent flowing water for larvae, juveniles, and adults; 2) relatively coarse substrates; 3) appropriate habitat types in terms of gradient, temperature, channel characteristics, and food; 4) low levels or absence of detrimental nonnative fish; and 5) connective corridors between occupied habitats, even if periodically dewatered (70 FR 75546: December 20, 2005). The only one of these PCEs potentially affected by the Optimum Operation Alternative is the presence of nonnative fish, which is being minimized and mitigated by actions in the HCP. Thus, PCEs are not anticipated to appreciably diminish in future designations of critical habitat for the covered species of native fish.

SRP believes that future Horseshoe and Bartlett operations are not likely to adversely modify critical habitat for razorback sucker, spikedace, or other native fish species because those operations would not appreciably reduce or impair the value of PCEs that currently have been identified for razorback sucker habitat, that were previously proposed for spikedace, or that may be established in the future for other covered species in the Action Area; and because of the mitigation actions proposed for implementation (Subchapter V.D.2).

The estimated proportion of reservoir operation impacts on covered native species outside of the reservoirs themselves is based primarily on the assumption that nonnative fish recruited in Horseshoe and Bartlett and their progeny disperse and impact native fish habitat. Three-fourths of those impacts are assumed to occur in Reaches 4a, 4b, and 5, reflecting the assumption that nonnative fish move upstream from Horseshoe. A key assumption is that the nonnative fish produced in Horseshoe do not move long distances

upstream (Subchapter IV.B.4.a, Assumption #4). Although it is unlikely that large numbers of fish produced in Horseshoe would move far upstream, there is uncertainty with that assumption. As a result, adaptive management will be employed if more than one Horseshoe-tagged fish is found in any one year, or one Horseshoe-tagged fish is found in two successive years in Reach 5. A permit amendment would be necessary if one Horseshoe-tagged fish is found in two successive years or more than one Horseshoe-tagged fish is found in any one year outside of the Action Area upstream of Reach 5 (Subchapter V.D.4.f).

5. Impacts on Frog and Gartersnake Species

As with covered native fish (Subchapter IV.B.4), the impact of the Optimum Operation Alternative on lowland leopard frogs, northern Mexican gartersnakes, and narrow-headed gartersnakes is difficult to measure. Thus, the impact is addressed in terms of changes to potentially occupied habitat resulting from nonnative fish, crayfish, or bullfrogs produced in the reservoirs that could prey directly upon larval or adult lowland leopard frogs or their eggs, narrow-headed gartersnakes, and/or northern Mexican gartersnakes, or prey or compete with native prey species that are an important food resource for these species.

For purposes of the HCP, it is assumed that the entire Action Area could be potentially occupied habitat for these species at some point during the life of the Permit. Because the indirect impacts to the frog and gartersnake species are similar to those for native fish (i.e., nonnative fish produced in the reservoir that prey on individuals, or prey or compete with native fish), the native fish impact analysis and results are used to estimate impacts to the frog and gartersnake habitat. As listed in Table IV-5, the estimated impacts equal 33.9 river miles. Because some portions of the Action Area are unsuitable for these species, and because they are semiaquatic and dormant part of the year, this is a conservative estimate of potential impacts.

Critical habitat is not currently proposed or designated for lowland leopard frogs, northern Mexican gartersnake, or narrow-headed gartersnake. If such habitat is designated in the future, the HCP will have addressed any effects of Horseshoe and Bartlett operations on this habitat because of the habitat-based approach used in this HCP.

6. Impacts on Listed and Rare Plants, and Other Listed Wildlife and Species of Concern

As discussed in Subchapter III.A.2, listed and rare plants in the vicinity of Horseshoe and Bartlett are upland species that would not be impacted by the Optimum Operation Alternative. Similarly, other listed wildlife and species of concern would not be affected by the Optimum Operation Alternative because they are not directly or indirectly impacted by reservoir operations (Subchapter III.A.2).

7. Impacts on Water Resources

There would be little or no impact on the water supply of SRP and other water users as a result of the Optimum Operation Alternative. Relative to historical operations, a small amount of increased evaporation and consumptive use by riparian vegetation may occur in years when Horseshoe temporarily stores water to maintain tall dense vegetation.

However, this increased evaporation and consumptive use would be at least partially offset in years when more rapid drawdown occurs relative to historical operations.

8. Impacts on Recreation

A small decrease in recreation use would occur at Bartlett in years when Horseshoe is filled ahead of Bartlett in order to maintain flycatcher habitat in Horseshoe after two successive years of drought. These lower Bartlett levels would occur for a few months about once every 13 years on average, typically in late winter or early spring. The recreation impacts are not expected to be large because a minimum pool at Bartlett would be maintained that allows boat access, winter and early spring are not peak seasons for recreation at Bartlett, and a portion of the recreation users may choose to use Horseshoe during these infrequent occurrences.

9. Impacts on Geology and Geomorphology

No significant geologic or geomorphologic impacts would occur under the Optimum Operation Alternative in terms of changes in stream and floodplain morphology, including sedimentation. There would be no changes to stream and floodplain morphology upstream of Horseshoe, although mitigation measures may result in small improvements in some upstream areas due to watershed management activities, which are discussed further in *Chapter V. Actions to Minimize*. At Horseshoe, changes in the amount of suspended sediment in reservoir outflow and the pattern of sediment deposition may vary slightly under the Optimum Operation Alternative. Because large floods would continue to fill Horseshoe, normal sediment deposition patterns during these floods would not significantly change. However, under the Optimum Operation Alternative, SRP would periodically hold water in Horseshoe to maintain tall dense vegetation at the upper end of the reservoir, which may cause slight shifts in patterns of deposition because coarser sediments would settle out at the upper end at higher reservoir levels and additional vegetation may retain sediment at higher elevations. Impacts below Horseshoe would be limited. Because the reservoir would be periodically filled to a higher elevation, water released from the reservoir may have slightly lower levels of fine suspended sediments than if river flows were allowed to pass directly through the reservoir. However, no significant changes to downstream stream and floodplain morphology are expected to result from this slight change in sediment load (MEI 2004).

10. Impacts on Vegetation

Impacts on riparian vegetation from the Optimum Operation Alternative are discussed in relation to habitat for covered bird species in Subchapters IV.B.1 through IV.B.3. In summary, the amount of willow in Horseshoe is expected to increase and no significant adverse impact on riparian habitat below Horseshoe and Bartlett is expected (Subchapter III B.4.e).

11. Cumulative Effects on Covered Species

Cumulative effects under the ESA are those effects of future nonfederal (state, local government, or private) activities that are reasonably certain to occur during the course of the federal activity subject to consultation. Future federal actions unrelated to the Proposed Action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. With respect to the HCP, the federal

action is issuance of a Permit that authorizes continued operation of Horseshoe and Bartlett for water conservation. Cumulative effects on resources other than covered species are evaluated in the FEIS. These other resources include water resources, vegetation, wildlife, cultural resources, land use, and socioeconomics.

Within the conservation space at Horseshoe and Bartlett, no future nonfederal activities that may affect the covered species are reasonably foreseeable.

Cumulative Effects on Covered Bird Species. There are few privately owned parcels near Horseshoe and Bartlett. Most of the private land along the Verde River occurs upstream of Horseshoe in the Verde Valley near Camp Verde and Cottonwood, and downstream of Bartlett near Rio Verde. Further development or subdivision of these parcels may result in additional loss of riparian habitat, either by direct habitat loss or land use activities that indirectly contribute to habitat loss through accelerated erosion, channel destabilization, and wildfires.

Elsewhere in central Arizona and rangewide for the species, increasing development along rivers will have significant effects on the covered bird species. Effects are reasonably certain to occur directly to individuals or to habitat. Habitat fragmentation can have direct effects including mortality and overall changes in habitat suitability that can further reduce the carrying capacity of a particular habitat patch. Increased development also has the secondary effect of increasing predatory pets. Increases or changes in the types of potential cowbird foraging sites (e.g., bird feeders, corrals, and stockyards) may increase the potential for cowbird parasitism of local flycatchers. Increased human disturbance including recreational use of the river floodplains, particularly by ORVs or river floaters, may also adversely affect riparian habitat. Wildfires also destroy riparian habitat. In addition, the pumping of surface and ground water may result in reduced river flows, which in turn would result in decreased habitat quality and quantity.

Loss or degradation of suitable habitat for flycatchers, bald eagles, and cuckoos is likely to continue inside and outside of the Action Area. Under the Optimum Operation Alternative, periodic inundation of habitat at Horseshoe would result in occasional loss of habitat and productivity. Over the long term, habitat is likely to expand and be maintained by periodic inundation. Cumulative effects of the Optimum Operation Alternative in addition to other future actions could result in the periodic loss of habitat availability. However, the acquisition and management of suitable riparian habitat under the HCP would compensate for this periodic loss of habitat availability. With full implementation of these conservation measures, the Optimum Operation Alternative would not add appreciably to the regional cumulative effects because mitigation measures would be implemented. In addition, riparian habitat in the Verde watershed is likely to benefit from the watershed management efforts taken by SRP to offset impacts on native fish, frog, and gartersnake species which would reduce the overall cumulative effects of other activities.

Cumulative Effects on Covered Fish, Frog, and Gartersnake Species. Cumulative effects on native fish, frog, and gartersnake species from human activities in the Action Area are incorporated into the analysis of direct and indirect impacts from

continued reservoir operations under the Optimum Operation Alternative. As summarized in Subchapter IV.B.4, these activities will continue to result in large nonnative fish populations, dams and other stream barriers, surface water diversions and ground water pumping, changes in land use including urbanization and development, population growth, recreation, agricultural runoff, sand and gravel mining, other mining activities, roads and trails, livestock grazing, and wildfire. In turn, these activities result in modification of water quantity, water quality, watershed condition, hydrology, stream channel characteristics, riparian and aquatic vegetation, bank stability, and other aquatic habitat characteristics. Elsewhere in Arizona and rangewide, these same types of human activities and impacts affecting native fish, frog, and gartersnake habitat for covered species are also reasonably certain to occur.

The cumulative effects of the Optimum Operation Alternative in addition to other future actions could adversely affect the populations of covered native fish, frog, and gartersnake species. However, implementation of the minimization and mitigation measures provided in this HCP would more than offset the impact from continued reservoir operations.

12. Summary of Indirect Effects on Covered Species

Indirect effects are caused by the Proposed Action and occur later in time, but are still reasonably foreseeable (50 CFR 402.2). The Proposed Action in the context of the HCP is issuance of a Permit for continued operation of Horseshoe and Bartlett conservation space. Indirect effects on resources other than covered species are evaluated in the FEIS.

Indirect Effects on Covered Bird Species. As discussed above in this chapter, the primary indirect effects of the Optimum Operation Alternative are likely losses in productivity of covered species at Horseshoe and Bartlett. For flycatchers and cuckoos, these productivity losses would occur when habitat is lost or unavailable due to changes in reservoir levels. These productivity losses at Horseshoe and Bartlett will be offset by potential productivity at mitigation sites. For bald eagles, periodic losses of productivity are not expected to occur.

Indirect Effects on Covered Fish, Frog, and Gartersnake Species. As with cumulative effects, indirect effects of the Optimum Operation Alternative on covered fish, frog, and gartersnake species are part of the analysis of impacts from continued reservoir operations. These indirect effects are summarized in Subchapter IV.B.4.

Predation and competition by bullfrogs and crayfish are particularly important threats to the covered frog and gartersnake species. Reservoir operations under the Optimum Operation Alternative, involving rapid drawdown and minimizing the storage pool, are anticipated to limit bullfrog and crayfish populations at Horseshoe, as well as limit the nonnative fish populations in the Action Area.

C. Impacts of the No Permit and Modified Historical Operation Alternatives

The following sections summarize the impacts of the No Permit and Modified Historical Operation alternatives. Unless otherwise specified, the approach and background for each resource is the same as used for evaluation of the Optimum Operation Alternative in Subchapter IV.B.

1. No Permit Alternative

As described in Chapter II, FWS would not issue a Permit to SRP for continued operation of Horseshoe and Bartlett under the No Permit Alternative. Without a Permit, SRP would be expected to do everything within its control to avoid take of federally listed species associated with the continued operation of the reservoirs. To avoid the risk of take of flycatchers, Horseshoe would be operated to reduce the water level below the elevation at which flycatchers nested in the previous year before commencement of the nesting season. Unless not physically feasible due to high runoff, Horseshoe would be lowered in April to reach a target elevation in early May to expose flycatcher habitat.

If a bald eagle establishes a nest below the high water mark of the reservoirs, SRP would discuss with AGFD and FWS the need to rescue eggs or chicks threatened by inundation for subsequent reintroduction into the original nest after the water subsides or introduction into a foster nest in another territory if the nest is destroyed. SRP also would coordinate with AGFD and FWS to determine if the construction of an alternative nest structure in the immediate area is appropriate.

To avoid the take of currently listed native fish under the No Permit Alternative, SRP would empty Horseshoe as early and rapidly as practicable and keep it empty for as long as possible each year to minimize the production of nonnative fish species. SRP would also construct a fish barrier on Lime Creek to prevent nonnative fish from moving up that tributary from Horseshoe. In addition, SRP would work with the Verde native fish stocking program being implemented by AGFD and FWS to avoid take of stocked razorback sucker, Colorado pikeminnow, or other listed fish from Horseshoe and Bartlett operations. Currently unlisted native fish, frog, and gartersnake species that may be impacted by Horseshoe and Bartlett operations might become federally listed in the future and reservoir operations might then result in take. If an unlisted native fish, frog, or gartersnake species was subsequently listed, SRP would pursue the various options for ESA compliance identified in Subchapter II.B.1.

a) Impacts on Flycatchers, Bald Eagles, and Cuckoos

Under the No Permit Alternative, SRP would operate Horseshoe and Bartlett to avoid take of flycatchers, bald eagles, or cuckoos or adverse modification of critical habitat for the flycatcher. However, SRP would not periodically hold water in Horseshoe to maintain riparian vegetation, so less flycatcher nesting vegetation and cuckoo habitat would likely be available in Horseshoe on average over the long term than under the Optimum Operation Alternative. Similarly, fewer bald eagle perching trees are likely to be available at the upper end of Horseshoe over the long term under the No Permit Alternative. No significant impacts to riparian habitat downstream of the dams, including habitat that was occupied or may be occupied in the future by flycatcher, cuckoo, or eagle is expected due to operations (Subchapter III.B.4.e).

b) Impacts on Native Fish, Frog, and Gartersnake Species

Impacts of the No Permit Alternative on native fish, frog, and gartersnake species would be slightly less than those from the Optimum Operation Alternative. SRP would construct a fish barrier in Lime Creek to prevent nonnative fish from moving upstream from Horseshoe. Horseshoe would be drawn down rapidly to expose vegetation used for

flycatcher nesting, which would disrupt spawning of nonnative fish during early spring. However, there might be short periods of relatively stable water levels depending on water demand and inflow. SRP would coordinate with AGFD and FWS to prevent take of individual adult razorback suckers, Colorado pikeminnows, or other listed fish that could be stocked in the future in the Verde River. Horseshoe would be drained for as long as possible each year and would typically be completely drained by June, which would reduce spawning habitat for nonnative fish (Committee 2006). Because only adult razorback suckers and Colorado pikeminnows have been found in the Verde River, and recruitment has not been documented, the increment of nonnative fish produced by operations would not significantly impact stocked adult listed fish. The No Permit Alternative does not include reservoir or fisheries management (i.e., additional stocking) to benefit razorback suckers or Colorado pikeminnows. Thus, while the No Permit Alternative would avoid take of razorback suckers and Colorado pikeminnows, those species (in particular razorback suckers) would not benefit from maintaining high water levels, and this alternative would not support or provide suitable spawning or grow-out habitat for a sustainable razorback sucker population.

Impacts to native fish, frog, and gartersnake habitat from the No Permit Alternative over the next 50 years range from 2 to 70 percent for a total of 31.9 river miles as summarized in Table IV-6 (see Appendix 6 for more detailed information). These impacts are slightly less than under the Optimum Operation Alternative because water is not stored in Horseshoe for as long on average, which reduces the recruitment of nonnative fish. Unless future ESA compliance results in mitigation or other actions, these impacts would not be offset by SRP conservation efforts.

Table IV-6. Estimate of reservoir operation impacts on covered native fish, frog, and gartersnake species.

Reach	River Miles (Including Tributaries)	Proportion of Reservoir Impact	River Miles Affected
1	28	20%	5.6
2	21	5%	1.1
3	16	70%	11.2
4a	8	50%	4.0
4b	55	15%*	7.8
5	55	5%*	2.2
Total	183	—	31.9

*The percent impact in the mainstem reach is shown; the percent impact is less in the tributaries to this reach, ranging down to an average of 1.7 percent for a tributary.

Under the No Permit Alternative, there would be no impacts on critical habitat currently designated for razorback sucker or proposed for spikedace because the production of nonnative fish would be minimized.

c) Impacts on Listed and Rare Plants, and Other Listed Wildlife and Species of Concern

The No Permit Alternative would not impact listed and rare plants in the vicinity of Horseshoe and Bartlett because they are upland species (Subchapter III.A.2). Likewise, as discussed in Subchapter III.A.2, other listed wildlife and species of concern would not be affected because they are not directly or indirectly impacted by reservoir operations.

d) Impacts on Water Resources

In the short term, no impacts on water resources are expected to occur from the No Permit Alternative. In 2005, Horseshoe was full from March through early June without apparent impacts to nesting flycatchers or other listed species. However, in the future, as nesting vegetation grows at lower elevations in the reservoir and the flycatcher population continues to expand, the reservoir would likely have to be periodically lowered in April and early May to expose vegetation used by flycatchers for nesting in order to avoid take. At that time, significant losses of water supply would occur to SRP and other downstream water users due to releases of water to expose flycatcher habitat.

It is difficult to precisely predict the extent of water supply impacts given the uncertainties of how much future occupied nesting habitat would occur at lower elevations in Horseshoe and how much water would be released to expose that habitat. The approach employed for the Roosevelt HCP is used to provide an estimate of potential long-term impacts (SRP 2002), which is discussed below.

Releases of water to expose habitat would also have other minor water resource impacts. Such releases would result in slightly higher flows in spring than normal in the lower Verde River and cause spills at Granite Reef Dam on the Verde River. Given the relatively small volumes of water to be released compared to the wide natural variation in flows during the spring, these impacts on flow rates and spills are expected to be insignificant.

Approach. The impact of the No Permit Alternative on water supply is based on the reservoir operation modeling developed for the HCP (Subchapter IV.A.1 and Appendix 5). Two model runs were made for the analysis: 1) normal operation of Horseshoe storage up to the maximum capacity at an elevation of 2,026 feet; and 2) the No Permit Alternative where Horseshoe storage is constrained to a maximum elevation of 1,985 feet during the flycatcher nesting season of May through August. The difference between the two runs is the impact of the No Permit Alternative. The elevation of 1,985 feet reflects about 40 percent of the capacity of Horseshoe and was selected as the midpoint between the bottom of the reservoir (about 1,955 feet) and the reservoir elevation at which water no longer could affect flycatcher nesting (about 2,015 feet).

The estimated value of the water supply lost as a result of changes in operation of Horseshoe and Bartlett is based on the least-cost source to replace that supply. Effluent reuse was identified as the least-cost and most likely source of replacement water. The cost for effluent reuse is estimated to be $457 to $506 per AF (using discount rates of 5.5 to 7 percent, respectively) based on data provided by the City of Phoenix (Buschatzke 2004). These cost estimates were adopted for the economic analysis conducted for FWS

of the impacts associated with possible water losses associated with critical habitat designation in Horseshoe or Roosevelt (Industrial Economics 2005).

Water Supply Impacts. Under the No Permit Alternative, the long-term average annual net loss of surface water supplies to SRP and other water users would be about 4,500 AF/year (Appendix 5, Table 1).[35] SRP water users would lose an average of 2,400 AF/year, Phoenix would lose an average of 3,600 AF/year, and the SRPMIC would lose an average of about 600 AF/year. These losses would be partially offset by additional average annual supplies of 1,500 AF/year developed by Roosevelt NCS, which would benefit Phoenix (up to 50 percent) and the other cities. In addition, the estimates of impact on SRP water supply include an average annual increase of 6,500 AF/year in SRP ground water pumping to partially offset shortages caused by reduced Horseshoe storage (Appendix 5, Table 1). However, the cities served by SRP cannot fully utilize this additional ground water because their Assured Water Supply designations place strict annual limits on the amount of ground water that can be used by the cities in any year.[36] Ground water pumped by SRP and delivered to the cities is added to the amount of ground water pumped by the cities to determine compliance with these limitations. Therefore, the additional ground water pumped by SRP cannot serve as a replacement water supply for the cities. Thus, water from increased ground water pumping could not actually be used and must be added to the estimates of impact discussed above, resulting in a total long-term estimated impact of 11,000 AF/year (4,500 + 6,500). This assumes that the "gain" in water supply at Roosevelt NCS would somehow be redistributed to offset losses.

Using replacement costs of $457 to $506 per AF, the total water supply impact from a net loss of 11,000 AF/year would be about $5.0 to $5.6 million (M) per year. Long-term impacts may be greater or less than this estimate depending on how much water would need to be released to expose occupied flycatcher habitat.

e) Impacts on Recreation

Small impacts on recreation might occur under the No Permit Alternative due to earlier and more rapid drawdown of Horseshoe to avoid impact on listed species. Given the limited recreation use at Horseshoe, especially in April when most of the drawdown would occur, impacts are not expected to be significant.

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[35] Water losses due to alternative reservoir operations are in addition to shortfalls experienced due to years of low runoff.

[36] Annual ground water withdrawals by each city are limited to a phase-in ground water allowance and the annual incidental recharge component. The phase-in ground water allowance is a finite amount that will eventually go to zero for each city. The annual incidental recharge component is each city's "safe-yield" ground water withdrawal allowance, equivalent to the volume of incidental recharge returning to the aquifer each year within a city's service area (approximately 4 percent of each city's annual service area water use).

f) Impacts on Geology and Geomorphology

Under the No Permit Alternative, reservoir sedimentation would not significantly change from the current rate, although the pattern of sediment deposition might change slightly. Some sediment deposition likely would occur closer to the dam because water would not be held in storage as frequently as under historical operations. Also, water released from the reservoir to expose occupied flycatcher habitat might be slightly higher in fine suspended sediments than under the Proposed Action. However, no significant changes in stream or floodplain morphology would be expected from this slight increase in fine suspended sediments.

As noted under the Optimum Operation Alternative discussion of geologic and geomorphic impacts, alternate reservoir operations ranging up to the full release of flood flows would have an insignificant effect on downstream sediment mobilization on geomorphic surfaces (Subchapter IV.B.8).

g) Impacts on Vegetation

No direct impacts on riparian vegetation are expected from the No Permit Alternative (Subchapter III.B.4.e). However, the quantity of riparian habitat at the upper end of Horseshoe is likely to be less over time relative to the Modified Historical Operation or Optimum Operation Alternative because of constant early drawdowns to expose occupied flycatcher habitat (Subchapter IV.C.1.a).

h) Cumulative and Indirect Effects on Covered Species

Cumulative and indirect effects on covered species from the No Permit Alternative would be similar to those described for the Optimum Operation Alternative in Subchapters IV.B.10 and IV.B.11. However, slightly greater cumulative and indirect effects might occur to flycatchers and cuckoos because total productivity of these species along the Verde River would be lower in the future due to lower amounts of habitat at Horseshoe, which in turn would result in greater impacts from other reasonably foreseeable activities in the Action Area. There would be no cumulative or indirect effects on bald eagles. Relative to the Optimum Operation Alternative, the No Action Alternative would result in slightly greater cumulative and indirect impacts on native fish, frog, and gartersnake species because there would be no mitigation actions implemented as part of an HCP, which exceed the impacts due to the presence and operation of the dams.

2. Modified Historical Operation Alternative

As more fully described in Subchapter II.B.2, the Modified Historical Operation Alternative would involve issuance of a Permit by the FWS allowing the continued full operation of Horseshoe and Bartlett consistent with past operating objectives, along with implementation of minimization and mitigation measures.

As part of the Modified Historical Operation Alternative, the primary mitigation and minimization measure for flycatchers and cuckoos would involve acquisition and management of off-site riparian habitat in the Verde Valley and in the Safford Valley, or elsewhere in central Arizona. Minimization and mitigation measures for impacts of the Modified Historical Operation Alternative on native fish, frog, and gartersnake species would include the same types of measures employed for the Optimum Operation

Alternative, i.e., construction of a fish barrier on Lime Creek, rapid drawdown of Horseshoe during mid to late spring, minimization of summer pool and carryover storage in Horseshoe, assistance with stocking of razorback suckers in Horseshoe and covered native fish species in the Verde watershed, contributions to Bubbling Ponds Native Fish Hatchery, watershed management efforts and, if necessary, adaptive management (Subchapter V.D.2).

a) Impacts on Flycatchers, Bald Eagles, and Cuckoos

The flycatcher nesting model was run with the results of reservoir levels from the Modified Historical Operation Alternative. Because the water levels would not be managed to maintain tall dense vegetation at the upper end of the reservoir, it is assumed that the maximum possible habitat at the upper end of the reservoir would be about 55 acres less than under the Optimum Operation Alternative. Although less riparian habitat would likely be present at the upper elevations in the reservoir, the maximum predicted average amount of impact due to unavailable flycatcher habitat would be about 200 acres. This impact is slightly more than the 190 acres under the Optimum Operation Alternative because of the slower drawdown of Horseshoe in the spring and early summer under the Modified Historical Operation Alternative. Thus, the overall long-term productivity of flycatchers is likely to be slightly less than under the Optimum Operation Alternative because less flycatcher habitat would be available on average. No significant impacts to riparian habitat downstream of the dams, including habitat that was occupied, or could be occupied in the future, by flycatcher is expected (Subchapter III.B.4.e).

No adverse impacts on bald eagles are expected under the Modified Historical Operation Alternative. If bald eagles move their nests into the active conservation space of the reservoirs below the high water level, SRP would implement the same adaptive management measures specified for the Optimum Operation Alternative, which are described in Subchapter V.C.4. However, because drawdown of Horseshoe would not occur as early in the eagle breeding, nests placed in the upper end of the lake could be more frequently surrounded by water during the eagle fledging period compared to Optimum Operations. Eagles could be harmed or killed if they prematurely fall out of the nest into water. Possibly up to 7 nests may be built below the high water mark over the term of the 50-year Permit and impacted by the Modified Historical Operation Alternative based on the following data: 1) the frequency of past nest inundation and high water impacts, not including inundation of artificial nest structures (i.e., 4 in 30 years; Subchapter III.A.1.b.8); and 2) the success rate of past rescue attempts (Subchapter III.A.1.b.8). Thus, inundation due to the proposed operation and subsequent implementation of the adaptive management measures to rescue and foster eggs or nestlings (Subchapter IV.C.4.d) could impact up to 14 eggs, nestlings, or fledges associated with 7 bald eagle nests. As for flycatchers, no significant impacts to riparian habitat used by bald eagles downstream of the dams are expected (Subchapter III.B.4.e).

Impacts on cuckoos from the Modified Historical Operation Alternative would be the same as described above for flycatchers.

b) Impacts on Native Fish, Frog, and Gartersnake Species

Impacts of the Modified Historical Operation Alternative on native fish, frog, and gartersnake species would be slightly greater than those from the Optimum Operation Alternative because Horseshoe would not always be drawn down as rapidly or kept empty as long as possible. Under the Modified Historical Operation Alternative, water would be drawn down at historical rates based on demand and reservoir management constraints. In years when fill occurs, Horseshoe typically would be drawn down over a period of four months and be empty by mid-summer in average and below average water years (Committee 2006), which could allow more nonnative fish to reproduce in mid to late spring relative to other alternatives. Based on these parameters and baseline conditions, impacts to native fish, frog, and gartersnake habitat from the continued operation of Horseshoe and Bartlett under the Modified Historical Operation Alternative would range from about 2 to 80 percent for a total of 39.5 total river miles impacted as summarized in Table IV-7. More detailed information on the estimation of these impacts is provided in Appendix 6.

Table IV-7. Estimate of reservoir operation impacts on covered native fish, frog, and gartersnake species.

Reach	River Miles (Including Tributaries)	Proportion of Reservoir Impact	River Miles Affected
1	28	20%	5.6
2	21	5%	1.1
3	16	80%	12.8
4a	8	70%	5.6
4b	55	25%*	12.2
5	55	5%*	2.2
Total	183	—	39.5

*The percent impact in the mainstem reach is shown; the percent impact is less in the tributaries to this reach, ranging down to an average of 1.7 percent.

The adverse impacts of the Modified Historical Operation Alternative would be minimized by reservoir operations to rapidly draw down Horseshoe and keep it empty whenever possible. The remaining impacts would be offset through mitigation actions similar to those described in Subchapter V.D.2.

Impacts of the Modified Historical Operation Alternative on razorback sucker critical habitat would be slightly greater than those from the Optimum Operation Alternative. Under the Modified Historical Operation Alternative, nonnative fish species would be provided a slightly greater opportunity to spawn and reproduce in Horseshoe and, therefore, would contribute more to the impact of predation and competition on native fish, frog, and gartersnake species.

As discussed in Subchapter IV.B.4.b, there is some uncertainty about the extent that nonnative fish recruited in Horseshoe and Bartlett and their progeny disperse and impact native fish habitat. As a result, adaptive management will be employed if more than one Horseshoe-tagged fish is found in any one year, or one Horseshoe-tagged fish is found in

two successive years in Reach 5. A permit amendment would be necessary if one Horseshoe-tagged fish is found in two successive years or more than one Horseshoe-tagged fish are found in any one year outside of the Action Area upstream of Reach 5 (Subchapter V.D.4.f).

c) Impacts on Listed and Rare Plants, and Other Listed Wildlife and Species of Concern

The Modified Historical Operation Alternative would not impact listed and rare plants in the vicinity of Horseshoe and Bartlett because they are upland species (Subchapter III.A.2). Likewise, as discussed in Subchapter III.A.2, other listed wildlife and species of concern would not be affected because they are not directly or indirectly impacted by reservoir operations.

d) Impacts on Water Resources, Recreation, and Geology and Geomorphology

There would be no impact on water resources, recreation, geology, or geomorphology as a result of the Modified Historical Operation Alternative because operations would not change from past practices.

e) Impacts on Vegetation

Impacts on riparian vegetation from the Modified Historical Operation Alternative are discussed in relation to habitat for covered bird species in Subchapter IV.C.2.a. In summary, the amount of willow at the upper end of Horseshoe is expected to decrease and significant adverse impacts to riparian habitat below Horseshoe and Bartlett are not expected (Subchapter III.B.4.e).

f) Cumulative and Indirect Effects on Covered Species

Cumulative and indirect effects on covered species from the Modified Historical Operation Alternative would be similar to those described for the Optimum Operation Alternative in Subchapters IV.B.10 and IV.B.11. Slightly greater cumulative effects might occur to covered bird and fish species under the Modified Historical Operation Alternative because of slightly greater impacts from reservoir operations. However, conservation actions would be implemented to fully mitigate for impacts to covered bird species and native fish, frog, and gartersnake habitat from reservoir operations (Subchapter II.B.2).

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V. Actions to Minimize, Mitigate, Monitor, and Manage the Impacts of Optimum Operation of Horseshoe and Bartlett

Chapter V begins with a discussion of the relationship of the HCP to the flycatcher and razorback sucker recovery plans. This chapter then sets forth the HCP's minimization and mitigation measures for covered species, including measures to be undertaken as part of an adaptive management program if the Optimum Operation Alternative is implemented. Monitoring of the measures undertaken in the HCP, and monitoring of future conditions at Horseshoe and Bartlett including compliance with the Permit, are described in detail. SRP's management, coordination, and funding assurances for implementation of the minimization and mitigation measures are specified as part of the plan. Chapter V concludes with a discussion of the additional assurances (No Surprises) requested from FWS, the treatment of changed and unforeseen circumstances, and proposed provisions of the Permit and implementing agreement.

A. Relationship of the HCP to Recovery Plans

As discussed below, the HCP is consistent with recovery plans for the flycatcher, razorback sucker, spikedace, loach minnow, and Gila topminnow. Recovery plans have not been completed for the other listed species and are not required for nonlisted covered species.

1. Southwestern Willow Flycatcher Recovery Plan

The FWS approved the Recovery Plan for the Southwestern Willow Flycatcher (Flycatcher Recovery Plan) on August 30, 2002 (FWS 2002a). The Flycatcher Recovery Plan was used as a source of information and guidance in preparation of this HCP. As discussed below, SRP believes that the HCP is consistent with the Flycatcher Recovery Plan.

The HCP is required by law to ensure that incidental take under the Permit "will not appreciably reduce the likelihood of the survival and recovery of the species in the wild" (ESA Section 10(2)(B)(iv); 50 C.F.R. § 17.22(b)(2); FWS and NMFS 1996, p. 3-20). The HCP meets this criterion by increasing the amount of protected habitat and the level of management of riparian habitat available for use by flycatchers over current levels in central Arizona. As discussed in Chapter IV, Optimum Operation of Horseshoe and Bartlett under the HCP will help maintain riparian habitat in Horseshoe over the long term. In addition, the HCP provides for acquisition and permanent management of additional habitat along the Verde and Gila rivers in central Arizona (or other river systems if necessary).

Management Units within broader Recovery Units are the basic geographical components of the Flycatcher Recovery Plan (FWS 2002a, pp. 61–63). Horseshoe and Bartlett lie within the Verde Management Unit in the Gila Recovery Unit (Id., pp. 63, 65, Figure 4, and Table 10). The Verde Management Unit encompasses the Verde River watershed, from the confluence with the Salt River east of Phoenix to the upper reaches of the Verde River and its tributaries.

The Flycatcher Recovery Plan sets recovery criteria for the entire Verde Management Unit at 50 territories, and a delisting goal of at least 50 to 80 percent of that number if the overall goal in the broader Gila Recovery Unit is met (FWS 2002a, pp. 78–79, 85). Another important criterion for delisting is to have twice the amount of breeding habitat protected in each Management Unit as needed for the minimum number of territories, which in the case of the Verde Management Unit would be approximately 272 acres for the full 50 territories (FWS 2002a, pp. 80–81). As discussed below, SRP's efforts to maintain flycatcher habitat at Horseshoe; to establish, protect, and manage additional riparian habitat in the Verde Valley; and to prioritize mitigation land acquisition in the Recovery Unit to support additional territories, which are discussed in Subchapters V.C.1 and V.C.2, are in support of and consistent with these recovery criteria for the flycatcher.

a) HCP Minimization and Mitigation Measures

Several factors used in developing the Flycatcher Recovery Plan provide guidance in the development of mitigation efforts in the HCP. The Recovery Plan states that: (1) "Maintaining/augmenting existing populations is a greater priority than allowing loss and replacement elsewhere," and (2) "Establishing habitat close to existing breeding sites increases the chance of colonization" (FWS 2002a). To further flycatcher recovery goals, the HCP incorporates a specific effort to maintain riparian habitat in Horseshoe, especially at the upper end, to minimize impacts from reservoir operations. In addition, SRP's acquisition of mitigation habitat focuses on conserving riparian habitat near existing breeding sites (Subchapter V.C.2).

The Flycatcher Recovery Plan also provides guidelines for measures to minimize take or offset impacts from projects. These guidelines include: (1) "preventing loss of flycatcher habitat"; (2) "habitat should be replaced and permanently protected within the same Management Unit"; (3) "efforts should strive to acquire habitat before project initiation"; and (4) adequate funding should be provided "to ensure that habitat is managed permanently for the intended purpose." Additionally; "areas slated for protection as a means of offsetting impacts should be identified using existing documents that have evaluated habitat conservation priorities rangewide [e.g., Fichtel and Marshall 1999]; and should be conserved based on the following priorities: (1) occupied, unprotected habitat; (2) unoccupied, suitable habitat that is currently unprotected; (3) unprotected, potential habitat" (FWS 2002a, pp. 82 and 83). The selection of SRP's minimization and mitigation measures is consistent with these guidelines by focusing on conservation of riparian habitat that is used or may be used by flycatchers and that is within Horseshoe or the Verde Management Unit, using best efforts to obtain mitigation habitat prior to Permit issuance, funding ongoing management of the mitigation habitat, and focusing on priorities for acquisition outlined in existing documents (Subchapters V.C.1 and V.C.2). The rationale for obtaining habitat elsewhere in the Gila Recovery Unit is provided in Subchapter V.C.2.

Preventing Loss of Flycatcher Habitat. The loss of flycatcher habitat will be minimized to the maximum extent practicable by maintaining habitat at Horseshoe, especially at the upper elevations. In addition, the impacts of reservoir operation will be mitigated as a result of the HCP by the acquisition and protection of currently occupied

habitat or habitat that is expected to support flycatchers in the future through improved management along the Verde, Gila, or other rivers in central Arizona (Subchapter V.C.2).

Replacement and Permanent Protection of Habitat Within the Same Management Unit. The HCP will replace and permanently protect habitat in the Verde Management Unit to the maximum extent practicable and most, if not all, of the mitigation will occur in the Gila Recovery Unit (Subchapter V.C.2).[37] The mitigation provided in the HCP will result in additional habitat in the Verde Management Unit to support recovery goals in that unit. As discussed in Subchapter V.C.2.b, SRP's experience over the past five years of acquiring habitat in the Verde Valley indicate that it is only practicable to obtain about 50 acres of additional habitat in that location.

Efforts to Acquire Habitat Before Project Initiation. SRP will use its best efforts to establish mitigation prior to Permit issuance and is well along in the process, having obtained an option to acquire 150 acres of riparian habitat along the Gila River adjacent to mitigation properties acquired for the Roosevelt HCP (Subchapter V.C.2.b).

Adequate Funding. As discussed in greater detail in Subchapter V.E.5, SRP has committed adequate funding to ensure that the mitigation habitat will be permanently managed.

Identification of Areas Slated for Protection and Priorities for Selection. The selection of mitigation sites in the Verde Valley and Safford Valley, or elsewhere in central and east-central Arizona, if necessary, relies heavily on the Rangewide Assessment of Habitat Acquisition Priorities for the Southwestern Willow Flycatcher prepared by The Nature Conservancy (Fichtel and Marshall 1999). The criteria for mitigation site selection, which focus on sites already occupied or suitable for flycatchers, are provided in Subchapter V.C.2.

Amount and Quality of Compensation Habitat to be Acquired. Optimum operation of Horseshoe will not result in permanent impacts to flycatcher habitat and, in fact, will help maintain riparian vegetation in the reservoir. To the extent that the habitat is periodically unavailable, SRP is providing off-site habitat to replace the productivity that may be lost at Horseshoe. The mitigation measures to be implemented as part of the HCP will fully offset all anticipated impacts. Also, most, if not all, of the mitigation properties will be acquired long before any significant impacts occur (Subchapters IV.B.1.b and V.C.2). Notably, the Flycatcher Recovery Plan states that the mitigation ratio should be based on specific analyses conducted on a project-by-project basis (FWS 2002a). The amount of mitigation in the HCP is based on specific analysis of the need to compensate for loss of habitat at Horseshoe (Subchapters IV.B.1 and V.C.2). The criteria and characteristics provided in the Flycatcher Recovery Plan were used to identify mitigation properties and assure that replacement habitat was of similar quality for the flycatcher (Subchapter V.C.2.a).

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[37] A map of the Verde Management Unit and other management units in the Gila Recovery Unit is available at: http://www.fws.gov/arizonaes/Documents/SpeciesDocs/SWWF/Final%20Recovery%20Plan/Page%2066%20Figures/Fig4_Rec&Management_SWF.pdf.

b) Efforts Consistent With Recovery Actions Identified in the Flycatcher Recovery Plan.

The Flycatcher Recovery Plan suggests a number of actions that are believed to be important to flycatcher recovery where feasible, legal, and effective (FWS 2002a, pp. 96 to 136, emphasis added). Although the HCP is not required to contribute to the recovery of listed species, efforts consistent with recovery plans or recommendations and those that provide benefits to the species help to ensure that incidental take from continued operation of Horseshoe and Bartlett will not appreciably reduce the likelihood of survival and recovery of the species in the wild (FWS 1996). The suggested recovery actions in the Flycatcher Recovery Plan that are relevant to the HCP include: (1) modifying dam operations; (2) augmenting sediment downstream of reservoirs; (3) providing more water to riparian areas by more effective management of surface and ground water; (4) improving fire, recreation, and livestock management; (5) protecting habitat; (6) increasing population stability; and 7) monitoring. Each of these actions has been evaluated during the development of the HCP and has been incorporated into the HCP where feasible, legal, and effective.

Modifying Dam Operations. As to the first suggested action, possible changes to dam operations are extensively evaluated as part of the HCP, and modifying the operation of Horseshoe was determined to be the most biologically effective action over the long term, as well as the most feasible and legal alternative, both within Horseshoe and downstream of Horseshoe and Bartlett (Chapter II).

Augmenting Sediment Downstream of Reservoirs. The second suggested action, augmenting sediment downstream of reservoirs, is evaluated in the HCP and determined to be of uncertain effectiveness on the Verde River system and extremely costly (Appendix 3, Section II.B).

Providing More Water to Riparian Areas by More Effective Management of Surface and Ground Water. The HCP provides more water to riparian areas by managing water levels in Horseshoe to benefit the flycatcher. Also, native fish, frog, and gartersnake mitigation efforts to maintain instream flows along the entire Verde River mainstem would indirectly benefit riparian habitat in the Management Unit for flycatchers (Subchapters V.C.1 and V.D.2).

Improving Fire, Recreation, and Livestock Management. Improved fire, recreation, and livestock management on acquired properties is the specific reason for the mitigation measures described in Subchapter V.C.2. However, these issues would continue in the watershed as discussed under Subchapter IV.B.10, Cumulative Effects.

Protecting Habitat. Habitat protection is the focus of the HCP, as summarized above and described in Subchapter V.C.

Increasing Population Stability. Maintaining habitat at Horseshoe will increase population stability given the limited amount of flycatcher habitat available along the Verde River. The locations of mitigation land acquisitions for the HCP were selected in order to enhance flycatcher population stability by providing new habitat near existing populations, and increasing the populations at sites with relatively few birds (Verde and Safford valleys or elsewhere if needed), as described in Subchapter V.C.2.

Monitoring. The HCP incorporates monitoring measures for compliance, as well as for determining the effectiveness of management and restoration measures, using standard protocols (Subchapter V.C.3).

2. Razorback Recovery Plan and Goals

The FWS approved the Razorback Sucker Recovery Plan on December 23, 1998 (FWS 1998). An amendment and supplement to the plan was completed and approved in 2002, which provides site-specific management actions or tasks, recovery criteria, and goals (Recovery Goals) (FWS 2002b). The information and guidance provided in the recovery documents were used in preparation of the HCP, and the analysis of impacts and minimization and mitigation measures conform to and implement a number of the recommended actions. As discussed below, the HCP secures or improves habitat conditions for razorback sucker, and provides actions that support and enhance management efforts by natural resource agencies that conserve razorback sucker in the Verde River. As such, the Permit issued for the HCP, as required by law, "will not appreciably reduce the likelihood of survival and recovery of the species in the wild" (ESA Section 10(2)(B)(iv); 50 C.F.R. § 17.22(b)(2); FWS and NMFS 1996, p. 3-20).

Recovery criteria for the razorback sucker identify that, in addition to conservation of upper Colorado River basin and Lake Mohave populations, two self-sustaining populations must be established and conserved in the lower Colorado River basin. Based on past and current efforts by resource agencies (e.g., critical habitat designation, razorback sucker stockings, and revisions of fishing regulations), the Verde River may be one area that could support a razorback sucker population in the future. To support the survival and recovery of the razorback sucker in the Verde River, the HCP addresses four primary recommendations outlined in the Razorback Sucker Recovery Plan and Goals. First, to the maximum extent practicable, the Optimum Operation Alternative reduces the production of problematic nonnative fish (Management Action #10; FWS 2002b). Horseshoe operations will reduce or minimize the impacts of nonnative fish species on razorback sucker through interruption of nonnative fish spawning and lowering of recruitment and survival rates of nonnative fish in Horseshoe. The Razorback Sucker Recovery Plan and Goals also recommend the development of control programs for problematic nonnative species in the mainstem, floodplain, and tributaries that will identify levels of control and minimize negative interactions between nonnative fish and razorback suckers (e.g., Task C-3.1, FWS 2002b). To date, a nonnative fish control program and plan have not been developed by the resource agencies to implement removal or suppression efforts for nonnative fish in the mainstem of the Verde River. However, should a nonnative fish control program be developed and agreed upon by AGFD and FWS, SRP would redirect funding to those efforts as adaptive management in lieu of other mitigation activities if the nonnative management efforts are found by FWS to be equal to or provide greater conservation benefit than the primary mitigation measures in the HCP (Subchapter V.D.4).

Second, mitigation measures in the HCP to support hatchery facilities and stock adult and/or subadult razorback sucker into the Verde River meets Management Action #1 to "reestablish populations with hatchery raised fish" (FWS 2002b). The stocking effort and hatchery improvements are consistent with past, current, and future management

goals of the FWS and AGFD for razorback suckers in the Verde River (Jahrke and Clark 1999; AGFD 2001h). Third, the HCP provides and legally protects habitat necessary to sustain all life stages to support recovered razorback sucker populations (Management Action #3; FWS 2002b). This goal is accomplished though: 1) ongoing and future watershed management activities identified in Subchapter V.D.2 that secure water rights, maintain instream flow, and improve watershed conditions; and 2) under Optimum Operations, reservoir water levels will periodically inundate the floodplain within the conservation pool of Horseshoe, which mimics natural floodplain conditions and provides nursery, juvenile, and adult razorback with habitat to encourage recruitment. Finally, the HCP provides long-term (50-year) management and protection of habitat in the middle and lower Verde River (Management Action #14; Id.).

In summary, the reservoir operation and mitigation measures provided under the HCP are consistent with the criteria in the Razorback Sucker Recovery Plan and Goals, and will significantly support the future efforts of natural resource agencies to conserve the razorback sucker in the Verde River watershed.

3. Spikedace and Loach Minnow Recovery Plans

In September 1991, the U.S. Fish and Wildlife Service approved recovery plans (Plans) for the spikedace (FWS 1991a) and loach minnow (FWS 1991b). Revisions to both Plans are under way. The current Plans are nearly identical in their discussion of goals, objectives, and recommendations. The information and guidance provided in the Plans were used in preparation of the HCP, including the analysis of impacts, and development of minimization and mitigation measures, which conform to and implement a number of the Plans' recommended actions. As discussed below, the HCP helps protect or improve habitat conditions for the spikedace and loach minnow, and provides measures that support and enhance management efforts by natural resource agencies that conserve these fish in the Verde River watershed. As such, the Permit issued for the HCP, as required by law, "will not appreciably reduce the likelihood of survival and recovery of the species in the wild" (ESA Section 10(2)(B)(iv); 50 C.F.R. § 17.22(b)(2); FWS and NMFS 1996, p. 3-20).

The main recovery objectives of the Plans are the protection of existing populations and restoration of populations within portions of historical habitats. The Plans do not identify specific population targets; rather, they recommend that managers work to determine population demographic parameters (e.g., absolute and relative population numbers, reproductive and recruitment rates) that would support self-sustaining populations and the environmental conditions that would allow the species to thrive. To date, specific reintroduction locations within historical habitat, and specific population abundance or distribution (metapopulation) goals have not been established by FWS. However, the Plans identify nine primary objectives to conserve and recover the species (FWS 1991a, 1991b).

The HCP furthers six of the primary objectives to support the survival and recovery of the spikedace and loach minnow in the Verde River (FWS 1991a, 1991b). First, to the maximum extent practicable, the Optimum Operation Alternative reduces the production of problematic nonnative fish (Objective 1 – protection of existing populations, and Objective 5 – enhancement of habitats). Optimum Horseshoe operations will reduce the

impacts of nonnative fish species on spikedace and loach minnow through interruption of nonnative fish spawning and lowering the recruitment and survival rates of nonnative fish in Horseshoe. The HCP also provides mitigation measures to fully offset the impacts of nonnative fish species that may move upstream or downstream of the reservoirs. Additionally, the HCP meets the Plans' recommendations that private and public entities comply with Section 9 of the ESA, and that detrimental land and water use practices be discouraged (subpart of Objective 1). The HCP conservation measures were developed in cooperation with the FWS and AGFD to address SRP's potential impacts to habitat and incidental take of the species. The HCP provides long-term (50-year) management and protection of habitat in the middle and lower Verde River.

Second, mitigation measures in the HCP to support hatchery facilities and stocking of spikedace and loach minnow into the Action Area (as described in Subchapter V.B.2.d) address Objective 6 – reintroduction of the fish into historical habitats, and Objective 8 – captive propagation, of the Plans. Third, the HCP contributes to Objective 4 of the Plans – quantification of habitat and effects of habitat modification – by assessing habitat modification due to future operation of the reservoirs, and minimizes and mitigates those impacts. Finally, the HCP provides funding for information and education outreach efforts (Objective 9) in the watershed related to water management, which have benefits to native fish habitat protection and conservation.

In summary, the reservoir operation and mitigation measures provided in the HCP are consistent with the guidance provided in the Plans, and will significantly support the future efforts of natural resource agencies to protect, conserve, and recover spikedace and loach minnow in the Verde River watershed.

4. Gila Topminnow Recovery Plan

FWS approved the Gila Topminnow Recovery Plan on March 15, 1984 (FWS 1984), and is currently considering revisions to the Plan based on a draft dated December 1998 (Weedman 1998). The information and guidance provided in the recovery documents were used in preparation of the HCP, and the analysis of impacts and minimization and mitigation measures conform to and implement a number of the recommended actions. As discussed below, the HCP secures or improves habitat conditions for Gila topminnow, and provides actions that support and enhance management efforts by natural resource agencies that conserve Gila topminnow in the Action Area. As such, the Permit issued for the HCP, as required by law, "will not appreciably reduce the likelihood of survival and recovery of the species in the wild" (ESA Section 10(2)(B)(iv); 50 C.F.R. § 17.22(b)(2); FWS and NMFS 1996, p. 3-20).

Primary goals of the Recovery Plan (FWS 1984) to achieve down-listing and delisting of the Gila topminnow are to: 1) maintain, protect, and enhance existing natural topminnow populations; and 2) reintroduce topminnow into suitable sites throughout the historic range in order to establish self-sustaining populations. There are no remaining natural populations in the Action Area. The Lime Creek population is an introduced population, which is identified in the 1998 draft as a Level 2, long-lived, reestablished population and considered essential to the recovery of the species.

To support the survival and recovery of the Gila topminnow in the Action Area, the HCP addresses six primary recommendations outlined in the Recovery Plan (FWS 1984). First, habitat of the Gila topminnow is enhanced in the Action Area by the Optimum Operation Alternative that reduces, to the maximum extent practicable, the production of problematic nonnative fish. Also, the ongoing and future watershed management activities identified in Subchapter V.D.2 to secure water rights, maintain instream flow, and improve watershed conditions will improve habitat conditions for the species (see Step-down Outline #s 1.211 and 1.212; FWS 1984). Second, the mitigation measures in the HCP include construction of a fish barrier in Lime Creek to prevent the invasion by nonnative fishes and future stream renovation if an invasion occurs (see Step-down Outline #s 1.213 and 1.2131; FWS 1984). Third, the HCP mitigation measures support hatchery facilities at Bubbling Ponds Hatchery, which provide resources to maintain additional stocks or refugia of Gila topminnow if needed in the future (see Step-down Outline # 3.0; FWS 1984). Fourth, the HCP and incidental take permit provides legal compliance with the Endangered Species Act to conserve the topminnow (see Step-down Outline # 6.0; FWS 1984). Fifth, the HCP mitigation watershed management activities provide for educational outreach to inform the public about the importance of native fish conservation and the protection of habitats (see Step-down Outline # 7.0; FWS 1984). Lastly, the HCP native fish monitoring provides resources to survey the Lime Creek population and other areas within the Action Area (see Step-down Outline # 1.1; FWS 1984)

The available draft revised Recovery Plan (Weedman 1998) for the Gila topminnow includes similar conservation recommendations and objectives as the 1984 Recovery Plan (e.g., protection of natural and reestablished sites, prevention of nonnative fish invasion, periodic population monitoring, and information and education strategies). Specifically, the 1998 draft plan recognizes the importance of the Lime Creek population to recovery. Thus, the HCP mitigation measure to construct and maintain the fish barrier implements a key recommended conservation action to protect the population.

In summary, the reservoir operation and mitigation measures provided under the HCP are consistent with the criteria in the Gila Topminnow Recovery Plan and draft revised Recovery Plan, and will significantly support the future efforts of natural resource agencies to conserve the Gila topminnow in the Action Area.

B. Overview of Minimization and Mitigation, Monitoring, and Adaptive Management Measures

1. Minimization and Mitigation

Subchapters V.C and V.D describe the proposed minimization and mitigation measures to be undertaken as part of the HCP. These minimization and mitigation measures address the impacts of the Optimum Operation Alternative on covered species, which are discussed in Chapter IV. As summarized in the discussion of alternatives in Subchapter II.A, the proposed minimization and mitigation measures for impacts on covered species were prioritized based on: 1) maximization of benefits to covered species; 2) minimization of impacts on water delivery and power generation; 3) proximity of the mitigation measures to Horseshoe and Bartlett; and 4) feasibility of the proposed

measures. The largest and most direct impacts from the Optimum Operation of Horseshoe and Bartlett would occur to habitat used by flycatchers and cuckoos (Subchapters IV.B.1 and IV.B.3). Thus, high priority is given to minimization and mitigation measures that will offset impacts to flycatcher and cuckoo habitat (Subchapter V.C.1). Adaptive management for bald eagles is provided in Subchapter V.C.4.d. Minimization and mitigation measures for native fish species are provided in Subchapter V.D.

Section 10(b)(2)(i)(B) requires that "the applicant will, to the maximum extent practicable, minimize and mitigate the impacts" of the taking of species covered by the HCP. The HCP Handbook does not contain a definition of the term "maximum extent practicable," but, instead, calls for consideration of the adequacy of the proposed minimization and mitigation program, and whether the program is the maximum that can be practically implemented by the applicant (HCP Handbook, at 7-3, 7-4). Where the mitigation program provides substantial benefits to the species, the Handbook states that "less emphasis can be placed on the second factor."

A recent federal court decision has concluded that the requirements of Section 10(b)(2)(i)(B) are satisfied if the minimization and mitigation measures proposed to be implemented are "rationally related to the level of take under the plan." *See National Wildlife Federation v. Norton*, 306 F.Supp.2d 920, 927-28 (E.D. Cal. 2004).[38] The court noted that the words "maximum extent practicable," as used in the statute and interpreted in the HCP Handbook, "signify that the applicant may do something less than fully minimize and mitigate the impacts of the take where to do more would not be practicable" (Id. at 928). The court also concluded that "the statutory language does not suggest that an applicant must ever do more than mitigate the effect of its take of species." *Id.*

"The Norton court's conclusions regarding the "maximum extent practicable" standard appropriately focus on the level of impacts anticipated, and whether the measures proposed in the HCP are adequate to minimize and mitigate those impacts. Where the measures provided for in the HCP are sufficient to fully mitigate the impacts of the taking of covered species, the requirements of Section 10(b)(2)(i)(B) are satisfied (Id.). As discussed in Subchapters V.C.2 and V.D.2, the HCP fully mitigates the impacts on covered species from the continued operation of Horseshoe and Bartlett.

2. Monitoring

SRP will monitor compliance with the terms and conditions of the Permit (compliance monitoring) and the effectiveness of minimization and mitigation measures (biological monitoring) as provided in Subchapters V.C.3 and V.D.3. Monitoring also will be used to assess the need for adaptive management in response to changed circumstances. SRP will provide monitoring for compliance and effectiveness throughout the 50-year duration of the Permit.

[38] The term "rationally related to the level of take under the plan" was proposed by FWS as the appropriate approach for determining compliance with the "maximum extent practicable" standard.

The HCP Handbook (Handbook; FWS and NMFS 1996) describes monitoring measures required by Section 10 regulations of the ESA:

> "For regional and other large-scale HCPs, monitoring programs should include periodic accountings of take, surveys to determine species status in project areas or mitigation habitats, and progress reports on fulfillment of mitigation requirements (e.g., habitat acres acquired). Monitoring plans for HCPs should establish target milestones, to the extent practicable, or requirements throughout the life of the HCP, and where appropriate, adaptive management options" (p. 3-26).

The Handbook also specifies that "Monitoring must be sufficient to detect trends in species populations in the plan area but should be as economical as possible. Avoid costly monitoring schemes that divert funds away from other important HCP programs, such as mitigation" (p. 3-27). The monitoring programs in the HCP fully comply with the guidance provided by the Handbook.

3. Adaptive Management

Adaptive management is an integral part of the HCP and an important element of any habitat conservation plan (FWS and NMFS 1996, pp. 3-24 to 3-26). Adaptive management is based on a continuing process of action resulting from planning, monitoring, evaluation, and adjustment. As described below in Subchapters V.C.3 and V.D.3, monitoring in the HCP involves a repeated assessment of the populations of covered species and their habitats at Horseshoe, in the Verde River, and at mitigation sites in order to assess the status and changes of those variables. Based on the monitoring results, SRP and FWS will be able to determine how well the actions are meeting the goals and objectives, and the steps to be taken to modify activities to increase success, consistent with the provisions for adaptive management in the HCP. Annual reports and meetings will be used to evaluate and adjust management measures in accordance with changed circumstances.

SRP will implement adaptive management at Horseshoe under the HCP as described in Subchapters V.C.4, V.D.4, and V.F.1. These adaptive management measures encompass two general areas:

1) Program adaptive management—involving changes in circumstances affecting fundamental components of the HCP, e.g., mitigation of additional acres at Horseshoe if certain thresholds of impact to flycatcher habitat are exceeded at Horseshoe in the future (average unavailability of up to 200 additional acres occupied by flycatchers); and

2) Biological adaptive management—involving implementation of various management measures in response to changed circumstances at the mitigation sites or in the mitigation measures.

Subchapter V.F.1, *Changed Circumstances*, summarizes both types of adaptive management efforts provided in the HCP. The monitoring measures to determine if adaptive management measures and mitigation measures need to be implemented are provided below in Subchapters V.C.3 and V.D.3.

C. Minimization, Mitigation, Monitoring, and Management Measures for Covered Bird Species

This subchapter describes the minimization and mitigation measures for flycatchers and cuckoos to be implemented as part of the HCP. Bald eagles are addressed through adaptive management in Subchapter V.C.4.

Separate habitat mitigation for the cuckoo is not provided in the HCP because on-site and off-site minimization and mitigation measures for flycatchers also will benefit cuckoos. Habitat requirements for cuckoos and flycatchers overlap to a large degree. Both require blocks of tall dense riparian vegetation for foraging and nesting; and habitat must be relatively close to open water.[39] However, as described in Subchapter III.A.1.c, there are some small known differences in habitat preference: 1) flycatchers tend to use nest sites that are closer to water than cuckoos; 2) cuckoos do not nest as closely together as flycatchers; and 3) cuckoos appear to prefer at least 10-acre blocks of habitat for nesting and foraging, and generally do not use more narrow strips of habitat.

Because the mitigation measures for flycatchers are intended to support cuckoos as well, the following considerations are included in the selection of mitigation land in the HCP in Subchapter V.C.2.a:

- Cuckoos benefit from the creation or protection of riparian areas composed of dense riparian woodlands.
- For cuckoos, riparian woodlands should be at least 10 acres in size.
- Riparian woodlands should be provided in blocks rather than in strips.
- To the degree feasible, riparian habitat should be located in areas that favor a natural succession of vegetation so that there will be periodic establishment of dense riparian vegetation patches, which would provide high complexity of habitats available for breeding season needs of both cuckoo and flycatcher. Dense riparian habitat appears to be an important factor in nest site selection (FWS 2001).

As discussed below, SRP is undertaking extensive minimization and mitigation measures to offset impacts on flycatcher habitat at Horseshoe. Those measures will likewise minimize and mitigate impacts from future reservoir operations on cuckoo habitat. In summary, maintenance of willow habitat at Horseshoe, and acquisition of riparian habitat on the Verde and Gila rivers or elsewhere in central Arizona also will benefit cuckoos.

1. Minimize Impacts at Horseshoe

As noted in Subchapters III.B.1 and III.B.4.a, and Sections III.A and III.B of Appendix 3, there are limited opportunities to acquire and restore riparian habitat on private land for flycatchers and cuckoos along the Verde River. However, SRP will modify reservoir operations to make riparian habitat available earlier in the nesting season and to maintain riparian vegetation at higher elevations in the reservoir whenever

[39] Cuckoos also occasionally nest in tall dense mesquite or salt cedar near water.

possible (Subchapter II.B.3). In summary, the earlier and more rapid drawdown of Horseshoe whenever feasible in the spring will reduce impacts on native fish, frog, and gartersnake species by decreasing nonnative fish production. These drawdowns also will minimize impacts on flycatchers and cuckoos by making more habitat available early in the breeding season. In addition, after two successive years of low water levels due to drought, Horseshoe will be filled ahead of Bartlett, if feasible, to provide water to tall dense vegetation at the upper elevations of Horseshoe. Combined with the normal cycle of reservoir levels, which serve to establish and maintain riparian habitat in the reservoir, the modified reservoir operations will minimize impacts on flycatcher and cuckoo habitat.

2. Mitigation Habitat Acquisition and Management

In the future, the maximum amount of occupied flycatcher and cuckoo habitat predicted to be unavailable due to the operation of Horseshoe and Bartlett under the Optimum Operation Alternative is 200 acres on average (Subchapters IV.B.1.b and IV.B.3.b). However, the 200 acres is not expected to be permanently lost, rather the amount unavailable will vary spatially and temporally in the reservoir. The long-term operation of Horseshoe is expected to create additional habitat than what is present today, and on average, 260 acres is expected to be available as nesting habitat in the conservation pool of the reservoir. Unlike many projects, operations will temporarily make habitat unavailable; however, over the long term, operations that cause the raising and lowering of water levels are necessary to create and sustain flycatcher and cuckoo habitat. The amount of mitigation needed to offset these periodic impacts considered these unique conditions.

As part of the HCP, SRP will acquire and manage 200 acres of riparian habitat suitable for flycatchers and cuckoos in order to minimize and mitigate impacts to the maximum extent practicable. The habitat acquisition and management program is described below.

In addition, due to concerns about the potential impacts of ground water pumping and surface water diversions on the future water supply for mitigation lands, SRP will use its best efforts to protect that water supply. SRP's water supply protection program as part of this HCP will focus on special projects to specifically benefit mitigation habitat. Examples of such projects include ground water testing and modeling in the vicinity of mitigation lands, development and support of instream flow water rights, and research on the relationship between hydrology, habitat, and covered species. It is anticipated that the HCP funding of such special projects will typically be part of a cost-share agreement involving two or more agencies that share the same objective of protecting stream flow in the vicinity of mitigation habitat.

Adaptive management will be employed to address increases in impacts greater than 200 acres, if they occur. Increased impacts will be detected through monitoring, and additional mitigation and minimization measures will be implemented for up to 200 acres of additional habitat impacted to address these changed circumstances (Subchapters V.C.3 and V.C.4).

a) Habitat Acquisition and Management Principles

At least 200 acres of mitigation habitat will be acquired and managed in perpetuity to provide permanent habitat for flycatchers, cuckoos, and other wildlife. The acquired lands will have either currently occupied flycatcher and cuckoo habitat, or habitat that is expected to support flycatchers and cuckoos in the future through improved management. In combination with the minimization measures at Horseshoe, SRP believes that the acquisition of mitigation land will fully minimize and mitigate the impacts on flycatchers and cuckoos, thus entirely satisfying the Permit issuance criterion of minimizing and mitigating impacts to the "maximum extent practicable" (see the introductory paragraphs to this chapter).

Habitat acquisition and management will involve three components: 1) acquisition of suitable riparian habitat; 2) placement of conservation easements on that habitat to protect it in perpetuity; and 3) establishment and implementation of permanent management for that habitat. These components are described following the discussion of the amount and characteristics of the riparian habitat to be acquired and managed. This habitat also will be monitored and adaptively managed as discussed in Subchapters V.C.3 and V.C.4.

Amount of Acquired Riparian Habitat. The amount of riparian land to be acquired and managed is equal to the average annual amount of occupied habitat estimated to be unavailable at Horseshoe in the future (Subchapter IV.B.1.b). The decision to acquire and manage an amount of habitat equivalent to the average annual amount of occupied habitat unavailable at Horseshoe is based on a number of considerations:

- In the short term, which is likely to be as long as 5 to 10 years or more, there will be little or no impact on the availability of flycatcher or cuckoo habitat at Horseshoe because most of the habitat will remain viable for this period of time and continue to consist of very tall trees at the upper end of Horseshoe (Subchapter IV.B.1.b). This will mean that any additional flycatcher reproduction on mitigation lands during this period will be an increase to the regional flycatcher population.
- There will be no long-term permanent loss of flycatcher and cuckoo habitat at Horseshoe. Over the long term, the average annual amount of available flycatcher and cuckoo habitat at Horseshoe is estimated to be about 260 acres, ranging from a minimum of about 60 acres, to a maximum of about 450 acres in a given year. Conversely, the average annual amount of habitat that would be unavailable, modified, or lost would be 200 acres, ranging from 0 acres to about 390 acres in a given year (Subchapter IV.B.1.b).
- Modified Horseshoe operations are consistent with Flycatcher Recovery Plan guidelines to minimize impacts by helping to maintain suitable breeding habitat within the lakebed through management of reservoir levels, i.e., earlier and more rapid drawdown when feasible will make more habitat available and water management may allow germination, recruitment, and survival of riparian trees that could be used for breeding.
- Reservoir operations result in a biological process that creates and sustains flycatcher and cuckoo habitat over time, and improves habitat condition.

- SRP is including additional measures such as funding staff time for habitat management at Horseshoe and on the mitigation lands as described below.
- Unlike small projects mitigating for a few acres of impact, the level of mitigation in the HCP is relatively large, involving the acquisition, protection, and management of at least 200 acres of riparian land, which provides better quality blocks of habitat. Also, wherever possible, acquired lands will be adjacent to mitigation lands acquired for the Roosevelt HCP. Moreover, SRP is pursuing properties on the Verde and Gila, or San Pedro and other rivers with high quality riparian habitat, which creates a synergism with other conservation efforts to provide a greater overall benefit to wildlife.
- SRP will be acquiring, protecting, and managing habitat along rivers where there are already flycatchers and cuckoos breeding, which will increase the area along those corridors for colonization and movement and minimize the risk associated with concentration of habitat at Horseshoe in case of fire, flood, or other losses.

Characteristics of Acquired Riparian Habitat. The riparian habitat to be acquired and managed will have characteristics similar to the 200 acres that could be unavailable on average at Horseshoe. Those characteristics include some combination of the following criteria as provided in the Flycatcher Recovery Plan:

- Floodplain and stream hydrological conditions are favorable to habitat maintenance, i.e., subject to scouring floods, sediment deposition, periodic inundation and ground water recharge, and having low stream gradient (FWS 2002a). The dynamics of the natural processes and resulting patterns of riparian vegetation on the properties support breeding habitat for both flycatcher and cuckoo. These conditions already exist on occupied and suitable habitat, which are the priority for acquisition.
- Habitat will be located in proximity to Horseshoe within the Verde Management Unit or within the same Recovery Unit to the extent possible (FWS 2002a).
- Habitat occupied by flycatchers that is currently unprotected will be the highest priority for acquisition (FWS 2002a).
- Habitat that is suitable, but currently unoccupied in proximity to existing populations of flycatchers will be the second highest priority for acquisition (FWS 2002a).
- Locations where relatively large blocks of riparian land and patches of potential or suitable habitat greater than 10 acres in size can be acquired and protected, or that are in proximity to other riparian land conservation efforts, in order to allow natural stream processes to function and to minimize impacts from adjacent land uses (FWS 2002a).
- Locations where stresses to riparian habitat such as water diversions, grazing and adverse recreational uses, and stream channelization are minimized as much as possible (FWS 2002a).

- Riparian land will be acquired that has, or will have, the potential for similar or greater proportions of future flycatcher habitat found at Horseshoe, i.e., about 50 percent or more tall dense vegetation on a site-specific basis (Subchapter IV.B.1.a) and will have moist soil or surface water during the nesting season (FWS 2002a).
- Habitat acquisitions will be in a diversity of locations to minimize the risk of simultaneous catastrophic loss (FWS 2002a).
- For acquisition and credit of floodplain property that is not currently suitable for breeding flycatchers and cuckoos, SRP will predict the area of the floodplain at the time of purchase that would likely support suitable breeding habitat in the future due to long-term management and protection. Unless otherwise mutually agreed upon by FWS and SRP based on site-specific factors, the acreage of floodplain land outside of the active channel that is within 5 feet of ground water will be considered capable of supporting cottonwood and willow forest patches (Stromberg et al. 1996; Springer et al. 1999) that are similar to the occupied flycatcher and cuckoo habitat at Horseshoe. Acquisition of such habitat is a low priority for this HCP.

The criteria listed above have been successfully applied for habitat acquired as part of the Roosevelt HCP. Although not all mitigation properties were surveyed in 2005 due to recent acquisitions, the habitat is viable as indicated by the presence of flycatchers (37 territories) and cuckoos (23 detections) (SRP 2005c).

Acquisition of Riparian Habitat. SRP will acquire suitable riparian habitat through purchase of fee title or acquisition of conservation easements (see next paragraph for discussion of conservation easements). A third mechanism of acquisition might be participation in a joint venture with an agency or organization to acquire and manage larger blocks of riparian habitat. Under this third method, where SRP participates with a state or federal agency or conservation organization to provide permanent funding for properties to be acquired and managed in association with implementation of the HCP, part of the riparian habitat on those lands or properties will be credited toward SRP's obligation for habitat acquisition and management. The amount of credit toward SRP's obligations will be based on the proportion of funding provided by SRP in relation to the total cost of acquisition and management of the land. For example, if SRP and an agency or organization agree to acquire habitat that meets the goals and criteria in the HCP, but the agency's or organization's funds can only be used for acquisition, SRP could provide the funding for permanent management of the habitat. More specifically, if an agency spends $500,000 to acquire 150 acres of habitat and SRP commits $250,000 for permanent management, SRP will receive up to one-third of the total acreage (50 acres) as mitigation credits for that portion of the parcel that meets the characteristics of riparian habitat specified above. Riparian habitat acquired in a joint venture with another entity will not be double-counted as mitigation for both SRP and the other agency or organization.

Permanent Protection for Mitigation Property. Conservation easements or a similar form of permanent protection will be provided for all riparian habitat and other

land used for mitigation in order to ensure protection and management of the conservation of these lands beyond the term of the Permit into perpetuity, consistent with the provisions of the HCP. In some cases, the easement or other form of protection would be placed on the land as part of the purchase transaction; in other cases, they would be placed on the land following purchase of fee title by SRP. An example of a conservation easement is provided in Appendix 7. The holder of the conservation easement or other form of permanent protection will be an agency or organization acceptable to FWS.

Management of Mitigation Property. A manager for all acquired properties will be identified and a management plan will be developed, implemented, and permanently funded by SRP to ensure management of riparian habitat characteristics. For each property, SRP will develop a management plan acceptable to FWS within two years of acquisition in coordination with FWS and determine the management entity. The template for individual management plans is provided in Appendix 7. An excerpt from an example management plan prepared for the Roosevelt HCP is provided in Appendix 8. Each management plan will contain the following core elements:

- Collect baseline data on physical and biological attributes.
- Establish management goals including:
  - Providing ecological and conservation benefits to species covered by the HCP;
  - Protecting and enhancing a naturally functioning system to protect and maintain a dynamic mosaic of riparian vegetation communities, which provides habitat for both flycatcher and cuckoo over the long term;
  - Reducing threats such as cowbird parasitism and fire;
  - Building community support, coordinating with adjacent landowners; and increasing public awareness of SRP's conservation goals and strategies; and
  - Establishing other site-specific management goals for that property.
- Develop and implement strategies to achieve the management goals.
- Periodically survey for flycatchers and cuckoos, and monitor riparian vegetation and overall condition of the property.
- Evaluate management success using periodic surveys and vegetation monitoring data.
- Identify the need for and implement adaptive management measures if necessary.
- Annually review and amend the plan if necessary.

Specific management activities on mitigation properties, involving both initial and adaptive management measures, will include:

- Eliminating cattle grazing and adverse recreation impacts by erecting and maintaining fences to protect the riparian corridor;

- Surveying and managing cowbirds, if flycatchers are present, when and where appropriate (i.e., based on parasitism rates, flycatcher population, effectiveness, and other factors, in coordination with FWS);
- Providing signage, and meeting with neighbors and the public to increase awareness of threats to flycatchers, cuckoos, and riparian areas;
- Reducing the threat of fires using mowing, fire breaks, or controlled burns where needed;
- Coordinating fire response with local, state, and federal fire management entities;
- Increasing age-class diversity and cottonwood-willow overstory through planting of cuttings where necessary (i.e., where natural processes would no longer be expected to support recruitment) and feasible;
- Protecting trees from beavers using wire baskets, if necessary; and
- Removing invasive nonnative plants if necessary and feasible.

Management activities would be designed and implemented to maintain habitat and promote regrowth if necessary. Additional management measures and details are provided in Appendix 7.

Schedule for Conservation Measures. Within one year of the effective date of the Permit, at least 150 acres of mitigation will be in place in the form of acquisition of occupied or suitable flycatcher habitat, in accordance with the above requirements. Within 10 years of Permit issuance, SRP will ensure that another 50 acres of mitigation are provided. The potential delay of up to 10 years to acquire the remaining mitigation land is to provide every opportunity to purchase suitable habitat in the Verde Valley.

b) Location of HCP Mitigation Lands for Flycatchers and Cuckoos

Table V-1 summarizes the location of mitigation lands proposed for the HCP and the probability that SRP will be able to obtain high quality riparian land for mitigation in those areas. The probability of obtaining the proposed quantity of habitat is based on existing opportunities to acquire land or on the number of parcels and total land area identified as high priority in the *Rangewide Assessment of Habitat Acquisition Priorities for the Southwestern Willow Flycatcher* prepared by The Nature Conservancy under contract with Reclamation (Fichtel and Marshall 1999). These locations will minimize and mitigate for the potential take of flycatchers and cuckoos, further the conservation and recovery of these species, and are further described below.

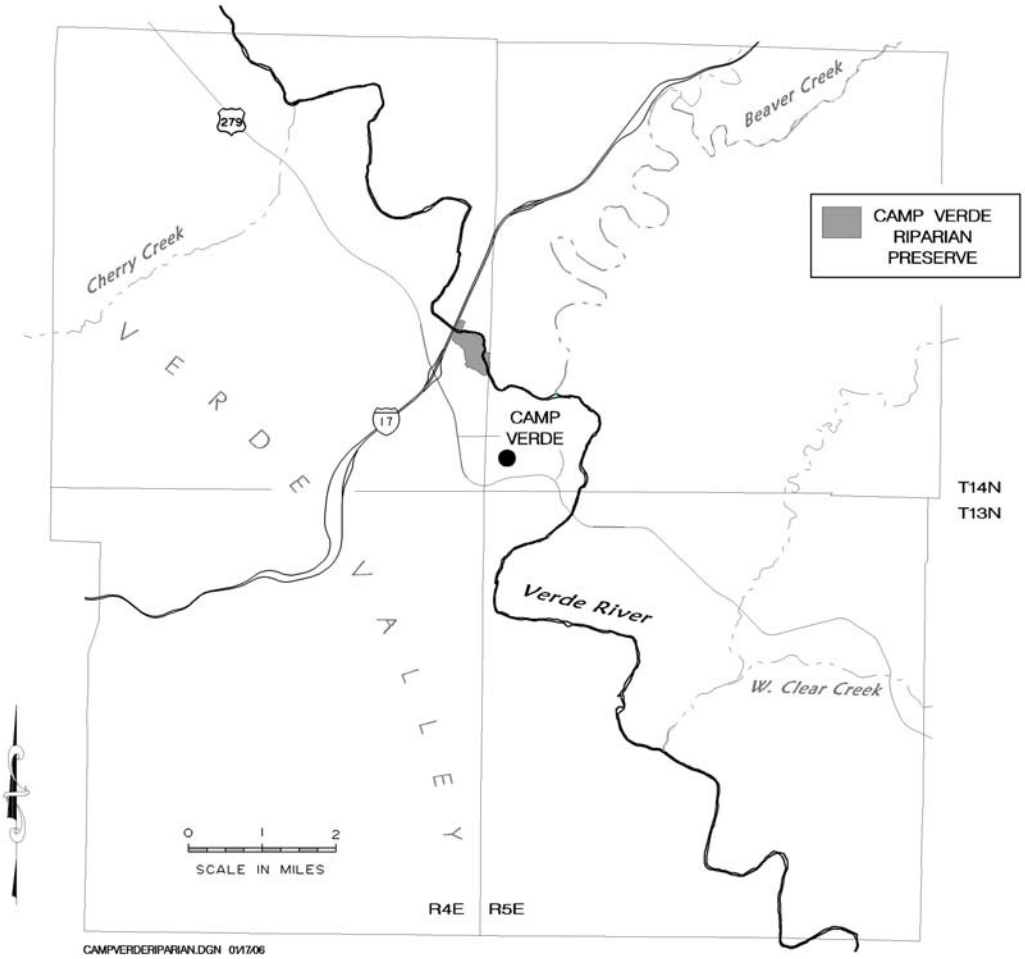
Table V-1. Locations of proposed mitigation lands.

Site	Acreage	Priority and Probability of Acquisition
Verde Valley	At least 50 acres if feasible	• High priority site for acquisition and management of riparian habitat. • There is a moderate probability that at least 50 acres of habitat can be acquired out of the 290 parcels and 1,900 acres of priority acquisitions identified by The Nature Conservancy (Fichtel and Marshall 1999). High land costs and small parcel sizes make it difficult to acquire a large enough contiguous tract for suitable habitat. • If additional acres are needed for adaptive management, the Verde Valley will be a priority for acquisition.
Safford Valley	At least 150 acres	• High priority site for acquisition and management of riparian habitat. • SRP has an option on one parcel with 150 mitigation acres, which is adjacent to a large block of habitat that has already been acquired as part of the Roosevelt HCP. • If additional acres are needed for adaptive management, there is a high probability that the necessary amount of habitat can be acquired out of the 125 parcels and over 2,500 acres of priority acquisitions identified by The Nature Conservancy (Fichtel and Marshall 1999).
San Pedro or Elsewhere in Central Arizona	Balance of habitat and other measures needed to reach 200 acres, or up to 400 acres if adaptive management is necessary	• Acquisition and management of riparian habitat in other areas in central Arizona will depend on whether sufficient mitigation habitat is obtained in the sites listed above. • There is a high probability that any remaining acres of habitat can be acquired out of the numerous parcels and thousands of acres of priority acquisitions identified by The Nature Conservancy (Fichtel and Marshall 1999).

Verde Valley Habitat Acquisition and Management

SRP intends to acquire and manage at least 50 acres of riparian habitat in the Verde Valley as part of the mitigation measures in the HCP. If possible, the habitat will be acquired adjacent to the flycatcher mitigation property already purchased by SRP for the Roosevelt HCP, known as the Camp Verde Riparian Preserve (Figure V-1). However, if habitat conservation in that area is determined to be infeasible, riparian habitat in other portions of the Verde Valley will be evaluated for acquisition and management. If insufficient habitat is found in the Verde Valley, the balance of the acreage will be obtained along the Gila or San Pedro river or elsewhere in central Arizona as described below.

Figure V-1. Location of Camp Verde Riparian Preserve.



Description of Riparian Habitat in the Verde Valley. The Verde River runs for approximately 140 miles from its headwaters at Sullivan Lake Dam near Paulden in Yavapai County eastward to Perkinsville, and then southeastward to its confluence with Fossil Creek where it continues southward until it joins with the Salt River. In general, the upper Verde River above the town of Clarkdale tends to be confined to a narrow

canyon that is scoured by floods periodically. From just upstream of the town of Clarkdale, the floodplain widens, and the river meanders through the Verde Valley for approximately 43 miles until it reenters a confined canyon about 10 miles below the town of Camp Verde (Fichtel and Marshall 1999). Habitat fragmentation, water diversion, trampling due to adverse recreational and livestock use of the river, and development pressures impact the biological integrity of the river (Id.).

Riparian vegetation in the Verde Valley is characterized by patches of cottonwood, willow, and mixed broadleaf riparian vegetation on a broad alluvial floodplain of sand, gravel, and cobble, with a relatively low stream gradient. Riparian vegetation varies in width from approximately 500 to 1,600 feet. The Verde River Management Plan for the flycatcher (SWCA 2000a) describes the following riparian communities along the Verde River: 1) salt cedar association consisting mainly of pure salt cedar with small bands of cottonwood and willow near the river; 2) cottonwood association, which includes trees up to 70 feet tall; 3) cottonwood/velvet ash (*Fraxinus velutina*)/Goodding willow/boxelder (*Acer negundo*) association, which is dense and ranges from approximately 60 to 70 feet in height; and 4) strand community within the active floodplain, which is dominated by sparsely vegetated salt cedar with some thick, young cottonwood interspersed with willow. Wetland communities include cattails (*Typha* sp.), sedges (*Carex* sp.), rushes (*Juncus* sp.), and grass associations (SWCA 2000a). The cottonwood groves have a fairly open understory due to the 1993 flood, which removed much vegetation, although regrowth is occurring (Castillo, pers. comm. 2001). These groves are often fragmented and interspersed with urban areas.

The Camp Verde Riparian Preserve (CVRP) encompasses nearly 1 mile of the Verde River just downstream of the I-17 bridge near Camp Verde (SRP 2005a). The floodplain on the CVRP is about 2,000 feet wide at its broadest point and is dominated by a mature cottonwood-willow woodland, with smaller areas of salt cedar, mixed riparian woodland, young cottonwood-willow, and other vegetation communities. Management issues on the CVRP and nearby lands include invasive plant species, fire, recreation trespass, and nearby urban development (SRP 2005b).

Biological Significance of the Verde Valley. Several groups and government entities have recognized the perennial sections of the Verde River as biologically significant. The Nature Conservancy has created a program to develop conservation goals and strategies that include consideration of the presence of flycatchers, bald eagles, and cuckoos as well as numerous other species that are federally protected or are species of concern (Fichtel and Marshall 1999). One study on the Verde River by Carothers et al. (1974), which was conducted just a few kilometers downstream from Dead Horse Ranch State Park near Camp Verde, reported some of the highest breeding bird densities in all of North America. "Not only do riparian habitats [such as those along the Verde River] support high breeding bird densities, they also provide cover and water to all classes of wildlife, movement corridors for larger species, and migration pathways for birds, including scores of neotropical migratory birds, and probably bats as well" (Tomoff and Ohmart 1994). The Environmental Protection Agency (EPA) developed a publication in 1995 called the "Verde River Advance Identification (ADID) Project" as part of a Phase I inventory of EPA efforts to protect ecosystems. This project extended from Sullivan

Lake to Horseshoe, covering 125 miles of the Verde River. The goals listed in the ADID report were to achieve a net gain in the quality and quantity of the Verde River riparian ecosystem in terms of acres, functions, and values; and to restore and manage the physical, chemical, and biological integrity of the Verde River riparian ecosystem (EPA 1995). The main environmental problems listed in the ADID report were: 1) sedimentation from sand and gravel mining and other land uses; 2) polluted runoff from abandoned hard-rock mines; 3) bank stabilization; and 4) flooding (EPA 1995).

Flycatchers and Cuckoos in the Verde Valley. In 2005, FWS designated critical habitat for the flycatcher along two segments covering approximately 90 miles of the Verde River (FWS 2005). One segment occurs in the Verde Valley and extends 14.4 miles from near the town of Clarkdale downstream to the upstream border of the Yavapai-Apache tribal lands. The other segment extends from the downstream border of the tribal lands to the upper end of Horseshoe.

Surveys for flycatchers along the Verde River in the Verde Valley have documented several small sites that have been occupied in one or more years, most consistently in sites near Camp Verde (Smith et al. 2002, 2003, 2004; Munzer et al. 2005; EEC 2004; Koronkiewicz and Rhodes 2005; Sogge, pers. comm. 2003, 2004). There is also anecdotal evidence of flycatcher nesting on private property that has not been surveyed (Fichtel and Marshall 1999).

As discussed in Subchapter III.A.1.c, relatively large numbers of cuckoos have been detected in the Verde Valley. On the CVRP, six cuckoos were detected during 2005 surveys (SRP 2005b).

Verde Valley Mitigation Land Acquisition and Management. As described above, SRP intends to acquire and manage at least 50 acres of riparian habitat along the Verde River, adjacent to the CVRP if possible (Figure V-1). Figure V-2 is a photograph of riparian habitat on the CVRP. The exact quantity and timing of acquiring land at this location will depend on the feasibility of acquiring appropriate riparian lands adjacent or in close proximity to the CVRP.

Ongoing SRP investigations of potential property purchases in the area indicate a number of constraints to riparian habitat conservation throughout the Verde Valley including uncertainties with land title, small parcel size, reluctant sellers, and potential encroachment by urban development. However, SRP will use its best efforts to acquire and protect additional mitigation land in this location. SRP has been researching properties, contacting and negotiating with landowners, evaluating titles, conducting appraisals, and acquiring land in the Verde Valley since June 2001, and discussions are ongoing with several landowners.

Figure V-2. Camp Verde Riparian Preserve.

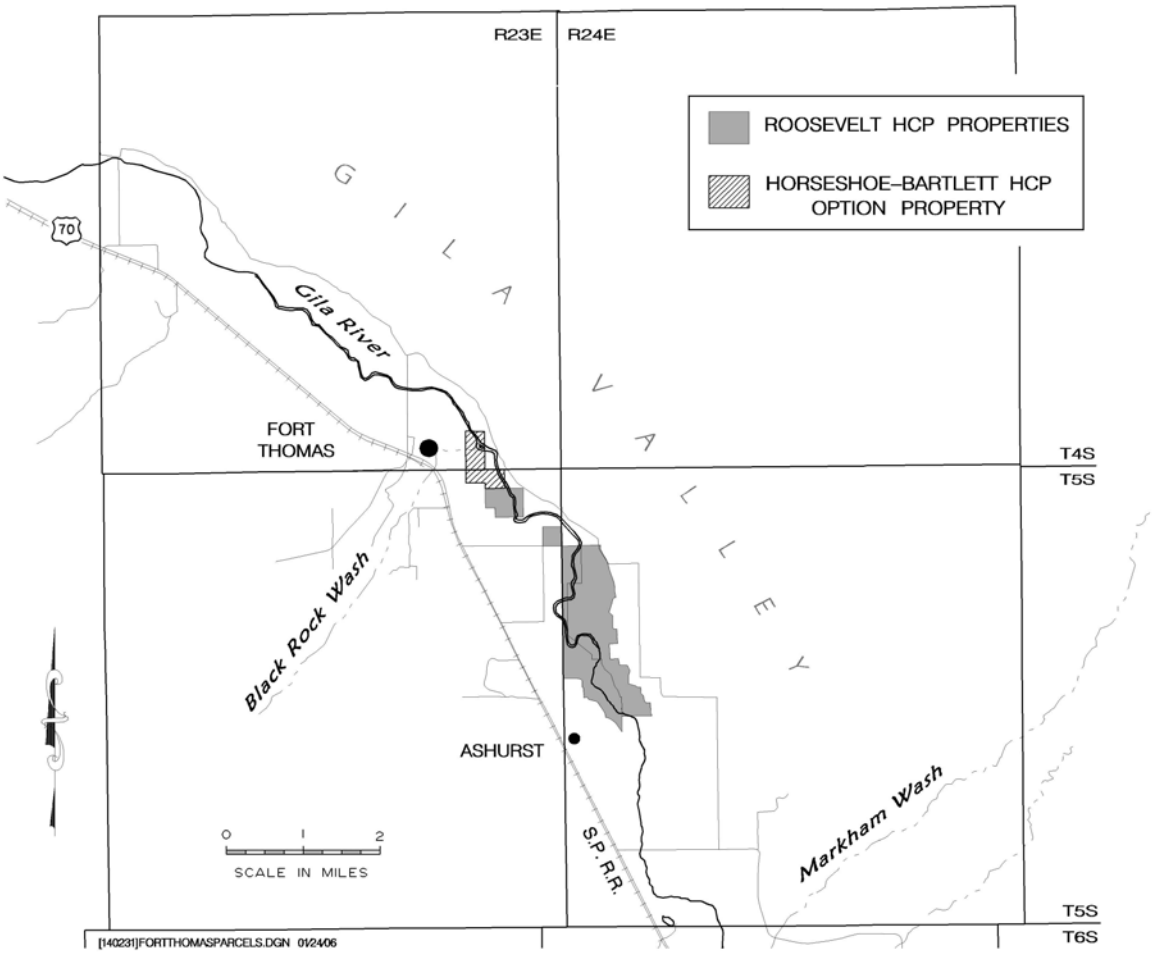
As with all of the mitigation lands acquired as part of this HCP, SRP will provide permanent management for any Verde Valley habitat acquisitions. The primary management goal will be to protect and enhance a naturally functioning system to protect and maintain a dynamic mosaic of riparian vegetation communities by identifying and removing or minimizing major stressors. Management funding will include initial construction or improvement, and long-term maintenance of fencing where feasible to minimize trespass by people and livestock. Management funding also may include provision of security patrols and other efforts needed to protect and manage the habitat as specified in the management plan for each property (Appendix 7). If flycatchers are present and cowbird parasitism is problematic, cowbird management will be employed as described in Subchapter V.C.4 below.

If SRP's efforts to conserve at least 50 acres of appropriate riparian habitat in the Verde Valley are unsuccessful, SRP will pursue the remaining mitigation land elsewhere. SRP will acquire and manage habitat at other location(s) that will be selected in consultation with FWS. The first priority for alternative sites will be to augment mitigation lands along the Gila and San Pedro rivers where SRP is conserving habitat as part of the Roosevelt HCP (see below). The quantity of habitat acquired or additional mitigation implemented at alternative sites will be at least 50 acres, i.e., the balance of the goal in the Verde Valley.

Safford Valley Habitat Acquisition and Management

SRP intends to acquire and manage at least 150 acres of riparian habitat along the Gila River in the Safford Valley as part of the mitigation measures in this HCP. SRP already has an option to purchase 150 acres of habitat adjacent to the flycatcher mitigation property acquired for the Roosevelt HCP (Figure V-3). However, if additional habitat were necessary because insufficient habitat could not be acquired in the Verde Valley, or adaptive management for habitat at Horseshoe was required, mitigation land in the Safford Valley would be evaluated for acquisition and management. If insufficient habitat were found in the Safford Valley, the balance of the acreage would be obtained along the San Pedro River or elsewhere in central Arizona as described below.

Figure V-3. Conservation properties owned or managed by SRP in the Safford Valley and location of option property.



Description of Riparian Habitat in the Safford Valley. The Safford Valley extends about 45 miles along the Gila River from the confluence with Bonita Creek downstream to the San Carlos Apache Indian Reservation (Fichtel and Marshall 1999). The Gila River is generally perennial through the Safford Valley, gaining flow as it moves downstream, although it can be intermittent during extended drought

(Reclamation 2005). Peak flows have exceeded 130,000 cfs and minimum flows in June occasionally approach 0 cfs (Id.). Fires and water diversions are the primary threats to riparian habitat in this area (Fichtel and Marshall 1999).

The Gila River floodplain is up to 1 mile wide in many locations and the river frequently shifts laterally (Reclamation 2005). Riparian vegetation is characterized by dense stands of salt cedar with occasional patches of cottonwood, willow, and mixed riparian vegetation on a broad alluvial floodplain of sand, gravel, and cobble, with a relatively low stream gradient (Id.). Dense patches of salt cedar and other woody riparian vegetation are typically 1,000 or more feet in width. Common shrub species found in the riparian communities include seepwillow (*Baccharis salicifolia*), coyote willow *(Salix exigua*), arrowweed (*Pluchea* sp.), burrobrush (*Hymenoclea monogyra*), quailbush (*Atriplex lentiformis*), and desert broom (*Baccharis sarothroides*) (Reclamation 2005; Dockens and Ashbeck 2005).

Biological Significance of the Safford Valley. A wide variety of wildlife can be found in riparian habitat along the Gila River. Bird species that may occur in the Safford Valley include Abert's towhee (*Pipilo aberti*), Bell's vireo (*Vireo bellii),* black phoebe (*Sayornis nigricans*), blue grosbeak (*Passerina caerulea*), common yellowthroat (*Geothlypis trichas*), Lucy's warbler (*Vermivora luciae*), mourning dove (*Zenaida macroura*), white-winged dove (*Z. asiatica*), northern cardinal (*Cardinalis cardinalis*), summer tanager (*Piranga rubra*), vermilion flycatcher (*Pyrocephalus rubinus*), cuckoo, flycatcher, yellow warbler (*Dendroica petechia*), and yellow-breasted chat (*Icteria virens*) (Id.). Mammals that likely use the riparian habitat include beaver (*Castor Canadensis*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), ringtail (*Bassaricus astutus*), badger (*Taxidea taxus*), striped skunk (*Mephitis mephitis*), hooded skunk (*M. macroura*), hog-nosed skunk (*Conepatus mesoleucus*), mountain lion (*Puma concolor*), black bear (*Ursus americanus*), bobcat (*Felis rufus*), collared peccary (*Tayassu tajacu*), mule deer (*Odocoileus hemionus*), and several rodent and bat species (Id.). Riparian-dependent reptiles and amphibians may include lowland leopard frog (*Rana yavapaiensis*), Woodhouse's toad (*Bufo woodhousii*), red-spotted toad (*B. punctatus*), Arizona toad (*B. microscaphus microscaphus*), and Sonoran mud turtle (*Kinosternon sonoriense*) (Id.).

Flycatchers and Cuckoos in the Safford Valley. In 2005, FWS designated flycatcher critical habitat along approximately 43 miles of the Gila River in the Safford Valley (FWS 2005). Surveys for flycatchers in the Safford Valley have documented several sites that are regularly occupied by the species (Smith et al. 2002, 2003, 2004; Munzer et al. 2005). In the most recent year of surveys on property recently acquired by SRP as part of the Roosevelt HCP, 148 flycatchers within 81 territories were found (SRP 2006).

Cuckoo surveys have been limited in the Safford Valley. However, two cuckoos were detected on Roosevelt HCP properties during the first year of surveys (SRP 2005c).

Safford Valley Mitigation Land Acquisition and Management. As described above, SRP intends to exercise an existing option to acquire and manage 150 acres of riparian habitat along the Gila River in the Safford Valley near Fort Thomas as shown on

Figure V-3. Figure V-4 is a photograph of riparian habitat on SRP's Fort Thomas Preserve, which was purchased as part of the Roosevelt HCP. If additional land were needed to implement this HCP, parcels adjacent to the Fort Thomas Preserve will be the highest priority. The exact quantity and timing of acquiring land at this location will depend on when the need to obtain this land arises. Prior purchases and investigations indicate that there are a number of constraints to habitat conservation in this area including uncertainties with land title and reluctant sellers. However, SRP will use its best efforts to accomplish its objectives.

Figure V-4. Safford Valley riparian habitat owned by SRP, Fort Thomas Preserve.

As with all mitigation lands acquired as part of this HCP, SRP will provide permanent management for Safford Valley habitat acquisitions. The primary management goal will be to protect and enhance a naturally functioning system to protect and maintain a dynamic mosaic of riparian vegetation communities by identifying and removing or minimizing major stressors. Management funding will include initial construction or improvement, and long-term maintenance of fencing where feasible to minimize trespass by people and livestock. Management funding also may include provision of security patrols and other efforts needed to protect and manage the habitat as specified in the management plan for each property (Appendix 7). If flycatchers are present and cowbird parasitism rates are problematic, cowbird management will be employed as described in Subchapter V.C.4 below.

If SRP's efforts to conserve sufficient amounts of appropriate riparian habitat in the Safford Valley are unsuccessful, SRP will pursue equivalent mitigation land elsewhere.

SRP will acquire and manage habitat at other location(s) that will be selected in consultation with FWS. The first priority for alternative sites will be to augment mitigation lands along the San Pedro River where SRP is conserving habitat as part of the Roosevelt HCP (see below).

Habitat Acquisition and Management Elsewhere in Central Arizona

To the extent that insufficient acreage to fulfill the HCP mitigation requirement is obtained in the Verde and Safford valleys, SRP will acquire and manage the balance of those acres of riparian habitat elsewhere in central or southern Arizona. Like the Verde and Safford valleys, riparian habitat conservation will focus on acquiring property through fee title or conservation easements. The priority for conservation efforts will be in areas where flycatcher populations currently exist or in areas that are in proximity to existing populations. The highest priority for additional acquisition and management efforts will be located along the lower San Pedro River near other properties purchased by SRP as part of the Roosevelt HCP. Other candidate areas are the Gila River near Winkelman or upstream from Safford, Arizona to Cliff, New Mexico; the middle San Pedro River Valley near Redington; the Hassayampa River near Wickenburg; the Salt and Gila rivers near and downstream of their confluence; and the Santa Cruz River between Tucson and Nogales.

The reaches along the San Pedro, Gila, Hassayampa, Salt River, and Santa Cruz rivers that will be considered by SRP for conservation are broad alluvial valleys. The floodplains are typically 1 to 2 miles wide with a relatively low gradient. The floodplain alluvium is composed of silt, sand, gravel, and cobble, with some areas of heavier soils along the lower reaches of the Salt and Gila rivers.

The riparian vegetation in these valleys includes patches of cottonwood, willow, mixed broadleaf riparian vegetation, mesquite, and salt cedar. Other common species of riparian vegetation are arrowweed and seepwillow (Fichtel and Marshall 1999). Habitat fragmentation, water usage, adverse recreational and livestock use of the floodplain, and development pressures threaten the riparian habitat in these locations (Id.).

These river reaches have been identified as important habitats in central Arizona for flycatchers and cuckoos as well as numerous other species that are federally protected or are species of concern (Fichtel and Marshall 1999). Relatively large populations of flycatchers occupy areas along the upper Gila River, including the Safford Valley (Paradzick et al. 2000; Fichtel and Marshall 1999; Smith et al. 2002). A few (one to three) territories have been documented along the Hassayampa River in past years (Paradzick et al. 2001). Although the Santa Cruz River, lower Salt River, and lower Gila River reaches do not have documented populations of flycatchers at present, they are within the flycatcher's historical range and have habitat that is a priority for acquisition (Fichtel and Marshall 1999). In 2002, two to three flycatcher territories were detected at Tres Rios and Arlington on the lower Gila River. Recent documentation of nesting flycatchers on Cienega Creek and the occurrence of late migrants highlight the restoration and recovery potential on the Santa Cruz River.

As with all other mitigation lands, SRP also will fund permanent management for the habitat. The primary management goal will be to protect and enhance a naturally

functioning system to protect and maintain a dynamic mosaic of riparian vegetation communities by identifying and removing or minimizing major stressors. Management funding will include initial construction or improvement, and long-term maintenance of fencing, where feasible, to minimize trespass by people and livestock. Management funding also may include provision of security patrols and other efforts needed to protect and manage the habitat as specified in the management plan for each property (Appendices 7 and 8). If flycatchers and cowbirds are present, cowbird management will be employed as described in Subchapter V.C.4.

3. Monitoring for Covered Bird Species

The goals of the monitoring program for covered bird species are as follows:

- Vegetation—At Horseshoe, the goal is to monitor the condition and distribution of riparian vegetation to assist in predicting future impacts to flycatcher and cuckoo habitat. At mitigation sites, the goal is to monitor the status of riparian and other vegetation to determine if management measures need to be implemented or modified.
- Flycatchers—At Horseshoe, the goal is to monitor habitat occupied by flycatchers to ensure compliance with the Permit, including whether adaptive management is required, and to detect long-term trends in population. At mitigation sites, the goals are to monitor species status and population trends, and cowbird parasitism.
- Cuckoos—At Horseshoe, the goal is to monitor long-term trends in populations. At mitigation sites, the goals are to monitor species status and population trends, and cowbird parasitism.
- Bald Eagles—The goal is to monitor potential bald eagle nesting in Horseshoe and Bartlett.

a) Permit Compliance Monitoring at Horseshoe

SRP will monitor compliance with the Permit by periodically collecting and evaluating information on occupied flycatcher habitat, the population status of flycatchers and cuckoos at Horseshoe, and potential nesting of bald eagles in Bartlett and Horseshoe as described below.

Monitoring Riparian Vegetation. SRP will use vegetation monitoring at Horseshoe to identify trends in the amount and height of tall dense vegetation to assist in the evaluation of whether the adaptive management thresholds or Permit limits may be exceeded. Beginning in 2008, SRP will monitor riparian vegetation every three years using aerial photography or remote sensing and field sampling. The aerial photos or remote sensing data will be used to map the extent of tall dense vegetation. The field sampling will be used to estimate the height of the tall dense vegetation. The three-year interval of vegetation monitoring is based on analysis of historical aerial photography, which indicates a relatively steady increase of woody vegetation in Horseshoe.

Monitoring Species. At Horseshoe, the goal of population monitoring is to assist in the evaluation of Permit compliance relative to the thresholds for adaptive management

and the cap on harm to occupied habitat. The method used to determine occupied flycatcher habitat in Subchapter IV.B.1.b will be used to monitor Permit compliance, i.e., the 394-feet radius around the center of territories with overlapping areas being joined into one polygon. The trend in occupied habitat, in combination with vegetation trends and runoff probabilities, will be used to predict the weighted average amount of habitat that would not be available for flycatchers in the future. The adaptive management threshold for flycatchers and cuckoos is an annual average of 200 acres of potentially impacted occupied habitat and the cap on harm to occupied habitat is 400 acres (Subchapter IV.B.1). In addition, Permit compliance monitoring will provide data to identify long-term trends in the Horseshoe flycatcher population. Beginning in 2008, SRP (under a separate research and recovery permit) will monitor flycatcher populations at Horseshoe at a minimum of once every three years using trained, permitted personnel to perform field surveys with appropriate survey protocol in order to determine the location of territories (e.g., Sogge et al. 1997; Rourke et al. 1999).[40] A three-year survey interval was chosen because native riparian trees (willow/cottonwood) generally require a minimum of three years before they are an adequate size for nesting (Paradzick 2005a), and three years will be sufficient to monitor trends of occupied habitat in established vegetation.

The goal of monitoring cuckoos at Horseshoe is to identify the long-term trend in the cuckoo population at Horseshoe. The cuckoo population at Horseshoe will be surveyed in 2008 and every three years thereafter for the duration of the Permit in order to establish the number of cuckoos at Horseshoe. Field surveys will use standard protocol (e.g., Corman and Magill 2000) unless otherwise agreed to by FWS and SRP.

Regular monitoring of the bald eagle breeding areas near Horseshoe and Bartlett will be accomplished by AGFD and FWS under their existing program. SRP has been supporting this monitoring effort since 1990 and is committed to continue funding, donate helicopter time, and contribute other in-kind services as a result of the Roosevelt HCP (SRP 2002). If the existing program ceases to exist, SRP will conduct periodic flights to identify if a bald eagle nesting area has become established below the high water marks of Horseshoe or Bartlett, which would trigger adaptive management. SRP will provide an average of two flights per year. The frequency and timing of these flights for a particular year will be variable and will be determined at the annual meeting with FWS based on runoff projections, the status of potential nesting trees in Horseshoe or Bartlett, and the likelihood of bald eagles nesting below the high water level of the reservoirs.

b) Monitoring the Effectiveness of Conservation Measures for Mitigation Properties

In addition to monitoring for Permit compliance at Horseshoe, SRP will monitor the effectiveness of conservation measures that are implemented for mitigation properties under the HCP. These include surveying of flycatcher and cuckoo populations at all mitigation sites and evaluating habitat conserved at mitigation properties. The schedule

[40] Field survey intensity and protocol will be agreed to by FWS and SRP in advance of the surveys and will be adapted to achieve the goal of monitoring.

and procedures for monitoring flycatcher and cuckoo populations and habitat at these sites are discussed below.

At mitigation properties, SRP will conduct standard protocol surveys for flycatchers and cuckoos in the first spring and summer following acquisition. If flycatchers are found, the property also will be surveyed for flycatchers the next year in order to establish a baseline. In addition to surveying the number of birds at each site, the number and locations of nests/territories will be noted where observed. Permitted field biologists conducting the survey will have several additional hours each day after conducting the morning survey to do nest searches and checks, identify signs of parasitism, and to assess other biological conditions at the mitigation sites. Following the initial survey(s), the mitigation sites will be surveyed for flycatchers and cuckoos every other year on average, but not less than every third year. The specific frequency of surveys for each site will be determined during an annual meeting—some sites may be surveyed every year for a period if necessary, sites with more stable populations and little cowbird parasitism may be surveyed every third year. The frequency of surveys also will incorporate the need to evaluate cowbird parasitism, as discussed below.

Periodic field mapping of riparian habitat will not be performed at the mitigation sites; however, field observations of the type, structure, and density of riparian and other vegetation and on-the-ground photography from fixed points will be collected at the same time as population surveys. Field observations will be recorded on a standard form to be developed as part of the management plans.

SRP (through trained, permitted personnel) will conduct nest searches following each flycatcher survey at occupied sites. Because flycatcher nests are difficult to locate and sample size may be small, cowbird parasitism data will be supplemented using nest checks of common surrogate species (e.g., yellow warbler, common yellow throat, bells vireo, yellow-breasted chat, song sparrow, Abert's towhee). Searches and nest checks will occur in the late morning, afternoon, or the morning following each survey. The goal will be to locate and check 10 or more active nests during each survey of the properties. Data will be collected on nest stage and contents of the nest, i.e., presence of flycatcher and cowbird eggs and/or nestlings. Sampling precautions identified in Rourke et al. (1999) will be followed to limit disturbance to adults and nestlings.

During flycatcher surveys, three nest checks per season will be sufficient to evaluate parasitism impacts because (1) cowbird breeding season peaks prior to peak flycatcher nesting season, thus nest checks of flycatcher and surrogate species will provide a conservative estimate of parasitism rates (Rourke, pers. comm. 2005); and (2) the flycatcher nesting cycle from egg laying to fledging requires 27 to 28 days (Rourke et al. 1999), thus there is high probability that one or two nest checks will occur during this period to capture incidences of parasitism.

If cowbird parasitism rates are low (less than 20 to 30 percent, but see threshold rate discussion in Subchapter V.C.4), nest checks to determine parasitism rates will be performed on the same schedule as presence/absence surveys. If authorized by a separately issued permit, surveyors may selectively remove cowbird eggs and nestlings, where appropriate and feasible, to lower rates. If, in later years, parasitism rates increase

above threshold levels and removal of eggs or nestlings is not effective or feasible, SRP will conduct nest checks in two consecutive years to confirm high rates, at which point additional mitigation strategies may be implemented as described in Subchapter V.C.4.

Occasional nest monitoring at mitigation sites will be implemented if a declining trend in number of birds is observed, and FWS and SRP find that evaluation of productivity will be of assistance in manageing the mitigation site. Nest monitoring will be conducted using AGFD techniques (Rourke et al. 1999) unless otherwise agreed by SRP and FWS.

4. Adaptive Management for Covered Bird Species

Three types of adaptive management will be employed with respect to flycatcher and cuckoo habitat conservation: (1) acquisition of additional habitat if impacts at Horseshoe are predicted to exceed the 200-acre threshold; (2) additional management measures on mitigation properties in response to changed circumstances; and (3) cowbird management. These adaptive management measures are described below. Adaptive management also will be used if bald eagles move their nests below the high water mark in Horseshoe or Bartlett, as discussed below.

a) Adaptive Management for Flycatcher and Cuckoo Habitat at Horseshoe

Adaptive management in the form of additional acquisition of mitigation land will be implemented by SRP if monitoring indicates that the weighted average amount of occupied flycatcher habitat expected to be unavailable in future years at Horseshoe would exceed 200 acres. If monitoring and modeling predict that more than 200 acres of occupied habitat will be unavailable annually on average, SRP will acquire and manage additional mitigation land within five years to address impacts for up to an additional 200 acres of unavailable occupied habitat, for a total of 400 acres.[41] The model used to estimate occupied habitat in the HCP (Subchapter IV.A.2), or a similar or more refined model, will be used as the predictive model unless otherwise mutually agreed upon by FWS and SRP. If more than 400 acres are unavailable or predicted to be unavailable in a single refill or drawdown, a Permit amendment will be necessary.

b) Mitigation Property Adaptive Management

As described in Subchapters V.C.2 and V.C.3, management plans and monitoring will be developed and implemented on all mitigation lands. Adaptive management will be employed as described in Appendix 7 to address age-class diversity, cottonwood-willow overstory, invasive species, fire, or other threats to the protected habitat.

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[41] Predictive modeling using all available information on Horseshoe inflows, vegetation, and flycatcher occupation will be used to evaluate the need to initiate efforts to acquire additional habitat. The actual quantity of additional habitat to be acquired will be based on occupied habitat determined using the method described in Subchapter IV.B.1.b. As provided in Appendix 8, SRP is required to notify FWS of a changed circumstance (such as an actual or predicted increase in occupied habitat above the 200-acre threshold) within 30 days of learning of the change, and initiate action within 90 days.

c) Cowbird Adaptive Management

Background. Brown-headed cowbirds (*Molothrus ater*) (cowbirds) can have negative impacts on reproductive success of flycatcher females and populations. They parasitize flycatcher nests by laying their eggs in the nests of hosts. Cowbird eggs hatch sooner and the young develop more quickly, so the cowbird young often outcompete the flycatcher young, which often results in no flycatcher young surviving to fledge. Cowbirds may also remove the eggs and nestlings of their host species, thereby acting as nest predators. Cowbirds are also quite prolific, laying up to 42 eggs in a 2-month breeding season (FWS 2002a).

Because of their affinity for forest edges, increases in forest edge due to forest fragmentation can increase parasitism frequency for many forest bird species, including neotropical migrants such as flycatchers. Some species of forest-inhabiting neotropical migrants have been found to suffer higher rates of nest parasitism in small isolated forest tracts than in large unbroken forests. In addition, parasitism levels are often higher in regions with highly fragmented forests than in largely forested landscapes (Smithsonian National Wildlife Park 2004).

Cowbirds parasitize host nests in riparian areas during morning hours, and congregate in feeding areas during afternoon (Thompson 1994). Cowbirds have been shown to commute distances of up to 11 miles from their morning breeding areas to their foraging areas. Tisdale-Hein and Knight (2003) suggest that as long as food resources are adequate within commuting distance of breeding sites in riparian habitat, then the densities of potential hosts likely determine localized cowbird densities during morning hours.

Factors that facilitate increased cowbird impacts include the expansion of suburban and agricultural areas, cattle and cattle congregation areas and/or corrals, increased cowbird access to riparian habitat through narrowed riparian zones, and habitat fragmentation due to trails or ORVs (Id.). Activities related to increased cowbird presence include human-created food sources such as campground crumbs and litter; and suburban areas with lawns, food, trash, bird feeders, and golf courses (Id.).

Decisions to initiate cowbird management on mitigation properties will be based on a number of site-specific factors, including the host population's current size, recent population trend, parasitism rate, amount of suitable habitat, and the extent of the losses attributable to cowbird parasitism (Rothstein et al. 2003). Rates of parasitism fluctuate with geographic location and over time. For example, between 1997 and 2000, cowbird parasitism of flycatcher nests ranged from 6 to 35 percent on the Verde River, 0 to 2 percent on the San Pedro River and Roosevelt, and 11 to 29 percent on the Colorado River (McCarthy et al. 1998; Paradzick et al. 1999; Paradzick et al. 2000; Paradzick et al. 2001). Between 2001 and 2005, parasitism rates at Roosevelt were less than 5 percent, except in 2002 when the rate rose to 38 percent. The cause for the increase is unknown but may be related to extreme drought conditions that lowered habitat quality, and fewer flycatchers and other songbirds attempted to nest in the area which concentrated parasitism on fewer nests. The impacts of cowbird nest parasitism on some populations may be large enough to warrant management efforts such as cowbird trapping.

Results from cowbird trapping studies have suggested that there are significant spatial and temporal differences in trapping effectiveness (Siegle and Ahlers 2004; Olsen, pers. comm. 2005; Raulston, pers. comm. 2005; Rourke, pers. comm. 2005). Some flycatcher-occupied sites located on major migration corridors have not benefited from intensive trapping (i.e., cowbird abundance did not decrease over time with trapping). In other areas, trapping is thought to have caused declines in cowbird abundance and parasitism rates. In some of these areas, the impacts of trapping lasted approximately three years after trapping ceased (Ryan and White 2004). However, as Braden and McKernan (1999) suggest, a manager's ability to statistically evaluate if trapping is increasing nest success and productivity of flycatchers is confounded by small sample sizes, variation in monitoring and trapping efforts, and the difficulty of detecting changes in parasitism rates. Additionally, trapping may negatively impact nontarget neotropical songbird species, which could get caught in traps. These concerns highlight the need to critically evaluate the effectiveness of all suppressive actions and use adaptive management to identify the most beneficial use of resources.

HCP Strategy. As part of HCP implementation, SRP will conduct presence/absence flycatcher surveys at each mitigation property. However, protocol surveys (Sogge et al. 1997) alone are inadequate to document the incidence of cowbird nest parasitism. Additionally, intense nest monitoring that adheres to the nest check guideline in Rourke et al. (1999) was designed to assess nest success and productivity, which is beyond the required scope of HCP monitoring and would cause unneeded disturbance to nesting flycatchers. Instead, SRP will locate and check flycatcher and common surrogate species nests for cowbird parasitism at a reduced frequency to minimize human disturbance, but at an interval that satisfies data needs.

Researchers working on the Bill Williams and Colorado rivers have found that parasitism rates of surrogate species between 1999 and 2004 were equal to or greater than flycatcher parasitism rates (Ryan and White 2004). Similarly, Braden and McKernan (1999) note that absolute nest parasitism rates (i.e., number of nests parasitized/total number of nests) overestimates impacts of parasitism on nest success because not all parasitized nests will fail, some nests may fledge both cowbird and flycatcher young, and some parasitized nests will fail regardless of parasitism due to other factors (e.g., predation). Thus, flycatcher and surrogate nest checks will provide a conservative assessment of cowbird parasitism impacts.

As parasitism data are gathered and assessed, SRP will work with FWS to institute a tiered approach to suppress cowbirds at mitigation properties if needed. Monitoring activities also will provide data to assess suppression effectiveness and adaptively manage conservation efforts.

Reporting and Assessing Parasitism Rates. Parasitism rates of flycatchers, and the combined rate of parasitism on flycatcher and surrogate species will be reported at the end of each breeding season (parasitism of individual nests will only be counted once). Parasitism rates will be reported as:

1) Number of flycatcher parasitized nests/number of flycatcher nests

2) Number of all parasitized nests/number all nests

Cowbird Egg and Nestling Removal and Threshold Rate. FWS and SRP will review parasitism rate monitoring data to determine the need to consider management actions. Where feasible and appropriate, surveyors may remove cowbird eggs and nestlings from flycatcher nests as the primary management tool to reduce parasitism rates. The significance (impact) of parasitism rates and need to institute additional suppressive actions will consider the threshold recommendation in the Flycatcher Recovery Plan and the more conservative method, i.e., incorporating data from common surrogate species that tend to have higher rates of parasitism. The initial threshold will be set at 20 to 30 percent; however, FWS in cooperation with SRP may adjust threshold rates based on monitoring results, trend in flycatcher abundance at the site, and future cowbird-songbird research results at other study areas.

If rates are found to be above the threshold level during two consecutive years of monitoring, FWS may require SRP to institute suppressive actions at flycatcher-occupied sites. SRP will confer with FWS to determine if suppressive strategies are needed and likely to be effective, and identify methods for evaluating effectiveness of those strategies. SRP will implement suppressive strategies if required by FWS and will monitor their effectiveness.

Adaptive Management Strategies. Although a landscape approach to cowbird management is recommended (Rothstein et al. 2003), most actions taken by SRP to manage cowbird parasitism rates are limited to the immediate vicinity of the property because SRP does not have authority over other properties. Below is a list of tiered measures that may reduce parasitism rates. Local habitat improvements (Action 1) and egg and nestling removal (Action 2) will be implemented first. If rates continue to be greater than threshold levels, SRP will coordinate cowbird control activities with surrounding landowners (Action 3) and monitor effectiveness for two to three years. Direct population control of cowbirds (cowbird trapping) will be implemented as a final measure because of the significant logistical difficulties, limited spatial and temporal effectiveness, and impacts to nontarget songbirds. Also, delay of direct control will allow for habitat measures to be fully implemented and assessed.

Management Measures.

1) Implement activities listed in the management plan that support the protection and enhancement of a naturally functioning system that will support a diverse mosaic of riparian vegetation communities. Examples of these activities include:
    a. Fencing riparian areas to exclude livestock to prevent the formation of trails and to eliminate grazing pressure on riparian habitat.
    b. Revegetating or allowing natural recovery of trails and livestock- or human-disturbed areas.
    c. Minimizing human activity on the mitigation properties and limiting activities to small areas away from riparian zones.

2) Coordinate cowbird control activities with adjacent landowners and preserve managers.
    a. Communicate with agencies and local preserve managers to understand cowbird impacts on flycatcher populations on a larger scale.
    b. Work with adjacent landowners, to the extent possible, to minimize activities that might increase cowbird populations in the area, coordinate cowbird control activities, and protect or enhance riparian habitat.
3) Implement direct cowbird population management.
    a. Where feasible and appropriate (e.g., considering nest height, vegetation density, potential for disturbance), surveyors will remove cowbird eggs and nestlings from flycatcher and other passerine nests that are located during surveys or follow-up nest searches.
    b. Removal of cowbird eggs or nestlings or addling of cowbird eggs will be performed by qualified field workers. Nest monitoring protocols and recommendations by FWS and AGFD will be followed to limit disturbance.

4) Implement additional direct cowbird population management.
    a. Trapping
        i. Trapping will be conducted according to established protocols (Siegle and Ahlers 2004).
        ii. Plans for trap placement, humane disposal, and methods of removal of nontarget species will be determined with input from FWS and AGFD.
        iii. Trapping will be conducted at one- to three-year intervals, and post-project monitoring (one to three years) will be used to evaluate effectiveness, and provide data for adaptive management strategies. Cowbird parasitism rates, interannual parasitism rates variation at other flycatcher sites, and flycatcher population trends also will be considered when assessing trapping effectiveness.
    b. Other techniques that may be tested and found to be effective in the future will be considered.

d) Bald Eagle Adaptive Management

If a bald eagle establishes a nest below the high water mark of the reservoirs, which is found during monitoring (Subsection V.C.3.a), SRP will discuss with AGFD and FWS the need to rescue eggs or chicks threatened by inundation for subsequent reintroduction into the original nest after the water subsides or introduction into a foster nest in another territory if the nest is destroyed. SRP will develop a coordinated plan with FWS and AGFD to identify when rescue actions would be required and the process to rescue any bald eagles, bald eagle eggs, or nestlings at Horseshoe or Bartlett. The plan will include triggers for winter monitoring at appropriate effort and frequency to determine if a nest has been built in the conservation space of the reservoir and the likelihood that the nest

would be impacted by spring storage. The plan will be complete within one year of Permit issuance, implementation will begin within two years of Permit issuance, and the plan will last for the duration of the Permit. The act of intervention itself (e.g., rescue of eggs, nestlings, or fledglings) and subsequent care also could result in potential harm and/or harassment of bald eagles, but these impacts would be addressed through coordination with FWS and the AGFD, and necessary permit by the appropriate entity would be obtained at that time. If a bald eagle nest is built below the high water mark within the footprint of the reservoirs during the life of the Permit, SRP will construct an alternative nest structure in the immediate area and maintain such structure for the remaining duration of the Permit. An alternative nest structure was successfully used by bald eagles at Horseshoe in the late 1970s and 1980 (Ohmart and Sell 1980; Grubb 1980). These measures would fully offset the potential impacts of continued reservoir operations on bald eagles.

As described in Subsection IV.B.2.b, no measurable impacts on bald eagle forage base or productivity are expected because ongoing operations will not appreciably change community composition or the abundance or distribution of individual species, and the small increase in predation and competition is mitigated to the maximum extent practicable (Subchapter V.D). As part of the native fish, frog, and gartersnake mitigation measures (Subsection V.D.2.e) and in coordination with AGFD and SRP, FWS may prioritize species for hatchery production and the location for stocking at the annual HCP implementation meeting. For example, to support bald eagle productivity in the future, FWS may recommend that HCP funding be used for Sonora and desert sucker propagation at the Bubbling Ponds Hatchery and that those fish be stocked in high priority bald eagle breeding areas in the Action Area consistent with Subchapter V.D.2.

D. Minimization, Mitigation, Monitoring, and Management Measures for Covered Native Fish, Frog, and Gartersnake Species

The overall goal of the minimization and mitigation measures for native fish, frog, and gartersnake species is to offset the future direct impacts to native fish caused from stranding and passage through the outlet works, and the indirect impacts to the native fish, frog, and gartersnake communities caused by operation of Horseshoe and Bartlett dams resulting in a small (relative to baseline) increase of nonnative fish produced in the reservoirs, which may compete with or prey upon native fish, frog, and gartersnake species. The native fish analysis (Subsection IV.B.4.b, Committee Report) found that significant shifts in nonnative fish population abundance and composition have already occurred and were part of the environmental baseline conditions. AGFD manages both native and nonnative fisheries statewide and in the Action Area. The proposed mitigation actions were evaluated both in context of the conservation benefits to offset the impacts and AGFD current policy and direction in the Action Area (e.g., Bartlett and downstream habitats are currently managed as a sport fishery). The HCP recognizes that AGFD policy direction could change in the future and, thus, adaptive management actions and flexibility in implementation of stocking efforts addresses those circumstances (Subsection V A.2). The primary means to offset the direct impacts of operation (stranding and passage injury) and the indirect impact of additional predation and competition by nonnative fish on covered native fish will be:

1. Minimizing or reducing nonnative fish reproduction, recruitment, and movement;
2. Augmenting/increasing native fish populations, distribution, and relative abundance; and
3. Maintaining water flows in the Verde River above Horseshoe.

Similarly, for lowland leopard frog, northern Mexican gartersnake, and narrow-headed gartersnake, the overall goal of the minimization and mitigation measures is to offset the indirect impacts to the native fish community due to a small (relative to baseline) incremental increase of nonnative predators produced in the reservoir, which may prey upon individual frogs or gartersnakes, and/or prey upon or compete with native prey species that are an important food source for the frog or gartersnake species. Thus, the offsetting benefits of specific minimization and mitigation measures for these species were considered to be equal to the benefits for native fish.

A matrix of covered native fish, frog, and gartersnake species and associated mitigation measures is provided below in Table V-2.

1. Methods

As with the impact analysis, the Committee developed the minimization and mitigation measures (Subchapter IV.B.4.a). The future impact on native fish habitat and potential adverse modification of critical habitat described in Subchapter IV.B.4 is anticipated to occur from an increase in predation and competition by nonnative fish produced in the reservoirs and their progeny, or by direct loss of individuals within the reservoirs (e.g., by stranding or passing through outlet works). SRP, AGFD, FWS, and others identified many possible mitigation and minimization activities (collectively, mitigation actions). Because of the difficulty of converting mitigation actions into benefits to river miles of native fish habitat, the Committee's approach to calculating mitigation credits followed the conceptual framework of Habitat Equivalency Analysis (NOAA 2000; Committee 2006). This process involved developing a Mitigation Credit Matrix by working through the following steps:

1. Evaluating the technical feasibility and legal authority of SRP to implement each proposed mitigation action; actions that were considered to have a low technical feasibility or were in direct conflict with AGFD policies or direction were eliminated from further analysis.
2. Establishing a set of criteria to evaluate mitigation actions.
3. Reaching consensus on the degree each mitigation action satisfied the criteria (expressed as a percentage).
4. Calculating the total river miles potentially suitable and feasibly available for the mitigation action, based on the impact analysis described in Subchapter IV.B.4.b.
5. Assigning the percentage contribution from SRP to the mitigation actions for shared projects.

6. Calculating the total possible river miles available for mitigation by each action (total river miles available multiplied by the percent contribution from SRP as part of the HCP).
7. Calculating the relative mitigation credit by multiplying the total possible river miles available for mitigation by the overall degree of criteria satisfaction (described in more detail below).

A list of 20 potential mitigation actions was compiled from earlier proposals by SRP and Phoenix, a proposed State Conservation Agreement (SCA) for native fish (AGFD 2005); and input and comments from AGFD, FWS, and others. The complete list of proposed mitigation actions and associated relative mitigation credits is provided in the Committee Report (2006). The 20 mitigation actions fall into nine general categories:

- Reservoir operation changes (level of fill, timing, and rate of releases)
- Fish barriers
- Nonnative fish removal (angler pressure, chemical/physical removal)
- Native fish stocking (hatchery improvements; numbers, species and locations of stocking, salvage and relocation)
- Habitat enhancement (refugia ponds, gravel washing)
- Statewide conservation efforts through the SCA
- Education
- Research and surveys
- Watershed management efforts

A set of criteria was established for evaluating each individual mitigation action:

1. The relative degree that the mitigation action directly mitigates or minimizes effects of the action on covered species and their habitat resulting from the Proposed Action (e.g., stocking native fish in or above Horseshoe mitigates take from stranding/internment caused by reservoir operations).
2. The geographical relationship of the mitigation action to impacted areas (areas close to the reservoirs are valued higher than more distant locations).
3. The number of native species benefited by the mitigation action (mitigation actions that benefit more species of native fish are valued higher than actions that benefit a single species).
4. The effectiveness of the proposed mitigation action to accomplish the stated objective. In particular, actions that potentially lead to self-sustaining populations, such as reducing the number of nonnative predators and competitors or increasing the size of native fish populations, are valued higher than actions dependent on perpetual management.

The Committee carefully evaluated the list of proposed mitigation actions. Consensus was reached on river miles available for each mitigation action and the degree

that each action satisfies the evaluation criteria. Total mitigation credit for each action was calculated by multiplying available river miles by the overall satisfaction rating for the criteria, which is an average of the satisfaction rating for each of the four criteria. The cumulative total of mitigation credits available from all possible mitigation actions is 82.0 river miles (Appendix 9). As discussed below, the most cost-effective and biologically effective mitigation actions, which are consistent with AGFD fish management policies, were selected for implementation to offset the total level of impacts.

2. Minimization and Mitigation Measures, Management, and Maintenance

The following minimization and mitigation measures will be employed as initial components of the HCP:

a) **Rapid Drawdown**—The rapid drawdown component of the Optimum Operation Alternative will reduce adverse impacts on native fish by adversely affecting the recruitment and growth of nonnative predators and competitors. This measure reduces the need for mitigation by 5.4 river miles downstream and 16 river miles upstream of Horseshoe, for a total of 21.4 miles of mitigation credit.

b) **Stocking of Small (Subadult or Fingerling) or Adult Razorback Sucker Into Horseshoe or Elsewhere**—SRP will provide funding support for AGFD to stock additional razorback suckers during Horseshoe fills when recruitment conditions may be favorable (every three to four years on average during high water years, e.g., 2005, and in years when the flycatcher habitat maintenance goal is in effect). FWS will provide incidental take coverage for take involved with the action of stocking listed fish in the biological opinion prepared for the Permit.[42] If FWS and AGFD determine that a different location should be stocked with razorback sucker, SRP's funding support would be redirected to that effort so long as FWS and AGFD determine that incidental take by third parties is addressed or can be avoided in that location. The mitigation credit for this component is 12.4 river miles for stocking in the anticipated locations. Depending on the new stocking location, the amount of credit for this measure might slightly decrease, but the combined overall mitigation credits would still be adequate.

[42] Issuance of a Permit by FWS would result in the implementation of the fish stocking provisions of the HCP. Therefore, any incidental take statement issued by FWS as part of its biological opinion on the impacts of issuance of the Permit would include incidental take coverage for the stocking of native sucker and other listed fish as provided in the HCP. After reviewing all of the documents related to the permit application, including the HCP, the biological opinion, and the FEIS, FWS may or may not issue a Permit. In the event that no Permit is issued, no SRP-funded fish stocking would occur and, therefore, no incidental take coverage for fish stocking would be needed for stocking funded by SRP.

c) **Install a Fish Barrier on Lime Creek**—SRP will pay 100 percent of the cost of construction of a fish barrier on Lime Creek to benefit the Gila topminnow, longfin dace, and lowland leopard frog. The mitigation credit for this component is 3.4 river miles.

d) **Bubbling Ponds Native Fish Hatchery Improvements and Support**—SRP will provide $500,000 in funding and in-kind support for planning, design, engineering, and fund-raising to improve and expand the Bubbling Ponds Native Fish Hatchery to benefit all covered species. The Bubbling Ponds Fish Hatchery is located along lower Oak Creek near Sedona (Figure IV-3). The mitigation credit for this component is 15.7 river miles.

e) **Stocking of Native Fish in the Verde Watershed**—SRP will provide funding support for AGFD to increase stocking of any of the covered species of native fish into the Verde watershed. Stocking of listed species supported by HCP funding will primarily occur in the portion of the Action Area between Horseshoe Dam and the downstream end of the Verde Valley in order to reduce concerns by third parties, unless incidental take by third parties is addressed or can be avoided by FWS and AGFD. HCP support of supplemental stocking of unlisted covered species may occur anywhere within the Action Area or elsewhere. At the annual HCP coordination meeting (Subsection V.E.2), AGFD and FWS will discuss and prioritize species and locations for stocking. FWS will provide incidental take coverage for take involved with the action of stocking listed fish in the biological opinion prepared for the Permit. The mitigation credit for this component is 9.0 river miles for stocking in the anticipated locations. Depending on the new stocking location, the amount of credit for this measure might slightly decrease but the combined overall mitigation credits would still be adequate.

f) **Watershed Management Efforts**—SRP will continue, and expand where feasible, its substantial watershed management efforts to maintain or improve stream flows, which benefit all mainstem species. These efforts include: 1) funding of stream gages and scientific studies; 2) funding and in-kind support for watershed improvements; and 3) administrative and legal efforts to curtail stream flow reductions from illegal surface water diversions and ground water pumping. As examples, the following is a partial list of Verde River water management activities in the past five years. Similar types of efforts and expenditures would be implemented for the duration of the Permit. However, without a Permit for operation of Bartlett and Horseshoe, most water management activities will be curtailed because they will be unnecessary or of less value because water could not be stored and managed in the reservoirs. The minimization and mitigation credit for this measure is 8 miles.

- **Aerial Photos.** Aerial photos of the Verde watershed are flown approximately every five years. These photos are used for various management and monitoring purposes. For example, photos were recently made available to Scott Bonar and his graduate students at the University

of Arizona for their study of native and nonnative fish and their habitats (Bonar et al. 2004).

- **GIS Data.** GIS coverages and data files are developed and updated for land and water uses in the Verde watershed, which are used for management and monitoring.
- **Staff Time and Expenses.** SRP Water Group staff, consultants, and attorneys participate in a wide variety of studies, meetings, forums, groups, legal proceedings, and other activities involving Verde River water management.
- **Standard Stream Gages.** SRP helps fund nine gages in the Verde watershed, including satellite telemetry and technical support.
- **Low Flow Stream Gages.** SRP helped install and maintain three low flow gages (Campbell Ranch below Paulden, Black Bridge at Camp Verde, and Verde Falls below Camp Verde) to monitor potential depletions of base flow from ground water pumping. Reclamation helped fund the gages near Camp Verde. SRP is also funding a reconnaissance study of low flow gage sites on Fossil Creek.
- **Northern Arizona University (NAU) Verde Watershed Research and Education Program.** SRP has contributed to this program since 2000. SRP's commitment has been extended until 2010.
- **Geologic and Ground Water Studies.** SRP has provided recent funding to the USGS and NAU in support of data collection, geologic map production, and studies of springs to evaluate ground water resources and pumping impacts.
- **Prescott National Forest.** SRP funded a test site for juniper clearing to improve watershed conditions by increasing runoff.
- **Funding of Watershed Initiatives.** Contributions to watershed groups for education, public outreach, and clean-up efforts. Past examples include funding of the Verde River Monitoring Program, Verde Canyon Railroad trip on watershed issues, Master Watershed Steward Program through Yavapai County Cooperative Extension, Arizona Watershed Alliance, Verde Watershed Association, and Oak Creek Canyon Task Force.

The benefit of the measures listed above to each covered species is noted in Table V-2. The overall mitigation credits assigned to the proposed SRP mitigation measures total 70 river miles. Because of the uncertainties inherent in assigning estimates of relative reservoir impacts and relative mitigation credits (expressed in surrogate terms of river miles), and to provide a net conservation benefit to the covered fish species, SRP will implement a suite of mitigation actions where the cumulative credits exceed the estimated level of impacts. The 70 river miles of credits are more than double the 34 river miles of relative impacts from the Optimum Operation Alternative, which more than offsets any uncertainty in their effectiveness, and is anticipated to provide conservation benefits to native fish species in addition to fully minimizing and mitigating impacts.

The mitigation measures for native fish would also benefit the covered frog and gartersnake species (Table V-2). The resulting mitigation benefit to these species would be approximately 70 river miles (Appendix 9), which is substantially greater than the impacts, thus fully offsetting impacts, addressing uncertainties, and likely providing a net conservation benefit to the species.

Table V-2. Summary of native fish, frog, and gartersnake minimization and mitigation measures (X = applicable).

Fish Species	Mitigation Measure					
	Rapid Drawdown	Stocking Razorback	Lime Cr. Fish Barrier	Fish Hatchery Funding	Stocking Other Species	SRP Watershed Management
Razorback sucker	X	X		X		X
Colorado pikeminnow	X			X	X	X
Gila topminnow	X		X	X	X	
Spikedace	X			X	X	X
Loach minnow	X			X	X	X
Roundtail chub	X			X	X	X
Longfin dace	X		X	X	X	X
Sonora sucker	X			X	X	X
Desert sucker	X			X	X	X
Speckled dace	X			X	X	X
Lowland leopard frog	X		X	X	X	X
N. Mexican gartersnake	X	X		X	X	X
Narrow-headed gartersnake	X	X		X	X	X

Management and Maintenance of Minimization and Mitigation Measures. SRP will fund annual management and mitigation measures for native fish, frog, and gartersnake species for the duration of the Permit as follows:

- Any additional costs of Horseshoe drawdown and operations resulting from Optimum Operations.
- An average of up to $15,000/year for the actual stocking of native fish in the Verde watershed as provided by the HCP.
- 100 percent of the maintenance costs of the Lime Creek fish barrier, and stream rehabilitation costs, if any.
- $25,000/year on average for operation and maintenance costs of the Bubbling Ponds Native Fish Hatchery.
- All costs for SRP watershed management efforts.

3. Monitoring of Native Fish, Frogs, and Gartersnakes

Monitoring of native fish, frog, and gartersnake populations and the effectiveness of the minimization and mitigation measures will require periodic surveys in Horseshoe and at several locations on the Verde above and below Horseshoe and Bartlett. The goal of the fish monitoring will be to assess native fish populations (composition and age-class structure) and detect movement of nonnative fish from the reservoirs. To the extent that the nonnative fish are large enough to tag or mark, nonnative fish captured in and near Horseshoe will be marked to provide data on survivorship and movement patterns to help assess the effectiveness of the minimization and mitigation measures.

The goal of the frog and gartersnake monitoring is to assess species status and general population trends. Monitoring of the fish community will also assess the effectiveness of the minimization and mitigation measures on reducing nonnative predation on and competition with frog and gartersnake species. Periodic frog and gartersnake status surveys will be conducted (dedicated six days of survey every five years) within the Action Area.[43] SRP will coordinate with FWS and AGFD to select and prioritize general survey areas in the Action Area on a regularly scheduled basis. All captured specimens will be processed for data collection, marked with passive integrated transponders for future identification, and released.

As recommended by the Committee, SRP will conduct or provide funding for an average of three surveys per year, at a maximum of four locations in any particular year. A survey "site" is defined as an area that can be sampled in one to two days, not including mobilization time. Specific survey methods and locations will be determined at the annual meeting from the following possible general locations:

[43] The total of 6 survey days is likely to be divided among seasons and among locations best suited for the species. In addition, biologists conducting fish surveys would be required to make every reasonable effort to capture and identify (or photograph for later identification) any ranid frog or gartersnake species observed incidentally while conducting fish sampling.

- In Horseshoe (fish survey and tag or mark fish)
- Site 1 upstream of Horseshoe (location to be determined; fish surveys)
- Site 2 upstream of Horseshoe (location to be determined; fish surveys)
- Site 3 upstream of Horseshoe (location to be determined; fish surveys)
- Frog and gartersnake surveys (locations to be determined)
- Lime Creek (fish and frog surveys)
- Below Bartlett (fish surveys, at least one location to be determined upstream of the Fort McDowell Indian Reservation)

During the first five years of implementation, the emphasis of monitoring will be to tag fish in Horseshoe and monitor for upstream movements out of the reservoir. Over time as data is gathered, the information and results will be used to best select and prioritize the locations and frequency of future sampling efforts (i.e., if tagged fish are found near the reservoir [Sheep Bridge] sampling locations will be moved successively upstream [e.g., Childs, Beasley Flat]) to inform the need to implement adaptive management.

It is intended that the monitoring effort and associated data provided by the HCP will be used or incorporated into ongoing and future watershed-wide sampling efforts by the FWS, AGFD, and other researchers, which will aid in assessing the multiple factors that influence the native fish, frog, and gartersnake communities (e.g., trout stocking, recreational use). The monitoring effort as proposed is to commensurate with the estimated level of impacts and sufficient to measure effectiveness of implementation of the minimization and mitigation actions (movement of species, and population composition and age class structure in Horseshoe and other areas) and assess the need to implement adaptive management measures.

4. Adaptive Management for Native Fish, Frog, and Gartersnake Species

The HCP and Permit will address potential changes of circumstances as follows:

a. If efforts to improve and expand the Bubbling Ponds Native Fish Hatchery are unsuccessful for any reason, SRP will provide remaining funds and fund-raising support for improvements and operation of another native fish hatchery, or such other measures designated by FWS in consultation with AGFD.

b. If FWS, in cooperation with AGFD, determines that a different location(s) in the Action Area or Verde River watershed should be stocked with razorback suckers or other listed species covered by the HCP, and those locations are found to be of equal or greater conservation benefit to the species, SRP's funding support would be redirected to that effort. However, potential third-party take at such alternative locations would be addressed or avoided by FWS and AGFD.

c. If FWS, in coordination with SRP and AGFD, determines that the minimization and mitigation actions are proving to be ineffective in achieving the desired result of mitigating impacts on native fish, SRP will provide remaining funds for nonnative fish control efforts in select mainstem reaches or tributaries in the

Verde watershed or such other measures designated by FWS in consultation with AGFD. In assessing the effectiveness of minimization and mitigation measures, FWS will consider: (1) trends of native and nonnative fish populations in various reaches in the Action Area; (2) the location of marked fish captures; (3) other federal, state, tribal, and private actions that could also be impacting the fish community; (4) other relevant fisheries research data in the Action Area and/or in the watershed; (5) AGFD fisheries management policy for the Action Area at that time; and (6) the availability of demonstrated new technology for managing the covered native fish, frog, and gartersnake species.

d. If it is not feasible to construct a barrier on Lime Creek, funding would be redirected toward construction of a barrier on another Verde River tributary, which would be selected in consultation with FWS, AGFD, and other interested agencies.

e. If monitoring efforts find nonnative fish have invaded from downstream to above the barrier in Lime Creek, SRP will fund rehabilitation of upper Lime Creek or contribute the same amount of funding to rehabilitation of another tributary.

f. If monitoring associated with the HCP or unrelated fish sampling conducted by AGFD or other entities finds a Horseshoe-tagged fish in Reach 5 (i.e., above Beasley Flat), monitoring locations will be prioritized in subsequent year(s) to focus sampling in Reach 5 and sampling sites near the Action Area boundary will also be included. If more than one Horseshoe-tagged fish is found in any one year in Reach 5, or one Horseshoe-tagged fish is found in Reach 5 in two successive annual surveys, SRP will provide a 10 percent increase in funding to hatchery and stocking efforts, or if state and federal agencies have native fish projects (e.g., renovations) scheduled at that time (or within the foreseeable future) in the Verde basin, SRP will redirect such funding to those efforts if requested by FWS. The trigger of more than one Horseshoe-tagged fish in any one year or one Horseshoe-tagged fish detected in two successive years, and the associated monitoring location priorities and schedule (i.e., focused tagging and sampling near the reservoir in the first five years of implementation) reflects the uncertainty of information concerning nonnative fish movements from the reservoir and provides a conservative trigger for adaptive management.[44] The 10 percent increase in funding would provide approximately 4.8 river miles of mitigation

[44] As discussed in Subchapter IV.B.4.b, although the majority of the impacts of reservoir operations on native fish habitat are estimated to result from nonnative fish recruited in Horseshoe moving upstream and subsequent dispersal of their progeny, a key assumption is that the majority of nonnative fish produced in the reservoir do not move long distances upstream, which would also limit dispersal of their progeny and their potential to spawn with, and potentially contribute to, the existing large self-sustaining populations of nonnative fish in the Verde River. The conservative trigger for adaptive management reflects that this assumption would be violated if multiple tagged fish were found in Reach 5, indicating that longer distances of upstream movement and greater dispersal of progeny are occurring than assumed in the HCP.

benefits (10 percent of 48.3 river miles, see Appendix 9), which would more than offset the expected increase in impacts, which are estimated to be less than 4.7 river miles.[45] If monitoring associated with the HCP or unrelated fish sampling conducted by AGFD or other entities find a Horseshoe-tagged fish in sampling efforts in two successive years or more than one Horseshoe-tagged fish in any one year above the Reach 5 Action Area, a Permit amendment will be necessary.

E. SRP Management, Coordination, and Funding

SRP commits to carefully manage and coordinate implementation of the HCP with other agencies and the public, and will fully ensure that adequate funding will be provided to meet all of its obligations in the HCP. Cost estimates based on currently available information are outlined in this section. SRP's funding methods and assurances are specified below and in the draft Implementing Agreement (Appendix 10).

As part of the basic commitments in the HCP, SRP will provide minimization measures at Horseshoe for covered species, acquisition of 200 acres of riparian habitat, and a variety of mitigation measures for native fish, frog, and gartersnake species. SRP also will ensure adequate funding of activities in support of the mitigation efforts such as providing funds for permanent management of mitigation lands; maintaining mitigation measures for native fish, frog, and gartersnake species; monitoring species and habitat conditions at Horseshoe and mitigation sites for 50 years; and providing staff to implement the HCP. If necessary, adaptive management measures will be implemented by SRP to address additional impacts on occupied habitat or if native fish, frog, and gartersnake conservation measures are found to be ineffective (as described above). These adaptive management measures will result in additional or redirected mitigation, monitoring, and management efforts.

1. SRP Management and Coordination

SRP will establish and maintain a half-time staff position in its Environmental Services Department to manage and coordinate implementation of the HCP. The person filling this position will be required to have previous experience with managing biological resource issues. The primary responsibility for this staff position will be to ensure that the HCP is fully implemented including all adaptive management, monitoring, and reporting measures. The following tasks will be included in the job description:

- Manage the acquisition of mitigation lands including identification, purchase, start-up activities (e.g., environmental clean-up if needed and fence construction), preparation of management plans, and providing for ongoing management.

[45] The maximum increase in reservoir impacts is unlikely to exceed 30 percent, which would bring the impact of reservoir operations in the stream reach above Horseshoe equal to the impact within the reservoir itself. A 30 percent increase in reservoir impacts in Reaches 4a, 4b, 5, and their tributaries would increase impacts by 4.74 river miles (Appendix 6) for a total impact of 38.6 river miles.

- Coordinate with SRP reservoir operators on optimum reservoir operations.
- Implement native fish, frog, and gartersnake mitigation measures in coordination with FWS and AGFD.
- Conduct vegetation monitoring at Horseshoe.
- Contract for native fish, frog, and gartersnake monitoring, and population surveys for flycatchers and cuckoos at Horseshoe and on mitigation properties as specified in the HCP.
- Coordinate with Tonto National Forest personnel on population surveys, the construction and maintenance of the Lime Creek fish barrier, and enforcement and management efforts for covered species at Horseshoe.
- Coordinate implementation of adaptive management and monitoring measures for bald eagles with FWS, AGFD, and the Tonto National Forest if such action is necessary.
- With AGFD, coordinate to the extent possible with FMYN on fish population surveys.
- Prepare annual reports to be submitted to FWS.
- Prepare budget recommendations and perform other administrative tasks related to implementation of the HCP, including maintaining the monitoring and management activities.
- Identify and implement adaptive management measures as necessary.

2. Annual Meeting

A meeting will be held on or before November 30 of each year among SRP, FWS, Phoenix, USFS representatives, AGFD, and mitigation property managers to review the past year's information and to make decisions for the upcoming year regarding monitoring and management. In addition to a discussion of the general status of HCP implementation, specific decisions will be made with respect to activities for the upcoming year.

3. Reporting

SRP will provide an annual report to FWS (Arizona Ecological Services and Albuquerque Regional offices), AGFD, Phoenix, and the USFS describing all HCP activities occurring during the past year including all management activities, monitoring results, status reports, and future action items on mitigation properties, and other activities associated with implementation of the HCP. A draft of the annual report will be sent to FWS prior to the annual meeting in October or November. It will be finalized by February 1 of the following year. The report will include a summary of the past year in terms of reservoir operations; vegetation monitoring; fish, frog, and gartersnake survey data; mitigation measure implementation; and data collected on listed and candidate species. All field data collected by SRP at Horseshoe and at the monitoring and mitigation locations will be appended to the report.

The draft annual report also will describe the past year's monitoring and management activities at mitigation sites, issues that have developed, adaptive management efforts that

have been implemented, and proposed monitoring and management efforts for the next year. The final annual report will include the specific monitoring and management activities for the upcoming year that are agreed to by SRP and FWS.

4. Habitat Mitigation and Management Costs

All costs in this section are estimated based on 2006 dollars. Inflation is incorporated into the present value calculations. Present values for staff positions and monitoring at Horseshoe are calculated with a 6 percent discount rate for 50 years. Present values for management and monitoring for off-site mitigation are calculated with a 6 percent discount rate in perpetuity.

a) Habitat Acquisition and Management Costs

Of the 200 acres of mitigation land to be acquired and managed by SRP, 150 acres will be in the Safford Valley and the remainder will be along the Verde or Gila river, or elsewhere in central Arizona. Based on SRP's experience with implementing the Roosevelt HCP, the cost to acquire 200 acres in the high priority areas is estimated to be about $900,000, including transaction, fencing, environmental, and other initial costs. This cost estimate anticipates that land costs in the Verde Valley could be as much as $10,000/acre. If the actual cost of land in the Verde Valley exceeds $11,000/acre, SRP will pursue land in the Safford Valley or elsewhere where the mitigation land purchases will be more cost effective.

The habitat mitigation properties acquired for the HCP will require permanent land management. Where applicable, land management includes enforcement of conservation easements, irrigation labor, fence replacement and maintenance, patrolling and enforcement, weed control, signage, fire management, water rights enforcement, tree planting and protection, and public education (Appendix 7). Based on experience with implementing the Roosevelt HCP, estimates of the average annual costs for management are $200/acre or $40,000/year for the 200 acres. The present value of these annual management costs in perpetuity is about $700,000. In addition, SRP will spend $12,000/year on average to fund special water supply protection projects, having a present value of about $200,000.

A contingency of $300,000 or about 20 percent of the present value of habitat acquisition and management costs is included in the budget to cover unexpected costs such as higher land prices or increased management efforts.

b) Native Fish, Frog, and Gartersnake Mitigation and Management Costs

The initial capital costs of native fish, frog, and gartersnake mitigation measures are estimated to be $600,000. Construction of a fish barrier on Lime Creek is estimated to cost $100,000 for permitting, design, concrete, supplies, helicopter time, and labor. SRP will provide $500,000 in funding or in-kind services to improve and expand the Bubbling Ponds Native Fish Hatchery. If either of these mitigation measures is infeasible, SRP will redirect the funding to the same type of activity in other locations, or such other measures as agreed upon by SRP, FWS, and AGFD.

Average annual maintenance and management efforts for hatchery, stocking, and other efforts are estimated to cost about $40,000/year. Operation and maintenance costs provided to the Bubbling Ponds Fish Hatchery are estimated to average about $25,000/year. Based on estimates from AGFD, stocking of razorback suckers and other native fish is estimated to cost an average of about $10,000/year. Other annual costs are estimated to average $5,000/year. The present value of these annual costs is about $700,000.

If unexpected costs occur, a contingency of $300,000, or about 20 percent of the present value of native fish mitigation and management costs, is included in the budget. Unexpected costs may include increased construction expenses or management efforts.

c) Monitoring and Overall Management Costs

SRP will monitor flycatcher and cuckoo populations at Horseshoe and at the mitigation sites after acquisition (Subchapter IV.E). Fish, frog, and gartersnake populations will be monitored in the Action Area. Based on substantial monitoring experience at Horseshoe and for the Roosevelt HCP mitigation sites, the average annual cost for flycatcher and cuckoo surveys is estimated to be about $50,000. Annual fish, frog, and gartersnake surveys are also estimated to cost about $50,000. SRP staff will perform vegetation monitoring at Horseshoe, and the cost is included in the staff expense estimated below. The total average annual cost estimate for covered species monitoring of $100,000 has a present value of about $1.7 M.

An SRP staff person will be dedicated one-half time to supervise implementation of the HCP, to prepare an annual report to FWS, to coordinate with agencies and land managers, and to perform or to contract for management and monitoring at the mitigation sites. At an annual cost of approximately $47,000 (including a vehicle and equipment), the present value is estimated to be $700,000 for the 50-year duration of the Permit.

A contingency of about 20 percent of the monitoring and SRP staff costs, or $400,000 in present value, is included in the budget to address uncertainties in the cost estimates.

d) Adaptive Management Costs

In the event that the unavailable habitat occupied by flycatchers at Horseshoe exceeds the 200-acre threshold, additional mitigation along with management and monitoring, will be required. The following maximum costs are based on the estimates developed in the preceding sections. Based on maximum adaptive management for flycatchers, up to an additional 200 acres of mitigation might be required. Using an average cost of $4,500/acre, the total acquisition cost could total as much as $900,000. The actual costs will depend on the amount of land that will need to be purchased to meet the adaptive management requirements in Subchapter V.C.4.a. Including contingencies of about 20 percent, or $400,000, will bring the total to a maximum of about $1.3 M.

Adaptive management costs for bald eagles in the event that nest areas are established below the high water mark of the reservoirs, or if the current FWS and AGFD monitoring efforts cease, are not possible to accurately estimate at this time due to uncertainties over the extent and timing of possible additional measures. However, SRP commits to fund the additional efforts (described in Subchapter V.C.4.d) if necessary and the cost is

included in the combined costs of management, monitoring, and contingencies provided below.

Adaptive management efforts for native fish, frogs, and gartersnakes primarily involve redirecting funding to other mitigation measures. However, monitoring and management costs may increase, which are included in the overall estimate of such costs in the next paragraph.

The combined costs of management, monitoring, and contingencies associated with adaptive management of additional acquired habitat; bald eagle measures; and native fish, frog, and gartersnake mitigation efforts is estimated to have a present value of $1.2 M or less, which is an average of approximately $70,000/year over the 50-year Permit period.

e) Cost Summary

The cost estimates provided above are summarized in Table V-3. The current estimated cost of mitigation for the Horseshoe HCP without adaptive management is about $6.1 M. If adaptive management is required to address changes in circumstances, estimated costs could increase by up to $2.5 M for a total of up to $8.6 M.

Table V-3. Horseshoe and Bartlett HCP cost estimates.

Habitat Acquisition and Management	Estimated Cost
Land acquisition (200 acres)	$0.9 M
Mitigation land management ($40,000/year)*	0.7 M
Water supply protection ($12,000/year)*	0.2 M
Contingency (~20 percent)	+ 0.3 M
Subtotal	$2.1 M
Native Fish, Frog, and Gartersnake Mitigation and Management	
Lime Creek fish barrier	0.1 M
Bubbling Pond Fish Hatchery	0.5 M
Fish management measures ($40,000/year)*	0.7 M
Reservoir operations and watershed management	Not quantified
Contingency (~20 percent)	+ 0.3 M
Subtotal	$1.6 M
Monitoring and Overall Management	
SRP staff implementation and reporting (½ FTE, $47,000/year)*	0.7 M
Horseshoe, Bartlett, and mitigation sites – includes covered species and vegetation, ($100,000/year)*	1.7 M
Contingency (~20 percent)	+ 0.4 M
Subtotal	$2.8 M
Grand Total	**$6.5 M**
Adaptive Management (if needed)	
Mitigation land and management, with contingency	Up to $1.3 M
Management, monitoring, and contingency*	+ Up to $1.2 M
Subtotal	Up to $2.5 M
Grand Total With Adaptive Management	**Up to $9.0 M**

*Present value of future average annual costs.

5. Funding Methods and Assurances

During the initial years of the Permit, SRP will include funds in its annual budget to minimize, mitigate, and monitor impacts on covered species and to implement the HCP. Funding requirements in these early years will include land acquisition costs as well as annual management and monitoring expenses. No later than five years after the Permit is issued, SRP shall ensure that permanent funding is available to meet its continuing obligations under the HCP, including measures in response to changed circumstances. Unless other methods of assuring permanent funding are selected by SRP,[46] principal will be placed in nonwasting accounts designated solely for that purpose. The accounts will

[46] If SRP finds it to be cost effective, it may substitute an irrevocable letter of credit, surety bond, insurance, or other suitable assurance of permanent funding, so long as the method of funding assurance is acceptable to FWS.

be in the form of segregated fund(s) at SRP or separate trust account(s).[47] Principal in the accounts will be of an amount to generate annual cash flow sufficient to satisfy SRP's continuing obligations under the HCP, as agreed to by FWS and SRP including cost increases due to inflation.[48] From time to time, SRP may reallocate a proportional amount of the principal from the accounts to a qualified organization that assumes permanent management responsibility for a mitigation property. If additional mitigation lands or other conservation measures are implemented under the adaptive management provisions of Subchapter V.C.4 or V.D.4, SRP will supplement the principal in the accounts to ensure that permanent funding is available to meet those additional obligations. While accounts are held or managed by SRP during the term of the Permit: 1) SRP will supplement the principal in the accounts if income from the accounts falls below the annual cash-flow requirement; and 2) SRP may withdraw excess principal if the principal in the accounts exceeds the amount required to generate income to pay annual expenses.

The cost estimates provided in this subchapter are based on the best data and information available at this time, and include contingencies. SRP commits to fully meet the actual costs of implementing the HCP, even if actual costs exceed these estimates.

F. Additional Assurances (No Surprises), and Changed or Unforeseen Circumstances

Two primary goals of the HCP program are: "(1) adequately minimizing and mitigating for the incidental take of listed species; and (2) providing regulatory assurances to Section 10 permittees that the terms of an approved HCP will not change over time, or that necessary changes will be minimized to the extent possible, and will be agreed to by the applicant."[49] Recognizing the importance of both of these goals, FWS

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[47] For segregated fund(s) at SRP or trust account(s), SRP will utilize prudent management of the financial assets of the accounts to generate income to pay for annual expenses. Investment criteria for the accounts follows:

1) Performance and portfolio data submitted by investment manager candidates must be audited by an independent CPA firm or must be otherwise verifiable, and must include at least 5 years of performance history.
2) Performance must track or exceed the Standard & Poor's 500 Index for domestic equities and the Lehman Brothers Government/Credit Bond Index for fixed income securities.
3) Investment manager candidates must demonstrate the stability of the investment organization.

[48] Initial annual cash flow will be agreed upon by SRP and FWS. Future cash flow requirements will be adjusted for inflation as measured by an annual index calculated by dividing the U.S. Department of Commerce's final estimate of the chain-type annual weights price index for the Gross Domestic Product for the most recently completed third quarter by the value of that same index for the third quarter of the prior year.

[49] HCP Handbook (FWS and NMFS 1996, p. 3-28).

has adopted "No Surprises" assurances, which address the allocation of responsibility for conservation and mitigation measures necessitated by the occurrence of changed or unforeseen circumstances affecting species that are covered by a Permit (50 CFR 17.22(b)(5) and (6) and 17.32(b)(5) and (6)). This section of the HCP addresses the application of "No Surprises" assurances should a Permit be issued for Horseshoe and Bartlett.

1. Changed Circumstances

In developing the HCP, SRP and FWS have identified all foreseeable "changed circumstances" [50] and agreed upon the conservation and mitigation measures that SRP will implement in response to such "changed circumstances," should they occur during the life of the Permit. These measures are listed in Table V-4. Changes in circumstances that have not been anticipated by SRP and FWS and that would result in substantial and adverse changes in the status of covered species are addressed as unforeseen circumstances in Subchapter V.F.2.

So long as the terms of this HCP are being properly implemented, FWS will not require the implementation of any conservation and mitigation measures in addition to those specified in this Subchapter V.F.1. Other than the "changed circumstances" specifically identified in this Subchapter V.F.1, all other changed circumstances affecting a species covered by the HCP shall be deemed "unforeseen circumstances," and shall be addressed as provided in Subchapter V.F.2.

[50] The ESA's implementing regulations define "changed circumstances" as "changes in circumstances affecting a species or geographic area covered by a conservation plan that can reasonably be anticipated by plan developers and the FWS and that can be planned for" (17 C.F.R. § 17.3).

Table V-4. Changed circumstances and associated conservation, mitigation, or management measures to be implemented by SRP.

Changed Circumstances	Conservation, Mitigation, or Management Measures
Channel shifts on mitigation lands such that riparian habitat is no longer anticipated to be available.	Acquire and permanently manage replacement riparian habitat (Subchapter V.F.1.a).
Habitat acquisition and management in target geographic area is infeasible.	Acquire and permanently manage other suitable riparian habitat (Subchapter V.C.2).
Decline of flycatcher or cuckoo populations at mitigation sites.	Implement additional monitoring and management (Subchapter V.C.3 and Appendix 7).
Invasion of exotic species at mitigation sites.	Implement eradication or control efforts (Appendix 7).
Cowbird parasitism exceeds threshold rate at mitigation sites.	Implement cowbird management strategies (Subchapter V.C.4.c).
More than 200 acres of occupied habitat are predicted to be unavailable on average to flycatchers due to Horseshoe operations.	Acquire and permanently manage other riparian habitat and implement other conservation efforts (Subchapter V.C.4.a).
Reversion of mitigation land title to Arizona or the United States with loss of ability to achieve HCP goal.	Acquire and permanently manage replacement habitat (Subchapter V.F.1.b).
Planning and fund-raising efforts to improve and expand the Bubbling Ponds Native Fish Hatchery are not successful.	SRP will provide remaining funds and fund-raising support for improvements and operation of another native fish hatchery, or such other measure(s) designated by FWS in coordination with AGFD (Subchapter V.D.4).
Minimization and mitigation actions prove to be ineffective in achieving the desired result of mitigating for native fish, frog, and gartersnake species.	SRP will provide remaining funds for nonnative fish control efforts or such other measure(s) designated by FWS in consultation with AGFD (Subchapter V.D.4).
Construction of Lime Creek fish barrier is infeasible.	SRP will redirect funds to another location in consultation with FWS, AGFD, and other interested agencies (Subchapter V.D.4).
Monitoring efforts find nonnative fish in Lime Creek or its replacement above the barrier.	SRP will fund rehabilitation of Lime Creek or contribute like funding to rehabilitation of another tributary (Subchapter V.D.4).
A bald eagle establishes a nest below the high water mark of Horseshoe or Bartlett.	SRP will work with AGFD and FWS to rescue eggs or chicks, and will construct and maintain an alternative nest structure in the immediate area (Subchapter V.C.4.d).
Flycatcher and cuckoo habitat loss from fire or scouring floods at Horseshoe or mitigation sites that causes long-term riparian habitat loss (i.e., natural recruitment is likely to be delayed due to environmental changes).	SRP will work with FWS, AGFD, and other agencies to restore habitat using HCP funds, if deemed necessary (Subchapter V.F.1.c).
In Reach 5, more than one Horseshoe-tagged fish is found in one year or one tagged fish is found in successive years.	Additional fish mitigation measures (Subchapter IV.D.4).

Changed Circumstances	Conservation, Mitigation, or Management Measures
Critical habitat designation for species covered by the HCP.	No additional measures by SRP.
New nonnative aquatic species are found in the Action Area.	No additional measures by SRP as part of the HCP because SRP is not responsible for these introductions and the life histories of new introductions benefiting from reservoir operations are likely to be adversely affected by optimum reservoir operations. Also, HCP mitigation measures may be redirected to other locations or activities in consultation with FWS and AGFD.
Additional stocking of nonnative fish occurs in the Action Area, or construction of a fish barrier in the Verde River watershed for management of native fish.	No additional measures by SRP; FWS should be consulted by AGFD or the project proponents regarding listed species. HCP mitigation measures may be redirected to other locations or activities by FWS in consultation with AGFD.
Downlisting or delisting the HCP species due to recovery.	No changes in measures implemented by SRP.
New or modified dams or diversions on the Verde River or its tributaries.	No additional measures by SRP (addressed by permitting of those facilities).
Toxic or hazardous spills into the Verde River or its tributaries.	No additional measures by SRP (clean-up and mitigation of impacts are the responsibility of the person(s) causing the spill). SRP will cooperate with other agencies to pursue funding and timely clean-up. HCP funding may be redirected to monitoring and emergency measures if requested by FWS.
Future listing of a nonlisted covered species.	FWS will automatically authorize take of such newly listed covered species as prescribed by regulation (63 FR 35, February 23, 1998).

a) Channel Shifts

The riparian habitat to be acquired as part of the HCP is inherently subject to changes as the result of floods. Such changes are desirable as part of the natural cycle of succession on riparian lands. However, over time, floods could shift the channel and floodplain to such an extent that all or part of the area acquired and protected by SRP will no longer be within the floodplain boundaries where depth to water and natural processes will no longer create and maintain riparian habitat. In such an event, SRP will acquire equivalent replacement habitat using the principles and locations described in Subchapter V.C.2.

b) Reversion of Title

Some of the floodplain parcels that SRP is considering purchasing for mitigation habitat may be subject to claims of title by the State of Arizona or an agency of the federal government because of navigable stream or other issues. If title to the parcel ultimately were to revert to the State of Arizona or the federal government, SRP will address the changed circumstance as follows. If title to compensation lands under the

HCP reverts to a state or federal agency, FWS, the agency, and SRP will confer at that time and attempt to develop a plan for continued management of the property for species protection, consistent with the terms of the Permit, HCP, and Implementing Agreement.[51] If the parties can reach agreement on management, SRP will continue to receive full mitigation credit for the land. If no agreement is reached within a period of time agreed upon by SRP and FWS, the land will be replaced with other mitigation land, and necessary measures undertaken to develop and implement a management plan for the newly acquired property within two years of acquisition.

c) Habitat Loss from Fire or Scouring Floods at Horseshoe or Mitigation Sites

If habitat loss from a fire or scouring flood occurrs at Horseshoe or the mitigation sites, SRP will work with FWS, AGFD, and other agencies to evaluate habitat impacts and to restore habitat to the extent feasible, as well as redirecting HCP funds to emergency and monitoring efforts. Long-term loss of habitat due to these causes is unlikely given the type and location of mitigation lands to be acquired for the HCP. However, SRP's contribution to the evaluation and restoration will be limited to the funds and staff time previously committed as part of the HCP.

2. Unforeseen Circumstances

In the event of unforeseen circumstances during the life of the Permit,[52] FWS and SRP will work together to redirect resources to address the unforeseen circumstances. For example, if SRP is still in the habitat acquisition phase, future actions may be redirected toward a particular high-priority parcel. In the context of management, funding may be redirected toward management of the unforeseen situation. Notwithstanding the foregoing, however, FWS shall not:

a) Require the commitment of additional land, water, or financial compensation by SRP other than those agreed to elsewhere in the HCP; or
b) Impose additional restrictions on the use of land, water, or natural resources otherwise available for use by SRP under the original terms of the HCP, including additional restrictions on the operation of Horseshoe, Bartlett, or other dams that are part of SRP's reservoir system to mitigate the impacts of continued operation of Horseshoe and Bartlett.

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[51] For example, the State of Arizona is legally required to manage lands within the bed and banks of rivers navigable at the time of statehood consistent with "public trust values." Federal agencies also are required to manage the lands they own in accordance with federal law. Both federal and state agencies are subject to the "take" prohibitions of Section 9 of the ESA for activities on lands they own.

[52] "Unforeseen circumstances" are defined as "changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers and the Service at the time of the HCP's negotiation and development, and that result in a substantial and adverse change in the status of the covered species" (17 C.F.R. § 17.3).

3. Identification of Changed or Unforeseen Circumstances

In order to ensure that appropriate measures can be taken in response to changed or unforeseen circumstances, SRP will undertake the following:

- Provide written notice to FWS within 30 days after learning that a changed circumstance listed in Table V-4 has occurred. As soon as practicable, but not later than 90 days after learning of the changed circumstance, SRP will modify its activities in the manner and to the extent required by this HCP and report to FWS on its actions.
- If SRP or FWS become aware of unforeseen circumstances as described in Subchapter V.F.2, they will notify the other and take the actions described in the previous subchapter (V.F.2) and the Permit (Appendix 11).

If any of these significant changes occur during the year, they will be summarized in the annual report.

G. Implementing Agreement and Permit

1. Implementing Agreement, Permit Terms and Conditions

In consultation with FWS, SRP has prepared a proposed Implementing Agreement and proposed Permit Terms and Conditions to include in the Permit. These documents are provided in Appendices 10 and 11, respectively.

2. Amendments to the HCP

a) Minor Amendments to the HCP

SRP may propose amendments to the provisions of the HCP using the following amendment procedures. Minor amendments to the HCP may include corrections of typographic, grammatical, and similar editing errors; correction of any maps or figures to eliminate errors; or other revisions to the HCP (e.g., changes in address or principal officer) that do not diminish the level or means of mitigation or increase the impacts to the covered species or their habitats. Such minor amendments will not materially alter the terms and conditions of the Section 10(a)(1)(B) permit. Upon the written request of SRP, FWS is authorized to approve minor amendments to the HCP if such amendments do not conflict with the primary purposes of the HCP.

b) All Other Amendments to the HCP

Other than minor amendments described in the previous subchapter, all other amendments to the HCP will be treated as proposed amendments to the Section 10(a)(1)(B) permit, subject to the procedural requirements of federal law or regulations that may be applicable to amendment of such a permit. Such proposed amendments may include, but are not limited to:

1. Changes in species covered by the HCP.
2. Changes in the geographical area included in the HCP beyond that covered by adaptive management.
3. Changes in provisions of the HCP addressing minimization and mitigation, monitoring, and adaptive management measures (Subchapters V.C and V.D).

4. Changes in the covered activities resulting in an increase in the anticipated take of covered species as provided in the Permit.
5. Exceedance of take authorized by the Permit.

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APPENDIX 1
SRP, PHOENIX, AND CITY WATER RIGHT SUMMARY

Introduction to SRP Water Rights

The Salt River Valley Water Users' Association (Association) has perfected rights to the use of the waters of the Salt and Verde rivers and their tributaries for the use and benefit of its shareholders since its establishment as an Arizona Territorial corporation on February 7, 1903. Rights also were perfected or reserved by the United States for the benefit of the Salt River Federal Reclamation Project and the use of the Association's shareholders. By agreement between the United States and the Association dated September 6, 1917, the United States turned over and vested in the Association all lands and water rights along with authority over and responsibility for all decisions relating to the care, operation and maintenance of the SRP water delivery system, including the SRP reservoirs on the Salt and Verde rivers. In addition, individual Association shareholders perfected rights to the normal flow of the Salt and Verde rivers between 1869 and 1910. The Association and the Salt River Project Agricultural Improvement and Power District (District) also possess certain water rights in their own right for use in operation of the project. As discussed below (see Basis of SRP Rights), all of these rights have been perfected pursuant to a variety of federal, territorial, and state statutes, as well as state and federal court decisions.

In addition to delivery obligations to Association shareholders, SRP is obligated to divert and deliver water from the Salt and Verde rivers and their tributaries to other water users including cities, irrigation districts, Indian communities, and individual users pursuant to rights that have been perfected under federal, territorial, and state statutes, as well as state and federal court decisions (see Chapter I, Appendix 1, and Summary of City Water Rights section in this Appendix). These independent water rights of other entities are in addition to the rights held by SRP and its shareholders.

As described in Chapter I, SRP operates the entire system conjunctively to provide water to meet its obligations. SRP was constructed as a comprehensive, multipurpose Reclamation project involving, among other things: (1) storing water on the Salt and Verde river watersheds; (2) diverting that water from the Salt River at Granite Reef Dam; (3) distributing water to a wide variety of users; (4) generating hydroelectric power at the dams on the Salt River; (5) transmitting and distributing that power; and (6) withdrawing and distributing ground water pumped from beneath Project lands. Likewise, the water rights that SRP uses to store water at Horseshoe and Bartlett are only part of the portfolio of water rights under which SRP supplies water to its shareholders and contractors. In addition, some reservoirs have water right entitlements for specific entities such as SRPMIC's rights in Bartlett, the rights of the City of Phoenix in Horseshoe, and FMYN's rights to store water in both of those reservoirs.

The summary of SRP water rights provided below includes specific paragraphs related to Horseshoe and Bartlett. However, the summary also describes the primary water rights associated with all of SRP's facilities because Horseshoe and Bartlett are operated in conjunction with the other major sources of SRP water. Thus, the use of each

of SRP's water rights are related to each other. Complete descriptions of all of SRP's water rights are on file at the Arizona Department of Water Resources (ADWR) in the following documents, as amended:

Salt River Watershed

- 39-1040
- 39-1041
- 39-1206
- 39-1207
- 39-1998
- 39-11951
- 39-11952
- 39-11953
- 39-11954
- 39-11955

Verde River Watershed

- 39-50053
- 39-50054
- 39-50055

Lower Gila Watershed

- 39-35212
- 39-35213
- 39-35216
- 39-35217
- 39-35218

East Clear Creek Watershed

- 39-84543

Summary of SRP's Water Rights

The basis, priority dates, sources, uses, and quantity of SRP's water rights are described in this section.

Basis of SRP Rights

Listed below is a summary of the basis of SRP's water rights:

1. The Decision and Decree, and all Decrees supplemental thereto, entered by the District Court of the Third Judicial District of the Territory of Arizona, In and For the County of Maricopa in Hurley v. Abbott, No. 4564, March 1, 1910 (Kent Decree). The rights recognized in the Kent Decree to the waters of the Salt and Verde rivers were perfected through the filing of various notices of appropriation and through the application of water for a beneficial use.

2. The Decision and Decree, and all Decrees supplemental thereto, entered by the District Court of the Third Judicial District of the Territory of Arizona, In and For the County of Maricopa, in United States v. Haggard, No. 19, June 11, 1903 (Haggard Decree), solely for lands included within the Salt River Reservoir District (SRRD) as defined in the Association's Articles of Incorporation. The rights recognized in the Haggard Decree to the waters of the Salt and Verde rivers were perfected through the filing of various notices of appropriation and through the application of water for a beneficial use.

3. The Decision and Decree, and all Decrees supplemental thereto, entered by the Superior Court, In and For the County of Maricopa, in Benson v. Allison, No. 7589, November 14, 1917 (Benson-Allison Decree), solely for lands included within the SRRD as defined in the Association's Articles of Incorporation. The rights recognized in the

Benson-Allison Decree to the waters of the Salt and Verde rivers were perfected through the filing of various notices of appropriation and through the application of water for a beneficial use.

4. The Federal Reclamation Act, 32 Stat. 388, and acts amendatory and supplementary thereto (Reclamation Act), as implemented by the United States and the Association through (1) the Association's Articles of Incorporation; (2) the Secretary of Interior's March 14, 1903 authorization of the Salt River Federal Reclamation Project; (3) Orders issued by the Secretary of Interior on March 2, 1903, March 7, 1903, July 18, 1903, July 20, 1905, July 27, 1903, December 14, 1904 and August 29, 1919, withdrawing public lands on the Salt and Verde river watersheds from all forms of entry for the use and benefit of SRP as authorized by the Reclamation Act; (4) an Agreement between the United States and the Association dated June 25, 1904, as amended; (5) an Agreement between the United States and the Association dated September 6, 1917, as amended; (6) Public Notices issued by the United States Department of Interior dated January 18, 1917, May 19, 1917, August 8, 1917, June 3, 1921, April 6, 1925, December 22, 1927, and April 10, 1928, which specify how lands described in the Notices can secure a permanent entitlement under federal and state law to receive federal reclamation water from the Association and the United States; (7) the completed Water Right Applications accepted and approved by authority of the Secretary of Interior for Homestead Lands Under the Reclamation Act and for Lands Other Than Homesteads Under the Reclamation Act between the United States and individual shareholders of the Association, which applications have been recorded in the Maricopa County, Arizona, Recorder's Office; (8) the contract between the Association and the United States, dated June 3, 1935, as amended (Verde River Storage Works), the contract between the Association and the United States, dated November 26, 1935, as amended (Construction of Bartlett Dam), and the agreement between the Association, Phelps Dodge Corporation and the Defense Plant Corporation, dated March 1, 1944 (Horseshoe Dam Construction and Operation); (9) the contract between the Association and the Salt River Project Agricultural Improvement and Power District, dated March 22, 1937 and approved by the United States on May 18, 1937, as amended; and (10) the 1906 Reclamation Act (Reclamation Act of April 16, 1906, 43 U.S.C. § 567, 34 Stat. 116) and contracts entered into in accordance with that Act (see Appendix 1). Included within the rights established by these statutes and documents is the exclusive right to the beneficial use of all ground water, whether appropriable or not under territorial or state law, beneath and appurtenant to the lands within the exterior boundaries of the SRRD.

5. Rights to the use of ground water reserved under federal law, whether appropriable or not under territorial or state law, beneath and appurtenant to the lands within the exterior boundaries of the SRRD based upon actions and documents set forth in Paragraph 4 above.

6. The Notice of Appropriation of Water posted on February 6, 1906 and recorded by Frank H. Parker, Secretary of the Association, with the Maricopa County, Arizona, Recorder's Office in Book of Canals No. 2 at Page 155 on February 8, 1906, relating to the waters of the Salt and Verde rivers and their tributaries.

7. The Notice of Appropriation of Water posted on March 4, 1914, and recorded by John P. Orme, President of the Association, on March 6, 1914, with the Maricopa County, Arizona, Recorder's Office in Book of Canals No. 2 at Page 379, relating to the waters of the Verde River and its tributaries.

8. Water rights for reservoirs on the Salt and Verde rivers for the storage and use of water for the generation of hydroelectric energy based upon an express Congressional reservation to the United States in Section 28 of the New Mexico and Arizona Statehood Enabling Act of June 20, 1910, 36 Stat. 557, 575, of "all land actually or prospectively valuable for the development of water power or power for hydro-electric use or transmission...." This reservation was effectuated through Article X, Section 6, of the Arizona Constitution and through the reservation of specific lands by Water Power Designation No. 5, Arizona No. 2; Water Power Designation No. 6, Arizona No. 3; and Water Power Designation No. 8, Arizona No. 5, all of which were signed by Secretary of Interior Franklin K. Lane on February 9, 1917. The lands reserved include the sites of Horse Mesa, Mormon Flat and Stewart Mountain dams and their respective reservoirs plus additional lands along the Verde River and several of its tributaries. This Congressional reservation of land impliedly, if not expressly, reserved sufficient unappropriated water from the Salt and Verde rivers and their tributaries to satisfy the purposes of the reservation. The United States' rights to these locations and the reserved waters were "turn[ed] over to and vest[ed] in the said Association" by the Contract between the United States and the Association dated September 6, 1917, as amended. The construction of the hydroelectric facilities on the Salt River, for the benefit of the Association and its shareholders, was approved by the Secretary of Interior by the Contract between the United States and the Association dated July 26, 1922, as amended. Moreover, on September 18, 1922, President Harding signed into law H.R. 10248, "An Act Authorizing the sale of surplus power developed under the Salt River reclamation project, Arizona," 43 U.S.C. § 598, which further implemented the Congressional purposes of the express reservation in the federal Enabling Act and the Arizona Constitution.

9. In addition to the rights under federal law described in Paragraphs 5 and 8 hereof, the Association, its shareholders, and the District are also the express intended beneficiaries of the water rights reserved by the United States through the reservation of federal lands on the watersheds of the Salt and Verde rivers and their tributaries, for National Forest preserves. The United States' federal entitlement to these reserved waters for the purpose of securing the water supply of the Salt River federal reclamation project was "turn[ed] over to and vest[ed] in the said Association" by the Contract between the United States and the Association dated September 6, 1917, as amended.

10. In addition to "turn[ing] over to and vest[ing] in the said Association" the lands and water rights discussed in Paragraphs 5, 8, and 9 above, the 1917 Contract between the United States and the Association also transferred from the United States to the Association "all water rights and franchises, and rights to the storage, diversion and use of water for irrigation or other purposes, water power, electric power and power privileges, with such right of possession of all thereof, as shall be necessary or convenient for the care, operation and maintenance of said project by said Association…." Included

in this transfer to the Association were (a) all rights acquired by the United States from the Hudson Reservoir and Canal Company which had posted and recorded Notices of Appropriation on April 22, 1893, with the Gila County, Arizona, Recorder's Office in Book of Miscellaneous Records No. 1 at Pages 478 to 480; on April 25, 1893, with the Maricopa County, Arizona, Recorder's Office in Book of Canals No. 1 at Pages 283-285; on April 29, 1893, with the Yuma County, Arizona, Recorder's Office in Book of Homestead and pre-emption Claims No. 1 at Page 76-78; on May 1, 1893, with the Office of the Secretary of the Arizona Territory in Book of Water Filings and Locations No. 1 at Pages 8-13; on August 26, 1893, with the Maricopa County, Arizona, Recorder's Office in Book of Canals No. 1 at Pages 310-312; on August 26, 1893, with the Gila County, Arizona, Recorder's Office in Book of Miscellaneous Records No. 1 at Pages 534-538; on February 1, 1894, with the Office of the Secretary of the Arizona Territory in Book of Water Filings and Locations No. 1 at Pages 53-57; on August 30, 1901, with the Gila County, Arizona, Recorder's Office in Book of Miscellaneous Records No. 2 at Pages 292-293; on August 31, 1901, with the Office of the Secretary of the Arizona Territory in Book of Water Filings and Locations No. 2 at Pages 191-195; on August 31, 1901, in the Office of the Secretary of the Arizona Territory in Book of Water Filings and Locations No. 2 at Pages 239-242; on February 26, 1900, in the Office of the Secretary of the Arizona Territory in Book of Filings and Locations No. 2 at Pages 131-133; on March 3, 1900, in the Office of the Secretary of the Arizona Territory in Book of Water Filings and Locations No. 2 at Pages 154-157; (b) all rights acquired by the United States from various appropriators and canal companies diverting and delivering water to shareholders/users within the exterior boundaries of the SRRD as described in the Association's Articles of Incorporation; (c) all rights established by the Notice of Appropriation of Water posted on February 6, 1906 and recorded by Louis C. Hill, Supervising Engineer, United States Geological Survey, on February 8, 1906 with the Maricopa County, Arizona, Recorder's Office in Book of Canals No. 2 at Page 156, relating to the Salt and Verde rivers and their tributaries for the use and benefit of the shareholders of the Association; and (d) all other rights to the storage, diversion, delivery, and use of water from the Salt and Verde rivers and their tributaries acquired by the United States for the use and benefit of the shareholders of the Association.

11. The Act of May 18, 1916, 39 Stat. 123, 130, which directed the Secretary of Interior to acquire water for 631 10-acre allotments on the SRPMIC Reservation. This Congressional mandate was carried out by the Secretary through contracts between the United States and the Association dated September 6, 1917, as amended, July 26, 1922, June 3, 1935, as amended (Verde River Storage Works), November 26, 1935, as amended (Construction of Bartlett Dam), and between the Association, Phelps Dodge Corporation, and the Defense Plant Corporation dated March 1, 1944 (Horseshoe Dam Construction and Operation), and through the SRPMIC Water Rights Settlement Act of 1988, Pub. L. 100-512, 102 Stat. 2549 (1988), and its implementing Settlement Agreement, and the FMIC Water Rights Settlement Act of 1990, Pub. L. 101-628, Title IV, 104 Stat. 4480 (1990), and its implementing Settlement Agreement.

12. Applications to Appropriate Nos. R-45, R-46, A-135, and A-136 filed by the Association on October 2, 1920 and Nos. R-71, R-72, and E-11 filed by the Association on December 12, 1921, as amended, for the construction of reservoirs and the initiation

of water uses on the Salt and Verde rivers. In addition, Application to Appropriate No. R-30, as amended, filed by the Auxiliary Eastern Canal Landowners' Association (the predecessor to Roosevelt Water Conservation District), on August 30, 1920, for the construction of Mormon Flat and Horse Mesa dams and their respective reservoirs on the Salt River. Application No. R-30 was assigned to the Salt River Valley Water Users' Association on November 28, 1921, which assignment was approved by the State Water Commissioner on December 28, 1921.

13. The Water Rights Registration Act Statement of Claims, Nos. 36-64086, 36-68097, 36-68098, 36-69451, and 36-69452 (all as amended) filed by the Association and the District on their own behalf and on behalf of the Association's shareholders. These claims relate to the waters of the Salt and Verde rivers and their tributaries.

14. The SRPMIC Water Rights Settlement Act of 1988, Pub. L. 100-512, 102 Stat. 2549 (1988), in which Congress validated the Association's right to store and deliver water stored behind the reservoirs on the Verde River so it could be assured of its ability to provide water to the SRPMIC as required by this settlement and to the Association's shareholders.

15. The FMIC Water Rights Settlement Act of 1990, Pub. L. 101-628, Title IV, 104 Stat. 4480 (1990), in which Congress validated the water storage rights of the United States and the Association for Bartlett and Horseshoe dams on the Verde River, and the Association's right to deliver water stored behind these dams to the Fort McDowell Indian Community as required by this settlement, as well as to the Association's shareholders.

16. The actual application of water from the Salt and Verde rivers and their tributaries to continuous beneficial uses by the Association and the District on their own behalf and on behalf of the Association's shareholders, and by individual shareholders.

17. The Grandfathered Service Area Right No. 57-2520 issued by the Arizona Department of Water Resources to the District pursuant to the Arizona Groundwater Code, together with the Registration of Existing Wells forms filed by the Association and the District.

18. The adverse possession by the District and the Association of water rights perfected by other users on the Salt and Gila rivers downstream from Granite Reef Diversion Dam through the open, notorious, hostile, exclusive, and continuous use of the entire flow of the Salt and Verde rivers (except rare flood events) by the Association, its shareholders and the District. From at least 1940 until 1965, the Association, its shareholders, and the District stored, diverted, and used the entire flow of the Salt and Verde rivers, and their tributaries, through complete diversion of those flows at Granite Reef into the SRP transmission and distribution system for use by SRP shareholders. From 1965 to the present, the Association, its shareholders, and the District continued to store, divert, and use the entire flow of these rivers except for infrequent flood flows spilling over Granite Reef Dam. The storage, diversion, and use of the flows of the Salt and Verde rivers and their tributaries by the Association, its shareholders and the District precluded any uses of these waters downstream from Granite Reef Dam by any other

water users, except to the extent such downstream uses were satisfied by water deliveries from SRP.

19. Certificate of Water Right 3696 for C.C. Cragin Dam and Reservoir, formerly known as Blue Ridge Dam and Reservoir.

Priority Dates

Priority dates for the use of various sources and types of water are as follows:

Normal Flow of the Salt and Verde Rivers and their Tributaries

1. Pursuant to the Decision and Decree, and all decrees supplemental thereto, entered by the District Court of the Third Judicial District of the Territory of Arizona, In and For the County of Maricopa, in Hurley v. Abbott, No. 4564, March 1, 1910 (Kent Decree), the priority dates set forth in the Kent Decree.

2. Pursuant to the Decision and Decree, and all Decrees supplemental thereto, entered by the District Court of the Third Judicial District of the Territory of Arizona, In and For the County of Maricopa, in United States v. Haggard, No. 19, June 11, 1903 (Haggard Decree), the priority dates set forth in the Haggard Decree.

3. Pursuant to the Decision and Decree, and all Decrees supplemental thereto, entered in Benson v. Allison, In the Superior Court of Maricopa County, State of Arizona, No. 7589, November 14, 1917 (Benson-Allison Decree), the priority dates set forth in the Benson-Allison Decree.

Stored Water of the Salt and Verde Rivers

1. The priority date for water stored at Roosevelt Lake, Apache Lake, Canyon Lake, and Saguaro Lake on the Salt River is January 1, 1893.

2. The priority date for water stored at Horseshoe Lake on the Verde River is July 27, 1903. The priority date for Bartlett Lake on the Verde River is December 14, 1904.

3. In addition to SRP's prior appropriation rights, the priority date for SRP's rights under federal law to store and use water for the generation of power at the reservoirs on the Salt and Verde rivers is no later than June 20, 1910.

4. In 1903, in accordance with the Reclamation Act of 1902 (32 Stat. 388), the United States authorized the Salt River Federal Reclamation Project (SRP) and began acquisition of canals and construction of Roosevelt Dam. Also in 1903, landowners within the SRRD began to subscribe to stock in the Association, which included the right to receive water impounded by Roosevelt Dam. As the water supply for SRRD lands was further developed with the construction of Stewart Mountain Dam, Mormon Flat Dam, Horse Mesa Dam, Bartlett Dam, and Horseshoe Dam, and with the installation of wells within the SRRD, additional lands were incorporated into the SRP in accordance with public notices issued by the United States Department of the Interior. These notices indicated the intention of the United States to serve water developed for the SRP to the lands within the SRRD. These notices were issued on January 18, 1917; May 19, 1917; August 8, 1917; June 3, 1921; April 6, 1925; December 22, 1927; and April 10, 1928. Each of these notices was made pursuant to Section 4 of the Reclamation Act. Following the initial 1917 notice which opened the SRP and provides an equal and proportionate share of the stored and developed water to all lands in the project, each subsequent notice

provides that "the water rights to be furnished the lands of the [Second through Fifth] Division shall be of the same right and priority as those furnished by the United States under said notices heretofore issued for the other lands of the project …."

East Clear Creek

1. The priority date for C.C. Cragin Dam and Reservoir is April 11, 1957.

Spill Water

1. The priority date for the use of flood flow waters from the Salt and Verde rivers in excess of the existing storage capacities of SRP reservoirs (Spill Water) is no later than February 8, 1906.

Underground Water

1. The use of underground water on SRRD lands began on or about January 1, 1882.

2. The priority date for SRP's rights under federal law for the use of underground water beneath the SRRD is March 14, 1903 (see Paragraph 4 above).

Sources of Water

The sources of water are the Salt River and its tributaries directly used or stored in Roosevelt Lake, Apache Lake, Canyon Lake, and Saguaro Lake on the Salt River; the Verde River and its tributaries directly used or stored in Horseshoe Reservoir and Bartlett Reservoir on the Verde River; East Clear Creek and its tributaries directly diverted from or stored in C.C. Cragin Reservoir; and all water underlying the SRRD.

Uses of Water

Water is used for municipal, domestic, commercial and industrial, irrigation, power production, mining, stockwatering, recreation, fish, and wildlife purposes.

Quantity of Water

The capacity of SRP's space in each reservoir is as follows:

SRP Storage Facility	Capacity in AF
Roosevelt Dam and Lake	1,366,966†
Horse Mesa Dam and Apache Lake	245,138
Mormon Flat Dam and Canyon Lake	57,852
Stewart Mountain Dam and Saguaro Lake	69,765
Bartlett Dam and Reservoir	178,186
Horseshoe Dam and Reservoir	41,515‡
C.C. Cragin Dam and Reservoir	15,000
Total	1,974,422

†This capacity does not include the NCS space in Modified Roosevelt.
‡This capacity does not include the 67,702 AF of Phoenix Gatewater space in Horseshoe.

The annual amount of water right is the capacity of each reservoir with continuous filling from January 1 to December 31.

The combined maximum flow rate for diversion from the Salt and Verde rivers and wells is about 5,090 cfs. This maximum diversion rate includes the design capacities of the Arizona Canal (1,900 cfs) and South Canal (1,700 cfs) at Granite Reef Dam. When

sufficient surface water is available for diversion into these canals, SRP has transmitted a flow of water greater than the design capacities. For the Arizona Canal, the maximum recorded flow to date is 2,115 cfs. For the South Canal, the maximum recorded flow to date is 2,401 cfs. The maximum flow rate for the Arizona and South canals includes the entitlements to Haggard normal flow specified in the Kent and Benson-Allison decrees (see Basis of SRP Rights, paragraphs 1 to 3 above).

The maximum flow rate for diversion from C.C. Cragin Reservoir is about 33 cfs. The maximum diversion rate is claimed for the period from January 1 to December 31.

The maximum flow rate for diversions from wells is about 1,490 cfs. The maximum diversion rate is claimed for the period from January 1 to December 31.

Phoenix Water Rights in Horseshoe

As discussed in Chapter 1, SRP is responsible for the operation of the storage capacity behind the spillway gates at Horseshoe Dam (Gatewater space). Phoenix holds Certificate of Water Right No. 1999 with a priority date of June 12, 1947. The current capacity of the city's space in Horseshoe reservoir is 67,702 AF. The annual amount of the right is the capacity of the storage space created by the addition of the spillway gates with continuous filling up to 150,000 AF. The purpose of the appropriation is to provide water for domestic and municipal use in Phoenix.

Summary of City Water Rights

According to the Cities of Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, Scottsdale, and Tempe, the following is a representative list of the rights and entitlements of these cities to store, deliver, divert, and use water from the Salt and Verde rivers and their tributaries:[1]

(1) Permits to Appropriate Surface Water and Certificates Of Water Right Nos.:
Permit No. 33-96226
Permit No. 33-96227
Permit No. 33-96228
Permit No. 33-96229
Permit No. 33-96230
Permit No. 33-96231
Permit No. 33-96623; Certificate No. 96623
Permit No. A-402
Permit No. R 640/A-2063; Certificate No. 1999

(2) Water Rights Registration Act Claim Nos.:
36-80565 (as amended)
36-102503
36-102496 through 36-102502
36-102504 through 36-102560

[1] Letter from V.C. Danos, Arizona Municipal Water Users Association to Paul Cherrington, SRP; January 14, 2002.

36-102645 through 36-102647
36-64086

(3) Application No. R2517

(4) Permit No. R2128

(5) Certificate of Water Exchange Enrollment Nos. 67-541985 and 67-541980

(6) Amended Certificate of Water Exchange Enrollment between Salt River Valley Water Users Association and City of Tempe, ADWR Certificate #67-542004, granted May 20, 1996

(7) Amended Certificate of Water Exchange Enrollment between Salt River Valley Water Users Association and City of Glendale, ADWR Certificate #67-541992, granted March 2, 1998

(8) Certificate of Water Exchange Enrollment No. 67-541968

(9) Certificate of Water Exchange Enrollment No. 67-541998

(10) Certificate of Water Exchange Enrollment No. 67-541993

(11) Certificate of Water Exchange Enrollment No: 67-547270

(12) Service Area Right No. 56-002043

(13) Service Area Right No. 56-002030

(14) Service Area Right No. 56-002009

(15) Service Area Right No. 56-002029

(16) Service Area Right No. 56-002037

(17) Service Area Right No. 56-002018

(18) Service Area Right No. 56-002030

(19) Service Area Right No: 56-002017

(20) Statement of Claimant Nos:
39-07007927
39-0550153
39-0550154
39-0550155
39-L8 37666
39-L8 37667
39-L8 37668
39-L8 37669
39-L8 37670
39-L8 37671
39-L8 37672
39-L8 37673
39-L8 37674
39-L8 37675
39-L8 37676
39-L8 37677
39-L8 37681
39-L8 37682

39-L8 37683
39-L8 37686
39-L8 37687
39-L8 37691
39-7929
39-37600 through 39-37608
39-00198
39-007930
39-37521a, d, e, f, g, j, and k
39-50055
39-37577
39-L837520
39-077926
39-37614 through 39-37622
39-38631
39-37623
39-37624
39-37625
39-37626
39-37627
39-37628
39-37629
39-37630
39-37631
39-37632
39-37633
39-37634
39-37635
39-37636
39-37637
39-37638
39-37639
39-37640
39-38823
39-38824
39-007931
39-L835405

(21) Kent Decree

(22) Benson-Allison Decree

(23) Reclamation Act, 32 Stat. 388 (1902)

(24) Domestic Water Service Agreement Between the Roosevelt Water Conservation District and the City of Chandler

(25) Domestic Water Service Agreement Between the Roosevelt Water Conservation District and the City of Mesa, April 6, 1995

(26) Domestic Water Service Agreement between the Roosevelt Water Conservation District and the Town of Gilbert, February 20, 2001.

(27) The Salt River Pima-Maricopa Indian Community Water Rights Settlement Act of 1988, Pub. L. 100-512, 102 Stat. 2549 (1988), in which Congress validated the rights of the City of Phoenix to store water in Horseshoe Reservoir as required by the settlement agreement.

(28) The Fort McDowell Indian Community Water Rights Settlement Act of 1990, Pub. L. 101-628, Title IV, 104 Stat. 4480 (1990), in which Congress validated the rights of the City of Phoenix to store water in Horseshoe Reservoir as required by the settlement agreement.

APPENDIX 2
SUMMARY OF SETTLEMENTS AND CONTRACTS REQUIRING SRP WATER DELIVERIES

Table I-2 of Chapter I lists the entities that are entitled to SRP water deliveries, and the settlements and agreements that define SRP's delivery obligations pursuant to the water right entitlements of those entities. Those settlements and agreements are summarized below. A list of additional delivery obligations involving exchanges, CAP interconnections, and recharge facilities also is provided.

Horseshoe and Bartlett

Settlements and agreements specifically addressing storage in Horseshoe and Bartlett are summarized in this section. Delivery quantities in recent years are listed for entities that have specific rights to water stored in Horseshoe and Bartlett—the City of Phoenix, Fort McDowell Yavapai Nation, and the Salt River Pima-Maricopa Indian Community.

City of Phoenix

Operative Document(s): 1946 Agreement Between Salt River Valley Water Users' Association and the City of Phoenix, A Municipal Corporation; 1948 Contract Between the United States of America, the City of Phoenix, Arizona, and the Salt River Valley Water Users' Association Providing for the Installation of Spillway Gates at Horseshoe Dam.

Basis: The City of Phoenix obtained the rights to use water stored by Horseshoe Reservoir in consideration for payment of the cost to install gates in the spillway of Horseshoe Dam. The spillway gates enabled SRP to store additional water behind Horseshoe (thus the common name of "Gatewater" for this entitlement). The initial storage capacity was about 76,000 AF but is currently 67,702 AF due to sediment accrual. Phoenix holds a Certificate of Water Right issued by the State of Arizona for the storage and use of this water.

Delivery Obligation: The City may accrue up to 150,000 AF of storage credits. The agreement provides that water will be stored on the Salt River side of the SRP system if necessary to avoid spills of storage credits from Bartlett. To further reduce the likelihood of spill of credits, Phoenix has directed SRP to store Gatewater credits, which would otherwise spill from SRP storage space, in NCS as provided by the Modified Roosevelt Operating Agreement (see summary below under "Cities of Chandler, Glendale, Mesa, Phoenix, Scottsdale, and Tempe; NCS in Modified Roosevelt").

Annual deliveries of Gatewater to Phoenix for the years 1995 through 2002 are listed below.[1]

Year	Gatewater Deliveries (AF)
1995	16,254
1996	29,406
1997	8,212
1998	14,610
1999	34,209
2000	16,681
2001	170
2002	1,289

Fort McDowell Yavapai Nation
(Formerly the Fort McDowell Indian Community)

Operative Document(s): (1) Fort McDowell Indian Community Water Rights Settlement Agreement, January 15, 1993; and (2) the Fort McDowell Indian Community Water Rights Settlement Act of 1990, Pub. L. 101-628, Title IV, 104 Stat. 4480 (1990).

Basis: Under the Water Rights Settlement Agreement and Act, SRP is obligated to deliver water (including exchanges of CAP water) to the Fort McDowell Yavapai Nation (FMYN), to store water for FMYN, and to release a minimum flow of water from Bartlett except in extreme drought and emergency situations.

Delivery Obligation: SRP is required to: 1) store up to 3,000 AF of water for FMYN; 2) provide up to 6,730 AF/year of SRP stored water for use by FMYN; and 3) deliver up to 3,368 AF/year from the Roosevelt Water Conservation District's (RWCD) stored water entitlement (see Roosevelt Water Conservation District below). In addition, SRP is obligated to exchange up to 13,933 AF/year of FMYN's CAP water for SRP stored water. The maximum annual diversion by FMYN from the Verde River under the Settlement Agreement is 36,350 AF/year, including the exchange of CAP water. However, the long-term lease of a FMYN CAP allocation has reduced that maximum diversion amount to 31,824 AF. Finally, SRP is required to release a minimum flow of 100 cfs year-round from Bartlett Dam plus water orders on the Verde River except in situations of emergency, drought, or water quality problems specified in the Settlement Agreement. Drought is defined as any time that 1) total SRP storage is less than 50 percent of normal for the month, <u>and</u> 2) SRP Verde storage is less than 80,000 AF from March through November, or 60,000 AF from December through February.

[1] Gatewater is one of a variety water supplies available to Phoenix that vary in magnitude from year to year.

Annual deliveries of water from SRP to FMYN for the years 1995 through 2002 are listed below.

Year	FMYN Deliveries (AF)
1995	8,242
1996	10,714
1997	6,868
1998	11,069
1999	12,010
2000	9,543
2001	11,390
2002	11,541

Phelps Dodge Corporation

Operative Document(s): Agreement Between Salt River Valley Water Users' Association, Phelps Dodge Corporation, and Defense Plant Corporation, 1944; as supplemented.

Basis: Phelps Dodge and the Defense Plant Corporation agreed to construct Horseshoe Dam in order to develop a supply of water for the copper mining operations at Morenci as part of the national defense program. SRP agreed to exchange water for diversion by Phelps Dodge from the Black River, a tributary of the Salt River above Roosevelt, in return for the ability of the dam to provide water for SRP in addition to that needed for the mining operations. Phelps Dodge obtained a Certificate of Water Right from the State of Arizona for 250,000 AF of the water to be stored at Horseshoe.

Delivery Obligation: SRP is required to provide up to 40 AF/day or 14,000 AF/year to Phelps Dodge in the exchange. SRP still holds credits of about 148,000 AF in the Phelps Dodge account because Phelps Dodge minimized the use of the 250,000 AF of initial credits by importing water from the Blue Ridge and Show Low reservoirs in the Little Colorado River watershed. Since 2002, diversions from the Black River for delivery to Phelps Dodge operations at Morenci have been in exchange for CAP water delivered to SRP under an agreement with the San Carlos Apache Tribe and the Bureau of Reclamation.

Salt River Pima-Maricopa Indian Community

Operative Document(s): (1) Agreement between the United States and the Salt River Valley Water Users' Association Verde River Storage Works, 1935 (as amended); (2) Salt River Pima-Maricopa Indian Community Water Rights Settlement Agreement, February 1988; and (3) the Salt River Pima-Maricopa Indian Community Water Rights Settlement Act of 1988, Pub. L. 100-512, 102 Stat.2549 (1988).

Basis: In 1916, Congress directed the Secretary of Interior to provide water for 6,310 acres of allotted land on the Salt River Indian Reservation (Act of May 18, 1916, 39 Stat.

130). SRP agreed to cooperate with the Secretary in providing water to these allotments (see Contract dated September 6, 1917 between the Salt River Valley Water Users' Association and the United States). In 1935, SRP and the United States on behalf of SRPMIC contracted to build Bartlett Dam to carry out the provisions of the 1916 Act. As a result of the Bartlett Agreement, SRPMIC is entitled to about 20 percent of the stored water developed by the dam and SRP is entitled to the rest of the stored water.

Under the 1988 Water Rights Settlement Act and Agreement, SRPMIC is entitled to: (1) seasonally store up to 7,000 AF of water in Roosevelt, including in a portion of the NCS space; (2) a variable share of SRP stored water depending on storage level; and (3) RWCD water credits. In addition, as part of the settlement, SRP provides surface water from the Salt and Verde, in exchange for pumped underground water via a three-way exchange with the Roosevelt Irrigation District and the City of Phoenix. The 1988 Agreement also modifies the calculation of Bartlett credits that accrue to the Community by increasing the allotment of water to the Community to 20,000 AF at the end of any year in which all the of the following conditions occur:

- Storage is greater than 178,186 AF for 292 days,
- The allotment of credits generated during that year is less than 7,000 AF, and
- The end of the year allotment is less than 20,000 AF.

Delivery Obligation: Under the Bartlett Agreement, SRP credits SRPMIC with up to 60,000 AF of storage credits and is required to deliver up to 20,000 AF/year to SRPMIC from those credits. On average, SRPMIC develops and uses about 18,000 AF/year of Bartlett credits. As a result of the settlement, SRP is obligated to annually deliver water to SRPMIC: (1) up to 26,500 AF of SRP stored water (the annual amount varies from 0 to 26,500 AF depending on the amount of water stored in SRP reservoirs on May 1 of each year); (2) up to 7,000 AF of normal flow stored in Roosevelt; and (3) up to 8,000 AF of RWCD water, in addition to SRPMIC's rights to normal flow under the Kent Decree. The settlement also requires SRP to deliver up to 20,000 AF/year of surface water as part of the three-way exchange with the Roosevelt Irrigation District and the City of Phoenix.

Annual deliveries of water from SRP to SRPMIC for the years 1995 through 2002 are listed below.

Year	SRPMIC Deliveries (AF)
1995	48,324
1996	58,323
1997	68,275
1998	57,920
1999	64,324
2000	63,188
2001	64,388
2002	63,795

Other Settlements and Agreements

Settlements and agreements involving water supplied from SRP water sources, including Horseshoe and Bartlett are summarized in this section.

Buckeye Irrigation Company

Operative Document(s): Basis of Settlement of Litigation Between Buckeye Irrigation Company and the Salt River Valley Water Users' Association, 1943; as supplemented.

Basis: Approximately 18,750 acres of lands within Buckeye were awarded water rights under the 1917 Benson-Allison Decree. These lands have been irrigated since the late 1800s. In 1943, SRP and Buckeye settled a water rights suit filed by Buckeye claiming that SRP was interfering with its water rights by upstream diversions and ground water pumping.

Delivery Obligation: As a result of the 1943 settlement, as supplemented, SRP is required to deliver 1.1 percent of SRP diversions at Granite Reef Dam for specific lands served water by SRP (about 238,000 acres of Association lands and about 11,000 acres of other specific lands including Townsite and Indian lands). During the period 1951 to 1997, SRP delivered an average of about 8,140 AF/year under the contract. In addition, Buckeye received about 8,780 AF/year of tailwater from the SRP system.

Cities of Chandler, Glendale, Mesa, Phoenix, Scottsdale, and Tempe New Conservation Space in Modified Roosevelt

Operative Document(s): (1) Agreement Among the United States, the Central Arizona Water Conservation District, the Flood Control District of Maricopa County, the Salt River Project Agricultural Improvement and Power District and Salt River Valley Water Users' Association, and the Arizona Cities of Chandler, Glendale, Mesa, Phoenix, Scottsdale and Tempe, the State of Arizona, and the City of Tucson for Funding of Plan Six Facilities of the Central Arizona Project, Arizona and for Other Purposes, April 15, 1986; and (2) Operating Agreement for Additional Active Conservation Capacity at Modified Roosevelt Dam among the Salt River Project Agricultural Improvement and Power District, Salt River Valley Water Users' Association, United States Bureau of Reclamation, and the Flood Control District of Maricopa, December 14, 1993 ("Operating Agreement").

Basis: The Cities obtained the rights to use water stored by the additional storage capacity or NCS created by Modified Roosevelt Dam in consideration for contributions to the cost of construction. The Cities hold the water rights to use the stored water in their city delivery systems.

Delivery Obligation: SRP is required by the Operating Agreement to minimize releases of water over, around, or downstream of Granite Reef Diversion Dam in accordance with the following SRP conservation storage management objectives (in order of priority):

1. "*Maintain the safety and integrity of the dams.*
2. *Maintain sufficient SRP storage to meet SRP water delivery obligations.*

3. *Optimize reservoir storage for SRP use within the SRP reservoir system.*
4. *Maintain adequate SRP carryover storage for following years in case of low runoff.*
5. *Conjunctively manage ground water pumping given reservoir storage and projected runoff and demand.*
6. *Maximize hydrogeneration.*
7. *Operate to permit necessary facility maintenance*." (Operating Agreement, Section 7.1)

SRP is obligated to deliver or exchange the NCS water to the Cities on demand subject to operational constraints and delivery agreements. In addition, SRP is obligated to deliver water stored in NCS by the SRPMIC to the SRPMIC (see summary of SRPMIC entitlements and delivery obligations, below).

Gila River Indian Community

Operative Document(s): Contract for Pumping Water for Maricopa Indians on Gila River Indian Reservation (1936), as supplemented; Gila River Indian Community Water Rights Settlement Act of 2004, Pub. L. 108-451, 108 Stat. 3478; Gila River Indian Community Water Rights Settlement Agreement (2003), as amended.

Basis: The Maricopa lands have water rights under the Haggard and Benson-Allison decrees for 1,080 acres. Like other Benson-Allison water rights, these lands are located along the lower Salt River and the Gila River below the confluence of the Salt and Gila (on the Gila River Indian Reservation just west of the town of Laveen). As upstream diversions and ground water pumping increased, the United States raised issues with SRP regarding interference with the Reservation's water rights. SRP entered into the contract with the United States to resolve the disputes over these issues.

As part of the Gila River Indian Community Water Rights Settlement Agreement and Act, SRP is obligated to provide stored water, reservoir capacity, and various other contributions to the Community. The 1936 Maricopa Contract was amended and restated as part of the Agreement and Act.

Delivery Obligation: Under the Agreement and Act, SRP is required to provide the following water supplies to the Gila River Indian Community: (1) 5,900 AF/year under the Maricopa Contract; (2) up to 35,000 AF/year of stored water, depending on the amount of water stored in SRP reservoirs on May 1 of each year; and (3) long-term storage via exchange for up to 45,000 AF/year of the Community's CAP water. The Settlement became enforceable in late 2007.

Lennox – Lakin

Operative Document(s): Agreement Between Loring C. Lennox and the Salt River Valley Water Users' Association, 1921, as supplemented and amended.

Basis: These lands have water rights under the Benson-Allison Decree for about 160 acres near the confluence of the Aqua Fria and Gila rivers. Like other Benson-Allison water rights, these water users raised issues with SRP regarding interference with their water rights as upstream diversions and ground water pumping increased.

Delivery Obligation: SRP agreed to deliver water for use on these lands in order to resolve the dispute involving the issues of interference with the Benson-Allison water rights. For the period 1951 through 1997, SRP delivered an estimated average of 750 AF/year to these water right lands.

Maricopa Garden Farms

Operative Document(s): Agreement Between the Fidelity Savings and Loan Association and the Salt River Valley Water Users' Association, 1924.

Basis: These lands have been irrigated since the early 1900s. The majority of the lands have water rights under the Benson-Allison Decree. Like other Benson-Allison water rights, these lands are located along the lower Salt River and the Gila River below the confluence of the Salt and Gila. As upstream diversions and ground water pumping increased, these water users raised issues with SRP regarding interference with their water rights. SRP entered into this agreement to resolve the disputes over these issues.

Delivery Obligation: SRP is required to deliver water to about 1,263 acres of land in Maricopa Garden Farms under the same terms as SRP shareholder lands. From 1951 through 1997, SRP delivered an average of 1,660 AF/year to lands in Maricopa Garden Farms.

Municipal Delivery Contracts

Operative Document(s): Water Delivery and Use Agreements between SRP and the cities of Avondale, Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, Scottsdale, Tempe, and Tolleson. The most recent of these agreements are: Avondale (1996); Chandler (1994); Gilbert (1994); Glendale (1994); Mesa (1994); Peoria (1995); Phoenix (2001); Scottsdale (1994); Tempe (1994); and Tolleson (1995).

Basis: The cities of Avondale, Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, Scottsdale, Tempe, and Tolleson act as agents for the owners of lands with water rights to the Salt and Verde rivers and take delivery of those waters from SRP for distribution to said lands through the cities' distribution systems. These water right lands include: (1) SRP member land; (2) other contract lands summarized in this Appendix 1 (e.g., Maricopa Garden Farms, New State, Peninsula-Horowitz, and St. John's); (3) lands served pursuant to the 1906 Reclamation Act (Reclamation Act of April 16, 1906, 43 USC § 567, 34 Stat. 116); and (4) non-shareholder Kent Decree lands (Decision and Decree entered by the District Court of the Third Judicial District of the Territory of Arizona, In and

For the County of Maricopa in Hurley v. Abbott, No. 4564, March 1, 1910, as supplemented and amended). The basis of water rights for SRP member lands is described in Appendix 2. The basis of water rights for other contract lands is summarized as part of the description of those contracts elsewhere in this Appendix 1. The bases of water rights for lands in categories (3) and (4) are described below.

The 1906 Reclamation Act permitted the Secretary of the Interior to contract for permanent or temporary delivery of stored water to cities and towns within the vicinity of a federal reclamation project. Pursuant to the 1906 Act, SRP (specifically, the Association), as operator of the Project, entered into contracts with cities and towns in the Salt River Valley for the delivery of stored water to designated lands within those cities and towns ("1906 Act lands"). Most of these 1906 Act lands also have water rights under the Kent Decree.

Some lands entitled to water under the Kent Decree did not become shareholders in SRP. SRP is obligated to deliver Kent Decree water to these non-shareholder lands, which are located in various portions of the Salt River Reservoir District (SRRD, see Figure I-2).

Delivery Obligation: SRP is required to deliver water to the cities of Avondale, Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, Scottsdale, Tempe, and Tolleson under the municipal water delivery contracts for: (1) SRP member lands; (2) other contract lands; (3) lands served pursuant to the 1906 Reclamation Act; and (4) non-shareholder Kent Decree lands. The delivery obligations for SRP member lands are described in Appendix 1 and the delivery obligations under other contracts are summarized in this Appendix 2. The latter two categories, the 1906 Act and non-shareholder Kent Decree lands, comprise about 11,000 acres within the SRRD. SRP is obligated to provide water to the 1906 Act lands on the same basis as shareholders, and to the Kent Decree lands as provided in the Kent Decree. These agreements also provide for the exchange of non-SRP water for SRP water supplies and the use of SRP's delivery system to facilitate these exchanges.

New State Irrigation and Drainage District

Operative Document(s): Agreement Between New State Canal Company, Landowners, and the Salt River Valley Water Users' Association, 1924.

Basis: These lands have been irrigated since the early 1900s. The majority of the lands have water rights under the Benson-Allison Decree. Like other Benson-Allison water rights, these lands are located along the lower Salt River and the Gila River below the confluence of the Salt and Gila. As upstream diversions and ground water pumping increased, these water users raised issues with SRP regarding interference with their water rights. SRP entered into this agreement to resolve the dispute.

Delivery Obligation: SRP is required to deliver water to about 2,342 acres of land in New State under the same terms as shareholder lands. During the period 1951 through 1997, SRP delivered an average of about 3,700 AF/year to New State lands.

Peninsula-Horowitz

Operative Document(s): Agreement Between the Salt River Valley Water Users' Association, Roosevelt Irrigation District, and Valley Bank and Trust Company, N.P. McCallum, George Taylor, T.W. Barker, C.W. and Bertha Boggs, A.B. Vauk, W.A. Thompson, and Maude M. Tanton Grimshaw, 1930; as supplemented.

Basis: These lands have been irrigated since the early 1900s. The majority of the lands have water rights under the Benson-Allison Decree. Like other Benson-Allison water rights, these lands are located along the lower Salt River and the Gila River below the confluence of the Salt and Gila. As upstream diversions and ground water pumping increased, these water users raised issues with SRP regarding interference with their water rights. SRP entered into this agreement to resolve the disputes over these issues.

Delivery Obligation: SRP is required to supply up to 2 AF/year to about 2,263 acres of land in Peninsula-Horowitz.

Roosevelt Water Conservation District

Operative Document(s): (1) Agreement Between the Salt River Valley Water Users' Association and Roosevelt Water Conservation District, 1924; as supplemented and amended. Congress confirmed this agreement and its amendments in the Salt River Pima-Maricopa Indian Community Water Rights Settlement Act of 1988, 102 Stat. 2549.

Basis: In settlement of the Roosevelt Water Conservation District's (RWCD) claims to water, and in consideration for RWCD lining and maintaining canal lining, RWCD is entitled to delivery of water by SRP.

Delivery Obligation: SRP is required to deliver 5.6 percent of: (1) SRP diversions at Granite Reef Dam for specific lands; and (2) certain diversions by the City of Phoenix from the Verde River for use within SRP. SRP stores credits for RWCD at Bartlett and at Roosevelt. A portion of RWCD's water entitlement is delivered to the FMYN and SRPMIC (see the summaries for those two entities in this appendix).

St. John's Irrigation District

Operative Document(s): Agreement Between St. John's Irrigation District and the Salt River Valley Water Users' Association, 1924; as supplemented.

Basis: These lands have been irrigated since the early 1900s. The majority of the lands have water rights under the Benson-Allison Decree. Like other Benson-Allison water rights, these lands are located along the lower Salt River and the Gila River below the confluence of the Salt and Gila. As upstream diversions and ground water pumping increased, these water users raised issues with SRP regarding interference with their water rights. SRP entered into this agreement to resolve the disputes.

Delivery Obligation: SRP agreed to deliver up to 9,400 AF/year to about 2,031 acres within the St. John's Irrigation District.

Other Delivery and Exchange Obligations

In addition to the obligations listed above, SRP is required to exchange and deliver water to the entities listed in the table below and with the cities listed below the table.

SRP Exchange Agreements

Entity	Location
Tonto National Forest	Various locations on the watershed
U. S. Bureau of Reclamation and San Carlos Apache Tribe†	Black River, tributary to Salt River
U. S. Bureau of Reclamation (Dead Storage)	Future delivery obligation at various locations
Rio Verde Utilities	Lower Verde River
Phelps Dodge Corporation	Pinal Creek, tributary to Salt River
Roosevelt Lake Marina	Roosevelt Lake
Lakeview Park Marina	Roosevelt Lake
Apache Lake Marina	Apache Lake
Maricopa County Sheriff's Aid Station	Apache Lake
Maricopa County Sheriff's Aid Station	Canyon Lake
Saguaro Lake Marina	Saguaro Lake
Saguaro Lake Guest Ranch	Saguaro Lake
Arizona Department of Transportation	Various locations on the watershed
Central Arizona Water Conservation District	Various locations in the Salt River Valley

†San Carlos Apache Tribe Water Rights Settlement Agreement, March 30, 1999 and the San Carlos Apache Tribe Water Rights Settlement Act of 1992, Pub. L. 102-575, Title XXXVII, 106 Stat 4740 (1992), as amended.

(1) Water Transportation Agreement between Salt River Valley Water Users' Association and City of Phoenix, July 23, 1991.

(2) Water Transportation Agreement between Salt River Valley Water Users' Association and City of Tempe dated February 11, 1993.

(3) Water Transportation Agreement between Salt River Valley Water Users' Association and the City of Chandler dated September 10, 1991.

(4) Water Transportation Agreement between the Salt River Valley Water Users' Association and the City of Peoria, July 22, 1991.

(5) Water Transportation Agreement between the Salt River Valley Water Users' Association and the City of Scottsdale, September 3, 1991.

(6) Water Transportation Agreement between Salt River Valley Water Users' Association and City of Glendale, October 2, 1991.

(7) Water Transportation Agreement between the Salt River Valley Water Users' Association and the City of Mesa, February 16, 1994.

(8) Water Transportation Agreement between the Salt River Valley Water Users' Association and the Town of Gilbert, November 25, 1997.

(9) Granite Reef Underground Storage Project Intergovernmental Agreement Among the Salt River Valley Water Users' Association, Salt River Project Agricultural and Power Improvement District and the Municipal Corporations of Chandler, Gilbert, Mesa, Phoenix, Scottsdale and Tempe, February 26, 1993.

(10) Agreement for Conveyance of GRUSP Storage Entitlement between the Salt River Valley Water Users' Association and City of Chandler, August 25, 1993.

(11) CAP/SRP Interconnection Intergovernmental Agreement Between Salt River Valley Water Users' Association, Salt River Project Agricultural Improvement and Power District And Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, Scottsdale and Tempe, July 26, 1989.

(12) New River and Aqua Fria Underground Storage Project Intergovernmental Agreement Among the Salt River Valley Water Users' Association, Salt River Project Agricultural and Power Improvement District, and the Municipal Corporations of Avondale, Chandler, and Glendale, February 26, 1993.

(13) Multiple agreements with various entities to use SRP facilities as a ground water saving facility.

(14) Multiple agreements with various entities to exchange SRP ground water or surface water for CAP water.

APPENDIX 3
ALTERNATIVES AND MITIGATION MEASURES ELIMINATED FROM FURTHER CONSIDERATION

As summarized in Chapter II of the HCP, a number of alternatives and mitigation measures considered by SRP were eliminated from further consideration by SRP after evaluation of their feasibility and similarity to other alternatives. These rejected alternatives and mitigation measures are described in detail below.

I. Breach Horseshoe and Bartlett Dams

This alternative would involve breaching Horseshoe and Bartlett Dams to avoid potential take. This alternative was determined to be infeasible because it defeats the purpose of SRP's operation of Horseshoe to provide water to meet shareholder demands and water rights, and to meet the contractual obligations to and the water rights of Phoenix, the SRPMIC, the FMYN, and other entities (see Appendices 1 and 2). Breaching the dams is also beyond the action under review by FWS, which is SRP's operation of the reservoirs. Moreover, breaching the dams would be in violation of Congressional approval of the FMYN, SRPMIC, and Gila River Indian Community water rights settlements (see Appendix 2). In addition, there would be major adverse socioeconomic and environmental impacts resulting from the loss of water supply provided by the reservoirs, although some environmental effects could be beneficial.

II. Changes in Horseshoe and Bartlett Operations

SRP, FWS, and the public identified several Horseshoe and Bartlett operational alternatives. Each of those alternatives was carefully considered and one, the Optimum Operation Alternative, was selected as the Proposed Action. Several other operational alternatives were evaluated and eliminated from further consideration due to similarity to the alternatives under consideration or infeasibility for various reasons. The eliminated alternatives included modifying the timing and extent of storage, vegetation management in Horseshoe, releasing water to mimic the natural hydrograph, and providing sediment to the Verde downstream of Bartlett Dam. These rejected alternatives are described below.

A. Modifying the Timing and Extent of Storage

Alternatives that involve modifying the timing or extent of storage in the Verde reservoirs primarily would involve changing the operation of the Verde dams to increase nesting opportunities by avoiding periodic inundation at Horseshoe Reservoir, which has topographic and soil characteristics more suitable for vegetation growth than Bartlett Reservoir. Modifying the duration of storage in Horseshoe could also minimize the production of nonnative fish, which would reduce possible predation on native fish. One of these alternatives, Optimum Operation, which involves changing the timing and duration of storage in Horseshoe, was selected as the Proposed Action. Other alternatives involve various caps on the maximum elevation of storage in Horseshoe to reduce the impact on habitat available for flycatcher and cuckoo nesting or to reduce the threats of nonnative fish on native species. Those alternatives are infeasible, would not meet the purpose and need of these reservoirs to store water, or would result in greater impacts on covered species. Thus, they were eliminated from further consideration.

1. Modified Full Operation of Horseshoe and Bartlett With Vegetation Management

This alternative would involve SRP's continued full operation of Horseshoe and Bartlett up to their maximum storage elevations, with the addition of operating objectives to establish tall dense vegetation at the upper end of Horseshoe above an elevation of 2,010 feet to minimize impacts to flycatchers and cuckoos, and to manage Horseshoe Reservoir levels to minimize impacts to covered native fish species and provide mitigation for the razorback sucker. Also, unoccupied patches of trees below an elevation of 2,010 feet in Horseshoe, which are subject to periodic disturbance due to inundation and flooding, would be thinned in order to prevent future use of these areas by listed bird species. In addition, patches of unoccupied trees at the upper end of Horseshoe would be thinned occasionally to remove overly mature trees, which would allow regeneration of younger trees. This alternative would also include implementation of measures to minimize and mitigate the take of covered species.

The Modified Full Operation alternative was eliminated from consideration because frequent maintenance of full reservoir levels in Horseshoe would enhance the opportunities for nonnative fish reproduction and thereby increase the threats to native fish species. Also, more habitat for flycatchers and cuckoos would likely be available on average if vegetation in the lower part of the reservoir was not periodically thinned, especially given the uncertain efficacy of establishing additional habitat above an elevation of 2,010 feet.

2. Releases of Water to Mimic the Natural Hydrograph

The Southwestern Willow Flycatcher Recovery Plan suggests that reservoir operations may be modified to benefit downstream riparian habitat (FWS 2002a, Appendices I and J). Specifically, the Plan identifies "loss of annual peak flows, frequent loss of low flows, loss of flow variability at all levels, and sediment starvation (fine materials)" as effects of SRP's Verde River dams (Id.).[1] Similarly, some persons suggest that mimicking the natural hydrograph would benefit downstream native fish. In light of this guidance and public input, SRP evaluated this alternative in greater detail than other alternatives eliminated from consideration.

a. Modeling Results

Re-operation of Horseshoe and Bartlett to mimic the natural hydrograph of the Verde River below those dams would entail releasing flood inflows during late winter and early spring. In order to evaluate this alternative, SRP modeled reservoir operations using SRPSIM (see Chapter IV.A.1 and Appendix 5 for a description of the model). The purpose of the modeling was to estimate the effects of flood flow releases on the water supply to SRP, Phoenix, Indian communities, and other water users; spills of water past Granite Reef Dam; and reservoir storage.

Several assumptions were used in the modeling of reservoir operations:

1. Normal operations would occur in Bartlett from May 1 through January.

[1] SRP has identified several flaws in the hydrological analysis on which this statement is based (SRP 2002).

2. Horseshoe gates and outlet works would remain fully open from May through August to avoid impacts to existing flycatcher nesting habitat, with normal operations from September 1 through January.
3. Inflows would be released to the maximum extent possible during the peak runoff season of February, March, and April by eliminating storage above the spillway crests in Horseshoe and Bartlett and utilizing the maximum outlet capacity when inflows equal or exceed that capacity.[2]

The results of the modeling indicate that significant effects would occur to water supply, spills, and reservoir storage because about 60 percent of Horseshoe and Bartlett storage would not be available during peak runoff. Total surface water deliveries would decline by an average of 32,400 AF/year, including losses of 15,600 AF/year to SRP water users and contractors; 10,300 AF/year to Phoenix; 1,800 AF/year to SRPMIC; and 4,700 AF/year to the cities with storage rights in NCS. Water spilled at Granite Reef Dam would increase an average of 42,300 AF/year due to the releases of Verde flood flows. SRP reservoir levels would be consistently lower because of the releases from Horseshoe and Bartlett and increased use of water from the Salt River. Average annual impacts from operating the reservoirs to mimic the natural hydrograph are summarized in Table 1.

Table 1. Summary of Average Annual SRPSIM Results from Mimicking the Natural Hydrograph; Current Reservoir System and Demand: 1889-2002 Inflows.

Variable	Natural Hydrograph Versus Historical Operation (AF)
Surface Water Deliveries	
SRP Deliveries*	-15,600
Phoenix Gatewater Deliveries	-10,300
SRPMIC Deliveries	-1,800
NCS Deliveries	-4,700
Total Surface Water	-32,400
Spills	
Salt River	-3,700
Verde River	+46,000
Total Spills (Granite Reef)	+42,300
Reservoir Contents (Avg. Sept. 30)	
Horseshoe	-5,400
Bartlett	-25,600
Roosevelt	-65,400

*Includes all contract deliveries except NCS, SRPMIC and COP.

[2] The spillway crest elevation is 2,000 feet at Horseshoe and 1,748 feet at Bartlett.

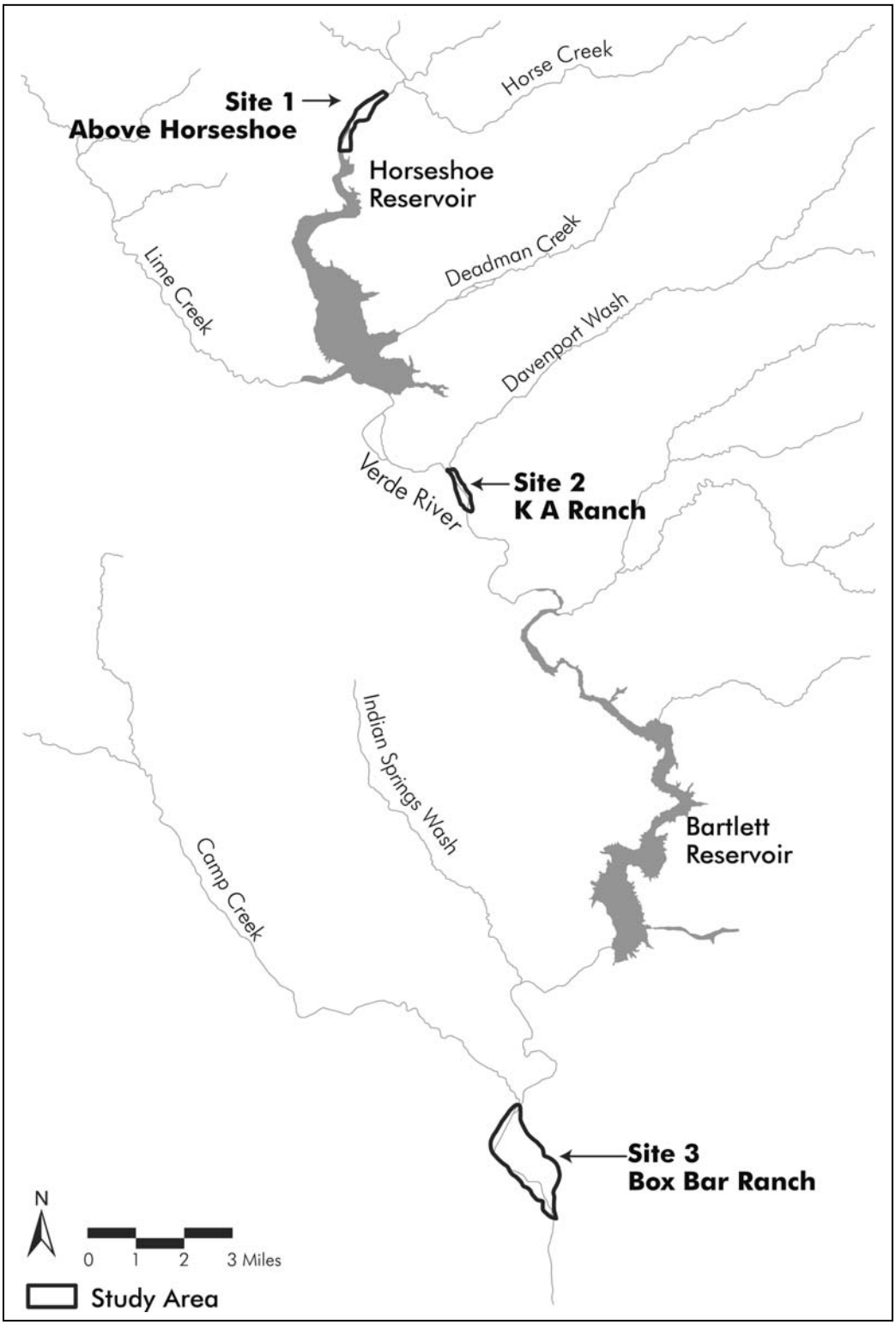
b. Recent Studies on the Effect of Horseshoe and Bartlett Operations

In 2003, Mussetter Engineering, Inc. (MEI) completed a study of fluvial geomorphology at three study sites in support of a companion study of riparian vegetation in relation to operation of Horseshoe and Bartlett (MEI 2004). The MEI analysis focused on inundation and substrate stability at each study site. The location of the three study sites is shown in Figure 1. In summary, the MEI report concludes:

- Operation of Bartlett and Horseshoe has caused little, if any, morphological or sedimentological adjustment of the Verde River.
- The changes in hydrology caused by the dam operations reduce the frequency of inundation and mobilization of sediments. The effect downstream of Horseshoe is less than the effect downstream of Bartlett because of the smaller capacity of Horseshoe.
- The reduction in frequency of flood events below Bartlett enables vegetation to become better established and withstand higher magnitude floods.
- Alternative reservoir operations, ranging up to the full release of flood flows, would have an insignificant effect on the duration of inundation and sediment mobilization on the floodplain at the three study sites. Thus, there would be little effect on the disturbance regime important for establishing and maintaining the health of riparian vegetation.

In 2004, ERO Resources Corporation (ERO) completed a riparian vegetation study, which is the companion report to the MEI geomorphology analysis (ERO 2004). The riparian vegetation study concludes that the floodplain occupied by tall woody riparian vegetation along the lower Verde River is dynamic in both the regulated and unregulated reaches. In general, the acreage of tall woody vegetation acreage increased at the three study sites in Figure 1 since aerial photos first became available in 1934, prior to the construction of Bartlett and Horseshoe dams in the late 1930s and early 1940s. Comparison of vegetation types and long-term trends for the study sites indicates that flow regulation has not had an overall significant adverse effect on establishment and maintenance of tall woody vegetation stands through 2003. A slightly greater increase in tall woody vegetation at the two regulated sites over the past 60 years suggests that the dams may have provided a slight long-term benefit to persistence of woody stands by reducing the frequency and magnitude of scouring. More recently, the minimum flow of 100 cfs below Bartlett since 1994 is likely of benefit to downstream tall woody vegetation.

Figure 1. Location of Study Sites, Lower Verde River Geomorphology and Riparian Vegetation Studies.



After reviewing the draft reports for the MEI and ERO studies summarized above, FWS expressed concern that Horseshoe and Bartlett attenuation of small to moderate flood flows with intervals of less than 10 years may have ongoing adverse effects on riparian communities along the lower Verde River (FWS 2004a). This concern was based on literature and personal communications indicating that: 1) "smaller, more regular floods … move the most sediment and shape channel characteristics"; and 2) "a wide range of river flow is critical to the establishment and maintenance of the abundance, distribution, and age classes of riparian vegetation." However, FWS did not conclude that these effects would rise to the level of take for any of the species covered by the HCP. While the FWS drew their conclusions based on numerous studies of dams, rivers, and riparian vegetation in the western and other portions of the United States, the substantial differences in the physical and hydrological characteristics of the dams and operations, including the relative size and operation of reservoirs on the Verde River, must be considered to fully evaluate how operations influence downstream riparian vegetation communities (SRP 2004; ERO 2004).

SRP agrees that components of the hydrograph are an important influence on the riparian plant community. However, SRP disagrees with the *a priori* assumption that the reduction in frequency of small to moderate floods always results in significant changes to channel geomorphology and always causes amounts of riparian forest compared to a natural hydrograph. As part of preparation of this HCP, the existing literature was reviewed in detail and site-specific fluvial geomorphology data and riparian plant community data were obtained for the Verde River reaches above and below the dams (ERO 2004; MEI 2004). The published papers and reports describe the ecological processes that drive riparian plant recruitment and dynamics (e.g., flood cycles and drought) to the site-specific channel morphology and vegetation patterns observed on the landscape. These process-to-pattern relationships provide an understanding of how Horseshoe and Bartlett reservoir operations may influence the composition and structure of the downstream riparian plant communities, and how operational changes may influence wildlife use of these communities.

SRP concluded, based on the broad spectrum of literature, that reduction in small to moderate floods, coupled with higher base flows and similar frequency of moderate to large floods compared to the natural hydrograph, would likely produce equal or greater amounts of riparian forest than would otherwise be present, primarily due to higher survivorship of seedlings (ERO 2004; Lytle and Merritt 2004). This "expected" pattern of riparian vegetation was confirmed by the site-specific studies detailed in MEI (2004) and ERO (2004) – both found slightly higher abundance of riparian forest compared to pre-dam conditions. Based on the ecological theory concerning the drivers of riparian plant community dynamics and the empirical data, SRP concluded that the downstream effects to sensitive species and their habitats would be negligible, and in some cases could be positive, e.g., for the flycatcher. The remaining FWS concerns were addressed with revisions to the final MEI and ERO reports (SRP 2004; MEI 2004; ERO 2004).

Vanessa Beauchamp and Julie Stromberg of Arizona State University have been conducting riparian vegetation studies along the Verde River since 2000 and their preliminary results support the findings described above. The study sites include locations above and below Horseshoe and Bartlett. Although the studies have not been completed,

a recent abstract regarding cottonwood-willow stand structure summarizes a portion of their results:

> Cottonwood (*Populus* sp.) and willow (*Salix* sp.), the dominant overstory species in western riparian forests, are disturbance-adapted species with narrow germination windows. Changes to flood cycles often lead to a decrease in recruitment success and survival of these species. This research investigates the effects of damming on the flow regime of a river managed for urban and agricultural water supply, and on the structure and composition of riparian cottonwood-willow forests downstream from the dam. Fifty-five years of stream gage data were used to compare flow regimes on unregulated and regulated reaches of the Verde River in central Arizona. The species composition, stem density, and basal area of cottonwood- (*P. fremontii*) and willow- (*S. gooddingii* and *S. exigua*) dominated stands were compared in above and below dam reaches. Dam operation has decreased peak flows and flow variability, shifted the timing of high flows, and increased summer base flows. However, regulated reaches along the Verde still experience spring floods in very wet years, allowing for periodic cottonwood and willow regeneration. Cottonwood and willow stem density was not different between above and below dam reaches in sapling (1-10 year) and mature (11-54 year) stands, but cottonwood stem density in old-growth (55+ year) stands was higher in unregulated reaches ($P < 0.01$). Flow regulation has altered other attributes of the riparian vegetation. For example, some measures of tree and shrub richness varied between reach types. Also, stem density of salt cedar (*Tamarix ramosissima*), a stress-tolerant, reproductively opportunistic species, was higher in regulated reaches, for sapling classes only (5.82 ± 2.15 stems/m^2 vs. 0.03 ± 0.03 stems/m^2, $P < 0.001$) (Beauchamp and Stromberg 2004).

To summarize these recent studies, Verde reservoir operations do not appear to be having a significant adverse effect on cottonwood and willow recruitment below the dams. As discussed in the next section, fewer old-growth cottonwoods below Bartlett appear to be the result of a combination of factors, several of which occurred in the late 1970s, and some of which have since been addressed.

c. Past Studies on the Effect of Horseshoe and Bartlett Operations

Several studies and publications pertaining to tall woody vegetation along the lower Verde River are available. The Department of Zoology at Arizona State University (Ohmart 1979) evaluated the historical changes in riparian vegetation and wildlife along the Verde River as part of a study to assist planning for future river development. The report identified a number of changes in riparian vegetation along the Verde River since the mid-1800s including inundation by Bartlett and Horseshoe, phreatophyte eradication, irrigation development, changes in river flow, grazing, land development, and invasion of tamarisk.

McNatt et al. (1980) studied riparian habitat and instream flows on the Fort McDowell Reservation near the mouth of the Verde River. The report found high cottonwood mortality in the late 1970s, possibly from the combined effect of severe drought and ground water pumping. Large releases of water from Bartlett Dam every 8 to 10 years or

planting of cottonwoods was recommended to maintain a productive cottonwood community. The report also concluded that a minimum flow of 200 cfs would maintain and enhance fish and wildlife resources and riparian habitat.

In 1986, as a part of water right negotiations among SRP, the United States, the FMYN, Phoenix, and other parties, ERO evaluated the riparian vegetation communities on the Fort McDowell Reservation using ground and aerial vegetation surveys, analysis of historical aerial photos dating from 1934, coring of cottonwoods to determine age, soil studies, and analysis of surface and ground water hydrology (SRP 2002). In 2001, SRP did extensive hydrological analysis on the effect of Horseshoe and Bartlett on river flow (Id.). Findings from these studies are summarized below:

- The status of cottonwood and willow along the lower Verde River results from a combination of natural fluctuations and man-induced changes, including such factors as channel migration, land use, pumping, drought, and dam operations.
- Broad, extensive areas of riparian woodland were not present prior to dam construction.
- River morphology has not changed significantly since the construction of Bartlett Dam.
- Given the small size of the SRP reservoirs on the Verde in relation to annual runoff, the natural hydrograph is not substantially modified by reservoir operations.
- Vegetation density on the active floodplain of the lower Verde River has increased since the late 1930s when river flows became regulated as the result of the construction of Bartlett Reservoir.
- Some cottonwood regeneration continues to occur on the Fort McDowell Reservation; for example, a number of saplings near the Highway 87 bridge resulted from high flow events in 1978 and 1980.
- Recreational use of riparian areas and grazing by cattle and horses are major impacts on establishing cottonwood/willow communities along the lower Verde. As a result, recruitment of new trees and shrubs from high flow events has been limited.
- Upstream from the Fort McDowell Reservation, above Needle Rock, a relatively high-gradient channel and riparian land uses (e.g., grazing) appear to be the biggest factors limiting riparian vegetation.
- Management of recreation and livestock impacts or reestablishing trees by direct plantings have the greatest potential to promote perpetuation of cottonwood and willow on the Fort McDowell Reservation.
- High bank cottonwood trees that are overly mature have been a focus of concern due to bald eagle nests in some of those trees. These cottonwood trees appear to be decadent primarily as a result of age, disease, and a declining water table due to the natural migration of the channel to the other side of the floodplain.

- A minimum stream flow of 100 cfs would have a beneficial effect on sustaining cottonwood and other riparian vegetation by helping to maintain stable ground water levels.

A minimum flow of 100 cfs released from Bartlett Dam was incorporated into the water rights settlement with the FMYN and has been in effect since 1994 (SRP 2002).

In 1999, Dr. William Graf prepared a paper on the fluvial hydrology of regulated rivers for incorporation into the Southwestern Willow Flycatcher Recovery Plan (FWS 2002a; Appendix J). Dr. Graf used 1945–1991 gage data above and below the dams and 1904–1944 gage data at the lowest gage location to evaluate the effects of storage and releases of water on Verde River flows. Major findings in his paper are:

- The dams created conditions of numerous periods of very low flow and no flow, which result in a loss of the surface water stream and less recharge to the alluvial aquifer.
- Larger "ordinary low flows" for most of the year provide ecological benefits by increasing ground water recharge and a larger surface water stream.
- Reduced mean annual peak flow and increased variability of annual peak flows have resulted in a smaller active channel.
- Fine sediment is stored behind the dams and is not deposited along the channel downstream resulting in poor substrate for cottonwood, willow, and tamarisk.
- As noted above, the minimum flow established in 1994 addresses the first of Dr. Graf's findings. Also, recent studies indicate that any changes in the size of the active channel or sediment transport have not significantly affected recruitment of cottonwood and willow.

To summarize these past studies, a combination of factors including ground water pumping and periods of no water releases from Bartlett appear to have caused the death of some cottonwood trees in the late 1970s, which resulted in the establishment of a 100 cfs minimum flow in 1994. Otherwise, cottonwood and willow recruitment below the dams appears to be affected primarily by factors other than operation of Horseshoe and Bartlett.

d. Legal and Regulatory Issues

Reservoir operations to mimic the natural hydrograph are not "reasonable" alternatives from a legal or regulatory perspective because:

- Opening the Horseshoe and Bartlett spillways and valves for part of the year would violate the Congressionally-approved FMYN, SRPMIC, and Gila River Indian Community water settlements;
- These measures are not necessary to avoid take, and SRP would not adopt those operations of its own accord; and
- FWS or other federal agencies do not have authority, under the ESA or other applicable law, to require such operations.

Indian Settlements

In 1988, Congress enacted the Salt River Pima-Maricopa Indian Community Water Rights Settlement Act (SRPMIC Act), which enabled SRP, SRPMIC, the United States, and other parties to sign the SRPMIC Water Rights Settlement Agreement (SRPMIC Agreement). The Act and Agreement provide the following benefits to SRPMIC from Horseshoe and Bartlett:

- Modification of the 1935 Bartlett Contract to increase the amount of stored water available to SRPMIC under certain circumstances (up to 60,000 AF of storage credits and delivery of up to 20,000 AF/year;
- A portion of the total water stored in SRP's reservoirs on the Verde Rivers; and
- Stored water credits for various allocations and exchanges.

Additional information on the SRPMIC Act and Agreement is provided in Subchapter I.E.2 and Appendix 1.

In 1990, Congress enacted the Fort McDowell Indian Community Water Rights Settlement Act (FMIC Act). In 1993, the Fort McDowell Indian Community (now known as the FMYN), the United States, SRP, Phoenix, and other parties signed the Water Rights Settlement Agreement (FMIC Agreement). With respect to Horseshoe and Bartlett, under the FMIC Act and Agreement, SRP is required to provide FMYN with the following:

- Storage of up to 3,000 AF/year of water for a period of 25 years;
- Up to 6,730 AF/year of SRP stored water;
- Up to 3,368 AF/year from the Roosevelt Water Conservation District's (RWCD) stored water entitlement;
- Up to 13,933 AF/year stored water in exchange for FMYN's Central Arizona Project (CAP) entitlement; and
- A minimum release of 100 cfs from Bartlett plus water orders on the Verde River except in situations of emergency, drought, or water quality problems.

In the FMIC Act, Congress validated the water storage rights of the United States and the Association for Bartlett and Horseshoe, and the Association's right to deliver water stored at Horseshoe and Bartlett to FMYN as required by the FMIC Agreement, as well as to the SRP's shareholders. Additional information on the FMIC Act and Agreement is provided in Subchapter I.E.2 and Appendix 1.

In 2004, Congress enacted the Gila River Indian Community Water Rights Settlement Act (GRIC Act), which approved the 2003 Settlement Agreement. The GRIC Act validated SRP's storage rights in all of the reservoirs, and confirmed SRP's authority and responsibility under the 1917 contract with the United States for the care, operation, and maintenance of the water delivery system, including the reservoirs. Under the GRIC Act and Agreement, SRP is obligated to provide stored water and reservoir capacity, a portion of which is derived from Horseshoe and Bartlett. SRP's obligations to the Gila River Indian Community include:

- 5,900 AF/year under the Maricopa Contract;

- Up to 35,000 AF/year of stored water, depending on the amount of water stored in SRP reservoirs on May 1 of each year; and
- Long-term storage via exchange for up to 45,000 AF/year of the Gila River Indian Community's CAP water.

Additional information on the GRIC Act and Agreement is provided in Subchapter I.E.2 and Appendix 1.

Re-operating Horseshoe and Bartlett to mimic a natural hydrograph would reduce the amount of water available to SRPMIC, FMYN, and GRIC from the water settlements. Such operations would violate the terms of the Congressionally approved water settlements for these three Indian communities.

Unnecessary Action

Implementation of the Natural Hydrograph alternative, which would have severe negative consequences for water supplies, is not needed in order to avoid the take of covered species. Implementation of the No Permit Alternative, which would have less severe water supply impacts, is sufficient to avoid take. Further, adoption of reservoir operations to mimic the natural hydrograph would violate three of SRP's reservoir operation goals:

- Maintain sufficient storage to meet water delivery obligations;
- Optimize reservoir storage within the reservoir system; and
- Maintain adequate carryover storage in case of low runoff.

In turn, SRP could be subject to legal liability by failing to conserve water for its shareholders and contractual users. Also, SRP could face legal liability from flood damage claims.

NEPA/ESA Issues

An EIS needs only evaluate "reasonable" alternatives under 40 CFR 1502.14. The Ninth Circuit has defined those alternatives to mean "... those reasonably related to the purposes of the project." *Laguna Greenbelt, Inc. v. Dep't of Transportation*, 42 F.3d 517 (9th Cir. 1994). However, "NEPA does not require the consideration of alternatives ... which are infeasible ...." *Headwaters, Inc. v. BLM*, 914 F. 2d 1174 (9th Cir. 1990). In the context of FWS' consideration of approval of an incidental take permit under Section 10, measures that are not reasonably related to the purposes of SRP's water storage or that are not needed to avoid or minimize take are not within the range of reasonable alternatives to be considered in the analysis. Likewise, in the context of Section 7 of the ESA, FWS can only propose reasonable and prudent alternatives that are within its authority as an action agency, and, further, that are necessary to avoid the likelihood of jeopardy to the continued existence of listed species or the destruction or adverse modification of listed species' critical habitat (50 CFR § 402.02). FWS does not have the legal authority to direct SRP's operations of Horseshoe and Bartlett; nor does compliance with Section 7 require the operation of Horseshoe and Bartlett to mimic the natural hydrograph. Other reservoir operations alternatives can be implemented by SRP that would be consistent with Section 7, while allowing the continued operation of Horseshoe and Bartlett for

conservation storage purposes. Given the findings that additional releases of water from the Verde dams to mimic the natural hydrograph: 1) would reduce water supplies to SRP and its contractors; 2) would provide limited, if any, benefit to riparian vegetation along the lower Verde River; and 3) would face significant regulatory and legal obstacles, this alternative was eliminated from further consideration as part of the HCP.

3. Other Storage Alternatives

Retaining more water in Horseshoe was suggested as an alternative to provide potential benefits to bald eagle productivity (Driscoll, pers. comm. 2007). This alternative was eliminated from consideration because it would cause greater impacts to other covered species, i.e., inundation of flycatcher and cuckoo habitat, and greater impacts on native fish, frog, and gartersnake habitat from increased nonnative fish recruitment. Moreover, none of the reservoir operation alternatives were determined to have a significant adverse impact on bald eagles, and the Optimum Operation Alternative is intended to conserve and help recover native fish species, which should provide a long-term benefit to bald eagles.

Other reduced take alternatives were considered in addition to Optimum Operation and Modified Full Operation with Vegetation Management. Such alternatives would cap maximum Horseshoe water levels at some point between the bottom of the Horseshoe spillway (elevation 2,000 feet) and the top of the spillway gates (elevation 2,026 feet). Given that there is no clear basis to pick a particular elevation at which to set such a cap, and the relatively small amounts of change in incidental take resulting from such alternative reservoir operations, consideration of other storage alternatives is not necessary or desirable. "NEPA does not require a separate analysis of alternatives which are not significantly distinguishable from alternatives actually considered, or which have substantially similar consequences" [citation omitted] (Headwaters, Inc. v. BLM, 914 F. 2d 1174 (9th Cir. 1990)).

B. Providing Sediment to the Lower Verde

In some locations, scientists find that riparian vegetation is limited in river reaches downstream of dams because of a lack of sediment (FWS 2002a, J-10). Dr. Julie Stromberg, a member of the Southwestern Willow Flycatcher Recovery Team, suggested that SRP investigate the feasibility of bypassing sediment from above Horseshoe Reservoir to downstream of Bartlett Dam (Stromberg, pers. comm. 2001a). As a result of that suggestion, several alternatives to provide sediment to the lower Verde River were evaluated by SRP. These alternatives are discussed below.

Passing of sediment can be accomplished through diversion dams where relatively high water velocities can be maintained, but not in storage reservoirs where large pools of water form during high inflows. It was concluded that it was not feasible to operate the Verde reservoirs to pass significant amounts of sediment through the dams because the large pools slow water velocity and cause sediment to fall from suspension. Thus, mechanical measures to transport sediment around the Verde reservoirs were evaluated.

A reconnaissance cost estimate to haul sediment by truck from Horseshoe to the foot of Bartlett Dam was developed. The estimate is based on transporting about 4 AF of silt

per year (about 8,500 cubic yards around the dams).[3] The initial costs of extending the roads to the loading and unloading locations is relatively small, about $100,000. However, the annual costs are quite large. Loading, hauling, and dumping the sediment is estimated to cost about $400,000 per year. Most of this sediment would not be permanently deposited along the stream, but would eventually be transported by the Verde River to SRP's Granite Reef Diversion Dam where it would need to be dredged out again. Assuming that 75 percent of the additional sediment would reach Granite Reef, the estimated dredging cost would be about $600,000 per year. With annual costs estimated at about $1 M, uncertain benefits to riparian vegetation (see Section II.A.1 above), and potential impacts to bald eagles, aquatic life, and other wildlife from heavy equipment operations, this alternative was determined to be infeasible.[4]

A slurry pipeline to convey sediment also was evaluated. The capital cost to construct a pipeline and provide power to the system is estimated to exceed $8 M. Annual costs, including increased dredging of Granite Reef, are estimated to be about $700,000. This alternative also was determined to be infeasible given the high capital and annual costs, uncertain biological benefits to protected species, and adverse environmental impacts. In addition, Clean Water Act permitting may be difficult to obtain because of potential water quality concerns with adding sediment to the Verde River.

For the reasons described above, the alternatives to provide sediment to the lower Verde River as a means of restoring riparian vegetation to mitigate for impacts at Horseshoe and Bartlett were eliminated from further consideration as part of the HCP.

III. Measures to Minimize or Mitigate Impacts on Listed Species — Salt and Verde Watersheds

Many alternative measures to minimize or mitigate impacts of Horseshoe and Bartlett operations on listed species were examined. Feasible measures were incorporated into the HCP. Infeasible measures and the reason(s) for elimination from further consideration are briefly summarized below.

A. Protect and Restore Riparian Habitat on Public Land Along the Verde River

As with private land, an intensive search for suitable riparian habitat that is likely to be used by flycatchers on public land was conducted in the Verde watershed. The search found a few small areas of good quality riparian vegetation, but all are limited in existing or potential size. Along the Verde River, there are historical records of flycatchers nesting

[3] The average annual sediment inflow to Horseshoe is estimated to range from about 400 to 650 AF (Corps 1981). Transportation of this large amount of sediment was determined to be extremely costly, so 1 percent of the lower end of the range was used for a feasibility analysis.

[4] Dredging sediment from Horseshoe would provide benefits to SRP by extending the effective life of the reservoir and increasing storage capacity. However, these benefits are small unless very large amounts of sediment are dredged annually. It is unlikely that dredging large amounts of sediment would prove to be cost effective given that the cost of moving sediment is about $250,000 per AF.

in or adjacent to some of these areas. In addition, there are lands within the floodplain that might be restored, but the Forest Service is already working in some of these areas to improve riparian vegetation.

The Forest Service manages much of the land along the Verde River. Only a few areas with the potential for restoration through intensive management such as fencing, planting, and irrigation were identified. The remaining National Forest lands were determined to be unsuitable for efforts to develop riparian vegetation that is likely to be used by flycatchers due to the narrow width of the floodplain and high stream gradient.

One alternative suggested during scoping was to minimize or mitigate the impact of Horseshoe and Bartlett operations by greater management of livestock grazing on Tonto National Forest lands. Additional management of livestock grazing or other measures to protect or improve riparian habitat on National Forest lands were eliminated from further consideration in the HCP because federal agencies already have a duty to manage these lands for listed species subject to Section 7(a)(1) and (2) of the ESA.

Another alternative examined at the inlet to Horseshoe was the construction of a grade-control structure (low dam) across the floodplain at Ister Flat, just above the high water level of the reservoir. The purpose of the structure would be to redistribute water and sediment above and downstream of the low dam to promote riparian vegetation growth and to minimize the impact of floods on existing riparian vegetation downstream of the structure. Based on engineering analyses conducted as part of development of the Roosevelt HCP, such a structure would have a high cost and provide a small amount of riparian woodland (estimated at 50 to 100 acres). Thus, this alternative was determined to be infeasible and eliminated from further consideration.

B. Removal of Catch Limits on Nonnative Fish

This alternative would involve requesting AGFD to remove limits on the sport harvest of nonnative fish in all or part of the Action Area in an effort to reduce competition and predation by nonnative fish on native species. This alternative might provide some benefits in conjunction with other management measures; however, it is not certain how effective this alternative would be in significantly reducing the effect of nonnative fish on native species due to limited access to long reaches of river above Horseshoe, the opportunistic nature of sport harvest, and targeting of selective species by fisherman. Also, removal of catch limits may be of concern to AGFD because of possible public opposition. In any event, this alternative was eliminated from further consideration in the HCP because it is not under the control of SRP.

C. Chemical Removal of Nonnative Fish In and Below Bartlett

The use of chemicals (rotenone or antimycin) to remove nonnative fish in and below Bartlett Dam has been suggested as a possible mitigation measure for the HCP. The primary reasons for elimination of this alternative are because SRP and AGFD have concerns with the use of chemicals due to public perception of water quality impacts and AGFD is also concerned with sport-fishing effects from chemical removal in these locations. In addition, in large reservoirs or streams such as Bartlett and the Verde River, it would be difficult to effectively kill all of the fish, leaving the remaining fish to reproduce and offset the benefits of removal. Chemical methods would kill all types of fish, including natives covered by the HCP. Also, unless all sources of nonnative fish are

controlled in the watershed, reintroduction or reinvasion would result in reproduction, which would offset the effects of removal and require repeated renovations. For example, unless nonnative fish were simultaneously controlled everywhere upstream and downstream from the control reach, nonnative fish would likely find their way into Bartlett or the Verde below Bartlett. For these reasons, this alternative was not considered further as part of the HCP.

D. Chemical Removal of Nonnative Fish In or Above Horseshoe

For discussion of issues with chemical removal of nonnative fish in or above Horseshoe, see the previous paragraph. This alternative was eliminated from consideration in the HCP because of these same issues.

E. Fund Gravel-Washing Research to Improve Native Fish Spawning

This alternative is based on the need for clean spawning gravels for many native species, especially roundtail chub. Sediment frequently coats gravel substrate in Southwestern streams, lowering reproductive success. However, the effectiveness of this method is highly uncertain, and combined with the relatively high cost for implementation, this alternative is of questionable value and cost effectiveness. Moreover, this alternative was not considered further in the HCP because the HCP Handbook discourages research as a minimization or mitigation measure.

F. Salvage of Native Fish from SRP Canals

This alternative would be to salvage native fish from SRP canals during dry-up and stock them back into the Verde, primarily below Bartlett. This alternative is already being implemented to a limited extent through cooperative efforts by SRP, AGFD, and Reclamation, although more work needs to be done to evaluate potential genetic and disease effects from transplanting these fish. However, the primary reason for elimination of this alternative as part of the HCP was because this action would require an expansion of the Action Area. Instead, SRP substituted support for hatchery production and stocking of native fish in the Verde as a mitigation measure (see Section V.C).

G. Develop Refugia Ponds in Upper Verde

This alternative would be to develop off-channel habitats to provide refugia for native fish based upon a report by Minckley et al. (2003) for conservation opportunities along the lower Colorado River. The opportunities to construct off-channel habitat along the Verde River floodplain are limited by the topography, geomorphology, and hydrology of the Verde River. Relative to the Colorado River, the Verde River floodplain is more confined, and more susceptible to frequent flooding and channel movement, than the floodplain of the lower Colorado River. Thus, this alternative was eliminated from consideration as part of the HCP.

H. Develop Quarantine Facility

A quarantine facility would assist transplanting of native fish from one location to another. The facility would provide an opportunity to ensure that potential disease and genetic issues are evaluated before stocking the fish into a new location. Because fish transplants are not a proposed measure for the HCP, development of a quarantine facility was eliminated from further consideration.

I. Participate In and Support Development of State Conservation Agreement

The State Conservation Agreement (SCA) for native fish species is intended to benefit an assemblage of native fish whose habitat requirements are shared by the species covered in the HCP. However, FWS was not supportive of including SRP funding toward implementation of the SCA (e.g., funding AGFD personnel to develop and implement the SCA) as a minimization and mitigation measure in the HCP. FWS is concerned that funding constraints, and the possible lack of legal protections for species included in a SCA, could lead to limited success. This alternative was eliminated from further consideration because FWS preferred that the HCP focus on specific on-the-ground mitigation measures within the Action Area. HCP minimization and mitigation measures could later be incorporated into the SCA, if appropriate.

J. Fund Spikedace-Loach Minnow Surveys

Because this is not a specific mitigation measure for operation of Horseshoe and Bartlett, and because the HCP Handbook discourages research as a minimization or mitigation measure, this alternative was eliminated from further consideration. However, fish sampling (for all species) is proposed as an activity to monitor the implementation effectiveness of the minimization and mitigation measures.

K. Fund Information and Education Program for Native Fish

This alternative would involve publishing, or funding the publication of, a document addressing the best management practices for the Verde River and its tributaries. Natural resource agencies and private landowners managing lands along the Verde River could use recommendations regarding maintenance and development of the riparian community and the native riparian/aquatic wildlife it supports. Although this measure could be of benefit in the long term, it was eliminated from further consideration because more direct and effective minimization and mitigation measures are available for implementation in the HCP.

L. Prioritize Stocking of Listed Fish Below Bartlett

The Committee recommended that stocking covered fish species below Bartlett be one of the priorities in the HCP (Committee 2006). However, concerns were raised later that stocking listed species in this location could adversely affect third parties having existing, ongoing activities in the area, such as anglers and water users, unless they already had sufficient take coverage for their actions. As a result, it was decided that HCP funding would only support stocking of listed species in the portion of the Action Area between Horseshoe Dam and the downstream end of the Verde Valley in order to avoid or minimize those third-party impacts, unless FWS and AGFD determine that such incidental take would be addressed or avoided. HCP funding could continue to support supplemental stocking of unlisted covered species below Bartlett.

IV. Measures to Minimize or Mitigate Water Supply Impacts Resulting from Changes in Reservoir Operations

As discussed in Chapter II of the HCP and in Section II of this appendix, certain changes in reservoir operations could reduce impacts on listed species. One reason for rejecting several of those alternatives is loss of water supply. There were a number of

measures suggested during public scoping that SRP and other water users might consider to offset the loss of water supplies. One of these measures, increased use of effluent, is considered to be potentially feasible to replace a portion of the water supply lost from re-operation of Horseshoe and Bartlett. However, as discussed below, other water supply alternatives are quite limited. Competition for water resources in central Arizona is very high given the limited water supply and growing population (ADWR 1994, pp. xxxi-xxxiv). As a result, many of these water supply alternatives are already being pursued to the maximum extent possible. For example, purchase and retirement of agricultural lands is a source of future water supply that is occurring steadily through urbanization and is already being pursued by municipal providers. For other alternative water supplies, the opportunities to minimize or mitigate impacts using these replacement supplies are limited due to numerous legal, institutional, or physical constraints (e.g., state and federal law including Arizona's Groundwater Management Act, court decrees, agreements, and contracts; and CAP canal capacity).

A. Additional Ground Water Pumping

Because the dependable surface water supply in Arizona is insufficient to meet demand, water users have relied on mining ground water for decades to meet their needs. In 1980, the legislature recognized that withdrawal of ground water in many basins exceeded the safe annual yield, which threatened the general economy and welfare of the state and its citizens. The legislature enacted the Groundwater Management Act, (Act; A.R.S. §§ 45-401 et seq.), restricting the use of ground water in Active Management Areas (AMAs) where the ground water overdraft is most severe. SRP, cities, and other entities that receive water from SRP are located within the Phoenix AMA. The Act imposes many limits on the use of ground water in AMAs:

- The Act prohibits residential development unless there is a 100-year assured water supply (AWS) available for the development (A.R.S. § 45-576). Most municipal water providers have qualified for and maintain a designation of AWS by demonstrating that sufficient water is physically, legally, and continuously available to meet a projected future water demand for at least 100 years. Under these designations, the volume of ground water that may be pumped by each designated water provider in the Phoenix AMA typically represents less than 10 percent of the provider's demand. Most of the supply must be derived from other sources. The ADWR regularly reviews the AWS of designated providers, and may terminate a designation if a water provider is unable to maintain sufficient qualifying water supplies. All of the cities that receive Salt and Verde river water delivered by SRP rely on that water as a significant component of their AWS designation.
- The Act requires that all water users in the AMAs comply with mandatory conservation regulations specified in a series of management plans designed to reduce ground water use. The management goal for the Phoenix AMA is safe-yield. ADWR has adopted the Third Management Plan for all AMAs for the period 2000 to 2010. Under the plan for the Phoenix AMA, municipal water providers must comply with a gallons-per-capita-per-day program or an alternative conservation program approved by ADWR.

- The Act restricts the geographic area in which municipal ground water pumping is allowed, and requires a permit to drill a new well. It permits a city to pump ground water only within its service area, which is the land actually being provided with water by the city and any additional areas that contain an operating distribution system owned by the city (A.R.S. §§ 45-492, 45-402). A city may not extend its service area to expand its access to ground water (A.R.S. § 45-493). A city may drill a new well in its service area only after demonstrating to ADWR that the new well will not unreasonably increase damage to surrounding land or other water users (A.R.S. § 45-598).
- The Act prohibits, with limited exceptions, pumping and transporting ground water from outside an AMA for use within an AMA. Although ground water withdrawal and use outside AMAs is regulated less stringently than within the AMAs, very little ground water is legally available to the cities because the legislature has forbidden use within AMAs (A.R.S. § 45-551).
- Violations of the Act are punishable by civil and criminal penalties. ADWR may inspect property to determine compliance with the Act, and may issue cease and desist orders for violations (A.R.S. §§ 45-633, 45-634). Violators are subject to civil penalties of up to $10,000 per day, and criminal charges ranging from misdemeanor to felony counts (A.R.S. §§ 45-635, 45-636).

Thus, the requirements of the Groundwater Management Act restrict the use of ground water as a replacement supply for Salt and Verde river water that would be lost to the cities if SRP's reservoir operations are changed. Because the majority (and ever-increasing proportion) of SRP water use is supplied for municipal use, replacement of water supplied by Horseshoe and Bartlett with additional ground water pumping in the Phoenix AMA is not a feasible alternative and was eliminated from further consideration.

B. Reduction of Water Use Through Conservation and Management Measures

Comments received during scoping of the HCP and EIS suggest that SRP, cities, and other water users dependent on water from Horseshoe and Bartlett potentially could more fully utilize available water supplies through implementation of water conservation measures (also known as water demand management programs) in order to offset the loss of water supplies from Horseshoe and Bartlett. However, these measures are already being implemented as a result of intensive regulation under the Act in order to conserve ground water (see previous section) and the recent drought.

SRP Conservation and Management Efforts

SRP participates in many activities to conserve and manage water, including:

- SRP operates the canal and lateral system to ensure that lost or unaccounted for water does not exceed 10 percent of the total water delivered. For 2001 and 2002, only 5.8 percent of the total water delivered was lost and unaccounted for, primarily due to the following water conservation programs:
    - On-site SRP water conservation lab that provides flow meter calibration services that ensure meters measure flow as accurately as possible—to within 2 percent of actual flow.

  - Ongoing canal lining program. Over 90 percent of SRP canals are lined, which prevents seepage and ensures that most of the water diverted is delivered.
  - SRP's computerized monitoring and control of the water delivery system ensures that gates are adjusted properly to meet water orders, and provides accurate water measurement readings along the canal system.
- SRP's Agricultural Services Program provides information to agricultural customers, such as:
  - Irrigation scheduling and plant tissue analysis, which ensures that the correct amount of water and fertilization is being applied.
  - Water measurement instrumentation, which provides proper water measurement techniques and devices that accurately measure water delivered.
- SRP has operated the Granite Reef Underground Storage Project (GRUSP) since the early 1990s. The Project is designed to store and bank excess renewable water supplies (surface water and reclaimed water) for use during drought. GRUSP has stored over 600,000 AF of water. A portion of this water will be left in the aquifer. Another recharge facility, the New River-Agua Fria Underground Storage Project, has been developed on the west side of the Salt River Valley. In addition, SRP has operated as a Groundwater Savings Facility since 1996, using CAP or other sources of water in place of ground water, thereby banking ground water for future use.
- SRP is purchasing variable frequency drives for many of its ground water wells. These devices adjust the pumping capacity at a ground water well to meet actual water demand. Without the variable frequency drive in place, the wells are pumped at full capacity and the rate cannot be adjusted, sometimes resulting in over delivery of water.
- In partnership with the Salt River Valley (Valley) cities, the Arizona Municipal Water Users Association, and Reclamation, SRP has provided:
  - Support to the award winning "Water—Use It Wisely" campaign, including technical and advertising support at major cultural and sporting events and other public venues across the Valley.
  - Sponsorship of events at home improvement stores located throughout the Phoenix metropolitan area promoting the use of water conservation devices for the home.
  - Sponsorship of events at shopping malls throughout the Phoenix metropolitan area promoting the planting of low water use plants, including water scheduling tips.
  - Provided table tent cards distributed to members of the Arizona Restaurant Association for display on tables in participating restaurants stating that water will be served only upon request.
  - Sponsorship of *100 Ways in 30 Days to Save Water* in all Arizona Home Depot stores promoting water conservation through in-store workshops.

- Radio campaign broadcasts across several radio stations throughout the summer and fall stressing the need to conserve water.
- Developed a Desertwise™ model home series in conjunction with Pulte Homes, a major homebuilder in the Phoenix metropolitan area.
- SRP has taken the lead in communicating Arizona's drought situation and corresponding water conservation message to make water conservation a daily habit. This is accomplished through newspaper and business journal editorials, presentations to the business community, and public statements in Valley newspapers and on TV.
- SRP sponsors the Conley Elementary School xeriscape demonstration garden where Bermuda grass has been replaced with native desert plants and vegetation.
- SRP sponsors the Center for Native and Urban Wildlife, an organization that has developed an award winning educational program on the use of native plants to create an attractive low water use landscape.
- SRP's Education Outreach Program includes:
    - Teacher training on the Arizona water story, with a strong emphasis on water conservation.
    - Classroom offerings by SRP employees regarding water conservation to local schools (grades 4 through 8).
    - Several water conservation publications intended for public distribution.
    - Development of a water education video that includes water conservation tips.
- Xeriscape landscaping has been installed at SRP facilities and no winter over-seeding of turf areas will occur during droughts; water fountains are operated minimally to conserve water.
- SRP's Measurement Services group implemented the Turf & Plant Management Program aimed at large turf areas such as high occupancy areas, schools, churches, and parks, to assist in maximizing efficient water use on their existing landscaping.
- An SRP employee was assigned full time to the Governor's Drought Task Force during the development of the plan. A component of the end result of this committee is a statewide water conservation plan.

SRP also maintains and continues to implement numerous other water management and conservation efforts. These programs include:

- Water transfers and exchanges.
- Conservation measures such as canal lining (over 90 percent are now lined).
- Increased operational flexibility through conjunctive use of alternative supplies.
- Water rights enforcement.
- Water acquisition.

City Conservation Efforts

The cities in SRP's service area have implemented several very successful wide-ranging conservation programs since enactment of the Act in 1980. Conservation initiatives include low-flow plumbing fixture codes, local ordinances governing water intensive landscaping, landscape conversion and plumbing retrofit rebate programs, public information and education programs, commercial and industrial conservation programs, and water conservation grant programs. The "Water—Use It Wisely" campaign has won numerous local and national awards, including Valley Forward's Crescordia Award for Environmental Education. A follow-up study shows that 69 percent of Salt River Valley (Valley) residents recall the campaign, and the number of residents seeing or hearing about steps they can take to conserve water has increased from 20 percent to 55 percent. Nearly all Valley residents (96 percent) report that they have taken steps to conserve water.

Xeriscape educational programs have been instrumental in reducing the number of lawns and water-intensive landscaping installed with new homes. A 1999 study showed that 70 percent of new homes installed xeriscapes, up from 20 percent in 1985. The cities, through the Arizona Municipal Water Users Association (AMWUA) Regional Water Conservation Committee, received an award from the Arizona Nursery Association for their efforts in promoting the xeriscape concept.

Water conservation efforts have been effective in slowing the growth of demand for water. The population of the Phoenix AMA increased from 1,452,305 in 1980 to 2,696,315 in 1998, an increase of 86 percent. During the same period, municipal water use in the Phoenix AMA increased from 528,000 AF to 718,483 AF, an increase of only 36 percent.

The City of Phoenix has been at the forefront of water conservation efforts in the Valley. The methods range from direct assistance to low-income families, to teach-the-teacher programs for schools. The program also includes primary research and legislative approaches. Since 1985, Phoenix has had a full time water conservation program within the Water Services Department (WSD). It now consists of a water conservation coordinator and four additional professionals, plus three support staff members and one position shared with another department. The current budget is approximately $1.8 M per year. The WSD conservation office manages a number of programs to help citizens take personal responsibility for their water use and to conserve water. The Phoenix conservation program includes the following components:

> **Project WET (Water Education for Teachers)—**A program to teach classroom teachers about water. This "train the teacher" program is contracted to the University of Arizona Water Resources Research Center. Project WET is a two-day intensive course on all facets of water and provides an opportunity for teachers to try classroom activities in a peer environment. Teachers leave with a number of resources and an activity book with materials and ideas for all age levels. In addition to teacher training, Phoenix distributes to teachers more than 100,000 pieces of curriculum guides, additional reproducible materials, as well as expendable materials for student use.

School Assembly Programs—Through the University of Arizona, performances of the Arizona Puppet Theater about water conservation for primary grades, as well as an assembly-type water conservation magic show performed by Abracadabra for upper level elementary school students.

"Water—Use it Wisely"—Active participation and funding of the "Water—Use It Wisely" campaign. This media campaign was developed jointly by Phoenix and other Salt River Valley cities as a consistent water conservation message. The campaign is based on consumer research about what citizens say they want to know about water conservation. Most Salt River Valley water providers, as well as others in and out of Arizona, have adopted the campaign.

Workshops—"How-to" video workshops for adults in English and Spanish in water conservation topics, including: low water use landscape design; irrigation systems and control; care of desert plants; landscaping for seasonal color with low water use plants; and drought survival indoors and out.

Industrial Audits—Programs for industrial, institutional, commercial, and multifamily water customers provide "how-to" on-site audits of water use and recommendations about how to conserve in a cost-effective manner. Recent efforts have focused on water conservation in restaurants. A program to replace pre-rinse nozzles with low water use versions and whole restaurant audits is being implemented.

Plumbing Upgrades—Replacement of older plumbing fixtures with newer water-efficient fixtures. This is the most significant action that can be taken to conserve water inside the home. Phoenix promotes the installation of water conserving hardware in older homes and requires such hardware in new construction through building codes. Plumbing upgrade hardware, including showerheads and faucet aerators for single-family homes, have been provided free to Phoenix homeowners since 1982. On request, Phoenix staff installs the hardware for residents unable to perform the work themselves. Phoenix underwrites programs to perform water audits and plumbing hardware replacement programs, including toilet replacement and leak repair, for lower income residents, as well as those living in targeted "Fight Back" neighborhoods. This focused program has been rated among the most effective uses of resources and one of the most significant in saving water in a study conducted by the Morrison Institute for Public Policy at Arizona State University. Phoenix staff also performs audits for multifamily owners and managers, recommending changes in plumbing hardware, irrigation practices, and common-area water uses such as pools and central cooling systems. Showerheads, if appropriate, are provided for installation by the management. Efforts to expand this program to concentrate on outdoor water use are currently underway, including outdoor water use audits for homeowners.

Irrigation Systems—Instruction and help for property owners, contractors, and property management staff in the installation, maintenance, and operation of automated irrigation systems that save water. Recent efforts are focusing on education of landscape professionals in the proper set-up and use of irrigation

systems. Phoenix administers the ADWR regulatory program for facilities with more than 10 acres of turf, and also contracts with the University of Arizona to determine evapotranspiration rates and guidelines for watering frequency and amounts for all landscape applications.

Partnerships—Repairs and upgrades to homes of lower income inner-City residents are provided through partnerships with community-based organizations. One of these partnerships is with the City o Phoenix's Human Services Department, jointly funded by Water Services and Human Services. The Water Services Department (WSD), the Arizona Department of Commerce Energy Office, and Southwest Gas Corporation have funded another partnership jointly. Phoenix's retrofit program has provided service with funding coming from WSD, a grant from the Arizona Department of Water Resources, and another from the U.S. Bureau of Reclamation.

Research—Sponsorship and active participation in basic research focused on identifying new technologies, methods, and/or products for water conservation. Research cooperators have included Arizona State University, University of Arizona, the American Water Works Association Research Foundation, and the Environmental Protection Agency. In addition, studies of the relative effectiveness of public education programs help focus efforts to achieve optimum results.

Programs for City Staff—Conservation messages are provided in the employee newsletter City Connection, employee events, and other methods. In addition, the conservation staff works directly with other departments to reduce water use. For example, the Parks Department irrigation control system was developed with the assistance of the conservation staff.

Other Programs—Participation in local, regional, and national efforts to coordinate water conservation messages. Phoenix is a key player in the regional Arizona Municipal Water Users Association Water Conservation Committee and helped to create the statewide Water Conservation Information Sharing Network. Through the Conservation Division of the American Water Works Association (AWWA) and the Western Urban Water Coalition, Phoenix has contributed to national efforts to elevate water conservation to a high public policy level. Phoenix was a founding member of the AWWA division and two members of the staff have served as trustees of that organization.

The Phoenix water conservation program should not be confused with water reduction methods that may be invoked during a drought. The conservation program targets lifestyle changes, water use practices, and physical systems. Thus, reduced water use resulting from conservation programs is intended to be permanent. In contrast, drought management targets short-term emergency solutions, which are expected to cease once the drought has ended. The water reduction methods used and public messages disseminated during a drought declaration are carefully crafted to be distinct from the conservation program. Water users must not abandon conservation just because a declaration of drought has ended and full water supplies are once again available.

The cities' existing planning processes for meeting future demands within their service areas already recognize the savings attributable to water conservation. The cities' ability to meet water demands with currently available and future water supplies is premised on the success of their conservation programs and resultant water savings.

Summary of SRP and City Conservation Efforts

Because SRP and the cities have already undertaken aggressive conservation measures as required by the Groundwater Management Act and limited water supplies, there is little or no opportunity to replace the loss of water supply from Horseshoe and Bartlett under the No Action alternative through water conservation. Thus, water conservation was eliminated from further consideration as an alternative to replace water supplies lost as a result of changes to operation of Horseshoe and Bartlett.

C. Recharge of Water

The recharge of water that would otherwise be stored at Horseshoe and Bartlett, water that would otherwise spill from the reservoirs, is limited by legal, institutional, and practical constraints. Arizona law limits SRP's ability to store water from the Verde River underground. A new appropriation or a change in water right generally is required to store water in a new location. Other water users with water rights to the Salt and Verde rivers would be entitled to protest new applications for appropriations or changes to water rights. State law also limits the long-term underground storage of water if its use is based on a decreed or appropriative water right. Such water must be recovered within 60 days of when it was recharged unless the appropriation specifies it can be stored underground.

SRP's Articles of Incorporation and federal reclamation law also place limitations on the location of any recharge project supplied by SRP water under these authorities; water rights appurtenant to Salt River Project lands cannot be used outside of the boundaries of the Project unless exchanged for another water supply (see Appendix 2; see also Salt River Reservoir District area on Figure I-2 for the boundaries of the Project). Thus, although it might be physically possible to recharge this water outside of the Project boundaries, the water would have to be brought back into SRP when it was recovered. This limitation restricts the location of recharge to an area near the SRP boundaries and greatly increases the costs of any such recharge project.

There is an additional practical restriction in the location of recharge because SRP facilities would have to be used to convey the water to the recharge site. This effectively limits the location of recharge sites to the Salt River between Granite Reef Dam and the confluence with the Gila River, or the lower reaches of the Agua Fria or New rivers.[5]

[5] The channel of the Salt River could be used to transport water for recharge but losses would be high and those losses would not count as "recharged water" under Arizona law (A.R.S. § 45-651 et seq.). Moreover, there are relatively few locations for recharge along the Salt River due to urbanization, flood control facilities, new recreation facilities (e.g., Rio Salado), nearby landfills, and relatively high ground water tables. The same issue with high ground water levels occurs along the Gila River downstream of the confluence with the Salt River.

Finally, there are limits on the maximum rate and total amount of water that could be recharged and recovered. Because SRP facilities would need to be used to convey the recharge water, and those facilities have limited extra capacity over and above the space needed to deliver water for other uses, the rate of transport to a recharge facility would typically be limited to flow of a few hundred cfs (compared to the inflow to Horseshoe and Bartlett during peak storage periods, which is thousands to tens of thousands of cfs). In terms of the recovery of water that is recharged, SRP utilizes its own production wells to withdraw previously recharged water as surface water. During a severe drought, the time that recharged water would need to be recovered, nearly every SRP well is being used to pump ground water to augment releases of water from the dams to meet water demands. Thus, large-scale recovery of recharged water would require that SRP's ground water pumping capacity be greatly increased at substantial cost. The capital, operation, and maintenance costs for new wells is estimated at $220 AF/year).

SRP's capacity in the Granite Reef Underground Storage Project (GRUSP), an existing recharge facility located adjacent to the Salt River on the Salt River Pima-Maricopa Indian Reservation, is about 25,000 AF/year or equivalent to about 35 cfs. GRUSP is actually permitted for 200,000 AF/year but it has never been able to approach that amount because the underground mound of water created by recharge encroaches on a nearby landfill. The modification and expansion of GRUSP to reach its permitted capacity is unlikely due to institutional and physical constraints. In addition to the significant constraint imposed by the landfill, the modifications would have to be acceptable to the SRPMIC, which have been reticent to approve additional land leases for recharge. Even if SRP was able to modify GRUSP to reach its full capacity, which is unlikely, SRP's share would be about 68,000 AF/year (about 93 cfs). SRP has developed another recharge facility along the Agua Fria River channel that has a capacity of 75,000 AF/year (about 104 cfs) (Id.). SRP is also investigating the possibility of recharging up to 10,000 to 15,000 AF/year (about 14 to 20 cfs) with wells (Id.). If feasible and fully implemented, the combined capacity of all of the recharge facilities described above would total about 180,000 AF/year (about 250 cfs) but the maximum rate of recharge would be significantly less than the thousands to tens of thousands of cfs that Horseshoe and Bartlett store or spill during peak periods of inflow.

In summary, recharge of water that could otherwise be stored at Horseshoe and Bartlett is severely limited by legal, institutional, and practical constraints:

- Arizona law would have to be changed to allow long-term underground storage of water, and other water users could object to a new appropriation or a change in water right.
- Additional recharge locations, rate of recharge, and total capacity are limited.
- Expansion of existing sites is limited by physical and institutional constraints.
- Available conveyance capacity between Granite Reef Dam and potential recharge sites is one to two orders of magnitude less than Horseshoe and Bartlett inflows to be stored.
- The cost to recharge and recover the water would be about $400/AF per year or more.

As a result of these limitations, the alternative of recharging water that would be stored or spilled from Horseshoe and Bartlett was eliminated from further consideration.

D. Use of CAP Water

Central Arizona Project (CAP) water is a portion of Arizona's entitlement to Colorado River water and is delivered from the Colorado River to the Phoenix AMA via the CAP canal. Arizona's entitlement to Colorado River water is governed by the "Law of the River," a complex set of federal laws, interstate compacts, treaties, and U.S. Supreme Court decisions. Although CAP water is surface water for limited purposes under state law (A.R.S. § 45-101), the right to use CAP water is governed by federal law.

In 2004, Congress enacted the Arizona Water Settlements Act, which allocated all remaining CAP supplies to various entities (Pub. L. 108-451, 108 Stat. 3478). Because all of the CAP water has been allocated for Indian, Municipal and Industrial (M&I), and agricultural use, CAP water cannot comprise a replacement water supply for lost Salt and Verde River water. Other Colorado River water is fully allocated to existing water users and other states (65 FR 48532, August 8, 2000; Boulder Canyon Project Act, 45 Stat. 1057 (1928); Upper Colorado River Basin Compact, October 11, 1948; Arizona v. California, 373 U.S. 546 (1963); Colorado River Basin Project Act, 82 Stat. 885 (1968)). Thus, the only additional Colorado River water available is excess CAP water, which would provide only a temporary water supply.

Excess CAP water is water that has not been scheduled for delivery pursuant to a long-term contract or subcontract and is available for delivery on a year-to-year basis. Excess CAP water also may include surplus Colorado River water when the Secretary of the Interior declares surplus conditions, meaning more than 7,500,000 AF of water is available to meet consumptive use demands in the Lower Basin states.[6] Little or no excess CAP water is currently available to meet new demands because several programs already rely on those supplies — water banking contracts with Nevada, ground water replenishment districts, and obligations to firm CAP water for Indian tribes and cities (ADWR 1998; CAGRD 2002; AWBA 2004). Moreover, quantities of excess CAP water will continue to diminish as subcontractors and Indian tribes take more and more of their allocations. Likewise, increased use of Colorado River water through development in the Upper Basin states, and reductions in supplies due to fluctuations in precipitation and runoff, will also reduce the amount of excess CAP water available.

In summary, CAP water is not a viable replacement source for water supplied from Horseshoe and Bartlett for the following reasons:

- CAP allocations are fully committed for existing and future Indian, M&I, and agricultural uses.
- Excess CAP water is being used to meet other demands in Arizona and will diminish over time.

For these reasons, the alternative was eliminated from further consideration.

[6] Criteria for coordinated long-range operation of Colorado River reservoirs pursuant to the Colorado River Basin Project Act (1970).

E. Use of Effluent

Effluent is the only water supply that is increasing in the Phoenix AMA.[7] While a substantial quantity of effluent is produced in the AMA, Salt River Valley cities already rely on much of this effluent to meet current and future water demands. Existing state law does not allow the direct use of effluent as drinking water. Thus, wastewater treatment plants and distribution systems in the Phoenix AMA are not designed for the production of potable effluent. As discussed below, increased reuse of nonpotable effluent is limited in quantity and is expensive to implement.

One alternative is effluent reuse from local water reclamation facilities. However, this option is not a feasible long-term replacement water supply alternative for several reasons. Each of the cities potentially impacted by reductions in Salt and Verde River water supplies under the reservoir operation alternatives utilize local water reclamation facilities to some degree. Nearly all of the effluent produced at local reclamation facilities is already put to beneficial uses and carries with it a long-term commitment to those uses. Water potentially available from future local reclamation facilities, or from expansions of existing local reclamation facilities, is already committed to future water demands within the cities' water service areas. In addition, for the cities that own capacity in the regional 91st Avenue Wastewater Treatment Plant ("91st Avenue plant") west of Phoenix on the Salt River, constructing additional local reclamation capacity for local reuse would also come at the expense of reducing a like volume of wastewater treated at the 91st Avenue plant. For these cities, any additional local opportunities to reuse reclaimed water as a replacement supply would reduce the amount of replacement water available to them through the effluent recharge project described below. Furthermore, per unit costs for local effluent production would greatly exceed per unit costs at the 91st Avenue plant.

The 91st Avenue plant produces most of the available effluent in the Salt River Valley. The cities of Phoenix, Glendale, Mesa, Scottsdale, and Tempe own the plant. However, much of the effluent produced by the 91st Avenue plant is already contractually committed to industrial and irrigation uses downstream of the plant. There is no infrastructure in place to transport the remaining effluent back upstream to the five cities' service areas where it could be reused. The costs for permitting and constructing the necessary infrastructure are high, ranging from approximately $457 to $506 per AF. Also, reducing flow downstream of the 91st Avenue plant may adversely affect riparian habitat for several miles downstream.

Storing the effluent underground is expensive and has numerous issues. Suitable recharge locations near the 91st Avenue plant are limited. Many areas near the 91st Avenue plant cannot meet regulatory recharge site requirements due to the presence of landfills or water logging. The only suitable recharge sites are located at a distance from the 91st Avenue plant where effluent is produced. Costs exceeding $57 M per year would be incurred in acquiring recharge sites, transporting the effluent to the sites, obtaining the

[7] In 1989, the Arizona Supreme Court held that effluent is neither ground water nor surface water, but a third type of water that belongs to the entity that generates it by treating wastewater. Arizona Public Service Co. v. Long, 160 Ariz. 429, 773 P.2d 988. Effluent is now codified as a third type of water by statute (A.R.S. § 45-101).

necessary permits to recharge the effluent, recovering the water, and transporting it to the location of reuse. The costs of this alternative are used in the analysis of impacts in Subchapter IV.C.1.

Despite the constraints, additional reuse of effluent is the most viable replacement source of water for reservoir operation alternatives that result in less surface water being supplied by SRP.

F. Acquisition of Water from Other Sources or Water Users

In addition to the potential water sources described above, other options were researched. However, there are few other sources of water available and the quantity available from most of those sources would be limited. Three potential alternatives were identified from published documents and public comments during scoping: 1) develop new supplies of surface water in central Arizona; 2) purchase water rights from other water users; or 3) import water from distant sources such as the Colorado River or ground water underlying remote basins in western Arizona. As discussed below, these options do not appear to be economically feasible and would face major legal, political, and environmental hurdles.

Development of additional surface water supplies cannot provide a replacement water source for Salt and Verde River water that would be lost if SRP's reservoir operations are changed. Except for infrequent flood flows, surface water in Arizona is fully appropriated (USGS 1985, p. 145). Infrequent flood flows could provide a reliable water supply only if they could be stored underground for later use or stored in a new reservoir. State law, however, limits the long-term underground storage of water that is derived from a decreed or appropriative water right. Such water must normally be recovered within 60 days from when it was stored (A.R.S. § 45-851.01). In addition, it would probably not be possible to acquire the necessary environmental permits to construct new surface water storage reservoirs to store flood flows.

A limited amount of water is available for lease or purchase from other water users in central Arizona. Except for CAP water, most of that water is from nonrenewable ground water sources. Moreover, most, if not all, of the CAP and other surface water sources in the Phoenix area are already destined to satisfy municipal demand as urbanization rapidly occurs in the metropolitan area (ADWR 1994). Thus, lease or purchase of renewable water supplies would not replace losses of water from Horseshoe and Bartlett but would simply redistribute the available water.

Importing additional water supplies from either the Colorado River or distant ground water basins would be akin to constructing a second, smaller CAP system. Even if such a system were built to only deliver 5 to 10 percent of the CAP supply (about 75,000 to 150,000 AF/year), the cost would be hundreds of millions of dollars. Moreover, and perhaps more importantly with respect to the listed species issue at Horseshoe and Bartlett, such a project likely would have large environmental impacts resulting from withdrawing water from a distant source and constructing a system over many miles. These impacts would likely negatively impact listed species and other wildlife, and have major socioeconomic effects.

For the reasons described above, the alternative of acquiring water from other sources or water users to replace reduced Horseshoe and Bartlett water supplies was eliminated from further consideration.

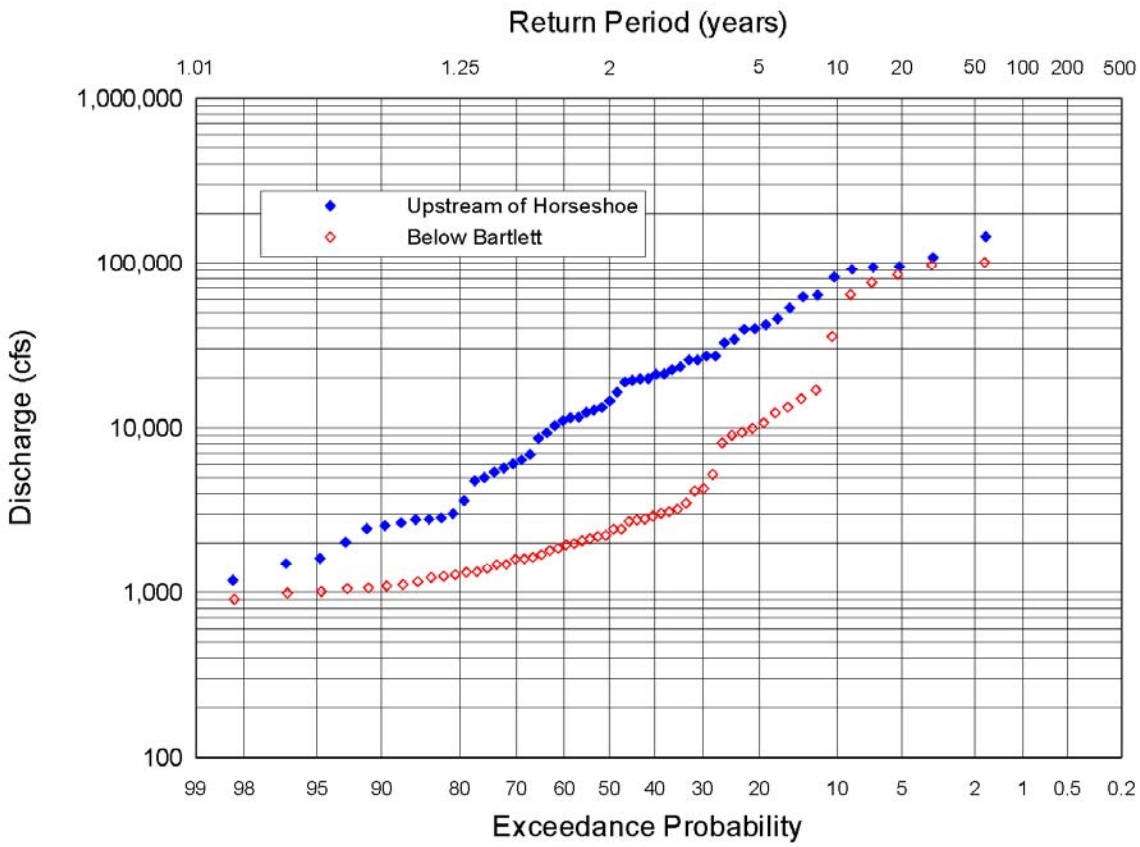
APPENDIX 4
ADDITIONAL HYDROLOGICAL DATA

Appendix 4 supplements hydrological data provided in Chapter III of the HCP. [1] Section 1 provides additional information on flood flows. Sections 2 and 3 provide monthly flow frequency data for the periods 1951 to 1990, and 1996 to 2005, respectively.

1. Flood Flows

Figure 1 shows the return period and exceedance probability for flood flows above Horseshoe and below Bartlett.

Figure 1. Comparison of Flood-frequency Curves for Upstream of Horseshoe Reservoir and below Bartlett Reservoir (MEI 2004).

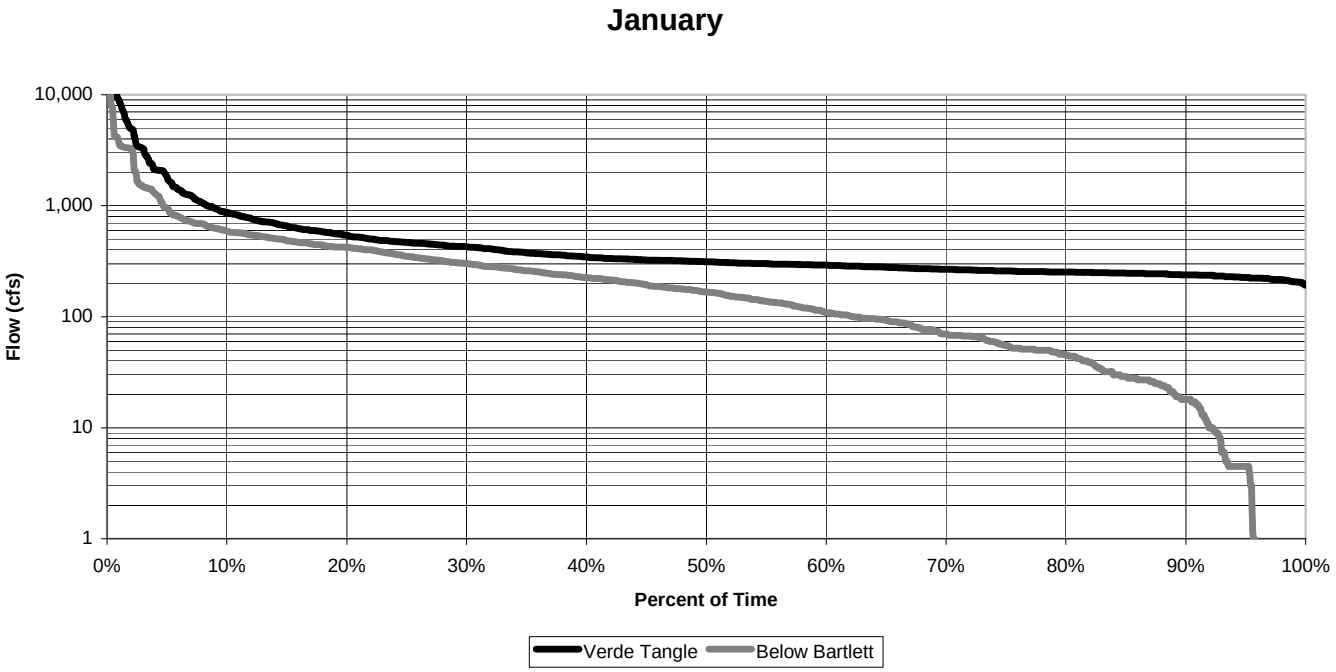


[1] See Chapter VI of the HCP for references to citations in this Appendix.

2. Monthly Flows—1951 to 1990

As discussed in Chapter III, Horseshoe and Bartlett alter the magnitude and frequency of downstream flows by a small amount. Figure 2 contains graphs of the cumulative frequency of flow for each month above and below the reservoirs to show the significance of these changes in flow distribution.

Figure 2. Monthly Cumulative Frequency Graphs of Verde River Flow Above and Below SRP's Dams, 1951-1990. (USGS gage data; shown as the cumulative percentage of time that flows are equaled or exceeded.)



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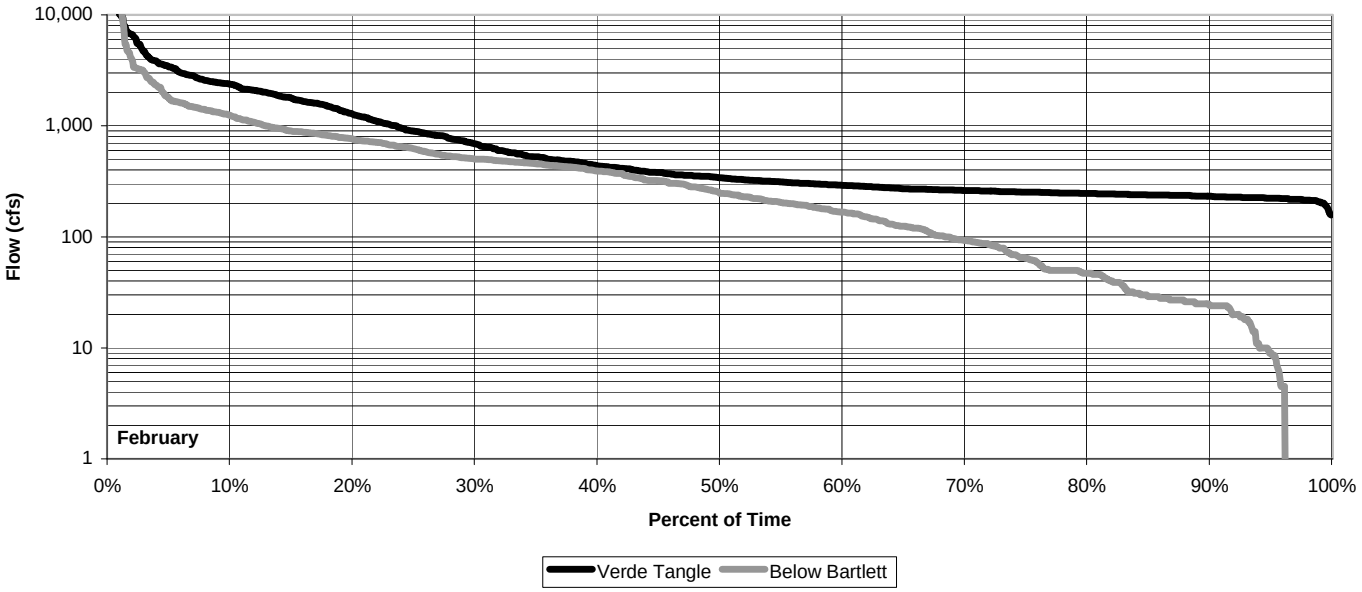

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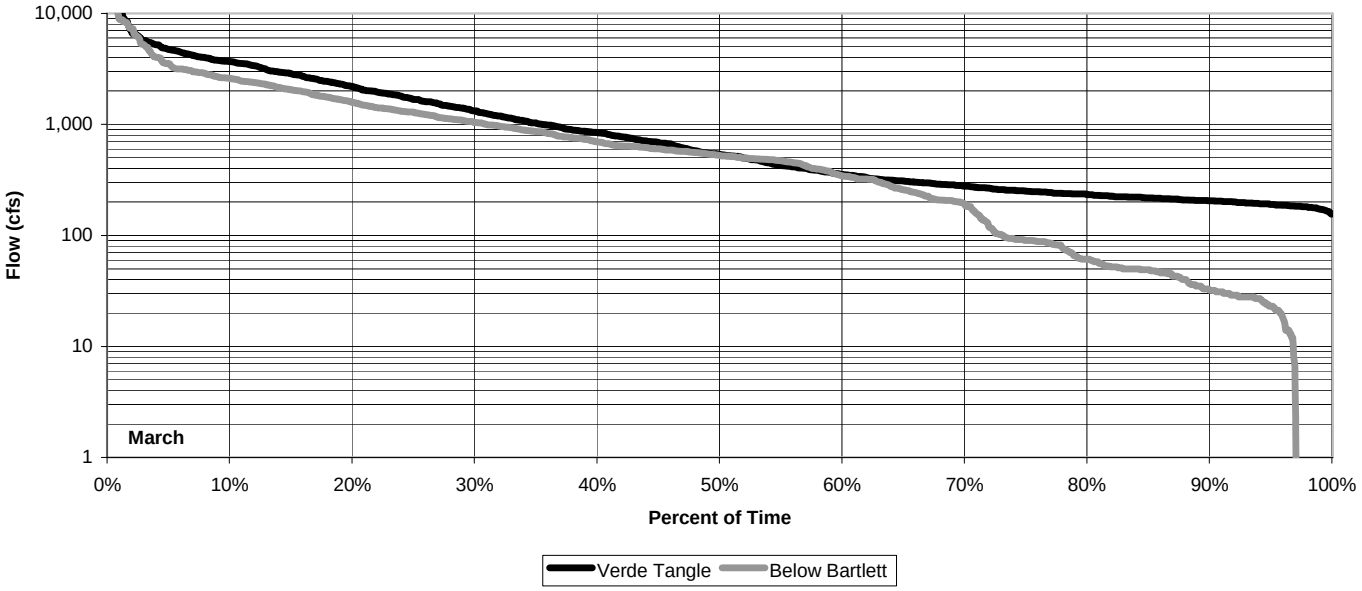

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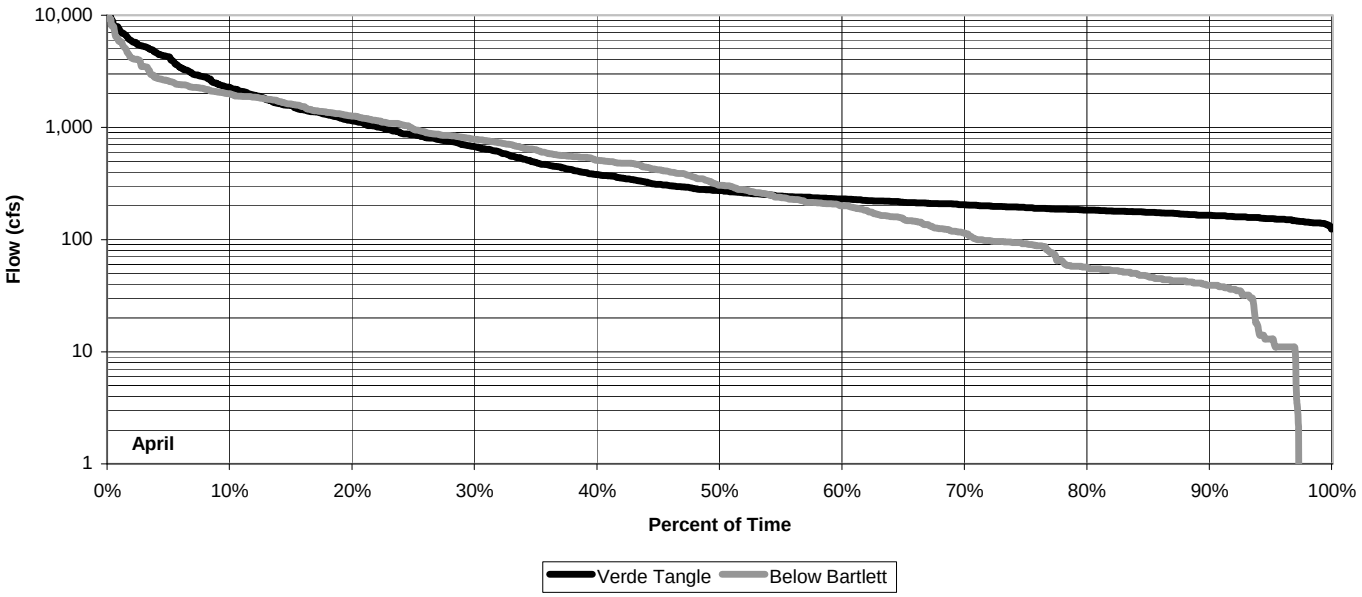
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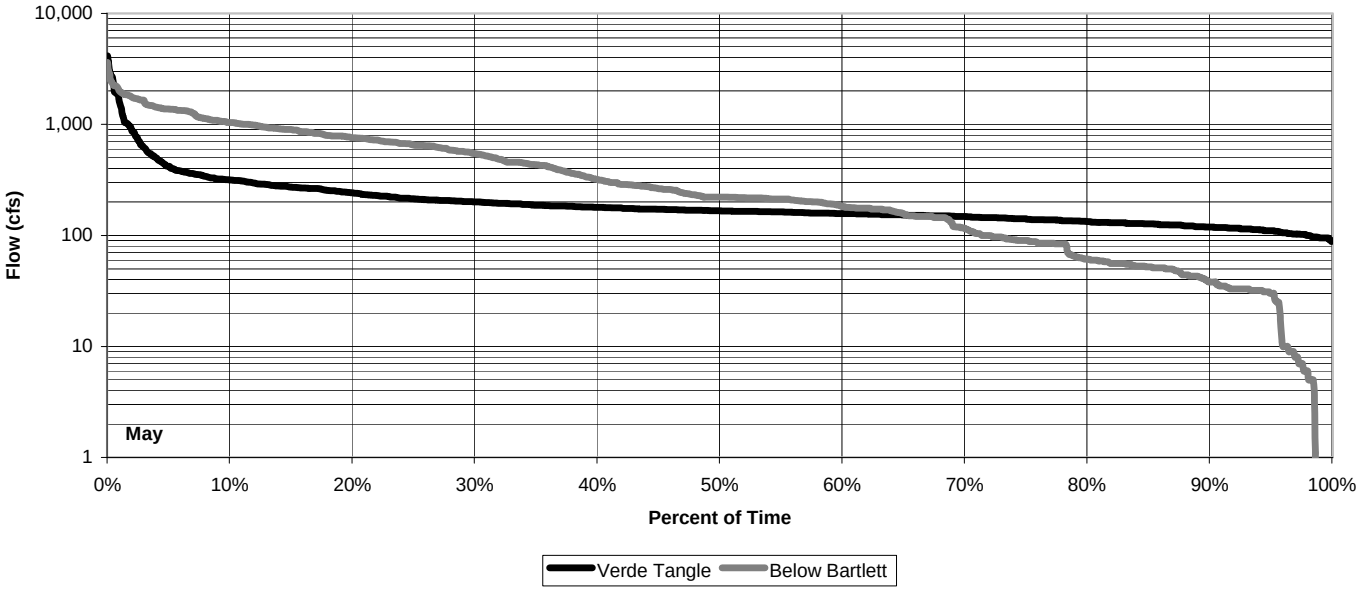
Percent of Time
Verde Tangle
Below Bartlett

May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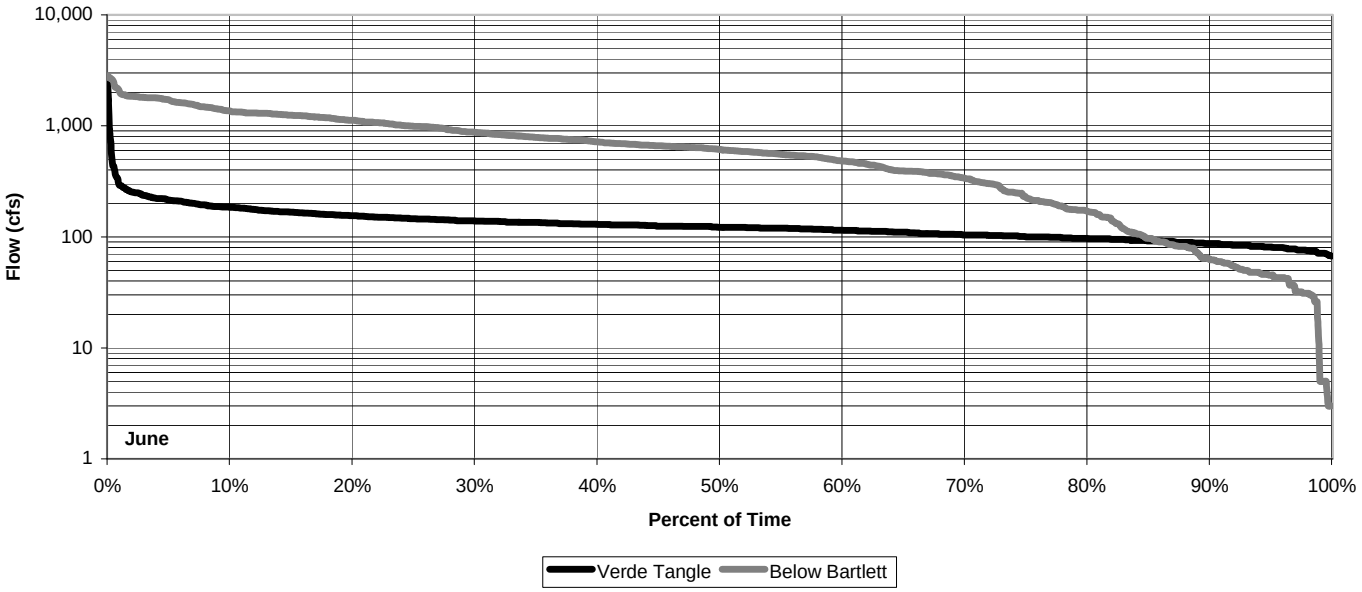
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Below Bartlett

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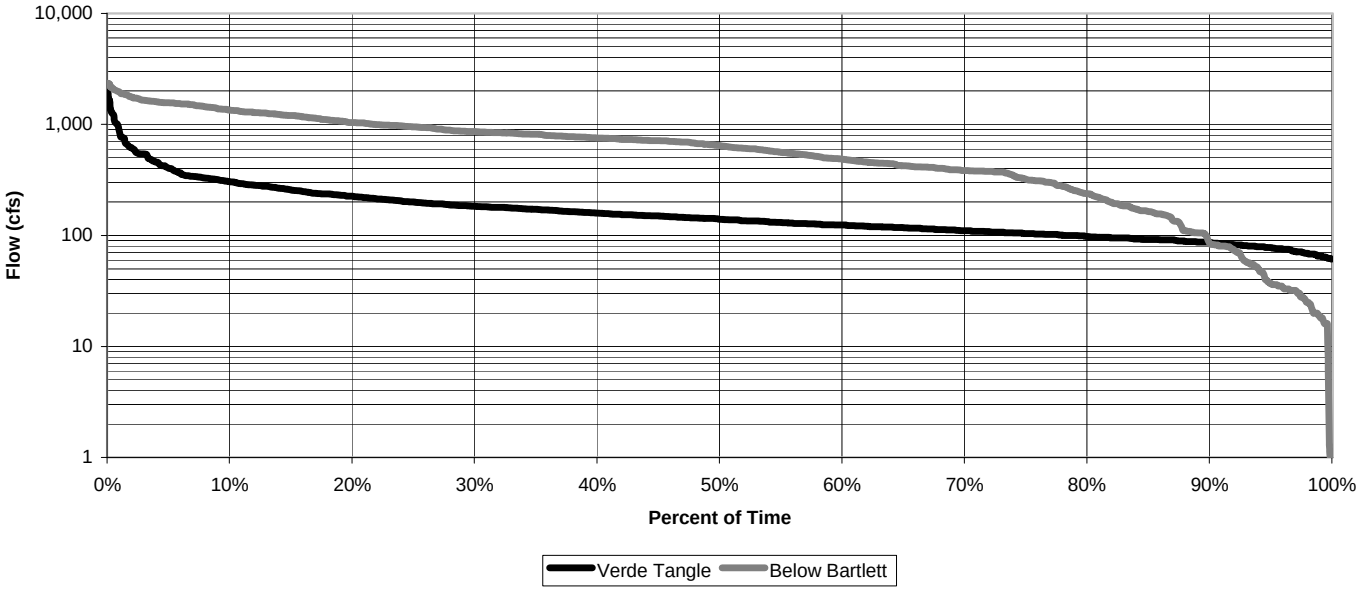
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Verde Tangle
Below Bartlett

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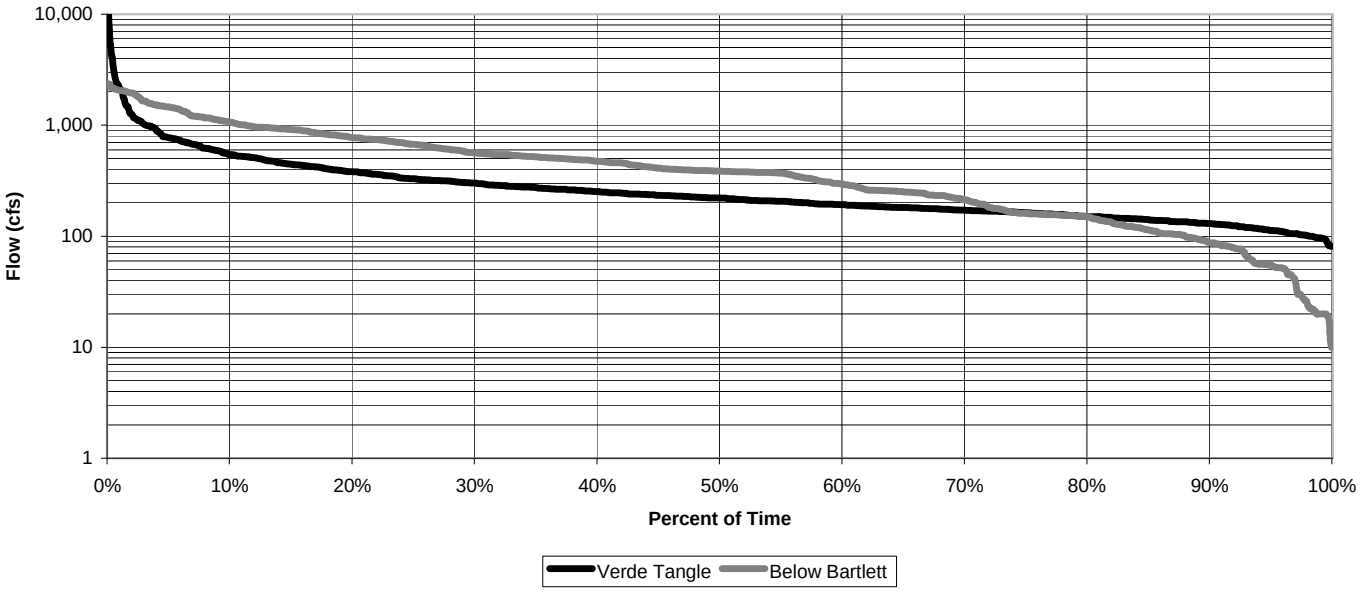

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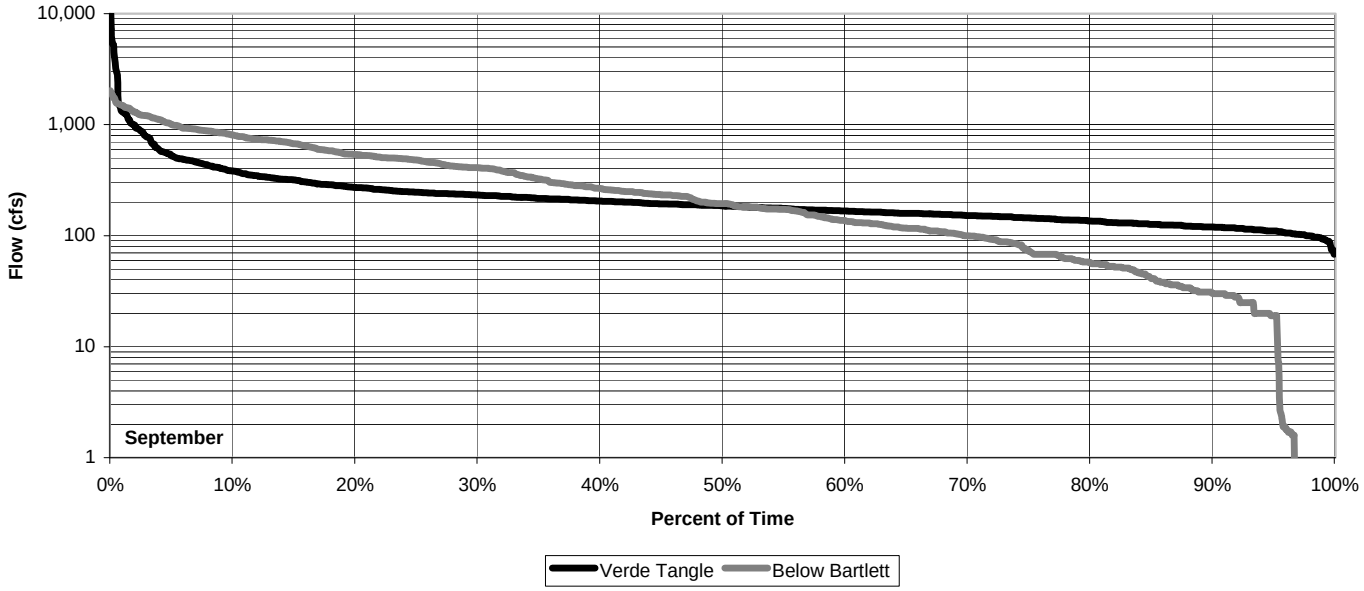

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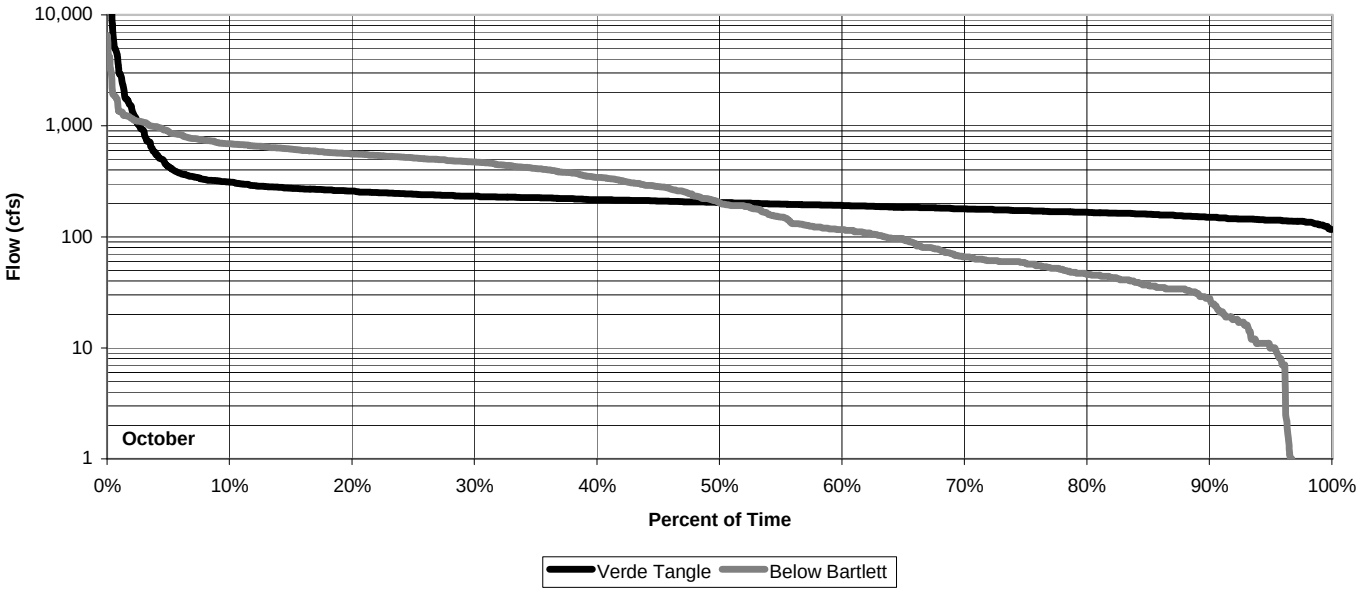

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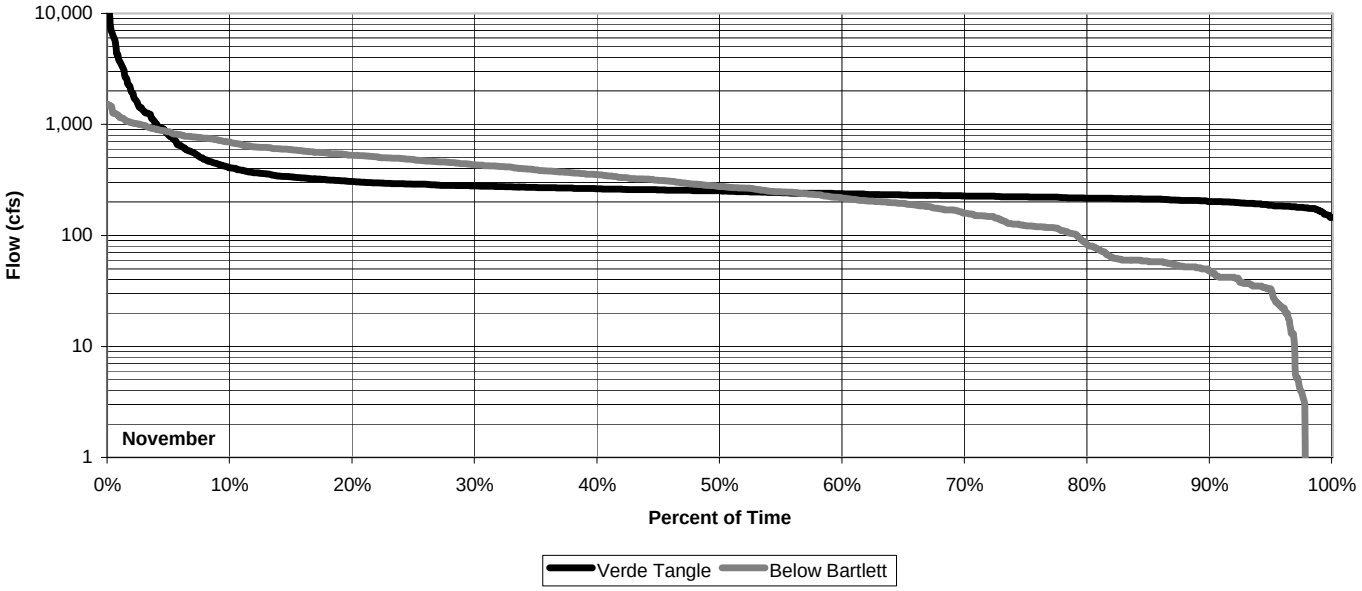

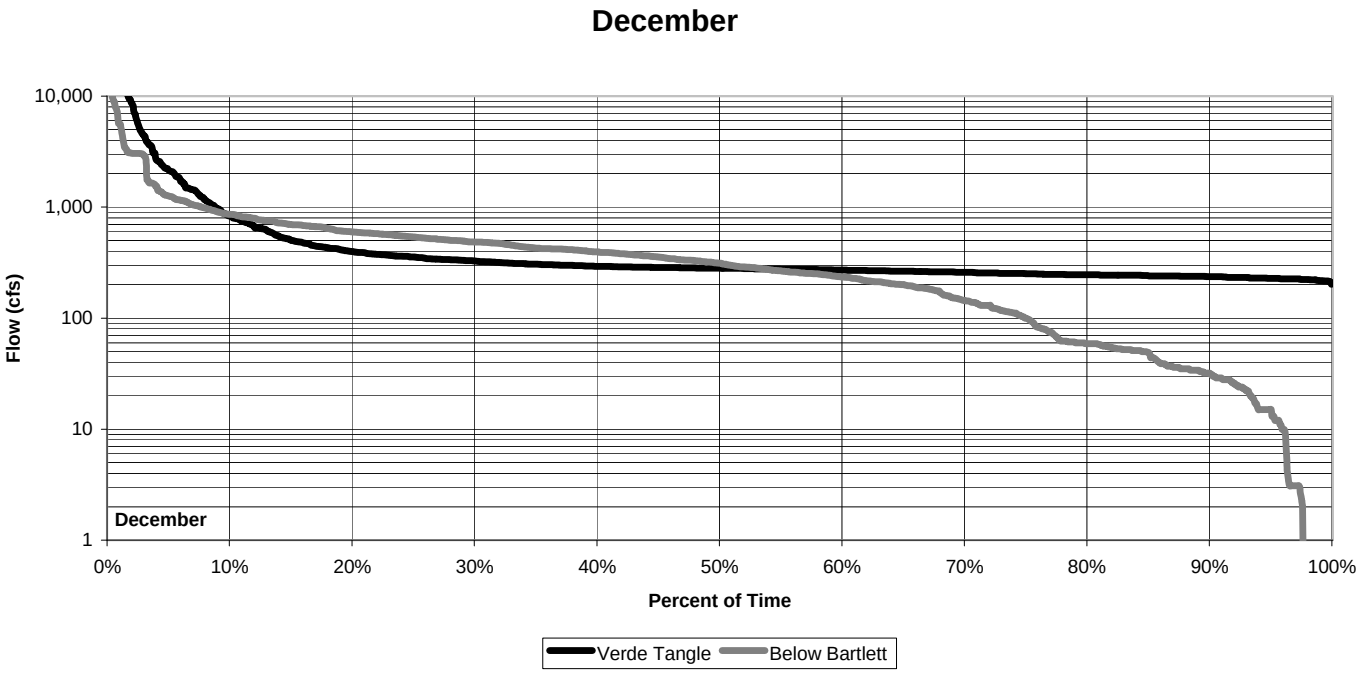
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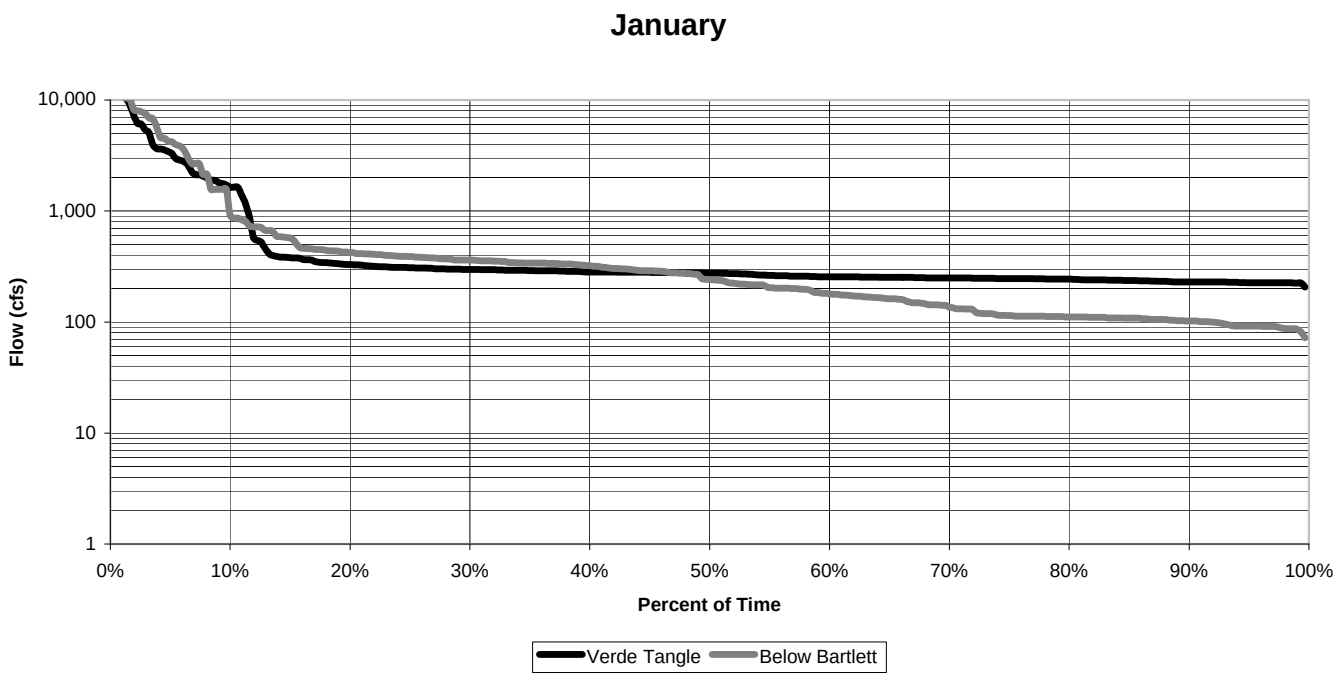
Percent of Time
Verde Tangle
Below Bartlett

3. Monthly Flows—1996 to 2005

As noted in Section 2, Horseshoe and Bartlett altered the magnitude and frequency of downstream flows, especially low flows, during the period from 1951 to 1990. Figure 3 contains graphs of the cumulative frequency of flow for each month above and below the reservoirs after the minimum flow was established in the mid-1990s.

Figure 3. Monthly Cumulative Frequency Graphs of Verde River Flow Above and Below SRP's Dams, 1996-2005. (USGS gage data; shown as the cumulative percentage of time that flows are equaled or exceeded.)



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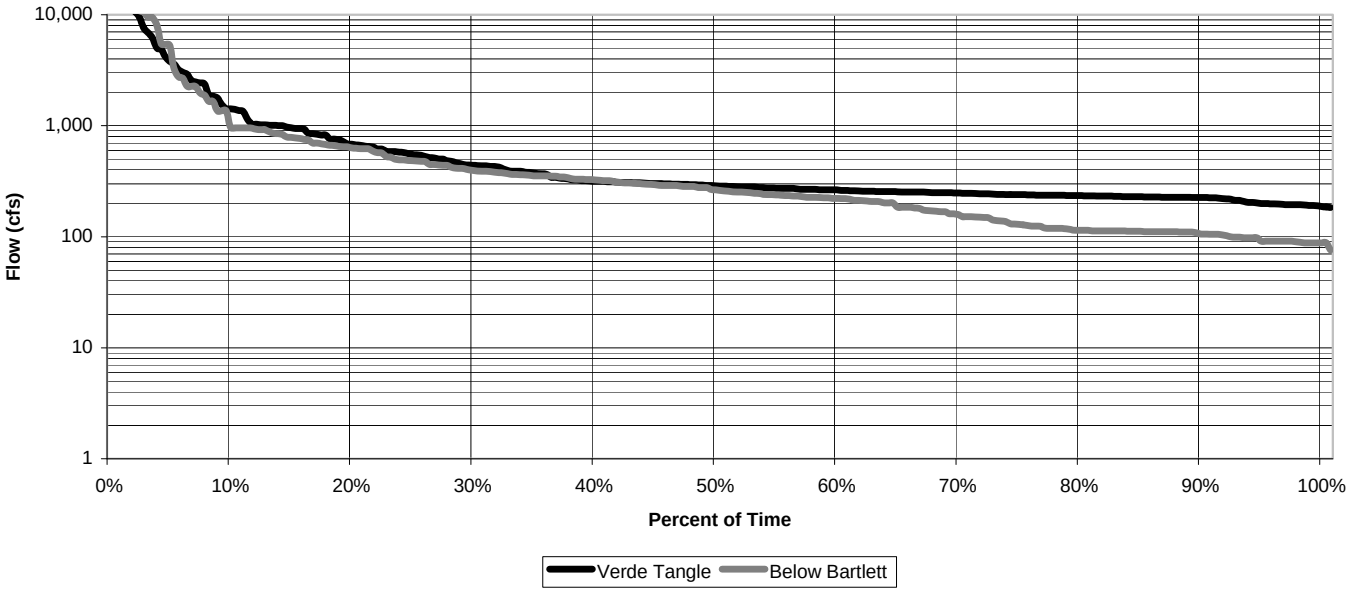

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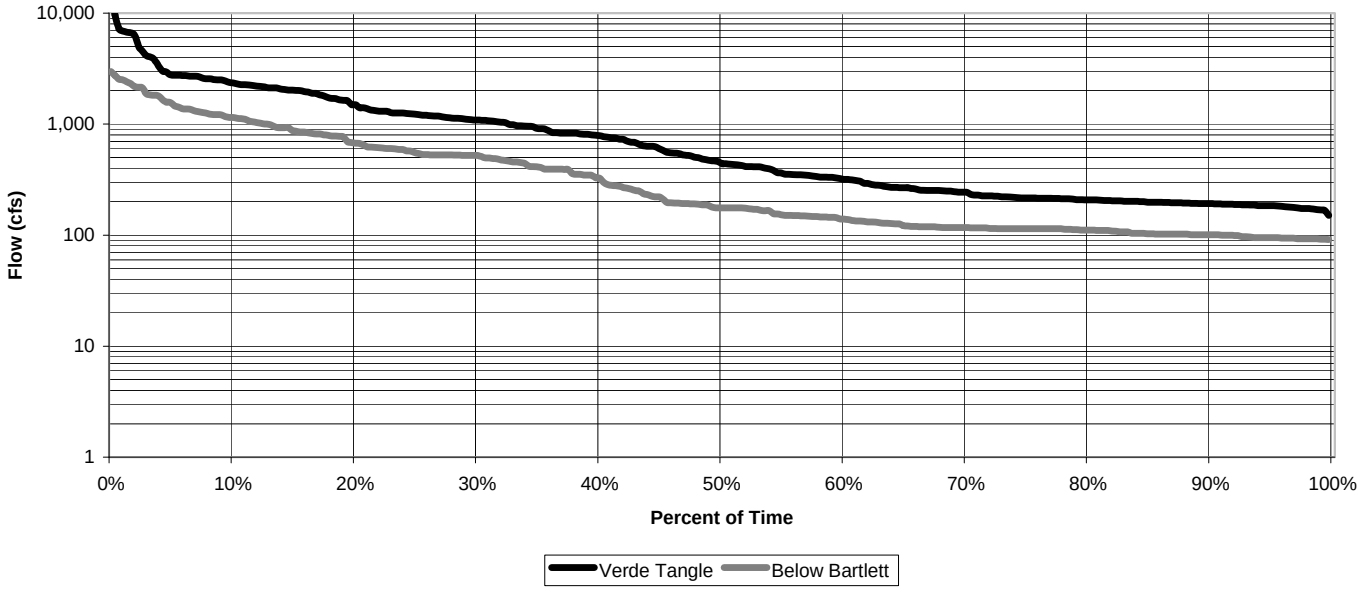

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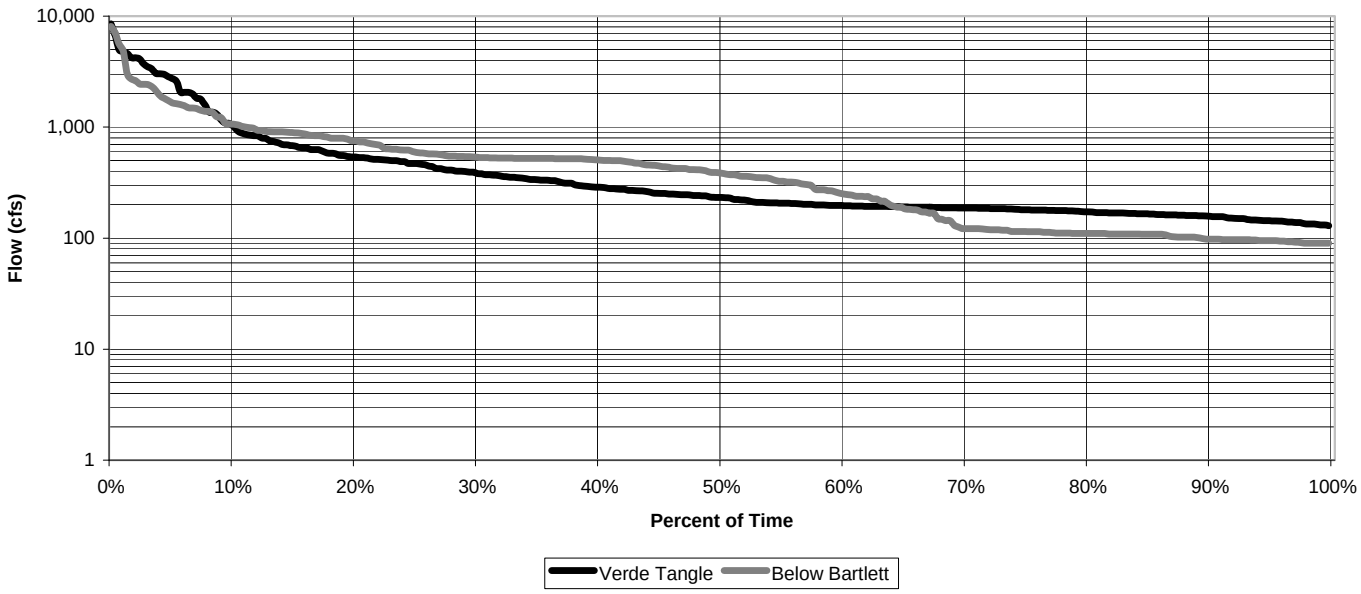
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Below Bartlett

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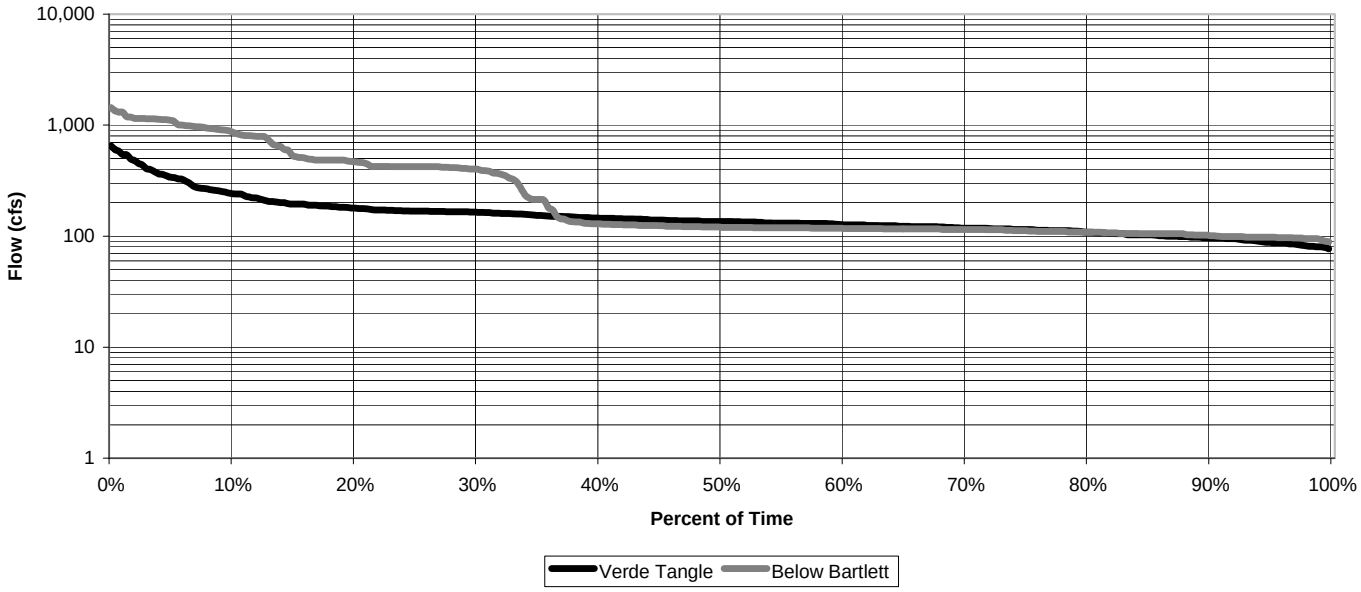
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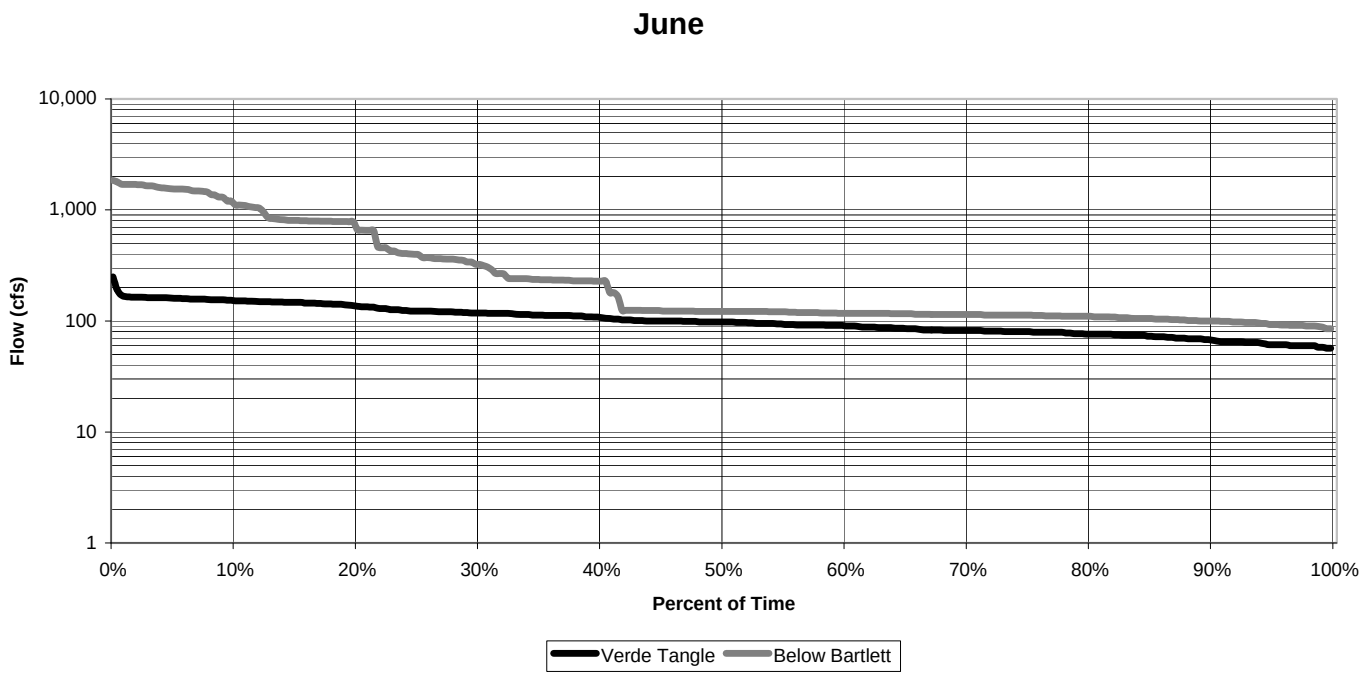
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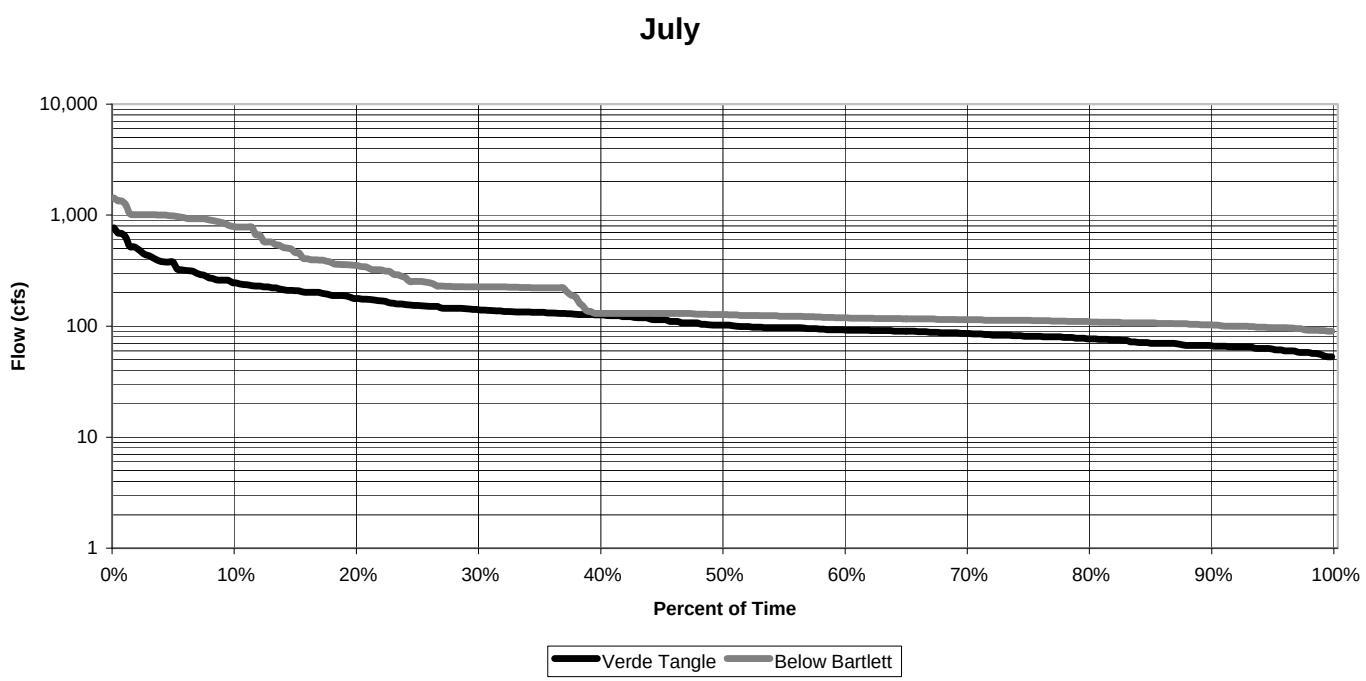
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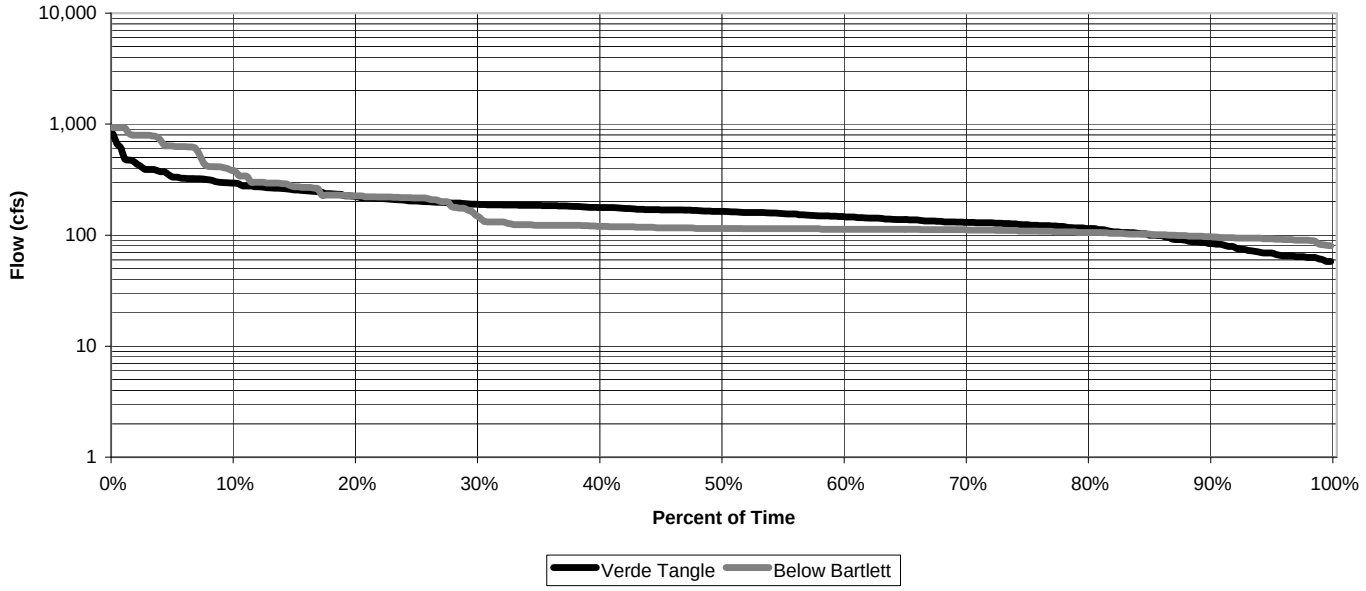

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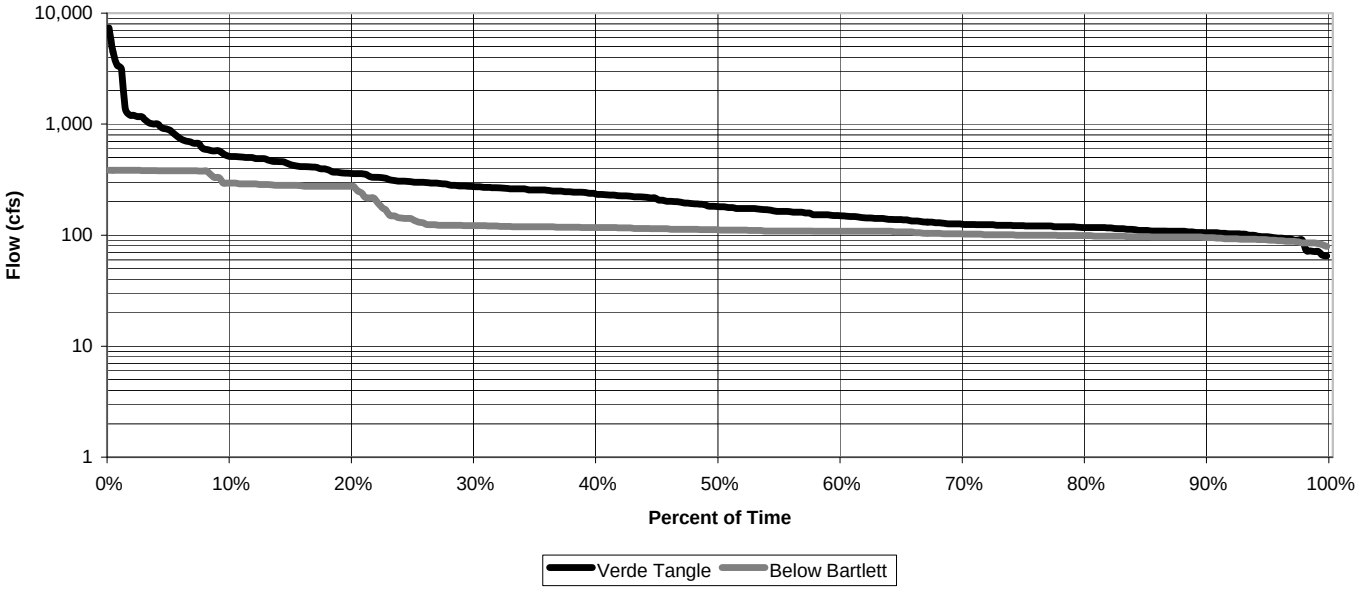

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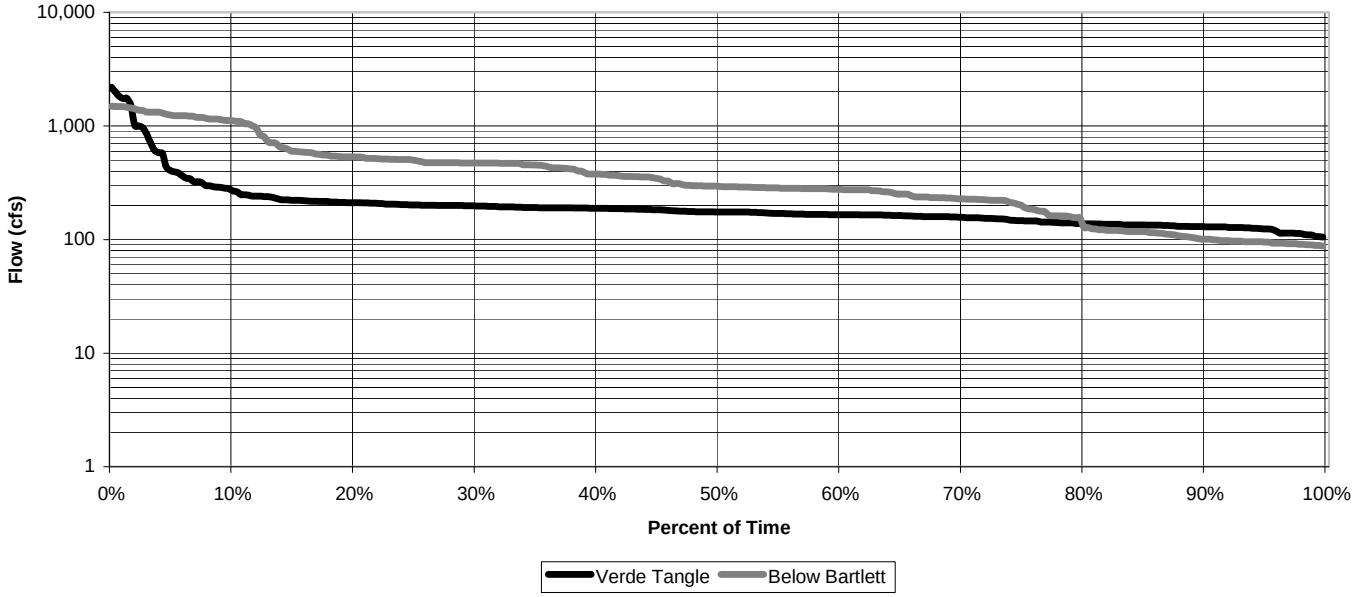

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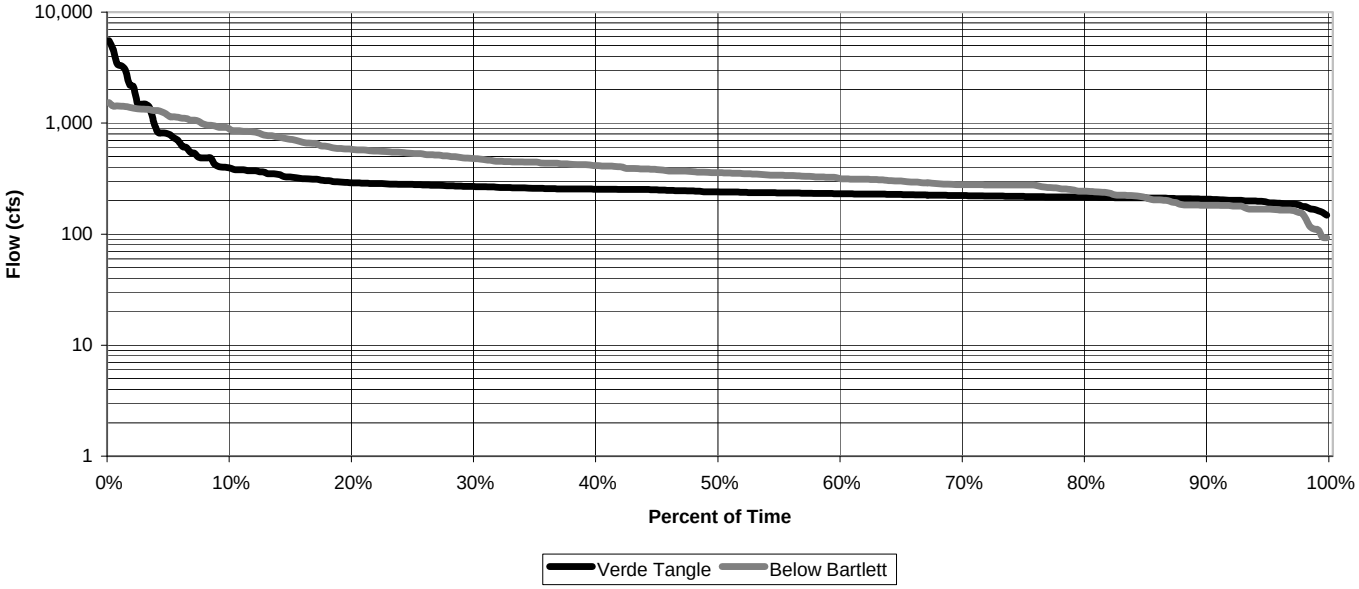

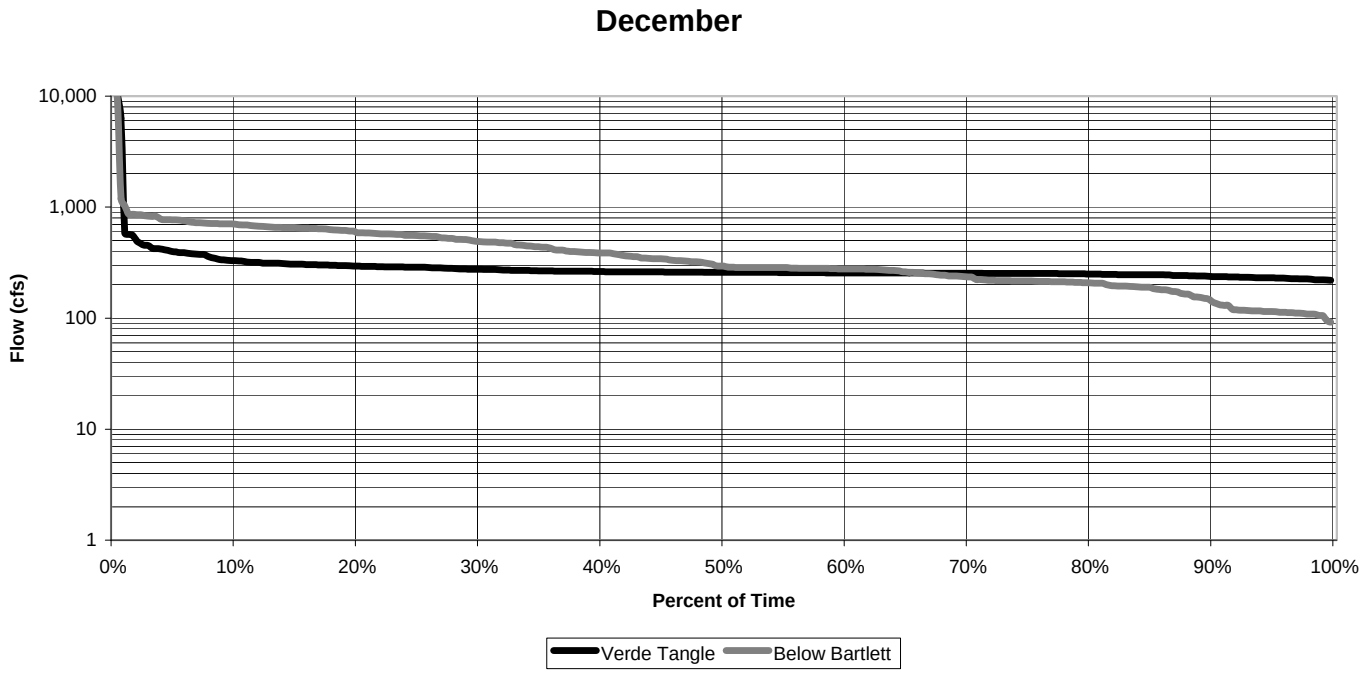
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APPENDIX 5
SRPSIM MODEL

Introduction

As summarized in Subchapter IV.A.1, SRPSIM is a long-term planning model used by SRP to evaluate reservoir operation alternatives. The SRPSIM model simulates reservoir operations using a monthly time step and is the same model used in Reclamation's consultation on modifications to Roosevelt Dam. That same version of the model is used in the analysis of impacts for the Roosevelt HCP to provide results that are comparable to the information used in the 1996 biological opinion issued by FWS. The primary parameters of the model are described below. Summaries of results from the model for each alternative are also provided in this appendix.

Model Parameters

Study Year

The study year for the modeling is 2001. This means that the physical configuration of the reservoirs, such as area/elevation/capacity data, reflect 2001 conditions.

Water Demand and Demand Distributions

SRP Demand. Basic SRP demand includes all on-Project deliveries (urban and agricultural), losses, and contract deliveries that are not modeled separately. Current total annual SRP demand at Granite Reef Diversion Dam (Granite Reef) averages 951,000 AF.

Annual contract deliveries that are not modeled separately and are included in SRP demand are estimated to total 167,000 AF: 1) 55,000 AF to the SRPMIC; 2) 15,000 AF to the FMYN; 3) 35,000 to the Roosevelt Water Conservation District (RWCD);[1] 4) 30,000 AF in the RID Exchange with Phoenix and SRPMIC; 5) 10,000 AF to the Buckeye Irrigation Company (BIC)[2]; and 6) 22,000 AF to miscellaneous contracts including the Gila River Indian Community, Lakin Cattle Company, St. Johns Irrigation District, and others (see Chapter I, Table I-1; Appendix 1). Annual system losses are estimated to be 80,000 AF.

River losses between the reservoirs and Granite Reef (the diversion dam where releases to meet water demands are diverted into the SRP canal system) are modeled at 28,000 AF per year.

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[1] RWCD is entitled to 5.6 percent of SRP surface water deliveries based on the 1920 contract, as supplemented and amended. This amount includes deliveries of RWCD water to the SRPMIC and FMIC under water rights settlement agreements effective in 1991 and 1994, respectively.

[2] BIC is entitled to 1.1 percent of SRP surface water deliveries based on the 1943 contract, as supplemented and amended.

The following monthly distribution for SRP demand is used in the model:

Month	Percentage	Month	Percentage
Oct	6%	Apr	10%
Nov	3%	May	11%
Dec	4%	Jun	13%
Jan	3%	Jul	14%
Feb	5%	Aug	12%
Mar	9%	Sep	10%
Total Winter	30%	Total Summer	70%

Phoenix Gatewater Demand. The City of Phoenix demand for Horseshoe Gatewater is assumed to be 25,000 AF per year based on the contract between SRP and Phoenix. The annual demand is subject to credit availability; therefore, less than 25,000 AF is delivered when Gatewater credits are not available.

SRPMIC Demand. The SRPMIC demand for water from the Salt and Verde rivers is 64,776 AF per year. One portion of this demand is comprised of up to 26,000 AF per year based on the water rights settlement that became effective in 1991. The remainder of the total annual demand includes 20,000 AF for Bartlett credits and 18,776 AF of Kent Decree (normal flow) water, of which 12,670 AF is for the north side SRPMIC lands and the rest is for the south side lands. As with other contract supplies, deliveries are only made when credits are available.

New Conservation Storage (NCS) Demand. The following estimated annual demands for NCS water are used for each of the six cities (as provided by the cities to Reclamation): Chandler, 21,500 AF; Glendale, 26,800 AF; Mesa, 20,000 AF; Phoenix, 13,750 AF; Scottsdale, 26,800 AF; and Tempe, 13,400 AF. Deliveries to meet these demands are subject to credit availability. The total NCS demand is 122,250 AF.

Reservoirs and Operations

Area-Capacity-Elevation Tables. The most recent tables for all the reservoirs were used (Roosevelt – 1995; Horseshoe – 2001).

Storage Allocations. Roosevelt Reservoir is the only SRP reservoir with a flood control zone. The different storage zones were defined in the May 1985 Reclamation Design Report (see table below).

Design Storage Zone	Elevation at Top of Zone (ft.)
Dead Storage	1,989
SRP Conservation	2,136†
NCS	2,151
Flood Control	2,175
Safety of Dams	2,218

†Varies from about 2,137 in 1995 to 2,136 as sediment accumulates in the Dead Storage Zone. The creation of Dead Storage in modified Roosevelt Reservoir resulted in an amount of water not available for shareholder use. To compensate for that amount of water, additional capacity was assigned to SRP Conservation storage (storage between elevations 2,136 and 1,989), which results in the top of SRP's Conservation storage being higher than elevation 2,136 until dead storage is filled with sediment.

Inflows. Water year 1889 (beginning October 1, 1888) was selected as the initial data year of modeling because relatively good flow records are available after that date. Inflow records from water year 1889 through water year 2002 are used as input to the model. The monthly inflows are based on gaged flows into Roosevelt Reservoir (Salt River plus Tonto Creek) and into Horseshoe Reservoir. The model calculates local runoff into the Lower Salt and Verde reservoirs as a percentage of total annual gaged inflow into each of the reservoir systems. Prior to the availability of gage records above Horseshoe Reservoir, Verde River inflows are estimated from the gage below Bartlett Dam.

Beginning Reservoir Storage and Credits. The beginning reservoir storage levels are estimates of what the reservoir storage would have been on September 30, 1888—the initial month of the model—had the reservoirs been in place at that time (baseline scenario). For the No Permit scenario, Horseshoe Reservoir beginning storage was set at 40,400 AF. The beginning credits in water accounts are the average credit balance for those accounts.

Spill Releases. Spill releases in the model occur when reservoir levels rise above the top of conservation storage. Maximum conservation storage in Modified Roosevelt Reservoir is to the top of NCS space at elevation 2,151.

Maximum spill release capacity from Stewart Mountain and Bartlett reservoirs is not limited in the model because the monthly time step obscures instantaneous flood flows. This means that once the top of conservation storage is reached, all inflows are released. With no constraints on spills, water in the flood control space is spilled within the month. The calculated spill is reduced by the demand.

If it is determined that spill releases need to be made, then a subroutine is called to calculate additional deliveries to be made to SRP shareholders and contractors above the normally scheduled deliveries (base demand). These additional deliveries are 70 percent of the base demand at Granite Reef (after subtracting river losses and adding in CAP diversions). The 70 percent is based on historical patterns of water use during spills. The deliveries in addition to the base demand cannot exceed the maximum diversion capacity at Granite Reef (3,600 cfs). Also, the additional deliveries cannot exceed the total spill releases from the reservoirs. Additional deliveries from the Verde and Salt reservoirs are proportional to the spill releases from each reservoir system.

Minimum Flow Requirements. The minimum flow release from Bartlett Reservoir is 150 cfs (100 cfs plus the estimated Verde River water order) as required by the Fort McDowell Indian Community Water Rights Settlement Agreement. The Fort McDowell Agreement became effective in 1994.

General Reservoir Operations. In baseline runs, reservoir operating rules are based on current operations. From October through April, releases are made from the Verde River to meet demand if sufficient storage is available. From May through September, releases are made from the Salt River reservoir system to meet demand minus the minimum flow from the Verde River reservoir system.

Contract Credits

Water contract credits are accounted for SRPMIC, Phoenix Gatewater, and NCS as summarized below.

SRPMIC. SRPMIC accrues Bartlett credits when the total Verde River storage is between 8,909 and 178,186 AF, and a positive change in storage occurs. SRPMIC is credited 20 percent of that change in storage, up to a maximum credit of 60,000 AF. SRPMIC also accrues credits to SRP stored water based upon May 1 total storage less credits stored under other contracts (net SRP storage). At net storage levels of 350,000 AF or less, no credits to SRP stored water are provided to SRPMIC. Between net storage levels of 350,000 to 1.5 million AF, SRPMIC credits to SRP stored water increase from 0 AF to 9,074 AF in proportion to increases in net storage. Above 1.5 million AF of net storage, up to 17,400 AF of additional credits to SRP stored water are provided to SRPMIC.

City of Phoenix. Phoenix accrues Gatewater credits in Horseshoe Reservoir when the total Verde River storage is between 219,701 AF and the top of the existing conservation storage on the Verde River (currently 287,403 AF at elevation 2,026), and a positive change in storage occurs. Phoenix is credited with that change in storage, up to a maximum storage credit of 150,000 AF, of which 67,702 AF is stored on the Verde River system and the remainder on the Salt system. Evaporation and seepage losses of 0.5 percent of the storage credit are charged against the account. If spills are being made at Stewart Mountain Dam and Phoenix credits are greater than 67,702 AF, Phoenix loses credits equal to the amount spilled, down to a minimum remaining credit of 67,702 AF.

NCS. Credits in NCS space accrue when existing SRP conservation storage is full and the amount of storage on the Salt River is increasing. The total of NCS credits cannot exceed the permitted capacity of NCS space (272,500 AF currently). Total credits are proportioned to individual cities based on their percentage of NCS entitlement. Storage credits in the SRPMIC seasonal re-regulation account (winter storage of normal flow entitlement) are subtracted from the total available NCS space to determine the storage space available for city NCS water.

Ground Water Pumping

The minimum annual amount of SRP ground water pumping required is 50,000 AF and the maximum annual pumping capacity is 340,000 AF. Even in times of spill, some ground water pumping is required to supply parts of the SRP service area that cannot be served by gravity flow of surface water.

Model Results

Summary of Output

Two SRPSIM model runs were made to evaluate the primary alternatives considered in the HCP:

1) The “Modified Historical Operation” Alternative with storage up to elevation 2,026 in Horseshoe; and
2) The “No Permit” Alternative where Horseshoe storage is constrained to a maximum elevation of 1,985 feet during the flycatcher nesting season (May 1 through August 31).

Summaries of water supply, pumping, spills, and reservoir contents for the Modified Historical Operation and No Permit alternatives are provided in Table 1.

Table 1. Summary of SRPSIM Results, Current Reservoir System and Demand, 1889-2002 Averages (1,000s of acre feet).

Variable	(1) Modified Historical and Optimum Operation	(2) No Permit	(3) Difference (2) – (1)
Surface Water Deliveries			
SRP Deliveries*	869.5	867.1	-2.4
Phoenix Gatewater Deliveries	19.7	16.1	-3.6
SRPMIC Deliveries	49.4	48.8	-0.6
NCS Deliveries	47.6	49.1	1.5
Total Surface Water	936.8	932.3	-4.5
SRP Ground Water Pumping	141.4	147.9	6.5
Spills			
Salt River	116.2	128.6	12.4
Verde River	126.6	123.2	-3.4
Total Spills (Granite Reef)	242.8	251.8	9.0
Reservoir Contents (Avg. Sept. 30)			
Horseshoe	5.9	1.3	-4.6
Bartlett	101.6	84.8	-16.8
Roosevelt	771.7	758.1	-13.6

*Includes all contract deliveries except NCS, SRPMIC, and COP.

To provide more detail on the variation between alternatives, additional summary statistics are provided in Table 2. Table 2 is organized parallel to Table 1 with comparisons between the model runs for key variables in terms of minimum, maximum, median, and average values.

Storage curves for the Modified Historical Operation alternative are shown in Figure 1 (3 pages) and for the No Permit alternative in Figure 2 (3 pages). Bartlett Reservoir Storage and Total Verde River Reservoir Storage are depicted in the figures.

Post Processing

The analysis of the Optimum Operation Alternative used SRPSIM model results from the Modified Historical Operation Alternative that were adjusted (using MS Excel) to increase the initiation and rate of Horseshoe Reservoir drawdown whenever feasible, and to fill Horseshoe prior to Bartlett after two consecutive years of low Horseshoe storage if sufficient runoff is available. Figure 3 (6 pages) shows the Horseshoe storage curve for the Optimum Operation Alternative with rapid drawdown and redistribution of storage from Bartlett to Horseshoe during droughts.

For comparison with model results, Figure 4 (2 pages) shows actual historical Bartlett Reservoir storage and total Verde River reservoir system storage. Bartlett Dam

construction was completed in the early 1940s and Horseshoe Dam was completed in the late 1940s.

Table 2. Comparison of Model Results for Modified Historical and Optimum Operation versus No Permit Alternatives (1,000s of acre feet).

	Modified Historical and Optimum Operation	No Permit	Difference
SRP Surface Water Deliveries			
Maximum	1231.0	1223.0	-8.0
Minimum	455.0	457.0	2.0
Median	885.0	879.5	-5.5
Average	869.5	867.1	-2.4
Phoenix Gatewater Deliveries			
Maximum	25.0	25.0	0.0
Minimum	0.0	0.0	0.0
Median	25.0	22.8	-2.2
Average	19.7	16.1	-3.6
SRPMIC Deliveries			
Maximum	61.4	60.4	-1.0
Minimum	29.6	32.9	3.3
Median	47.9	46.7	-1.2
Average	49.4	48.8	-0.6
NCS Deliveries			
Maximum	134.6	134.6	0.0
Minimum	0.0	0.0	0.0
Median	22.2	22.9	0.7
Average	47.6	49.1	1.5
Salt River Spills			
Maximum	1806.0	1964.0	158.0
Minimum	0.0	0.0	0.0
Median	0.0	0.0	0.0
Average	116.2	128.6	12.4
Verde River Spills			
Maximum	1381.0	1347.0	-34.0
Minimum	0.0	0.0	0.0
Median	0.0	0.0	0.0
Average	126.6	123.2	-3.4
Horseshoe Contents (Sept 30)			
Maximum	109.2	53.6	-55.6
Minimum	0.0	0.0	0.0
Median	0.0	0.0	0.0
Average	5.9	1.3	-4.6
Bartlett Contents (Sept 30)			
Maximum	178.2	178.2	0.0
Minimum	11.0	10.4	-0.6
Median	77.7	77.0	-0.7
Average	101.6	84.8	-16.8
Roosevelt Contents (Sept 30)			
Maximum	1385.5	1385.5	0.0
Minimum	17.6	17.6	0.0
Median	794.6	749.6	-45.0
Average	771.7	758.1	-13.6

Figure 1 (page 1 of 3).
Bartlett and Total Verde Storage
Modified Historical Operation Alternative

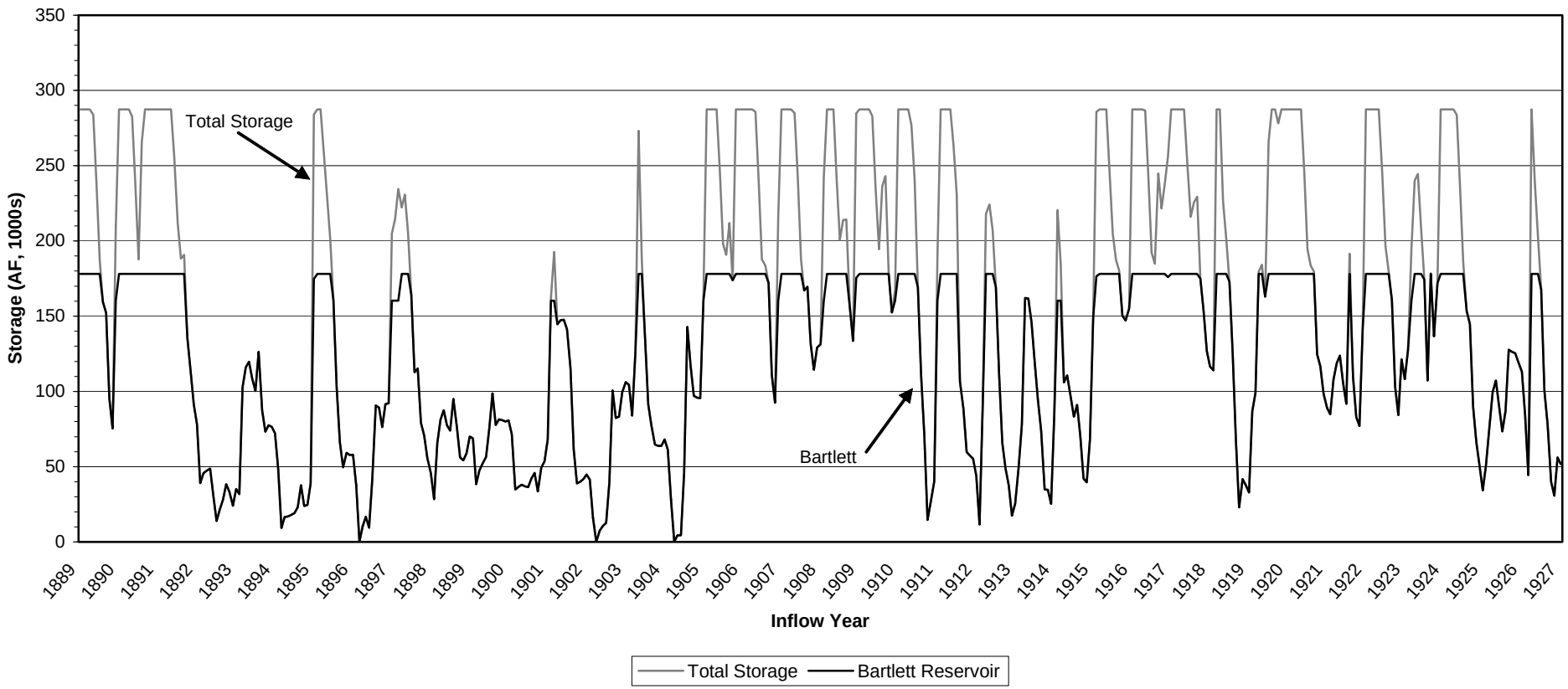


Figure 1 (page 2 of 3).
Bartlett and Total Verde Storage
Modified Historical Operation Alternative

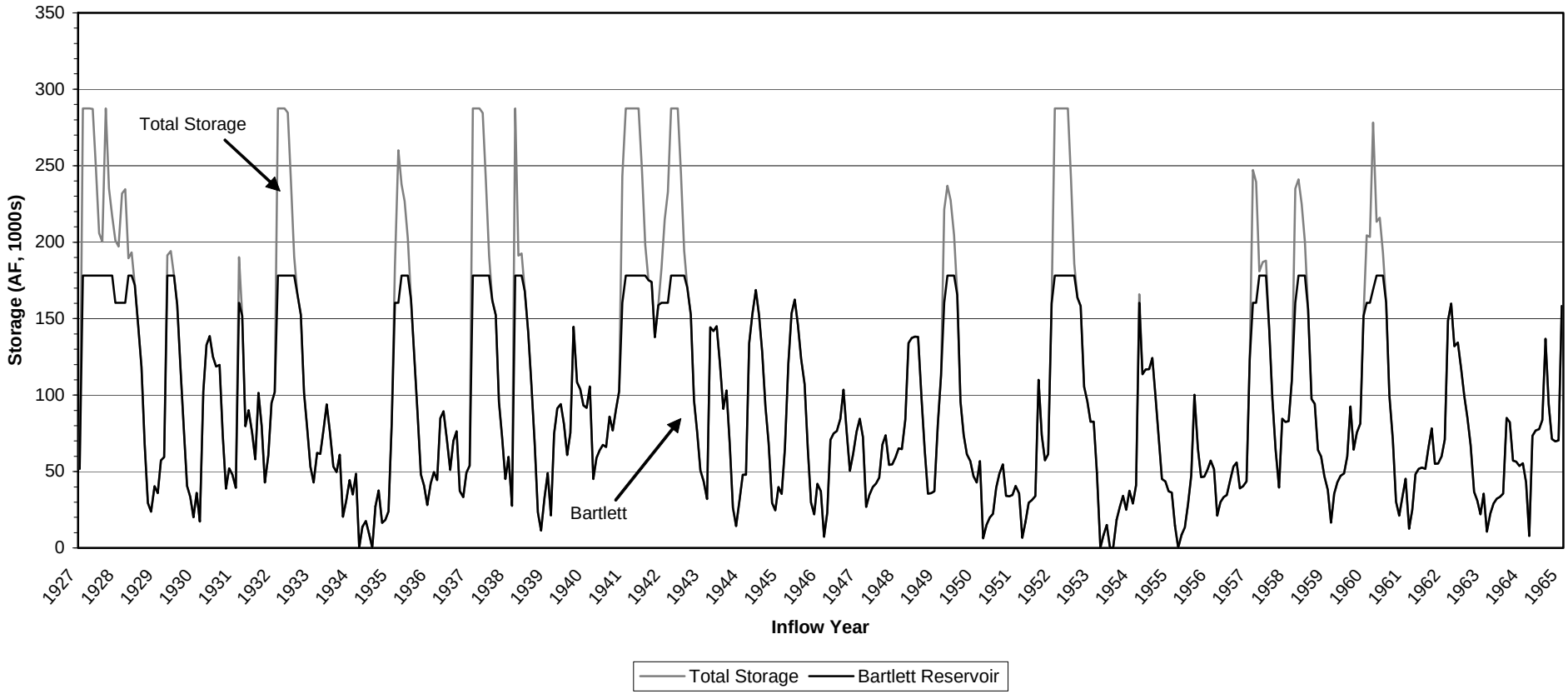


Figure 1 (page 3 of 3)
Bartlett and Total Verde Storage
Modified Historical Operation Alternative

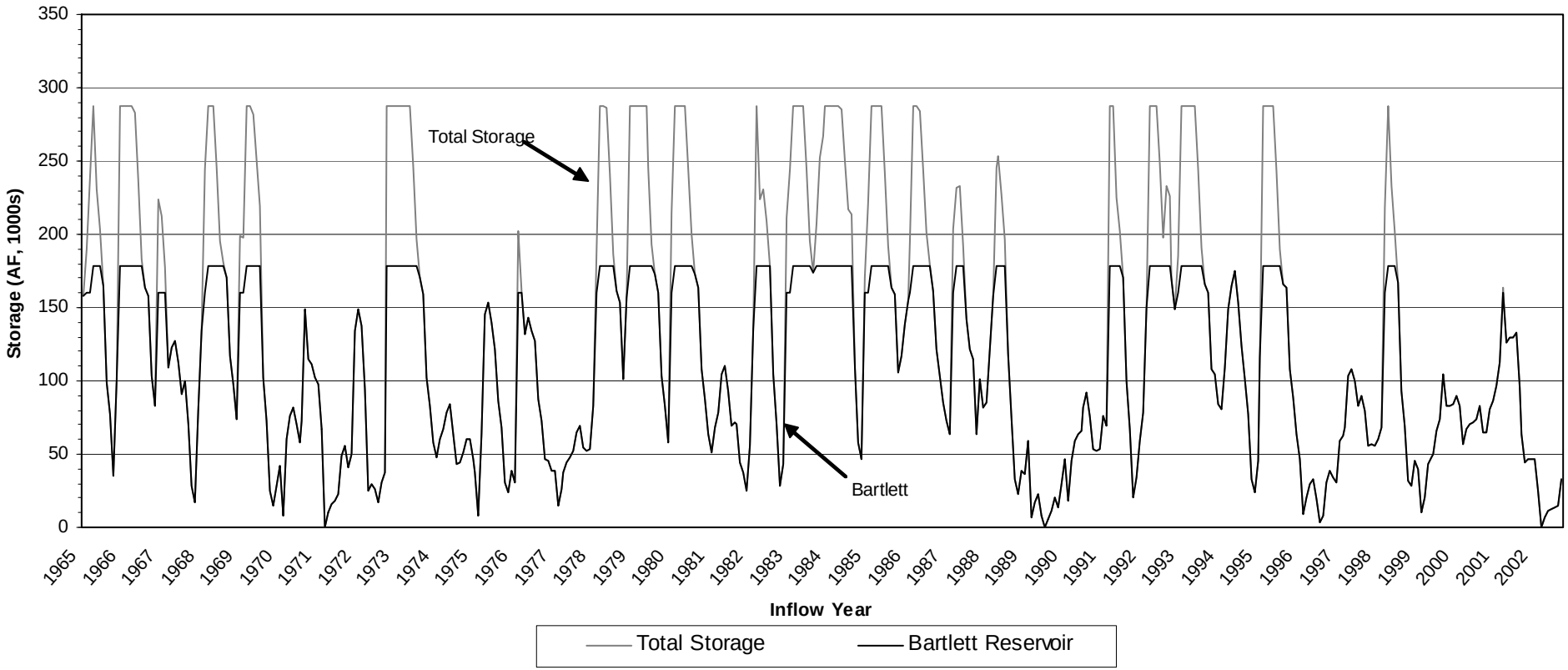


Figure 2 (page 1 of 3).
Bartlett and Total Verde Storage
No Permit Alternative

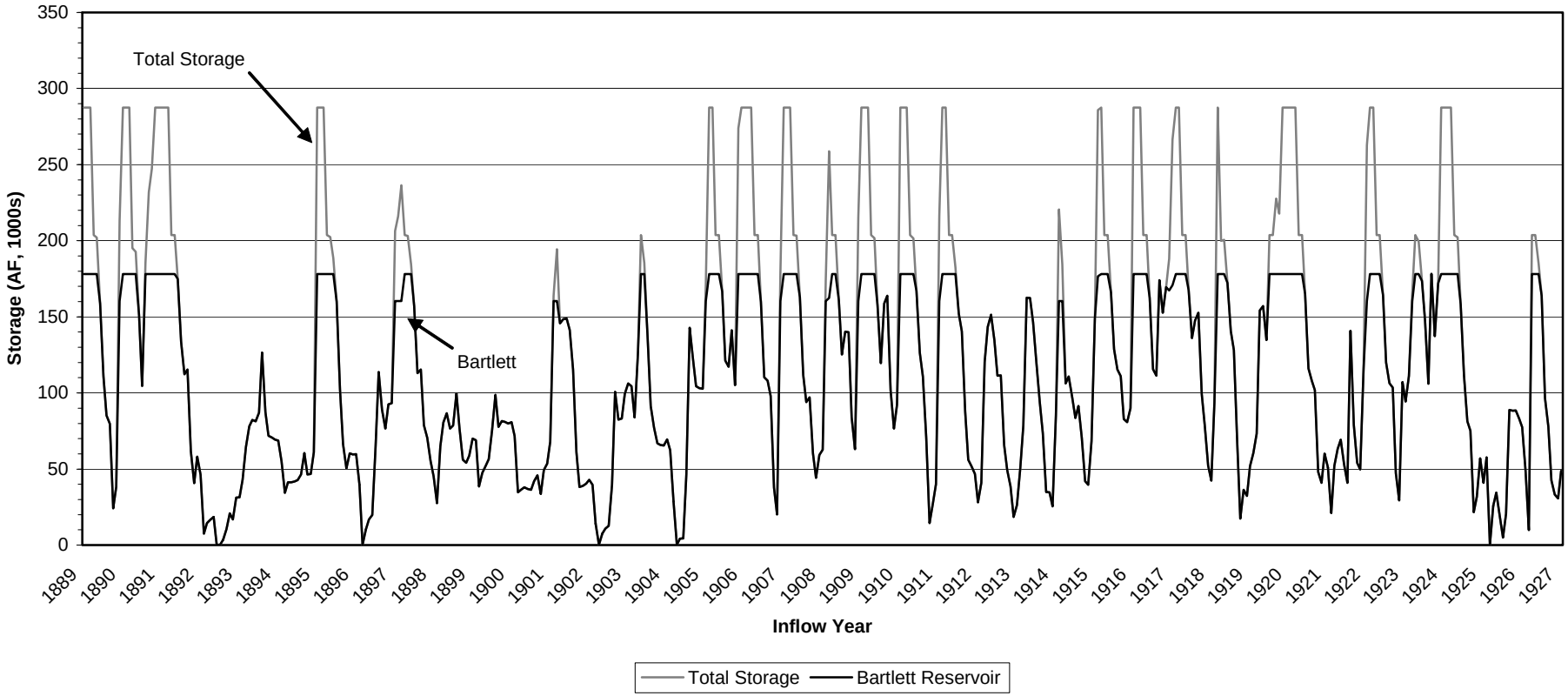


Figure 2 (page 2 of 3).
Bartlett and Total Verde Storage
No Permit Alternative

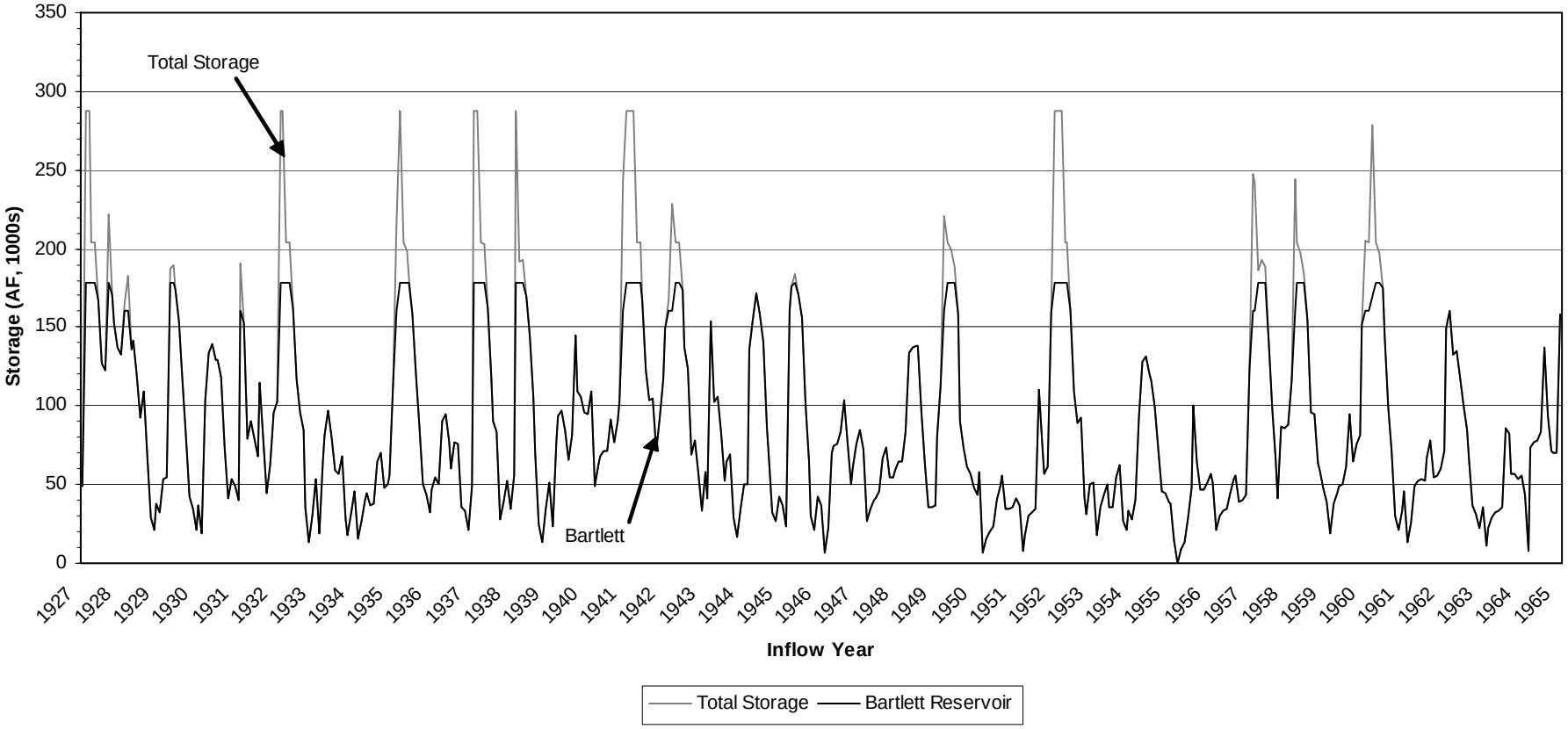


Figure 2 (page 3 of 3).
Bartlett and Total Verde Storage
No Permit Alternative

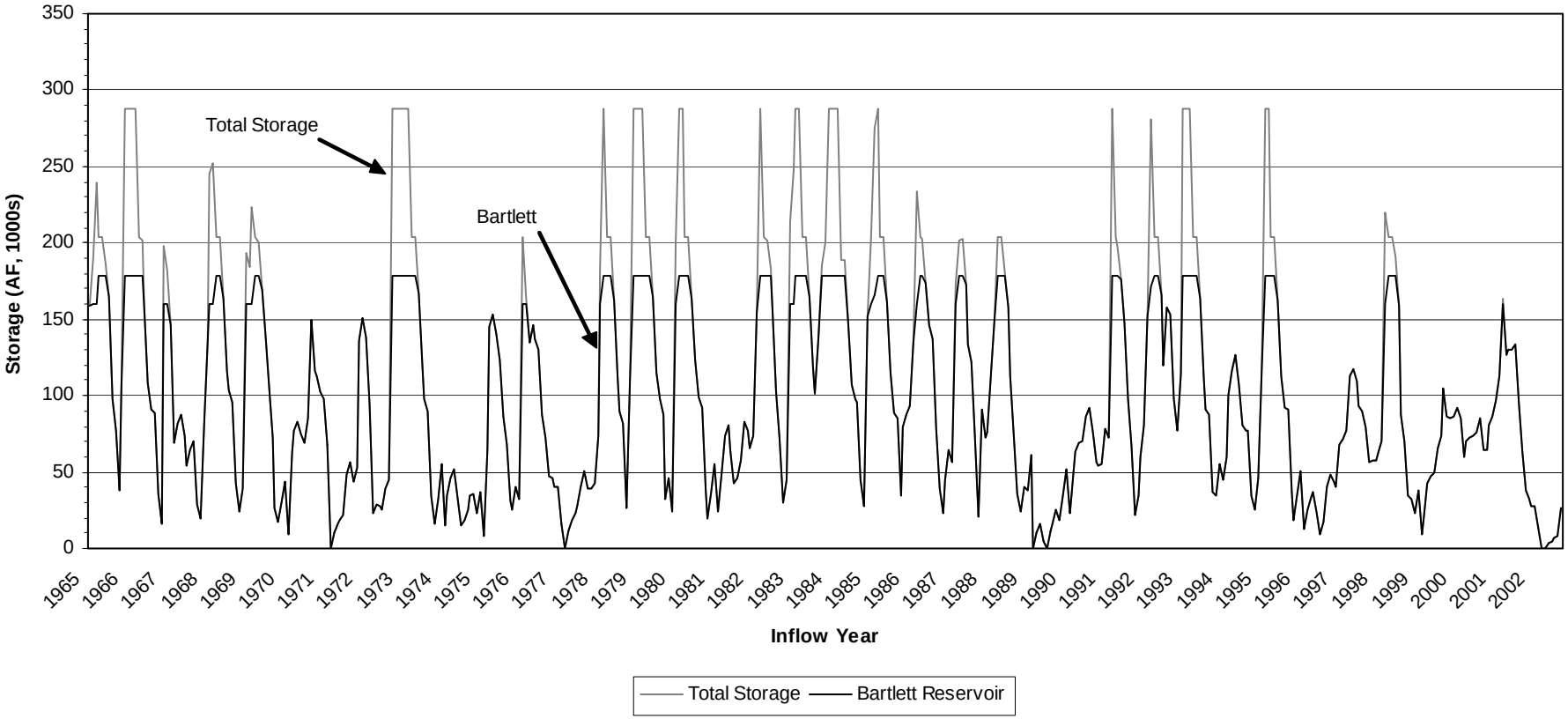


Figure 3 (page 1 of 6). Horseshoe Storage Under Modified Historical Operation and Optimum Operation Alternatives

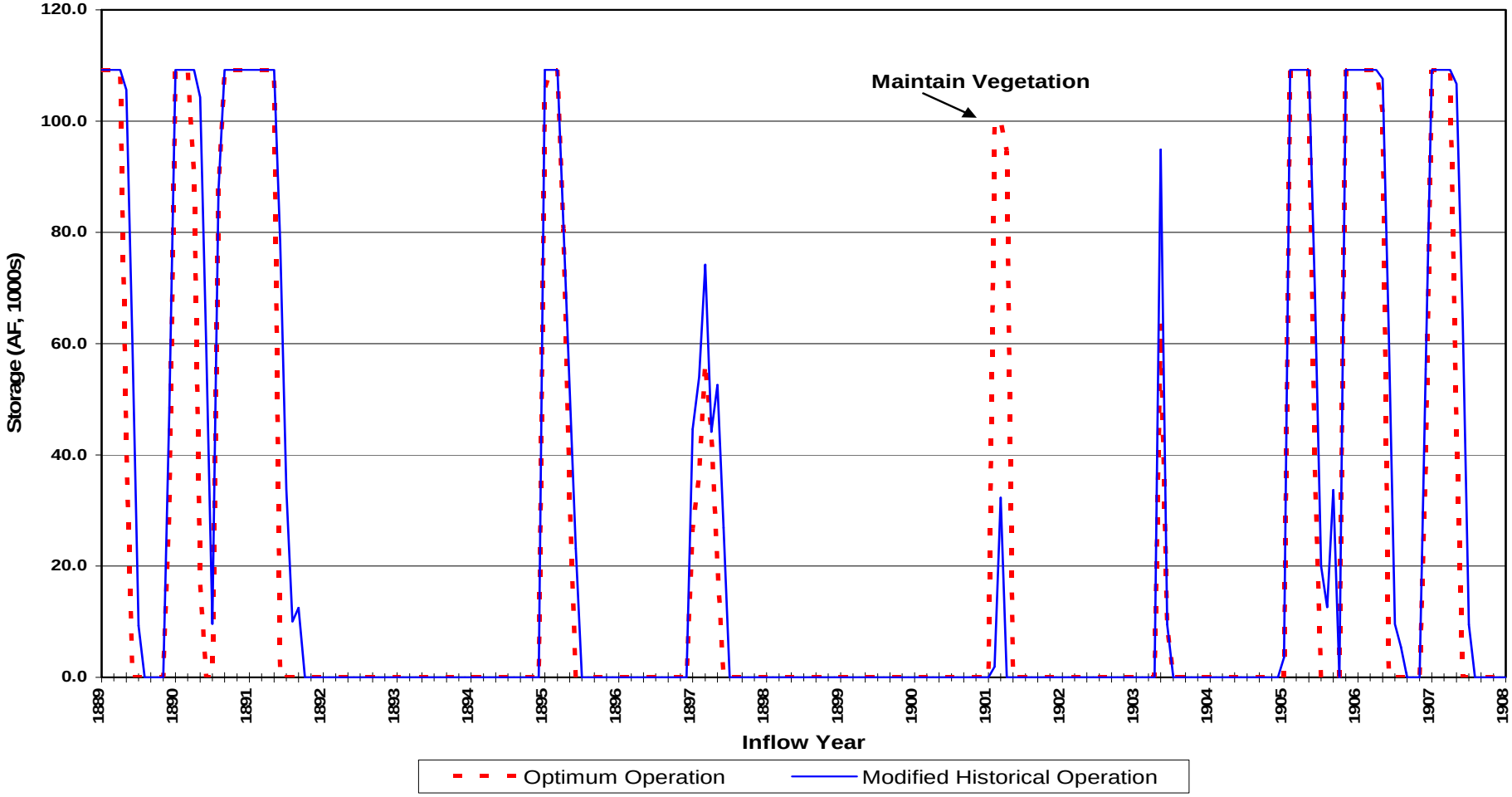


Figure 3 (page 2 of 6). Horseshoe Storage Under Modified Historical Operation and Optimum Operation Alternatives

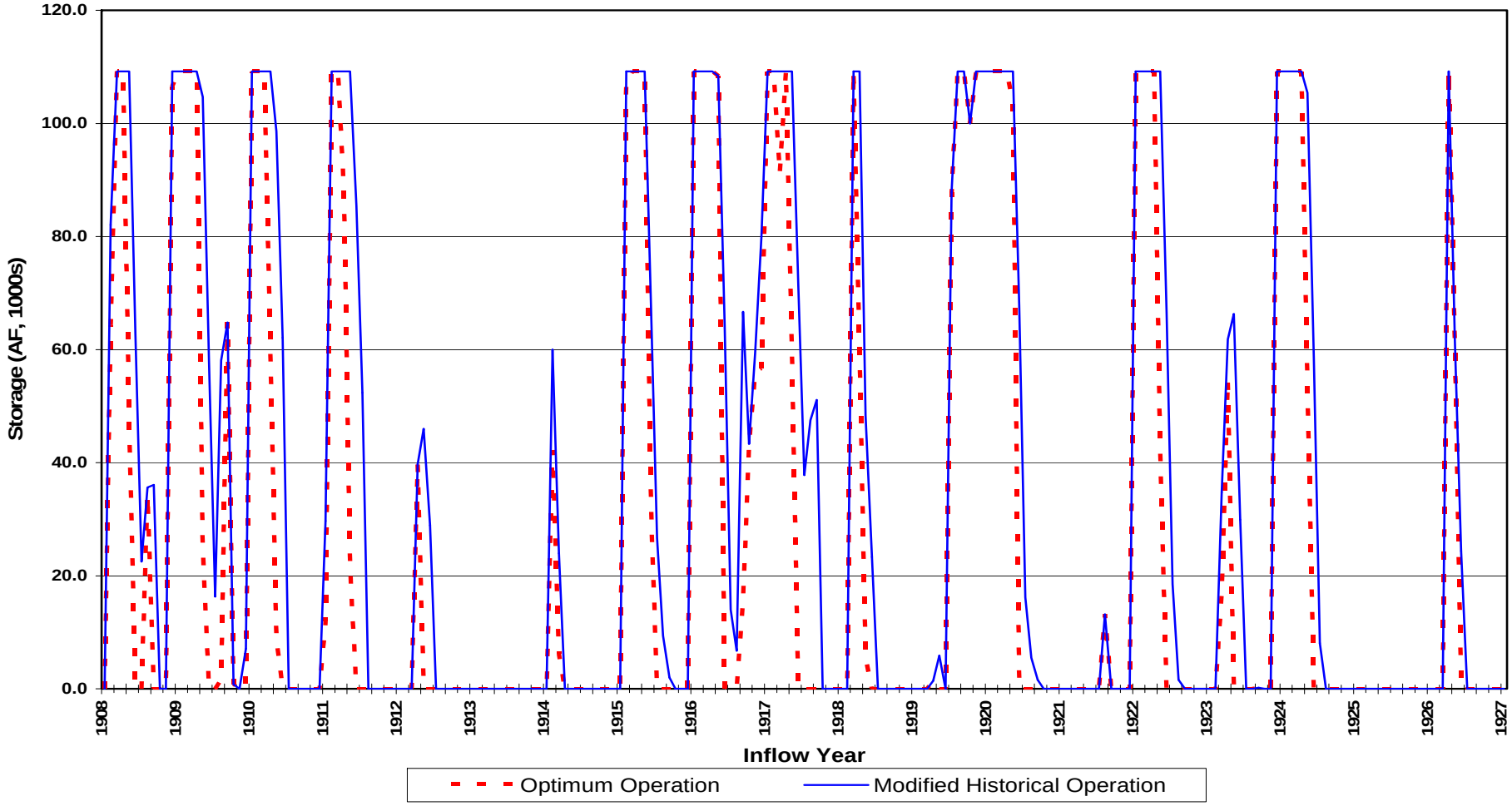


Figure 3 (page 3 of 6). Horseshoe Storage Under Modified Historical Operation and Optimum Operation Alternatives

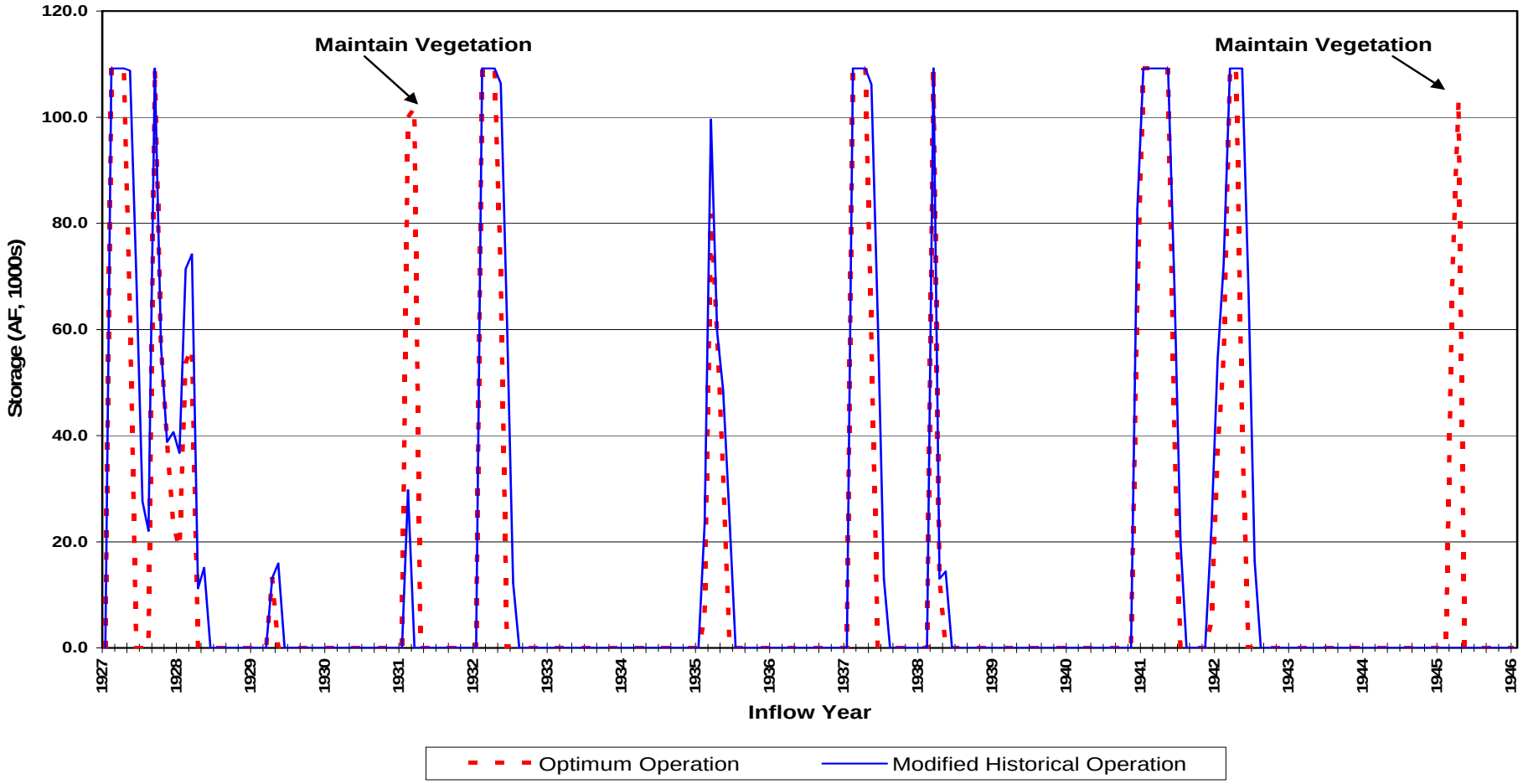


Figure 3 (page 4 of 6). Horseshoe Storage Under Modified Historical Operation and Optimum Operation Alternatives

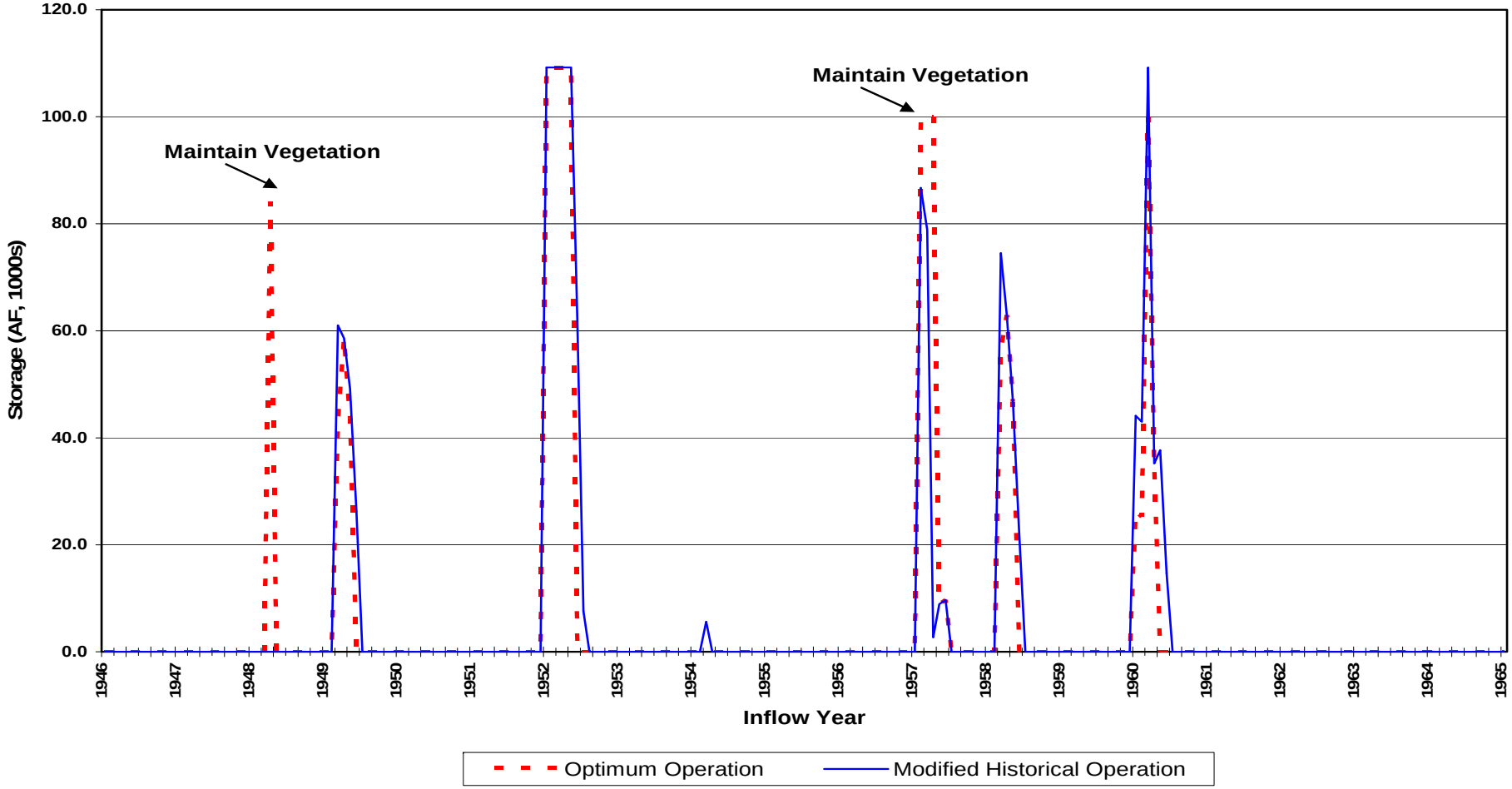


Figure 3 (page 5 of 6). Horseshoe Storage Under Modified Historical Operation and Optimum Operation Alternatives

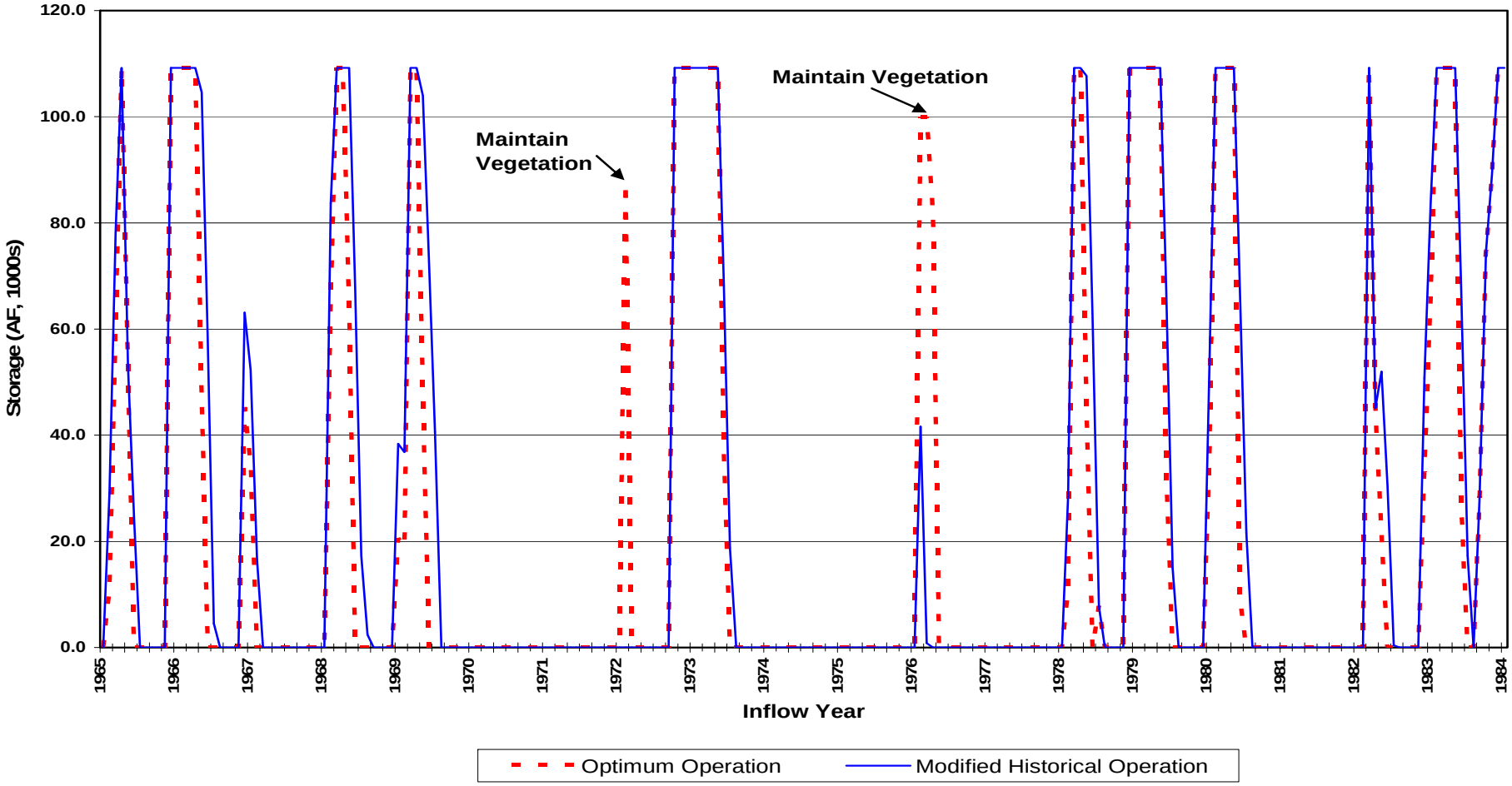


Figure 3 (page 6 of 6). Horseshoe Storage Under Modified Historical Operation and Optimum Operation Alternatives

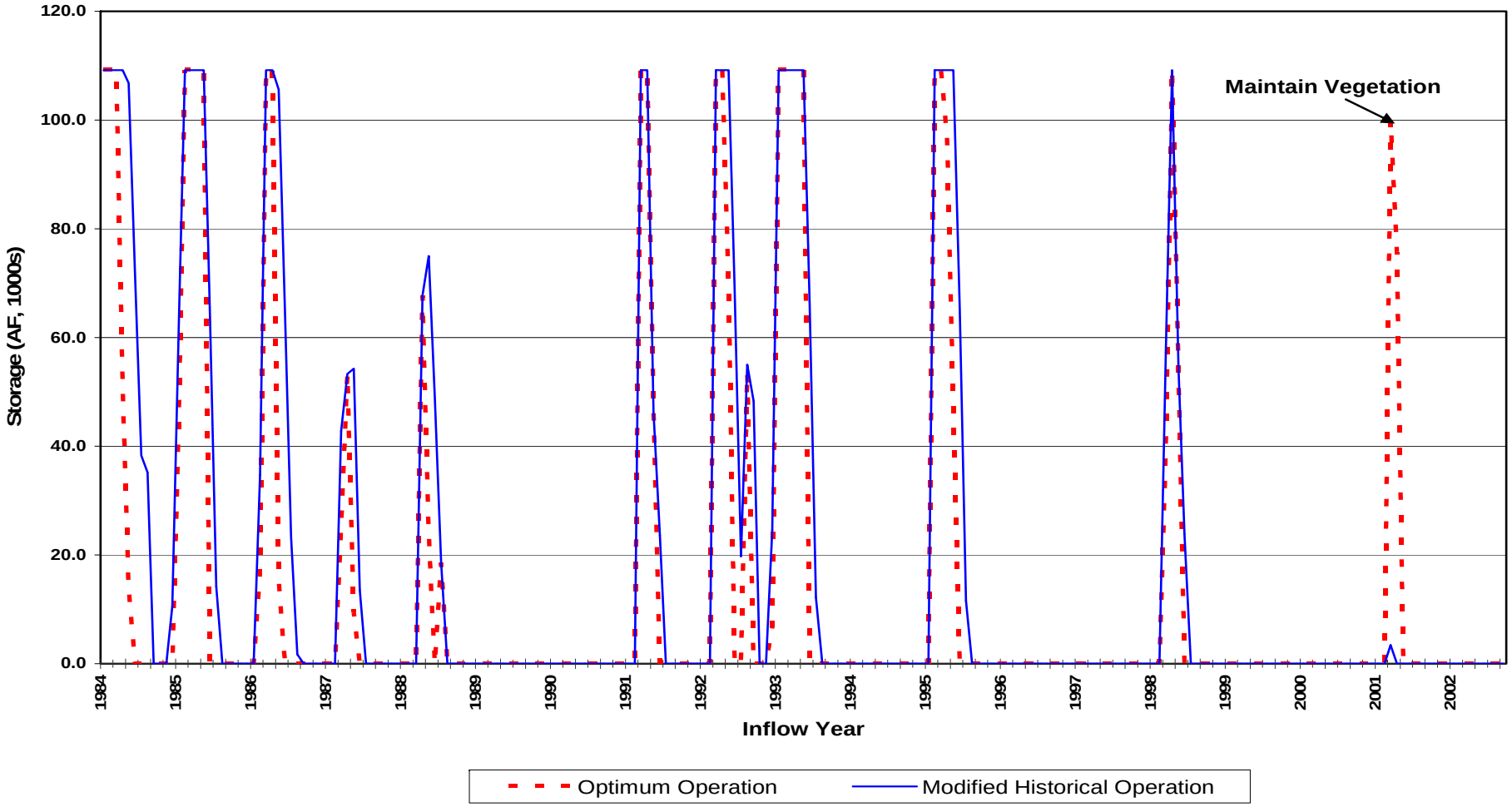


Figure 4 (page 1 of 2).
Bartlett and Total Verde Storage
Actual Historical Operation

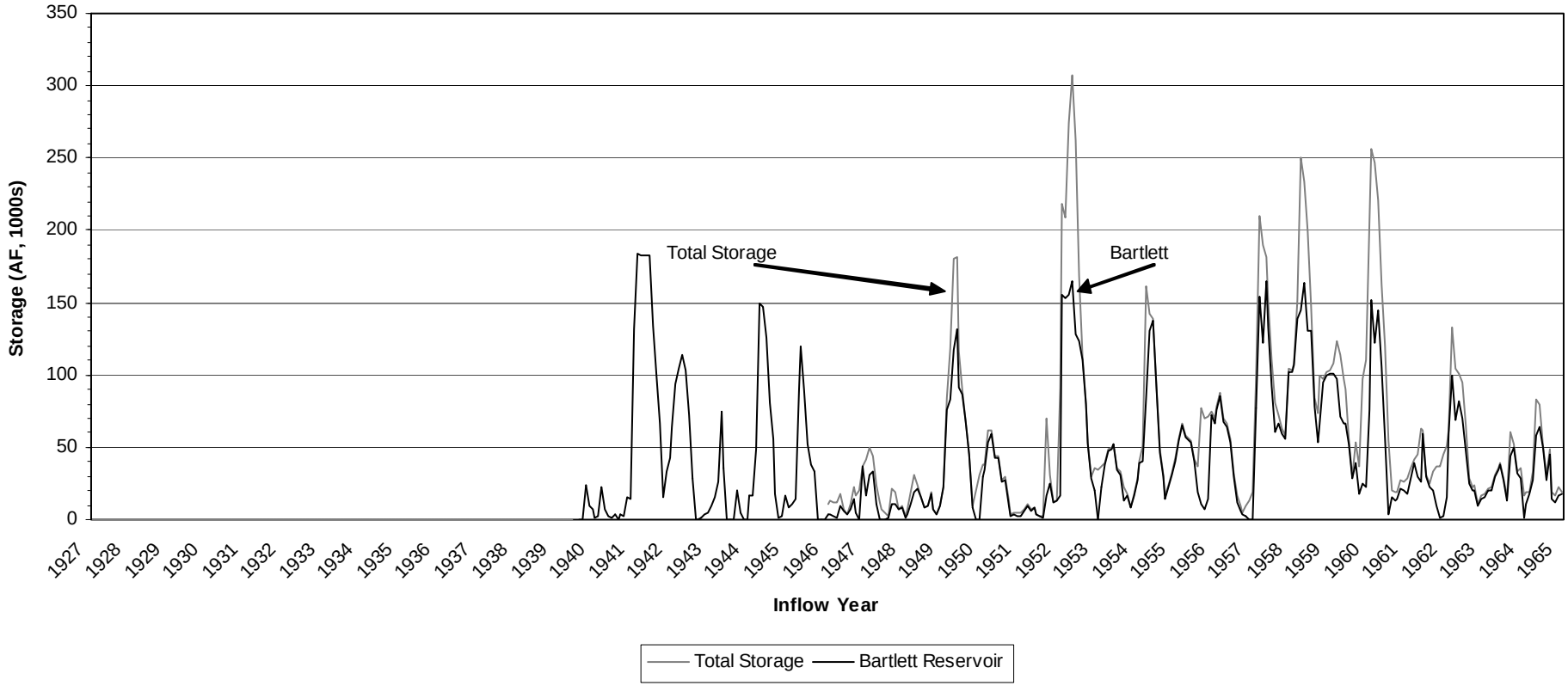
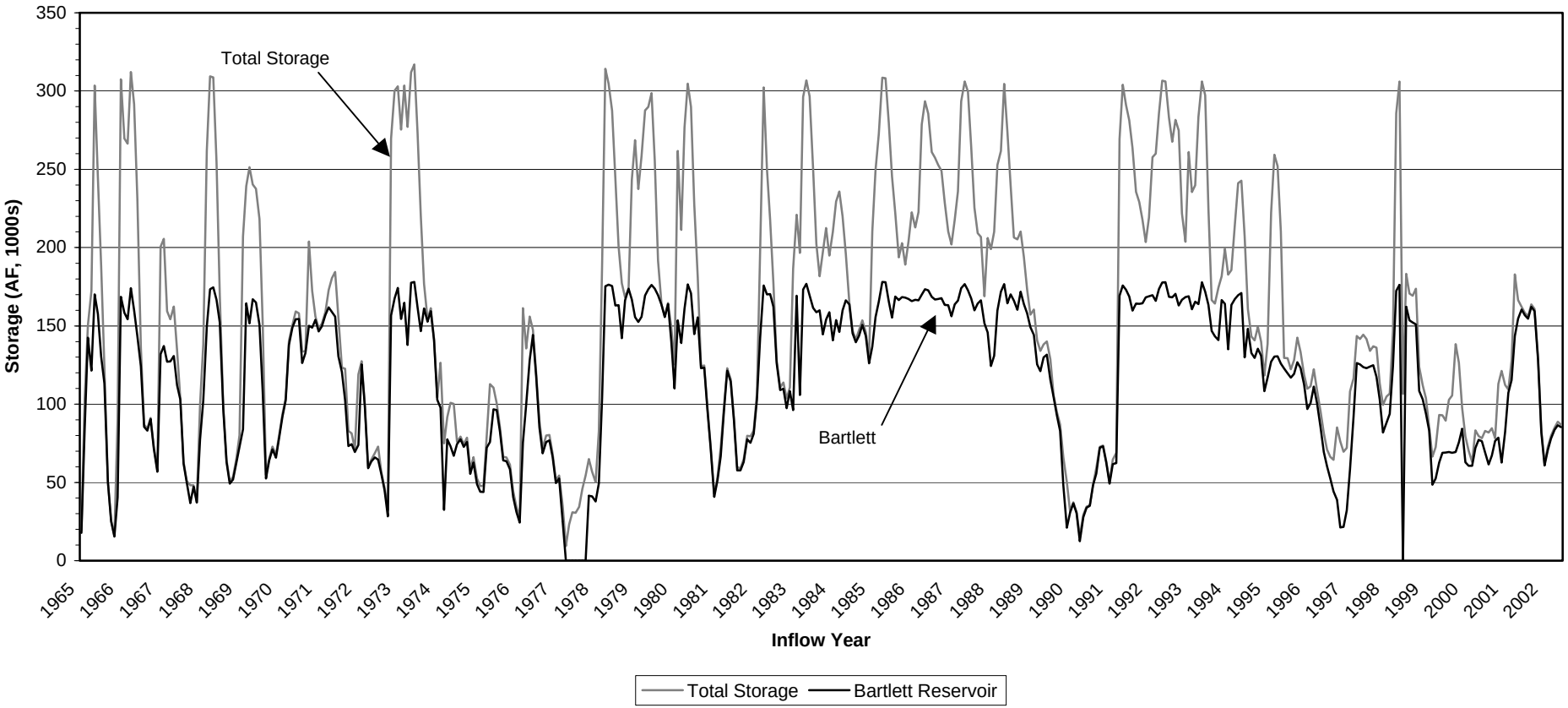


Figure 4 (page 2 of 2).
Bartlett and Total Verde Storage
Actual Historical Operation



APPENDIX 6
NATIVE FISH IMPACTS

As summarized in Subchapter IV.B.4, the Committee estimated adverse impacts on native fish species using the conceptual framework of Habitat Equivalency Analysis (NOAA 2000). The Committee concurred on the relative percent contribution from future reservoir operations on native fish populations and habitat in each stream reach based on all available data. Although discrete stream reaches were used for calculation purposes, the Committee recognized that impacts from reservoir operations are a continuum, which likely vary in proportion to distance from the reservoirs. The percentage for reservoir impact for each mainstem reach and tributary is shown in Table 1.

The final step in the analysis was to multiply the percent reservoir impact for each stream reach by total reach length to calculate the number of stream miles impacted by reservoir operations. This process was repeated for each of the alternatives (Table 1).

River mile impacts within the tributaries of Oak, Wet Beaver, and West Clear creeks were calculated using a process that reflects the continuum of decreasing impacts upstream from the mouth as described below.

Oak Creek

The estimated reservoir impact in the mainstem at the confluence is 5 percent. The Oak Creek reach extends to the first instream low-water road crossing located 3 miles upstream near Oak Creek Estates, and there are at least six water diversions upstream of this point to the Page Springs Hatchery. Above the diversions, the estimated reservoir impact is 0. The midpoint of 0 to 5 percent is 2.5 percent impact over the reach, which reflects the continuum of impacts steadily decreasing above the confluence. The average impact of 2.5 percent on 3 miles equals 0.08 mile of relative impact.

Wet Beaver Creek

The estimated reservoir impact in the mainstem at confluence is 5 percent. This impact was reduced by one-third (0.666 * 5 percent = 3.33 percent) in Wet Beaver Creek because the stream reach at the confluence is intermittent during the growing season. The reach extends upstream to the first instream diversion, which is located 12 miles upstream from the confluence near Montezuma Castle; there are also six other diversions in that area. Above the diversions, the estimated reservoir impact is 0. The midpoint of 0 to 3.33 percent equals 1.67 percent. The average impact of 1.67 percent on 12 miles equals 0.2 mile of relative impact.

West Clear Creek

The estimated reservoir impact in the mainstem at the confluence is 5 percent. This impact was reduced by one-third (0.666 * 5 percent = 3.33 percent) because the stream reach at the confluence is intermittent during the growing season. The reach extends 2 miles upstream to the first of three water diversions, past an infiltration basin at 1.3 miles where the stream dries up during the growing season. Above the diversions, the estimated reservoir impact is 0. The midpoint of 0 to 3.33 percent equals 1.67 percent. The average impact of 1.67 percent on 2 miles equals 0.03 mile of relative impact.

Table 1. Estimated Reservoir Impacts on Native Fish Communities.

Modified Historical Operation Alternative	**Mainstem Verde**						**Tributary Creeks**					
Reach	**1**	**2**	**3**	**4a**	**4b**	**5**	**Lime**	**E. Verde**	**Fossil**	**W. Clear**	**Wet Beaver**	**Oak**
River Miles (estimated)	28	21	10	8	44	38	6	8	3	2	12	3
% Reservoir Impact	20%	5%	80%	70%	25%	5%	80%	8%	18%	1.7%	1.7%	2.5%
River Miles Affected	5.60	1.05	8.00	5.60	11.00	1.90	4.80	0.66	0.54	0.03	0.20	0.08
Total River Miles Impacted	39.46											
No Permit Alternative	**Mainstem Verde**						**Tributary Creeks**					
Reach	**1**	**2**	**3**	**4a**	**4b**	**5**	**Lime**	**E. Verde**	**Fossil**	**W. Clear**	**Wet Beaver**	**Oak**
River Miles (estimated)	28	21	10	8	44	38	6	8	3	2	12	3
% Reservoir Impact	20%	5%	70%	50%	15%	5%	70%	8%	18%	1.7%	1.7%	2.5%
River Miles Affected	5.60	1.05	7.00	4.00	6.60	1.90	4.20	0.66	0.54	0.03	0.20	0.08
Total River Miles Impacted	31.86											
Optimum Operation Alternative (Proposed)	**Mainstem Verde**						**Tributary Creeks**					
Reach	**1**	**2**	**3**	**4a**	**4b**	**5**	**Lime**	**E. Verde**	**Fossil**	**W. Clear**	**Wet Beaver**	**Oak**
River Miles (estimated)	28	21	10	8	44	38	6	8	3	2	12	3
% Reservoir Impact	20%	5%	72%	55%	18%	5%	72%	8%	18%	1.7%	1.7%	2.5%
River Miles Affected	5.60	1.05	7.20	4.40	7.92	1.90	4.32	0.66	0.54	0.03	0.20	0.08
Total River Miles Impacted	33.90											

APPENDIX 7
TEMPLATE FOR MANAGEMENT PLANS
HCP MITIGATION SITES

This template provides the basic structure and content of the management plan to be developed for each mitigation property that SRP acquires and protects as part of the HCP. A specific management plan will be developed for each property in coordination with FWS and, where applicable, the land management entity. An example of the form of conservation easement agreed to by SRP and FWS is attached.

Baseline Data Collection At Sites

Baseline data on plant communities and fauna will be collected at each site. The Arizona Game and Fish Department (AGFD) Heritage Data Management System Program will be queried for species presence and rank of protection for species that may occur in the area. Information from AGFD surveys for species such as native fish, amphibians, reptiles, mammals, and plants, will also be requested where such work has been completed. Recent aerial photos of the site will be acquired.

The acreage of tall dense vegetation suitable for flycatcher and cuckoo breeding habitat will be documented and the potential acreage for establishment of additional areas of tall dense vegetation will be estimated. The acreage of other riparian and upland vegetation types that are present also will be documented.

Estimated stream flow, depth to the water table, and other available hydrological data will be collected at the time a property becomes protected. Hydrological data and hydrographical survey reports from the Arizona Department of Water Resources will be compiled if available. Where appropriate, soil and water quality samples also may be taken to evaluate the best methods to maintain or to encourage improvement and enhancement of riparian vegetation.

The baseline conservation values of the site will be summarized in the Baseline Documentation attached to the deed of conservation easement or other form of permanent protection used for the property.

Monitoring of Species Covered by the HCP

At all sites, flycatcher and cuckoo surveys will be completed during the first two field seasons following protection. Following the initial surveys, surveys will be conducted as provided in the HCP. During surveys, banded individuals will be noted and movements will be determined through coordination with the USGS Colorado Plateau Research Station or AGFD. Where appropriate, bald eagle nest trees will also be identified.

All survey information will be shared with the City of Phoenix, AGFD, USGS, and FWS, and will be summarized in annual reports submitted to FWS.

Laws and Policies Pertaining to Mitigation Sites

The following agencies, laws, and policies may apply to specific mitigation sites and surrounding properties:

- Endangered Species Act: surveys and actions appropriate to the protection of listed species.
- Clean Water Act: Section 404 permitting for dredge and fill operations, Section 319(h) for nonpoint source pollution.
- Clean Air Act: air quality issues.
- 1872 Mining Law: covering existing and new mining operations.
- Arizona Water Law: jurisdiction over water rights, water uses, and instream flow.
- State Historical Preservation Office: relating to cultural and archeological resources.
- Arizona Partners in Flight: developing priorities for species and habitat conservation.
- Local Natural Resource Conservation District: coordination in planning for land, water, and soil conservation.
- Local Forest Service, State Land Department, Bureau of Land Management, or other agencies with adjacent properties: coordination in planning for consistent land management for the benefit of covered species to the largest extent possible.
- Local law enforcement: coordination as to land use and protection from trespass.

The management plan for a specific property will describe the agencies, laws, and policies that apply to that property. Where appropriate, the agencies will be notified that the property is being protected as mitigation habitat and will be provided with a copy of the management plan. Contact information for each appropriate agency will be included in the management plan.

Management Goals

The overall management goal of the mitigation plan for each property is to provide ecological and conservation benefits to species covered by the HCP. All mitigation lands protected through the HCP will be managed with the benefit to flycatchers as the highest priority. The next priority will be management of those lands for cuckoos. Where bald eagles have breeding areas in the vicinity of the property, management will also include bald eagles as a priority.

The primary management goal within the active channel and floodplain is to protect and enhance a naturally functioning system to protect, maintain, and restore a dynamic mosaic of riparian vegetation communities by maintaining and enhancing surface and ground water conditions and removing major stressors of livestock grazing and motorized vehicular use of the floodplain.

A related management goal is to reduce threats such as cowbird parasitism and fire.

Another management goal is to build community support, coordinate with adjacent landowners, and increase public awareness of SRP's conservation goals and strategies.

The management plan for each property will identify the specific management goals for that property. These goals will be addressed using the strategies identified below.

Strategies To Achieve Management Goals

The management goals will be accomplished by a variety of measures, including:

1. Filing a deed of conservation easement on the property ensuring that the land providing mitigation for the HCP is permanently protected from development. A draft standard form for the conservation easement to be used on these properties is attached.
2. Mineral rights for the property will be acquired where feasible.
3. Eliminating cattle grazing and adverse recreation impacts by erecting and maintaining fences to protect the riparian corridor.
4. If flycatchers and cowbirds are present, cowbird monitoring and management will be used on the property if necessary, as provided in the HCP.
5. Regular or periodic patrolling for trespass cattle, all-terrain vehicle (ATV) use, and potential fire hazards; the frequency of patrols will depend on the intensity of human activity in the area. As a general rule, patrols will be conducted at least once a week on average.
6. Fencing preserve boundaries, providing signage, and meeting with neighbors and the public to increase awareness of threats to flycatchers and riparian areas, such as outdoor domestic cats, ATVs, fire hazards, bird feeders, trespass onto protected flycatcher habitat, and other issues as they arise. Informational brochures may also be created and distributed.
7. Cultivating relationships with agencies and private landowners to enhance cooperation for protecting endangered species, and for improving and protecting riparian areas.
8. Reducing the threat of fires and of riparian degradation due to recreational activity through signage and fencing.
9. Monitoring upland nonnative grasses and shrubs that ignite easily and using mowing, fire breaks, or controlled burns where needed.
10. Coordinating fire response with local, state, and federal fire management entities. A site-specific fire management plan would be developed and maintained for each property and be kept on file at each fire management agency.
11. Increasing age-class diversity and cottonwood-willow overstory through planting of cuttings where SRP determines that planting is feasible to implement and maintain, and where it would provide significant benefits to covered species. However, maintaining the natural disturbance cycles of streams or rivers will be the primary approach to maintenance of riparian vegetation.
12. If necessary, protecting trees in some areas from beavers using wire baskets.

13. Where feasible, removing nonnative plants that can become invasive (not including removal of tall, dense salt cedar which is used by flycatchers and occasionally by cuckoos for nesting and foraging). Research will be conducted to determine the most effective and least environmentally harmful methods.
14. Obtaining ADWR maps and data for the property and adjacent lands.
15. Aggressively asserting and defending all water rights associated with the protected properties.

Measures of Success

The following measures will be used to determine success:

1. The anticipated amount of tall dense riparian vegetation and other habitat suitable for flycatcher and cuckoo occupation is achieved, maintained, or increased.
2. Use of the site by flycatchers and cuckoos for breeding, or an eventual increase in the number of flycatchers and cuckoos using already established breeding areas, as determined through surveys.
3. Use of the site by bald eagles.
4. Water table depth is maintained or decreased over time and surface water is available to the maximum extent practicable, taking into account climatic cycles.
5. Livestock grazing is eliminated from riparian areas.
6. Adverse recreational use of the area (particularly ORVs) is substantially reduced or eliminated.

Management Timeline

A specific management plan will be developed for each property acquired by SRP for mitigation within two years of purchase. The management plan will be reviewed annually by SRP, City of Phoenix, FWS, and the property manager, and will be amended to the extent required by changed circumstances. The properties acquired by SRP for mitigation under the HCP will be protected and managed in perpetuity for the benefit of flycatchers and cuckoos.

DRAFT FORM
DEED OF CONSERVATION EASEMENT FOR HCP MITIGATION PROPERTIES

STATE OF ARIZONA §
§
COUNTY OF _____ §

THIS DEED OF CONSERVATION EASEMENT is made this _____ day of ____ 200_, by and between the Salt River Project Agricultural Improvement District (P.O. Box 52025, Phoenix, Arizona 85072-2025) and its assigns (hereinafter called "Grantor"), and _____ (____mailing address____) and its assigns (hereinafter called "Grantee").

WITNESSETH:

WHEREAS, the Grantor is the sole owner in fee simple of certain real property containing ____acres of land, more or less, located in _____ County, Arizona, being the same property described in a deed dated _____ conveyed by _____to_____ filed in the Records of _____ County, Arizona, in Book _____ Page _____, more particularly described in **Exhibit A**, attached hereto and made a part hereof, and

WHEREAS, the land described contains a riparian ecosystem including fish and wildlife habitat, water quality improvement, flood water retention, ground water recharge, open space, and aesthetics, hereafter referred to collectively as the "Conservation Values," which are summarized in **Exhibit B** (Baseline Documentation), attached hereto and made a part hereof. Additional documentation on the inventory of relevant feature of the property is on file at the offices of the Grantor, the Grantee, and the Arizona office of the U.S. Fish and Wildlife Service. The parties agree that the documentation of reports, maps, photographs and other materials provide an accurate representation of the property at the time of this conveyance and is intended to serve as an objective information baseline for monitoring compliance with the terms of this conveyance, and

WHEREAS, the Grantor desires to convey to Grantee the right to preserve and protect, enhance, and manage the "Conservation Values" of the property in perpetuity, consistent with the purposes as set out in this easement and with Arizona Revised Statutes 33-271 *et seq.,* and

WHEREAS, the Grantee and Grantor have a common desire to participate in the restoration and management activities on the easement area, in accordance with the Management Plan for the Property, dated _____, that was

developed and initiated for implementation by the Grantor, and which may be amended from time to time consistent with the Horseshoe and Bartlett Habitat Conservation Plan. The Management Plan, Horseshoe and Bartlett Habitat Conservation Plan, and related reports, maps, photographs, and other documents and materials are on file at the offices of the Grantor, the Grantee, and the Arizona and Region 2 U.S. Fish and Wildlife Service offices.

NOW THEREFORE, for and in consideration of the sum of $_____, the receipt of which is hereby acknowledged, the Grantor hereby sells, grants and conveys unto the Grantee, its successors and assigns, a conservation easement in perpetuity, restricting the use of the property by the Grantor so as to maintain in substantially the same condition as it now exists, in perpetuity, together with the right of access to, across, over any and all land of the Grantor included in this easement by authorized representatives of the Grantee, the Service, and its assigns, subject the mutual covenants, terms, conditions and restrictions contained herein and pursuant to the laws of the State of Arizona.

This conservation easement is conveyed subject to all existing rights-of-way; to all outstanding mineral rights; to rights of the United States and third parties in patents of record; and to rights of the State of Arizona, and to rights of third parties under any oil and gas leases, or any other rights reserved in third parties, if any, of record in _____ County, Arizona.

1. Reserved Rights. Grantor reserves to itself and to its official representatives and assigns, all rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in all uses of the Property that are not expressly prohibited herein and are not inconsistent with the purpose of this easement. Without limiting the generality of the foregoing, the following rights are expressly reserved:

   (a) To construct, maintain, and repair irrigation facilities or other structures to promote the growth of riparian vegetation.

   (b) To manage the Property consistent with the terms of the Horseshoe and Bartlett Habitat Conservation Plan.

   (c) To permit recreational use of the Property that does not substantially impact the Conservation Values of the Property.

   (d) To collect dead and down firewood for domestic use only and collect, use, dispose of, or sell salt cedar (not including removal of salt cedar that may be used by Southwestern Willow Flycatchers for nesting and foraging).

   (e) To build, maintain, and repair fences.

(f) To construct, maintain and repair trails and vehicle paths necessary to manage the property.

(g) To restore native plant communities on the Property.

(h) To use biocides and fertilizers for revegetation with native species and control of noxious weeds and insect pests subject to strict following of label recommendations; local, state and federal agency regulations for application; and generally accepted principles of safe and efficient use at the time of application.

(i) To assign management responsibilities for the Property to the Grantee or an appropriate conservation organization or agency.

2. Rights of Grantee. To accomplish the purpose of this easement, the Grantee and its assigns shall have the rights listed as follows:

(a) The right to preserve and protect the Conservation Values of the Property.

(b) The right to enter upon the Property at reasonable times in order to 1) monitor populations of listed species, and 2) monitor Grantor's compliance with and otherwise enforce the terms of this easement; provided that such entry shall not unreasonably interfere with Grantor's use and management of the Property and provided that there be reasonable notice of entry.

(c) The right to prevent Grantor from conducting or permitting any activity on or use of the Property that is inconsistent with the purpose of this easement, and to require the restoration of such areas or features of the Property that are damaged by any inconsistent activity or use. Grantee shall provide Grantor with ninety (90) days' notice of its objection to any such activity or use prior to the institution of any legal proceedings to enforce its rights granted herein.

(d) The right to trap and remove cowbirds from the Property on a sustained or a periodic basis to protect nesting native birds from nest predation.

3. Prohibited Use. Both the Grantor and the Grantee, for themselves and their successors, assigns, lessees, and any other person claiming under them, covenant and agree to cooperate in the conservation and maintenance of the said land and water, and for the purpose of

accomplishing the intent of this easement, agree they shall not allow any of the following activities:

(a) Construction or placing of any buildings, permanent camping accommodations, mobile homes, or billboards except construction of one building to house an office and equipment.

(b) Confinement livestock feeding in which animals are permanently located in enclosures and the majority of their feed supplied from outside sources. This includes, but is not limited to, cattle, dairy, ostrich, and emu farm operations.

(c) Establishment or expansion of agricultural production operations.

(d) Commercial enterprises or residential use inconsistent with protection of the Property's conservation values.

(e) Surface alteration, destruction of native vegetation, or introduction of nonnative species of vegetation, other than that necessary to accommodate the uses of the Property authorized herein.

(f) The legal or de facto subdivision of the Property for any purpose.

(g) Any use or activity that causes or is likely to cause significant soil degradation or erosion or significant pollution of any surface or subsurface waters.

(h) Dumping or storage (except as otherwise provided herein) of refuse, or other unsightly, offensive, or toxic or hazardous materials including, without limitation, livestock carrion.

(i) The introduction of nonnative species of noxious or aggressive character, which might adversely affect the natural values of the Property.

(j) Filling, excavating, dredging, mining, drilling, exploring or extracting minerals, hydrocarbons, soils, sand, gravel, rock, or other materials on or below the surface of the Property.

(k) Pumping ground water for other that on-site domestic and agricultural uses or restoration of native vegetation.

(l) Storage and use of biocides and chemical fertilizers, except for residential and agricultural purposes permitted herein. Aerial application of biocides or other chemicals is prohibited.

The fact that any prohibited use of the Property, or any use determined to be inconsistent with the purpose of this easement, becomes more economically valuable than the permitted uses, or that adjacent property is put to uses not permitted by this easement, has been considered by Grantor; and Grantor does not presume that such changes justify termination of this easement.

4. Remedies. If either Grantee or Grantor determines the other party is in violation of the terms of this easement or that a violation is threatened, the party making such a determination shall give written notice to that other party of such violation and demand corrective action sufficient to cure the violation and, where the violation involves injury to the Property resulting from any use or activity inconsistent with the purpose of this easement, to restore the portion of the Property so injured. If such other party fails to cure the violation within thirty (30) days after receipt of such notice thereof, or under circumstances where the violation cannot reasonably be cured within the thirty (30) day period, fails to begin curing such violation within the thirty (30) day period, or fails to continue diligently to cure such violation until finally cured, the party providing such notice may bring an action at law or in equity in a court of competent jurisdiction to enforce the terms of this easement, to enjoin the violation, ex parte as necessary, by temporary or permanent injunction, to recover any damages to which it may be entitled for violation of the terms of this easement or injury to any conservation values protected by this easement, including damages for the loss of scenic, aesthetic, or environmental values, and to require the restoration of the Property to the condition that existed prior to any such injury.

5. Costs of Enforcement. Any costs incurred by either party in enforcing the terms of this easement against the other party, including, without limitation, costs of suit and attorneys' fees, and any costs of restoration necessitated by violation of the terms of this easement shall be borne by the violator.

6. No Waiver of Rights. Any forbearance by Grantee or Grantor to exercise its rights under this easement in the event of any breach of any terms of this easement shall not be deemed or construed to be a waiver of such term or of any subsequent breach of the same or any other term of this easement or of any of Grantee's or Grantor's rights under this easement. No delay or omission in the exercise of any right or remedy upon any breach shall impair such right or remedy or be construed as a waiver thereof.

7. Acts Beyond Grantor Control. Nothing contained in this easement shall be construed to entitle Grantee to bring any action against Grantor for any injury to or change in the Property resulting from causes beyond Grantor

control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken by Grantor under emergency conditions to prevent, abate, or mitigate significant injury to the Property resulting from such causes or from railway accidents.

8. Costs and Liabilities. Grantor retains all responsibilities and shall bear all costs and liabilities of any kind including taxes and all assessments listed against the Property related to the ownership, operation, upkeep, and maintenance of the Property; except that liabilities resulting from any public access program provided or sponsored by the Grantee shall be the responsibility of the Grantee.

9. Notices. Any notice, demand, request, consent, approval, or communication that either party desires or is required to give to the other shall be in writing and either served personally or sent by first-class mail, postage prepaid, addressed as follows:

To Grantor: Attn: _____
Salt River Project
P.O. Box 52025
Phoenix, AZ 85072-2025
Telephone: (602) _____
Fax: (602) _____
e-mail: _____

To Grantee: _____

Or to such other addresses as either party from time to time shall designate by written notice to the other.

10. Recordation. Grantee shall record this instrument in timely fashion in the official records of _____County, Arizona and may re-record it at any time, as may be required, to preserve its rights in the easement.

11. General Provisions.

(a) Controlling Law. The interpretation and performance of this easement shall be governed by the laws of the State of Arizona.

(b) Liberal Construction. Any general rule of construction to the contrary, notwithstanding this easement, shall be liberally construed in favor of the grant to effect the purpose of this easement. If any provision in this instrument is found to be ambiguous, an interpretation consistent with the purpose of this easement that

would render the provision valid shall be favored over any interpretation that would render it invalid.

(c) Severability. If any provision of this easement, or the application thereof to any person or circumstance, is found to be invalid, the remainder of the provisions of this easement shall not be affected thereby.

(d) No Forfeiture. Nothing contained herein will result in a forfeiture or reversion of Grantor's title in any respect.

(e) Joint Obligation. The obligations imposed by this easement upon Grantor shall be joint and several.

(f) Successors. The covenants, terms, conditions, and restrictions of this easement shall be binding upon, and inure to the benefit of, the parties hereto and their respective personal representatives, heirs, successors, and assigns and shall continue as a servitude running in perpetuity with the Property.

(g) Termination of Rights and Obligations. A party's rights and obligations under this easement terminate upon transfer of the party's interest in the easement or Property, except the liability for acts or omissions occurring prior to transfer shall survive transfer.

(h) Taxes. Grantor shall pay all property taxes and assessments levied on the Property.

(i) Assignment. Grantee may assign the easement upon written consent of Grantor.

(j) Amendment. If circumstances arise under which an amendment to or modification of the Easement would be appropriate, Grantor and the Grantee may jointly amend the Easement; provided that any amendment to this easement shall be consistent with the purposes of the easement and with ARS 33-271 et. seq., shall not affect the perpetual term hereof, and shall not impair the Conservation Values of the Property set forth in Exhibit B hereto.

(k) Extinguishment. If circumstances arise in the future that render the purpose of this Easement impossible to accomplish, this easement can only be terminated or extinguished, whether with respect to all or part of Grantor's Land, by judicial proceeding in a court of competent jurisdiction.

TO HAVE AND TO HOLD, this conservation agreement hereby conveys unto Grantee and its assigns forever, an apportionment to the said land of the Grantor.

IN WITNESS WHEREOF Grantor and Grantee have set their hands on the day and year first above written.

GRANTOR:
Salt River Project
Agricultural Improvement District

GRANTEE:

_____ _____

(Each signatory must notarize)

ACKNOWLEDGMENT

STATE OF ARIZONA)
) ss:
COUNTY OF _____)

On this _____ day of _____ 2002, before me personally appeared _____ known to me to be the person who is described in and who executed the within instrument and acknowledged to me that he executed the same in his official capacity on behalf of said District.

My Commission expires _____. _____
Notary Public

ACKNOWLEDGMENT

STATE OF _____)
) ss:
COUNTY OF _____)

On this _____ day of _____ 2002, before me personally appeared _____ known to me to be the person who is described in and who executed the within instrument and acknowledged to me that he executed the same in his official capacity.

My Commission expires _____. _____
Notary Public

APPENDIX 8
ROOSEVELT HCP MANAGEMENT PLAN

MANAGEMENT PLAN
FOR
CAMP VERDE RIPARIAN PRESERVE

Yavapai County, Arizona

March 2005

Salt River Project
Siting and Studies Division
Environmental Services Department
P.O. Box 52025
Phoenix, AZ 85072-2025

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I. INTRODUCTION

On February 23, 2003, the US Fish and Wildlife Service (FWS) issued an Incidental Take Permit to Salt River Project (SRP) for the continued operation of Roosevelt Dam and Lake. Under the terms and conditions of the permit, the associated Implementing Agreement and the Roosevelt Habitat Conservation Plan (RHCP) (SRP 2002), SRP must acquire, protect, and enhance riparian habitat for the Southwestern willow flycatcher (*Empidonax traillii extimus*) (flycatcher), Western yellow-billed cuckoo (*Coccyzus americanus*) (cuckoo), Yuma clapper rail (*Rallus longirostris yumanensis*), and bald eagle (*Haliaeetus leucocephalus*).

The Camp Verde Riparian Preserve (CVRP) was acquired by SRP as part of the mitigation requirements for the Incidental Take Permit. CVRP is located east of the confluence of Interstate 17 (I-17) and the Verde River in Sections 24 and 25, Township 14 North, Range 4 East, in Yavapai County, Arizona. CVRP consists of nearly 1 mile of the Verde River and 124 acres of its floodplain, and contains high-quality riparian vegetation that serves as nesting and breeding habitat for flycatchers, cuckoos and, potentially, for bald eagles.

The purpose of the *Management Plan* is to identify the conservation goals for CVRP, the strategies by which the goals will be achieved, and the means by which success will be measured. In addition, this document will address some of the specific management practices that are to be implemented to secure the protection of nesting and breeding flycatchers and cuckoos and to maintain and enhance their habitat.

NOTE: For consistency in this document, the standard use of "river left" and "river right" will be used, i.e., as one looks downstream. The area north and east of the river channel becomes left bank/terrace and the area south and west of the river channel becomes right bank/terrace.

II. BASELINE DATA

Baseline data and description of the property's Conservation Values are detailed in the Baseline Inventory. Habitat zones are delineated on an aerial photograph of the property in Appendix A.

III. ECOLOGICAL GOALS

PRIMARY GOAL

The primary goal for management of this property is to provide ecological and conservation benefits to the flycatcher, cuckoo and bald eagle. Lands will be managed primarily for the benefit of the flycatcher and secondarily for the benefit of the cuckoo and bald eagle. Any management activity that is contrary to this objective will be disallowed on CVRP.

STRESS ASSESSMENT

Table 1 lists the conservation targets, past causes of habitat degradation or loss, and future threats that could potentially affect the integrity of the vegetation community and target species

populations.

Based on the evaluation conducted during development of the Baseline Inventory, the primary stressors to flycatcher and cuckoo habitat at CVRP appear to be predation, brood parasitism, encroaching urbanization, recreation impacts (e.g., trampling of vegetation and stream banks), and habitat loss. Habitat loss could result from fire, flood, invasion of unsuitable non-native vegetation, reduction in surface flows or depletion of groundwater.

TABLE 1. CONSERVATION TARGETS

	Riparian Area – river bottom	**River Terraces**	**Southwestern Willow Flycatcher**	**Yellow-billed cuckoo/bald eagle**
Historical Habitat Loss/ Degradation:	• Sand and gravel mining operations • Residential development • Stream diversions • Road construction • Recreation/off-road vehicles • Drought • Stream entrenchment	• Livestock grazing • Sand and gravel operations • Other commercial and industrial activities • Agricultural activity/irrigation • Residential development • Road construction • Groundwater pumping • Proliferation of noxious and invasive weeds • Drought	• All factors listed for riparian area • Predation • Brood parasitism • Disturbance from human interaction	• All factors listed for riparian area
Potential Threats:	• Fire • Incompatible development on adjacent lands • Expansion of groundwater pumping and diversions • Catastrophic floods • Expansion of incompatible recreation	• Incompatible development on adjacent lands • Vandalism/human trespass • Fire • Expansion of incompatible recreation • Invasion of noxious or invasive weeds	• All factors listed for riparian area • Habitat loss • Disturbance from human interaction	• All factors listed for riparian area • Habitat loss • Disturbance from human interaction

Currently, water supply and quality do not appear to be limiting factors for riparian vegetation. The Verde River has reliable perennial flows in this reach and maintains essentially a natural hydrograph, even though several irrigation diversions divert water upstream from CVRP during the growing season. However, future demand for water resources in the Verde watershed is expected to increase as populations within the watershed grow. In general, a multitude of

activities that may occur within the watershed may ultimately affect conditions on CVRP. Increased extraction of groundwater from the alluvial aquifer or increased diversion of stream flows may eventually affect riparian habitat on CVRP. Other hydrologic changes that may influence the riparian community's character include changes in the magnitude and frequency of floods, sediment loads and levels of total dissolved solids. These are beyond our ability to control or reverse and could possibly impact the functional integrity of the river channel and riparian habitat on the site.

APPROACH TO MANAGEMENT

Approaches to management will include:

- Promoting dynamic floodplain and ecosystem processes, including natural floodplain disturbance regimes.
- Protecting the riparian community from threats other than natural disturbance regimes, including threats to flycatcher and cuckoo nesting and breeding habitat, stream bank stability, riparian recruitment, water quality and water quantity.
- Enhancing hydrologic conditions to the extent practicable.

The approach to management within the active channel and floodplain will be to protect and enhance a naturally functioning system that will support a dynamic mosaic of riparian vegetation communities. Periodic flood events may re-distribute riparian vegetation within the floodplain, scouring some areas and providing beds for recruitment of new plants in other areas. Increases or decreases in the target habitat should be viewed in the appropriate temporal context given that desired disturbance regimes may temporarily decrease aerial extent and age-class diversity.

Actions to restore or enhance the quality of flycatcher and cuckoo habitat on this property will focus on allowing habitat to recover from past activities and on minimizing future negative impacts. Protection of riparian communities from threats other than natural disturbance regimes will be a priority for management. A combination of fencing, patrolling, and community coordination/education will be applied to minimize impacts from encroaching development and recreational use of the river.

Although the adjacent terrace vegetation community is not the primary target of management on this property, this area has the potential to provide secondary foraging habitat for both flycatchers and cuckoos. As time and resources allow, native plant species may be restored on the most disturbed terrace sites and actions will be taken to minimize noxious or invasive weed encroachment.

No flycatcher nests were found on CVRP during 2004 surveys (SRP 2004), but past reports (SWCA 2000a, SWCA 2000b) cite impacts from brown-headed cowbird (*Molothrus ater*) (cowbird) parasitism on the flycatcher population in this area. Therefore, the need for cowbird deterrence will be carefully evaluated each year at SRP's annual meeting with FWS. An approach to assessing cowbird parasitism impacts on the flycatcher population is presented in this document.

SRP recognizes that the reach of the Verde River crossing CVRP boundaries has been designated critical habitat for the razorback sucker (*Xyrauchen texanus*) (FWS 1994), which is listed as endangered under the Endangered Species Act (16 U.S. Code 1531-44, as amended). Although this species is not the primary focus for management of CVRP, it will benefit from proposed

management measures to protect and improve riparian habitat, including aquatic systems, on CVRP.

SRP's ability to control threats outside the boundaries of CVRP are limited. CVRP represents only a small segment of a large river system. Sources of stress that originate upstream or in the watershed may threaten the functional integrity of the floodplain within the site. (PNF 20001). Some of these stresses include increased run-off and peak flows due to devegetated slopes or soil compaction resulting from development, mining, grazing, fires or road-building activities within the watershed. Other off-site stresses include overdraft of the alluvial aquifer from groundwater pumping primarily for development, reduced surface water flows as a result of stream diversions, and declines in water quality resulting from non-point source pollution. However, SRP continues to take actions to protect its downstream water rights and, by doing so, protect instream flows in this reach.

IV. MANAGEMENT OBJECTIVES

A. List of Management Objectives

1. Human and Vehicular Trespass, Vandalism
   a. Manage the property so that it minimizes opportunities for human and vehicular trespass and discourages vandalism
2. Fire Management
   a. Reduce the potential for fires on the property by developing and implementing a fire management plan; adopt a policy of fire suppression on the property
   b. Educate the community to minimize fire threats on the property
3. Brood Parasitism on Southwestern willow flycatcher
   a. Reduce, to the extent necessary and possible, cowbird parasitism on flycatchers
   b. Coordinate control activities with other agencies, landowners in the vicinity
4. Habitat Enhancement or Restoration
   a. Evaluate the need for habitat enhancement or restoration and implement as necessary
5. Livestock Grazing
   a. Manage CVRP so that it remains free from livestock grazing
6. Invasive Plant and Weed Control
   a. Reduce or prevent, to the extent necessary and possible, proliferation of noxious and invasive herbaceous plant species, retaining special consideration for occupied salt cedar habitat
   b. Prevent the creation of a monotypic stand of salt cedar
7. Facilities Management
   a. Construct and maintain fences along the perimeter of CVRP
   b. Maintain existing roads and trails for fence maintenance and emergency access
8. On-site Property Management
   a. Hire a property maintenance technician to patrol, maintain, and protect the habitat, fences, and other facilities that are pertinent to protecting habitat

9. Community Support
    a. Build community support, coordinate with adjacent landowners, and increase public awareness of the conservation goals and strategies for CVRP
    b. Notify local governments, conservation groups, law enforcement agencies and others of the conservation status of CVRP
10. Conservation Easement
    a. Establish a conservation easement on CVRP according to the terms of the RHCP

B. Strategies to Achieve Management Objectives

Under the terms of the RHCP, FWS will meet with SRP annually to evaluate the effectiveness of management practices on protecting, maintaining, or enhancing populations of flycatchers and cuckoos on CVRP (SRP 2002). FWS may suggest modifications to these strategies as necessary to benefit these bird species.

Objective 1: Human and Vehicular Trespass, Vandalism

a. Manage the property so that it minimizes opportunities for human and vehicular trespass and discourages vandalism

Background

Local residents have had access to this property and have used it as a recreational resource for many years. Most of the recreational activities are low impact and include hiking and fishing. However, more destructive recreationists also frequent the area, especially off-road vehicle (ORVs) users. ORVs destroy habitat, fragment ecological communities by creating trails through them, and create sound and dust pollution that can disturb native fauna, particularly breeding animals.

Until recently, the sand and gravel operations of Mahan Materials limited the amount of recreational use CVRP received; however, since the cessation of mining activities, trespass by ORVs has become more frequent.

Currently, vehicles can access CVRP using a dirt road that parallels I-17 on the upstream side and continues under the I-17 bridges onto CVRP, connecting with North Roundup Road. The Town of Camp Verde owns the property on the upstream side of I-17. SRP is unable to fence this access point because fencing at this location could result in trapping of debris during a flood event that might impact the integrity of the I-17 bridges. North Roundup Road is the access point on the downstream side of the bridge, running parallel to I-17. Local residents regularly use this “short-cut” between neighborhoods, so blocking access with fences and gates will require community education and coordination with town officials.

Access issues also exist on the northern boundary of the property. A few of the residential property boundaries extend beyond the left bank into, what is currently, the active channel. Fortunately, these landowners maintain fences on the terrace. But it should be recognized that SRP has no control over the condition or location of these fences.

Actions

- SRP will fence the perimeter of CVRP, where possible (see Figure 1).
- SRP staff will meet with Town of Camp Verde officials to discuss and resolve access issues and trespass problems leading from their property on the north side of I-17 bridge.
- SRP will work with the local community to limit and eventually eliminate access at North Roundup Road. A progressive approach is proposed as follows:
    - Place signage on the road at the property boundary
    - Send letters to neighbors notifying them of the property boundary
    - Coordinate with town officials and local river organizations to educate the public
- Signs will be erected below the bridge, on fences and at all access points to deter trespass by vehicles and people.
- SRP will patrol CVRP regularly to ensure that trespass does not occur; vandalism will be reported to local law enforcement authorities.
- SRP will cooperate with the Town of Camp Verde, The Nature Conservancy, and the State Parks Department in their attempts to plan for recreational use of the river corridor so that flycatcher and cuckoo habitat is protected from disturbance during breeding season.

Objective 2: Fire Management

a. Reduce the potential for fire on CVRP by developing and implementing a fire management plan; adopt a policy of fire suppression on the property

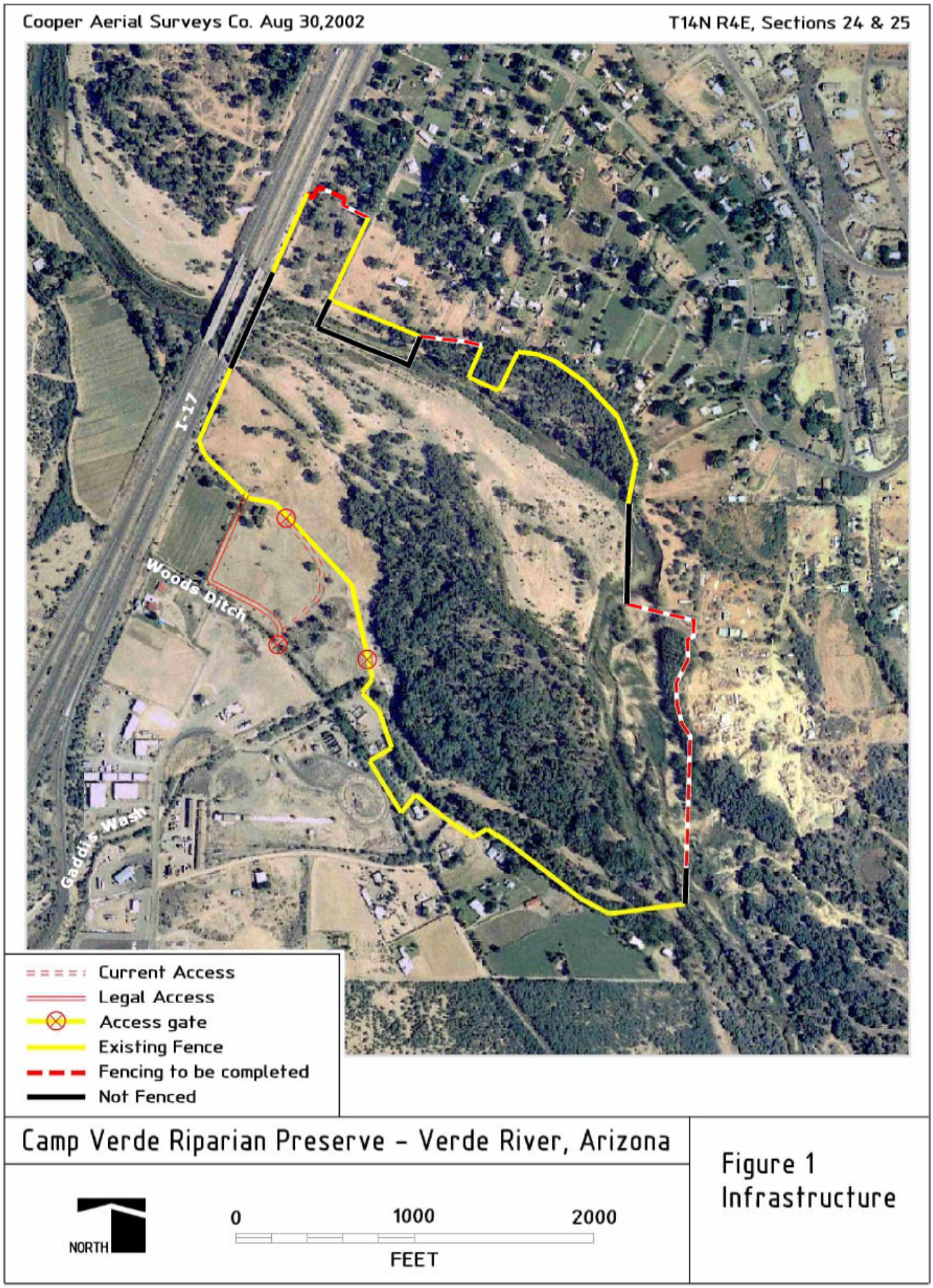
Background

Fire along the main river channel would likely destroy important habitat for flycatchers, cuckoos and eagles and possibly harm human lives as well. In accordance with the conservation goals identified for CVRP, the first priority after preserving human safety is to keep fire out of the cottonwood-willow and salt cedar riparian habitat. Based on predicted fire behavior for the various types of vegetation on CVRP, the highest risk to riparian habitat will occur when all fuel types are exhibiting heat and drought stress (Taecker 2006).

Actions

- Given the management priority of protecting flycatcher and cuckoo habitat on CVRP, a policy of wildfire suppression will be pursued.
- SRP will coordinate fire response with local, state, and federal fire management entities and will develop a site-specific fire management plan for CVRP to be kept on file at the appropriate fire management agencies in the area. The primary objective of the plan will be to outline response protocols in the event that a fire threatens the riparian communities.
- SRP will maintain close coordination with wildfire response agencies.
- A property maintenance technician (see Objective 8) will patrol CVRP regularly to identify potential fire hazards and eliminate them before they become problematic.

- If a condition of high fuel-load build-up exists, a strategy will be developed with FWS and local fire management agencies to minimize fuel loads.
- Educate local community to minimize the threat of fire in CVRP.


Cooper Aerial Surveys Co. Aug 30,2002
T14N R4E, Sections 24 & 25
I-17
Woods Ditch
Gaddis Wash
Current Access
Legal Access
Access gate
Existing Fence
Fencing to be completed
Not Fenced
Camp Verde Riparian Preserve - Verde River, Arizona
NORTH
0
1000
2000
FEET
Figure 1
Infrastructure

Objective 3: Cowbird Management

a. Reduce, to the extent necessary and possible, cowbird parasitism on flycatchers

Background

Brown-headed cowbirds (*Molothrus ater*) can have negative effects on reproductive success of flycatcher females and populations. They parasitize flycatcher nests by laying their eggs in their hosts' nests. Cowbird eggs hatch sooner and the young develop more quickly, so they often out-compete the flycatcher young, which usually results in no flycatcher young surviving to fledge. Cowbirds may also remove the eggs and nestlings of their host species, thereby acting as nest predators. Cowbirds are also quite prolific, laying up to 42 eggs in a two-month breeding season (FWS 2002).

Because of their affinity for forest edges, increases in forest edge due to forest fragmentation can increase parasitism frequency for many forest bird species, including neotropical migrants. Some species of forest-inhabiting neotropical migrants have been found to suffer higher rates of nest parasitism in small, isolated forest tracts than in large unbroken forests. In addition, parasitism levels are often higher in regions with highly fragmented forests than in largely forested landscapes (Smithsonian National Wildlife Park 2004).

Cowbirds parasitize host nests in riparian areas during morning hours, and congregate in feeding areas during afternoon (Thompson 1994). Cowbirds have been shown to commute distances of up to 11 miles from their morning breeding areas to their foraging areas. Tisdale-Hein and Knight (2003) suggest that as long as food resources are adequate within commuting distance of breeding sites (riparian habitat), then the densities of potential hosts likely determine localized cowbird densities during morning hours.

Factors that facilitate increased cowbird impacts include the expansion of suburban and agricultural areas and increased cowbird access to riparian habitat through narrowed riparian zones and habitat fragmentation due to trails or off-highway vehicles (Id.). Some activities related to increased cowbird presence include human-created food sources such as campground crumbs and litter, suburban areas with lawns, food, trash, bird feeders, and golf courses (Id.).

Decisions to initiate cowbird management should be based on a number of site-specific factors, including the host population's current size, recent population trend, parasitism rate, amount of suitable habitat and the extent of the losses attributable to cowbird parasitism (Rothstein et al. 2003). Rates of parasitism fluctuate with geographic location and over time. For example, between 1997 – 2000 cowbird parasitism of flycatcher nests ranged from 6 - 35% on the Verde River, 0 – 2 % on the San Pedro River, and 11 – 29 % on the Colorado River (McCarthy et al. 1998, Paradzick et al. 1999, Paradzick et al. 2000, Paradzick et al. 2001). The impacts of cowbird nest parasitism on some populations are large enough to warrant management efforts such as cowbird trapping.

Results from cowbird trapping studies have suggested that there are significant spatial and temporal differences in trapping effectiveness (Siegle and Ahlers 2004; T. Olsen, pers. comm. 2005; Raulston, pers. comm. 2005; Rourke, pers comm. 2005). Some flycatcher occupied sites located on major migration corridors have not benefited from intensive trapping (i.e., cowbird abundance did not decrease over time with trapping). In other areas, trapping is thought to have caused declines in cowbird abundance and parasitism rates. In

some of these areas, the effects of trapping lasted approximately three years after trapping was ceased (Ryan and White 2004). However, as Braden and McKernan (1999) suggest, a manager's ability to statistically evaluate if trapping is increasing nest success and productivity of flycatchers is confounded by small sample sizes, variation in monitoring and trapping efforts, and the ability to detect changes in parasitism rates. Additionally, trapping may negatively impact non-target neotropical songbird species, which get caught in traps. These results highlight the need to critically evaluate the effectiveness of all suppressive actions and use adaptive management to identify the most beneficial use of resources.

The impacts of cowbird nest parasitism on some populations are large enough to warrant management efforts such as cowbird trapping. The necessity for cowbird trapping on CVRP will be determined through application of a monitoring strategy and subsequent evaluation of information by SRP and FWS. In past years (i.e., 2002, 2003, and 2004), cowbird trapping was conducted by SWCA, Inc. on behalf of Harvard Investments on and adjacent to CVRP (Harvard Investments 2002, 2003). Trapping was part of mitigation requirements for an intended housing development on lands owned by Harvard Investments. The land has subsequently been sold and new development plans no longer have this mitigation requirement.

Actions

Although a landscape approach to cowbird management is recommended (Rothstein et al. 2003), actions taken by SRP to affect cowbird parasitism rates will necessarily be limited to the immediate vicinity of the property because SRP does not have authority over other properties. Below is a list of tiered measures that may reduce parasitism rates. Local habitat improvements (Actions 1 and 2) will be implemented first. If rates continue to be greater than threshold levels, SRP will coordinate cowbird control activities with surrounding landowners and monitor effectiveness for 2 to 3 years. Direct population control will be implemented as a final measure because of the significant logistical difficulties, limited spatial and temporal effectiveness, and effects to non-target songbirds. Also, delay will allow for habitat measures to be fully implemented and assessed.

1) Implement activities listed in the management plan that support the protection and enhancement of a naturally functioning system that will support a diverse mosaic of riparian vegetation communities. Examples of these activities may include:
   - Fencing riparian areas to exclude livestock to prevent the formation of trails and to eliminate grazing pressure on riparian habitat.
   - Revegetating or allowing natural recovery of trails and livestock- or human-disturbed areas.
   - Minimizing human activity on the mitigation properties and limiting activities to small areas away from riparian zones.
2) Coordinate cowbird control activities with adjacent landowners and preserve managers.
   - Communicate with agencies and local preserve managers to understand cowbird impacts on flycatcher populations on a larger scale.
   - Work with adjacent landowners, to the extent possible, to minimize activities that might increase cowbird populations in the area and to protect or enhance riparian habitat.
3) Implement direct cowbird population management.
   - Trapping

- Trapping will be conducted according to established protocols (Siegle and Ahlers 2004).
- Plans for trap placement, humane disposal and methods of removal of non-target species will be determined with input from FWS and AGFD.
- Trapping will be conducted at 1 to 3 year intervals, and post project monitoring (1 to 3 years) will be used to evaluate effectiveness, and provide data for adaptive management strategies. Cowbird parasitism rates, inter-annual parasitism rates variation at other flycatcher sites, and flycatcher population trends will also be considered when assessing trapping effectiveness.

- Removal of cowbird eggs or nestlings or addling of cowbird eggs may be performed by qualified field workers. Nest monitoring protocols and recommendations by FWS and AGFD will be followed to limit disturbance.
- Other techniques that may be tested and found to be effective in the future will be considered.

Objective 4: Habitat Restoration and Enhancement

a. Evaluate the need for habitat restoration and implement as necessary

Background

The river bottom contains high quality riparian habitat dominated by a Fremont cottonwood-Goodding's willow (*Populus fremontii-Salix gooddingii)* forest interspersed with salt cedar *(Tamarix ramosissima)*, velvet ash *(Fraxinus velutina)*, seep willow *(Baccharis salicifolia)* and coyote willow *(Salix exigua).* The active channel is lined with a variety of emergents, such as cattail, bulrush and spikerush. The riparian community exhibits a diverse age-class, structure and composition and is currently not in need of any restoration or enhancement actions. SRP recognizes that these conditions may be detrimentally affected by natural or man-caused events at some future date.

Portions of the right terrace of CVRP had been grazed extensively prior to SRP's acquisition of the property. The area was mostly denuded of vegetation, but is now dominated by weedy annuals and non-native grasses.

Actions

Existing riparian vegetation is of high quality. Therefore, there are no immediate plans to conduct habitat restoration or enhancement activities within the riparian corridor on this property. As part of the monitoring strategy, SRP will periodically evaluate habitat conditions (see Section VII. Monitoring).

In the future, if riparian habitat is detrimentally affected by an event, SRP's response will be to allow natural processes to restore riparian vegetation on site. If SRP determines that (1) natural processes will never adequately restore riparian habitat, (2) the site might benefit from enhancement or restoration and (3) enhancement or restoration is feasible, then a plan will be carefully developed and discussed with FWS.

Objective 5: Livestock Grazing

a. Manage CVRP so that it remains free from livestock grazing

Background

Two small herds of cattle graze on lands adjacent to the south and southwestern boundaries of CVRP. Minor incidences of livestock trespass may occur in these locations due to damaged fences or gates left open.

Actions

- Fence lines will be patrolled regularly and fences will be repaired quickly if there is a breach. Owners of trespass livestock will be contacted and livestock will be removed as quickly as possible.

Objective 6: Invasive Plant and Weed Control

a. Reduce or prevent, to the extent necessary and possible, proliferation of noxious and invasive herbaceous plant species

Background

Noxious and invasive plants are spreading rapidly throughout the western United States, choking out native species, damaging the health of the land and, in some cases, causing serious economic hardships. These plants have spread at an alarming rate because, unlike native species, there are no native herbivores, insects, fungi, or diseases to control their growth and spread in this country. Because of aggressive growth habits, invasive weeds often out-compete native plants, reducing plant diversity, altering plant composition, and destroying wildlife habitat (National Invasive Species Council 2001).

Infestation by some species results in monocultures with high fuel loads. Fire can actually benefit some weed species, giving them a competitive advantage over more shallow-rooted plants. Invasive aquatic plants can clog waterways, degrade water quality, deplete oxygen in the water, block out light, impede movement of fish and aquatic wildlife, increase the potential for mosquito habitat, slow water movement, and increase fine sediment deposits (National Invasive Species Council 2001).

Noxious and invasive plants are spread in many ways. Some seeds travel by natural means using wind and water, or by hitchhiking on wildlife, horses, livestock, and people. In addition, seeds can become embedded in the tire treads of motorized vehicles (National Invasive Species Council 2001).

The proximity of I-17 to CVRP makes this site particularly vulnerable to invasion. The spread of invasive and noxious weed seeds to CVRP from cars driving on I-17 adjacent to the property is a concern. Adjacent residential developments may provide a source for invasive plants that are planted as ornamentals. The river may also carry seeds onto the property from upstream sources.

Early detection and eradication of small infestations and prevention of new infestations provide the most cost-effective way to manage weeds. Effective management may require cooperation with all affected landowners, agencies, industries, and user groups (National Invasive Species Council 2001).

Actions

- SRP will monitor CVRP for presence and/or proliferation of invasive plant species. When a noxious or invasive plant that is not readily identifiable is suspected to be present on CVRP, the entire plant will be collected with roots and pressed in a plant press or large book or placed in a paper bag. Arrangements will be made to take the plant to one of the following for positive identification: Northern Arizona University Herbarium, Arizona State University Vascular Plant Herbarium, or the nearest Cooperative Extension office (Cottonwood).
- Where feasible, SRP will work to remove invasive or noxious plants (not including removal of tall, dense salt cedar, which is used by willow flycatchers and occasionally by cuckoos for nesting and foraging). Research will be conducted to determine the most effective and least environmentally harmful methods of removing noxious and invasive plants.
- Because these plants can often result in increased fuel loads, inspection and removal activities will be part of a fire-risk reduction program.

b. Prevent the creation of a monotypic stand of salt cedar

Background

Salt cedar is a needle-leaved deciduous tall shrub or short tree that was introduced from Eurasia at the end of the eighteenth century as an ornamental and, later, for erosion control. It has become extensively naturalized in the western United States, particularly since the 1920s, invading lowland river floodplains of the southern Rocky Mountains and the Southwest.

Like cottonwoods and willows, salt cedar establishes itself in moist alluvium, but unlike these natives that have a seed-production period of weeks, salt cedar will bloom and set prolific amounts of seed over a 5-month fruiting period. As a result, salt cedar sets viable seeds throughout the growing season, making them available for germination whenever soil moisture is adequate and competition from other phreatophytic woody species is minimal. Salt cedar also appears to establish successfully across a wider range of moisture and soil conditions than either broadleaf cottonwoods or Goodding's willow (Stromberg 1997). However, in a river system with a relatively natural hydrograph, such as the Verde River, cottonwoods and willows appear to be able to maintain dominance and even increase in the face of salt cedar encroachment (Stromberg 1997).

Salt cedar is now a naturalized component of the riparian forest system and provides nesting habitat for the flycatcher. However, because salt cedar duff is highly flammable, large increases in salt cedar stands may increase the chances of a wildfire in the riparian zone. Because of the increased risk of fire, active management strategies will be undertaken to inhibit the increase of salt cedar and thereby promote the recruitment of native riparian trees on this site.

Actions

- In the absence of a recruitment event, salt cedar tends to attain a competitive advantage over native riparian trees after fire. Therefore, the primary strategy to stem the spread of salt cedar will be fire suppression.

- Salt cedar removal is not considered a high priority at this time. In the future, salt cedar removal would be considered only in areas unoccupied by willow flycatchers (as suggested in the *Final Recovery Plan: Southwestern Willow Flycatchers*; FWS 2002) to encourage development of native vegetation, to replace salt cedar with native riparian vegetation, or to reduce a high fire risk.

Objective 7: Facilities Management

a. Construct and maintain fences along the perimeter of CVRP

Background

See discussion under Objective 1.

Actions

- CVRP perimeter will be fenced where feasible (see Figure 1). It is not possible to fence across the active river channel or along property boundaries that lie within the active river channel.
- A property maintenance technician (see Objective 8) will patrol the fence line on a regular basis and repair it as necessary.

b. Maintain existing roads and trails for fence maintenance and emergency access

- Two points of access to the property will be maintained, one on the north side at North Roundup Road and one on the south side at the point of legal access (see Figure 1).
- An informal foot trail exists along the left terrace of the river. This trail crosses both CVRP and private lands. The trail does not approach flycatcher territories. SRP will coordinate with neighbors on this bank of the river regarding any opportunities or problems this trail may present.

Objective 8: Property Management

a. Hire a property maintenance technician to patrol, maintain, and protect the habitat, fences, and other facilities that are pertinent to protecting habitat

Background

CVRP will need a regular on-site presence to conduct many of the activities that are outlined in this management plan and for regular maintenance purposes.

Actions

SRP will hire a property maintenance technician to perform the following tasks, at a minimum:

- Checking fence lines at least once a week on average (SRP 2002) and after every flood, making repairs as necessary.
- Patrolling regularly for trespass cattle, OHV use, human trespass, and potential fire hazards.
- In the case of livestock trespass, locating the rancher/owner and arranging for livestock removal.

- Coordinating with the Verde Natural Resource Conservation District, local fire district, wildfire response agencies, and other local groups.
- Coordinating with the conservation easement holder (see Objective 10).

Objective 9: Community Support

a. Build community support, coordinate with adjacent landowners, and increase public awareness of the conservation goals and strategies for CVRP

Background
Although CVRP is located in a rural community, it is surrounded by residential, commercial and light industrial development. The Town of Camp Verde is projected to increase in population in the years to come, placing even more pressure on the natural resources and habitats of the Verde River. Protecting CVRP will require coordination with community leaders, citizens, organizations and other agencies.

Actions

- SRP will cultivate relationships with agencies and private landowners to enhance cooperation for protecting endangered species, and for improving and protecting the riparian area for flycatcher and cuckoo breeding habitat.
- Notification will be sent to adjacent landowners and to the agencies listed in Section IX of this document informing them of the location and conservation status of the property.

Objective 10: Conservation Easement

a. Establish a conservation easement on CVRP according to the terms of the RHCP

Background

The RHCP states SRP will place a conservation easement on all mitigation acreage to ensure permanent protection, management and monitoring of these lands consistent with the provisions of the RHCP (SRP 2002:125).

Actions

- SRP will place a conservation easement on CVRP following the fee title purchase of the property. The conservation easement holder will be an agency or organization acceptable to FWS. The form of the easement is provided in Appendix 6 of the RHCP (SRP 2002).

V. MEASURES OF SUCCESS

Measures of success will be used by SRP to evaluate whether management actions are working to achieve the conservation goals and to adjust those actions when necessary. According to the RHCP (SRP 2002), the following measures are to be used to determine success:

- The anticipated amount of tall, dense riparian vegetation and other habitat suitable for flycatcher and cuckoo occupation is achieved, maintained, or increased
- Use of the site by flycatchers and cuckoos for breeding or an eventual increase in the numbers of flycatchers and cuckoos using already established breeding areas, as determined through surveys

- Water table depth is maintained or decreased over time and surface water is available to the largest extent practicable, taking into account climatic cycles
- Adverse livestock grazing is eliminated from riparian areas
- Adverse recreational use of the area (particularly ORVs) is substantially reduced or eliminated

VI. MONITORING

1. ELEMENT TO BE EVALUATED:

   Amount of tall dense riparian vegetation and other suitable habitat for flycatcher and cuckoo occupation

   MONITORING STRATEGY:

   a. Qualitative Vegetation Survey

   Field observations of the vegetation type, structure, density and extent will be collected during flycatcher and cuckoo surveys. Field observations will be recorded on the form found in Appendix C. (RHCP 2002: 163-164.)

   b. Aerial Photography

   A baseline aerial photograph was taken in November 2003 (see Appendix A and Baseline Inventory). Repeat aerial photographs will be taken periodically and compared to baseline conditions. Aerial photographs will be taken: (1) if some catastrophic event occurs, such as a flood or fire, (2) if flycatcher and cuckoo populations decline for no apparent reason, or (3) approximately every 5 years if neither of the triggers in (1) and (2) have occurred during the interim period.

   c. Ground Photography

   Permanent photo points will be established on the property. Repeat photographs will be taken annually during the growing season and after any catastrophic event (such as flood or fire) to maximize the ability to observe changes over time in vegetation and habitat conditions. Standardized forms will be used to record photo point information and photographs. See Appendix D for photo point data forms.

2. ELEMENT TO BE EVALUATED:

   Number of flycatcher and cuckoo territories

   MONITORING STRATEGY:

   a. Southwestern Willow Flycatcher

   SRP will conduct flycatcher surveys in the first two years following acquisition in order to establish a baseline. Surveys will be conducted using appropriate protocols to determine the location of the centers of territories. Survey protocols described in Sogge et al. (1997) will be used, unless directed otherwise by FWS.

   In addition to surveying the number of birds at each site, the number and locations of nests/territories will be noted where observed. Field biologists conducting the survey will be instructed to look for nests and signs of parasitism and to assess other biological conditions on the property after conducting the morning survey. (See RHCP 2002:163.)

After initial baseline surveys have been completed, populations will be surveyed every other year on average, but not less than every third year. The specific frequency of survey will be determined during the annual meeting with FWS.

Occasional nest monitoring will be implemented if a declining trend in number of birds is observed, and FWS and SRP find that an evaluation of productivity would be of assistance in managing the property. Nest monitoring will be conducted using AGFD techniques (Rourke et al. 1999) unless otherwise agreed by SRP and FWS.

During surveys, banded individuals will be noted and movements will be determined. All survey information will be shared with AGFD, USGS, and FWS, and will be summarized in annual reports submitted to FWS.

b. *Yellow-billed Cuckoo*

SRP will conduct cuckoo surveys in the first two years following acquisition in order to establish a baseline. Surveys for presence/absence will be conducted according to protocols described in Laymon (1998), Corman and Magill (2000) and Halterman (2002), unless directed otherwise by FWS.

In addition to surveying the number of birds at each site, the number and locations of nests/territories will be noted where observed. Field biologists conducting the survey will be instructed to look for nests and to assess other biological conditions on the property after conducting the morning survey. (See RHCP 2002:163.)

After initial baseline surveys have been completed, populations will be surveyed every other year on average, but not less than every third year. The specific frequency of survey will be determined during the annual meeting with FWS.

Occasional nest monitoring will be implemented if a declining trend in number of birds is observed, and FWS and SRP find that an evaluation of productivity would be of assistance in managing the property. Nest monitoring will be conducted using appropriate techniques agreed to by SRP and FWS.

During surveys, banded individuals will be noted and movements will be determined. All survey information will be shared with AGFD, USGS, and FWS, and will be summarized in annual reports submitted to FWS.

3. ELEMENT TO BE EVALUATED:

Cowbird parasitism on flycatcher nests

MONITORING STRATEGY:

As part of HCP implementation, SRP will conduct presence/absence flycatcher surveys at each mitigation property. However, protocol surveys (Sogge et al. 1997) alone are inadequate to document incidence of cowbird nest parasitism. Additionally, intense nest monitoring that adheres to the nest check guideline in Rourke et al. (1999) was designed to assess nest success and productivity, which is beyond the required scope of HCP monitoring and would cause unneeded disturbance to nesting flycatchers. Rather, SRP will locate and check flycatcher and common surrogate species nests for cowbird parasitism at a reduced frequency compared to nest monitoring guidelines to minimize human disturbance but at an interval which satisfies data needs.

Researchers working on the Bill Williams and Colorado rivers have found that parasitism

rates of surrogate species between 1999-2004 were equal to or greater than flycatcher parasitism rates (Ryan and White 2004). Similarly, Braden and McKernan (1999) note that absolute nest parasitism rates (i.e., # nests parasitized/total # nests) overestimates affects of parasitism on nest success because not all parasitized nests will fail, some nests may fledge both cowbird and flycatcher young, and some parasitized nests will fail regardless of parasitism due to other factors (e.g., predation). Thus, flycatcher and surrogate nests will provide a very conservative assessment of cowbird parasitism impacts.

As parasitism data is gathered and assessed, SRP will work with FWS to institute a tiered approach to suppress cowbirds at mitigation properties if needed. Monitoring activities will also provide data to assess suppression effectiveness and adaptively manage conservation efforts.

a. *Monitoring Method*

SRP will conduct nest searches following each protocol survey at occupied sites. Because flycatcher nests are difficult to locate and sample size may be small, parasitism data will be supplemented using nest checks of common surrogate species (e.g., yellow warbler, common yellow throat, bells vireo, yellow-breasted chat, song sparrow, Abert's towee). Searches and nest checks will occur late morning, afternoon, or the morning following each survey. The goal will be to locate and check ≥ 10 active nests at each "site" (or group of properties on a river reach) during each survey period. Data will be collected on nest stage and contents (flycatcher and cowbird eggs and/or nestlings). Sampling precautions identified in Rourke et al. (1999) will be followed to limit disturbance to adults and nestlings.

Three nest checks per season will be sufficient to evaluate parasitism impacts because 1) cowbird breeding season peaks prior to peak flycatcher nesting season, thus nest checks of flycatcher and surrogate species will provide a conservative estimate of parasitism rates (Rourke, pers comm. 2005); and 2) the flycatcher nesting cycle from egg laying to fledging requires 27-28 days (Rouke et al. 1999), thus there is high probability that 1 to 2 nest checks will occur during this period to capture incidence of parasitism.

b. Monitoring Frequency

Nest searches will be performed at all flycatcher occupied mitigation properties to establish a baseline (2 consecutive years). If rates are low (<30%, but see threshold rate discussion below), nest searches to determine parasitism rate will be performed on the same schedule as presence/absence surveys, as established in the RHCP. If, in later years, rates increase above threshold levels, SRP will conduct two consecutive years of nest checks to confirm high rates at which point mitigation strategies may be implemented.

c. Reporting and Assessing Parasitism Rates

Parasitism rates of flycatchers, and the combined rate of flycatcher and surrogate species will be reported at the end of each breeding season (parasitism of individual nests will not be counted more than once). Parasitism rates will be reported as:

1) # flycatcher parasitized nests/# flycatcher nests
2) # all parasitized nests/# all nests

d. Threshold Rate

FWS and SRP will review parasitism rate monitoring data to determine the need to consider management actions. The significance (impact) of parasitism rates and need to institute suppressive actions will consider the threshold recommendation in the Recovery Plan and the more conservative methodology, i.e., incorporating data from common surrogate species that tend to have higher rates of parasitism. Our proposal is to set the threshold at 30%. However, FWS in cooperation with SRP may adjust threshold rates based on monitoring results, trend in flycatcher abundance at the site, and future cowbird-songbird research results at other study areas.

If rates are found to be above the threshold level during 2 consecutive years of monitoring, FWS may require SRP to institute suppressive actions at flycatcher occupied sites. SRP will confer with FWS to determine if suppressive strategies are needed and likely to be effective, and identify methods for evaluating effectiveness of those strategies. SRP will implement suppressive strategies if required by FWS and will monitor their effectiveness.

4. ELEMENT TO BE EVALUATED:

Groundwater levels

MONITORING STRATEGY:

Although water table depth and surface water flows are listed as factors in measuring management success, collection of these data will not influence future management decisions or actions. Future changes in groundwater levels and surface flows will be dictated primarily by factors that are not within SRP's control, such as climatic variations, weather patterns, watershed activities and adjacent land uses. Therefore, groundwater levels will not be monitored on the property. However, SRP has two low-flow stream gages installed on the Verde River. Impacts to base flows on the river will be recorded and monitored at those gages.

5. ELEMENTS TO BE EVALUATED:

Reduction or elimination of livestock and recreational (ATV) trespass

MONITORING STRATEGY:

See Actions listed under Management Objectives 5 and 7.

VII. IMPLEMENTATION PLAN

The next steps toward implementation of this Management Plan are presented in Appendix B as an "action matrix." Included in this table is a series of actions to be taken over the next 2 years, a priority ranking for each action, the status of each action, and a list of the entities participating in task completion. The matrix is organized according to the management objectives listed in this document.

Management activities will be reviewed annually by SRP and FWS and will be amended to the extent required by changed circumstances.

VIII. LAWS AND POLICIES PERTAINING TO THE MITIGATION PROPERTY

The agency activities, laws, and policies that apply to CVRP are described in the *Baseline Inventory*.

IX. LIST OF CONTACTS AND OTHER RESOURCES

The following agencies have been notified that CVRP is being protected as mitigation habitat and will be provided a copy of the management plan. Contact information is provided for each agency.

Agency	Contact Information
US Fish and Wildlife Service	Greg Beatty Lead biologist – RHCP Implementation Lead biologist – Southwestern willow flycatcher 2321 W. Royal Palm Rd., Suite 103 Phoenix, AZ 85021-4951 Phone: 602-242-0210 ext. 247 Fax: 602-242-2513 Jennifer Graves Lead biologist - Yellow-billed cuckoo Biologist Phone: 602-242-0210
Arizona Game and Fish Department	Bob Broscheid Manager Habitat Branch 2221 W. Greenway Rd. Phoenix, AZ 85023-4312 Phone: 602-789-3605 Heather English Willow Flycatcher Survey Coordinator Phone: 602-789-3589
Yavapai County Sheriff's Office	Steven Waugh County Sheriff Yavapai County Sheriff's Department 3505 West Hwy 260 Camp Verde, AZ 86322 Front desk: 928-567-7710 Fax: 928-567-7740 http://www.co.yavapai.az.us/departments/Shf/ShfHome.asp

Agency	Contact Information
Yavapai County Supervisor's Office	Administrative Services Verde Valley Complex 10 South 6th Street Cottonwood, AZ 86326 Phone: 928-639-8110 Fax: 928-639-8146
Coconino National Forest	Ken Anderson District Ranger Red Rock Ranger District P.O. Box 300 250 Brewer Rd. Sedona, AZ 86339 Phone: 928-282-4119 Fax: 928-203-7539
Prescott National Forest	Dee Hines, District Ranger Verde Ranger District PO Box 670 300 East Hwy 260 Camp Verde, AZ 96322 Phone: 928-567-4121 Fax: 928-567-1179
Town of Camp Verde	Bill Lee Town Manager P.O. Box 710 473 South Main Street, Suite 102 Camp Verde, AZ 86322 Phone: 928-567-6631 ext. 102
Town Marshall's Office	33 Moser Lane P.O. Box 710 Camp Verde, Arizona 86322 Administration: 928-567-6621 Emergency: 911
The Nature Conservancy	Dan Campbell Verde Program Manager Verde Program Office 122 N. Cortez St., Suite 209 Prescott, AZ 86309 Office: 928-717-2843 Cell: 928-308-3274 Email: dcampbell@tnc.org

	Jean Calhoun Director of External Affairs Phoenix Office Phone: 602-322-6989
Verde Valley Weed Management Association	Kelly Spleiss Verde Ranger District Prescott National Forest Phone: 928-567-1126 kspleiss@fs.fed.us
Invasive and Noxious Plant Resources	
US Forest Service	www.fs.fed.us/invasivespecies
Weed Science Society of America	www.wssa.net
Southwest Exotic Plant Information Clearinghouse	www.usgs.nau.edu/swepic

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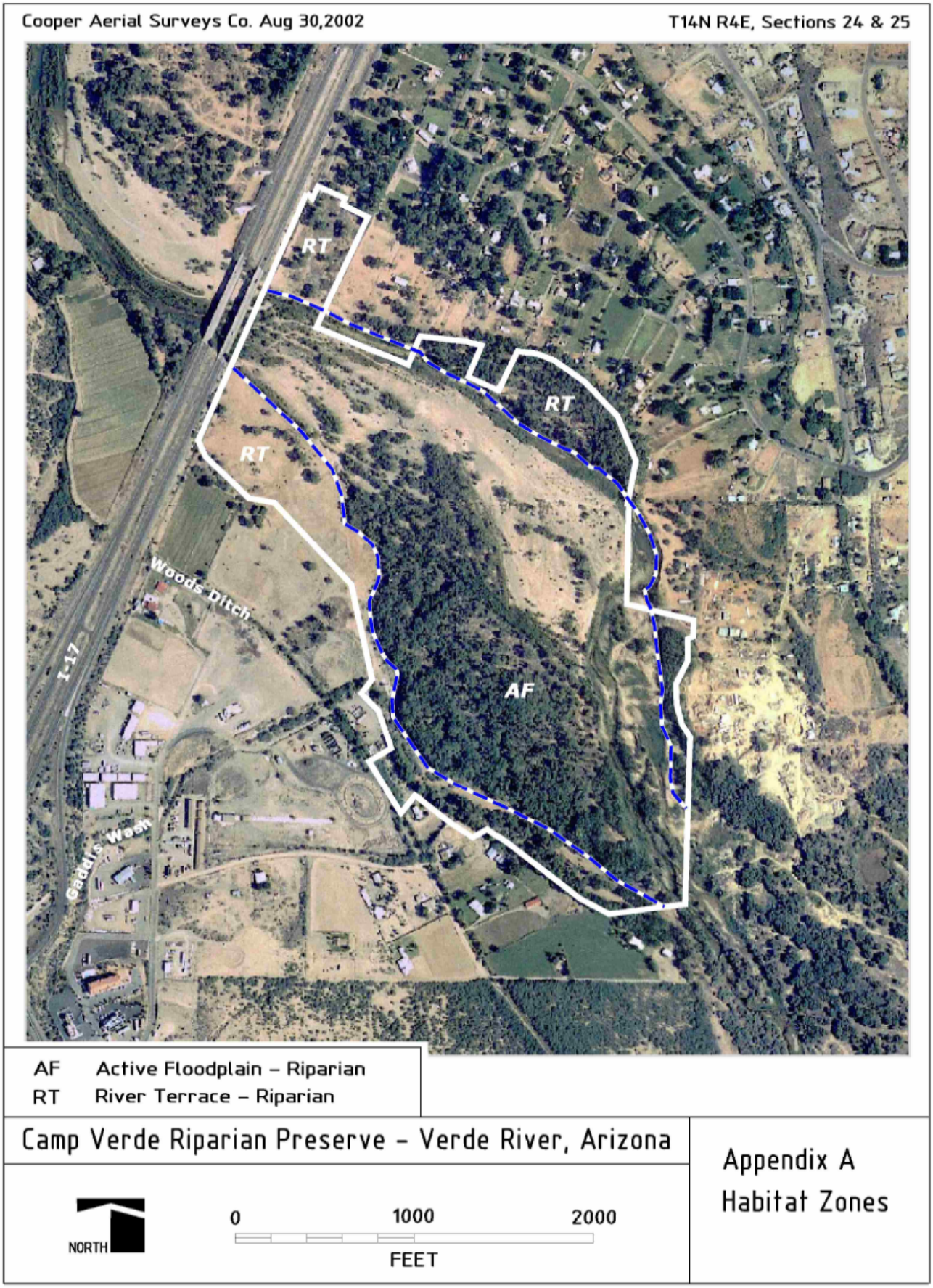
Appendix A

Habitat Zones


Cooper Aerial Surveys Co. Aug 30,2002
T14N R4E, Sections 24 & 25
RT
RT
RT
Woods Ditch
I-17
AF
Gaddis Wash
AF Active Floodplain – Riparian
RT River Terrace – Riparian
Camp Verde Riparian Preserve – Verde River, Arizona
Appendix A
Habitat Zones
NORTH
0
1000
2000
FEET

Appendix B

Implementation Matrix

Table 1. **Implementation matrix – Activities proposed for 2005 and 2006.**

Management Actions	Status	Target Date	Department
1. Human and Vehicular Trespass, Vandalism			
Meet with Town of Camp Verde officials to discuss management issues	Recurring	In process	SRP Env. Svc.
Install signage at access points and fences	Completed	July 2005	SRP Env. Svc. Contractor
Send letters to neighbors notifying them of property boundary and purpose	Re-survey in process	Postponed	SRP Env. Svc.
Coordinate / cooperate with Camp Verde, State Parks, TNC on recreational planning for corridor	In process	As necessary	SRP Env. Svc.
Patrol site regularly and report vandalism to local law enforcement	Ongoing	Conducted weekly, on average	Contractor
2. Fire Management			
Develop a fire management plan in coordination with fire management agencies	Completed	August 2005	SRP Env. Svc. Contractors
Patrol site regularly to identify and eliminate potential fire hazards	Ongoing	Conducted weekly, on average	Contractor
Make initial contact and maintain close coordination with wildfire response agencies	Completed/ongoing	August 2005	SRP Env. Svc. Contractor
Install signage to heighten awareness of fire risk on property	Completed	July 2005	SRP Env. Svc. Contractor
3. Cowbird Management			
Coordinate with agencies or landowners that may be conducting surveys or trapping in the vicinity	Completed/ongoing	Annually	SRP Env. Svc.
Clean up any garbage on-site that may attract cowbirds	Ongoing	As necessary	Contractor
Conduct cowbird trapping, if appropriate	Not started	TBD at Annual Meeting w/ FWS	SRP Env. Svc. Contractor
4. Habitat Restoration or Enhancement			
Conduct site evaluation to determine whether enhancement or restoration is necessary or appropriate at this time	Completed	September 2005	SRP Env. Svc.
Investigate whether SRP has ditch rights on Woods Ditch	Completed	September 2005	SRP Land Dept.
5. Livestock Grazing			
Patrol CVRP and maintain fences	Ongoing	Conducted weekly	Contractor
Remove any trespass livestock	Ongoing	As necessary	Contractor

Continued on next page

6. Invasive Plant and Weed Control			
Conduct survey to identify presence of invasive or noxious plants	Initiated	Spring/summer 2006; annually	SRP Env. Svc. Contractor
Develop a plan to eliminate or minimize problem species; initiate removal or control activities	Initiated	As necessary	SRP
Communicate findings and coordinate activities with N. Arizona noxious weed control group	Initiated	As necessary	SRP Env. Svc.
7. Facilities Management			
Finish constructing fences, where possible	Completed	November 2005	Env. Svc. Contractor
Maintain existing access roads for emergency access	Ongoing	As necessary	Contractor
Coordinate with neighbors on northern boundary regarding use of informal trail on left terrace	Ongoing	Ongoing	SRP Env. Svc. Contractor
8. On-Site Property Management			
Hire a property maintenance technician	Completed	April 2005	SRP Env. Svc.
Patrol property and conduct necessary maintenance activities	Ongoing	Conducted weekly, on average	SRP Env. Svc. Contractor
9. Community Support			
Cultivate relationships with agencies and private landowners to solicit cooperation in protecting habitat	Initiated	Ongoing	SRP Env. Svc. Contractor
Send letters to adjacent landowners with boundary map	In process	Once boundary issues have been resolved	SRP Env. Svc.
Give presentation to Verde Watershed Association	Completed	March 2005	SRP Env. Svc.
Meet with town officials and other organizations	Completed/ongoing	March 2006	SRP Env. Svc.
10. Conservation Easement			
Locate an entity to hold the conservation easement	Initiated	TBD	Env. Svc. Land
Complete conservation easement	Not started	TBD	Env. Svc.

Appendix C

Report Preparers and Reviewers

Ruth Valencia	Senior Environmental Scientist, SRP
Kay Nicholson	Biologist, Logan Simpson Design Inc.
Jason Fischer	Biologist, Logan Simpson Design Inc.
Jennifer Ashbeck	Project Manager/Biologist, Logan Simpson Design Inc.
Lynn Bredimus	Cartographer, SRP

APPENDIX 9
NATIVE FISH MITIGATION MEASURES

As summarized in Subchapter V.D.1, the Committee evaluated numerous possible mitigation actions in a Mitigation Matrix to convert those actions into benefits to river miles of native fish habitat (Committee 2006). The Matrix is provided below in Table 1. The columns in Table 1 are defined as follows:

Column A (Proposed Action) — List of possible mitigation and minimization activities (collectively, "mitigation actions") evaluated by the Committee.

Column B (Total River Miles Available for Credit) — Total river miles potentially suitable and feasibly available for the mitigation action based on the impact analysis in Subchapter IV.B.4.b.

Column C (Percentage Contribution From SRP) — Percentage contribution from SRP to the mitigation actions; 100 percent unless it is a shared project.

Column D (Net River Miles Available) — Product of Columns B and C.

Column E (Criteria = Directly Mitigates Take) — Relative degree (0 to 100 percent) that the mitigation action directly mitigates or minimizes the take of covered species or potential adverse modification of critical habitat resulting from the proposed action (e.g., stocking native fish in or above Horseshoe mitigates take from stranding/internment caused by reservoir operations).

Column F (Criteria = Geographic Relationship) — Geographical relationship of the mitigation action to impacted areas (0 to 100 percent, with areas close to the reservoirs valued higher than more distant locations).

Column G (Criteria = Number of Native Species) — Number of native species benefited by the mitigation action (0 to 100 percent, mitigation actions that benefit more species of native fish are valued higher than actions that benefit a single species).

Column H (Criteria = Effectiveness of Action) — Relative effectiveness (0 to 100 percent) of the proposed mitigation action to accomplish the stated objective. In particular, actions that potentially lead to self-sustaining populations are valued higher than actions dependent on perpetual management.

Column I (Overall Criteria Satisfaction) — Average of Columns E through H.

Column J (Total Credit) — Product of Columns D and I.

Table 1. Mitigation Matrix (in river miles).

A	B	C	D (BxC)	E	F	G	H	I	J (D x I)
Proposed Action	**Total river miles available for credit**	**Percent contribution from SRP**	**Net river miles**	**Degree of criteria satisfaction (expressed as %)**				**Overall criteria satisfaction (Avg. E-H)**	**Total Credit**
				Directly mitigates take	**Geographic relationship**	**Number of native species**	**Effectiveness of Action**		
Horseshoe rapid drawdown	**7.2**	**100%**	**7.2**	**60%**	**100%**	**80%**	**60%**	**75%**	**5.4**
Horseshoe rapid drawdown (upstream)	**20.1**	**100%**	**20.1**	**60%**	**100%**	**100%**	**60%**	**80%**	**16.0**
Provide for stocking of razorback into or above Horseshoe	**20.7**	**100%**	**20.7**	**100%**	**100%**	**10%**	**30%**	**60%**	**12.4**
Removal of catch limits on nonnative fish below Bartlett	5.6	10%	0.6	10%	100%	30%	10%	38%	0.2
Increase angler access to Horseshoe Lake	7.2	50%	3.6	10%	100%	80%	10%	50%	1.8
Fish barrier installed on Lime Creek	**4.3**	**100%**	**4.3**	**100%**	**100%**	**20%**	**95%**	**79%**	**3.4**
Physical removal of nonnative fish in tributaries	1.5	50%	0.8	90%	30%	70%	75%	66%	0.5
Chemical removal of nonnative fish in tributaries	1.5	50%	0.8	90%	30%	70%	95%	71%	0.5
Physical removal of nonnative fish in mainstem	4.4	0%	0.0	90%	100%	90%	15%	74%	0.0
Chemical removal of nonnative fish in mainstem	17.9	0%	0.0	90%	90%	90%	30%	75%	0.0
Capital improvements to Bubbling Ponds Hatchery	**25.0**	**100%**	**25.0**	**0%**	**100%**	**100%**	**50%**	**63%**	**15.7**
Assist AGFD with stocking native fish	**22.6**	**50%**	**11.3**	**100%**	**80%**	**90%**	**50%**	**80%**	**9.0**
Assist AGFD with research in Horseshoe and upstream	7.2	20%	1.4	0%	100%	20%	20%	35%	0.5

A	B	C	D (BxC)	E	F	G	H	I	J (D x I)
Proposed Action	**Total river miles available for credit**	**Percent contribution from SRP**	**Net river miles**	**Degree of criteria satisfaction (expressed as %)**				**Overall criteria satisfaction (Avg. E-H)**	**Total Credit**
				Directly mitigates take	**Geographic relationship**	**Number of native species**	**Effectiveness of Action**		
Participate and support State Conservation Agreement (SCA)	32.9	20%	6.6	10%	50%	100%	50%	53%	3.4
Develop refugia ponds – Upper Verde	14.2	20%	2.8	10%	10%	100%	20%	35%	1.0
Develop quarantine facility	32.9	50%	16.4	10%	10%	50%	10%	20%	3.3
Spikedace/Loach minnow survey	1.5	100%	1.5	0%	10%	20%	10%	10%	0.2
Fund gravel washing research	0.5	100%	0.5	0%	100%	10%	10%	30%	0.2
Fund Information and Education Program	34.0	5%	1.7	0%	1%	100%	1%	26%	0.4
SRP watershed management efforts	**20.1**	**100%**	**20.1**	**0%**	**30%**	**100%**	**30%**	**40%**	**8.0**
TOTAL									82.0
SRP Mitigation Total Credits (bold actions)									**70.0**

APPENDIX 10
DRAFT IMPLEMENTING AGREEMENT

By and Among
SALT RIVER PROJECT AGRICULTURAL IMPROVEMENT AND POWER DISTRICT,
SALT RIVER VALLEY WATER USERS' ASSOCIATION, and
U.S. FISH AND WILDLIFE SERVICE

TO ESTABLISH A MITIGATION PROGRAM FOR ENDANGERED, THREATENED AND CANDIDATE SPECIES AT HORSESHOE AND BARTLETT RESERVOIRS, MARICOPA AND YAVAPAI COUNTIES, ARIZONA.

This Implementing Agreement (Agreement) is made and entered into as of the ___ day of _____, 2008 by and among the Salt River Project Agricultural Improvement and Power District and the Salt River Valley Water Users' Association (collectively referred to hereinafter as SRP), and the United States Fish and Wildlife Service (referred to hereinafter as FWS).

1.0 RECITALS

This Agreement is entered into with regard to the following facts:

WHEREAS, portions of the riparian vegetation complex located within the conservation storage space at Horseshoe and Bartlett Reservoirs in Maricopa and Yavapai counties, Arizona, are occupied and utilized as habitat by the southwestern willow flycatcher, an endangered species, the bald eagle, a threatened species, and the yellow-billed cuckoo, a candidate species; and

WHEREAS, Horseshoe Reservoir, the Verde River and portions of its tributaries above Horseshoe Reservoir, and the Verde River below Bartlett Reservoir are occupied, or may be occupied during the term of the Agreement, by the following native fish, frog, and gartersnake species: razorback sucker, an endangered species; Colorado pikeminnow, an endangered species; Gila topminnow, an endangered species; spikedace, a threatened species; loach minnow, a threatened species; and roundtail chub, longfin dace, Sonora sucker, desert sucker, speckled dace, lowland leopard frog, northern Mexican gartersnake, and narrow-headed gartersnake, which are species that may be listed; and

WHEREAS, SRP, with technical assistance from FWS, has developed a series of measures, described in the Horseshoe and Bartlett Habitat Conservation Plan ("HCP"), to minimize and mitigate to the maximum extent practicable the incidental take from SRP's continued operation of the conservation storage space at Horseshoe and Bartlett Reservoirs on the subject listed and unlisted species and their associated habitats;

THEREFORE, SRP and FWS do hereby understand and agree as follows:

2.0 DEFINITIONS

The following terms as used in this Agreement shall have the meanings set forth below:

2.1 The term "Agreement" shall mean this Implementing Agreement.

2.2 The term "Compensation Lands" shall mean the 200 or more acres of land acquired and managed by SRP or its designated agent pursuant to the terms of the HCP.

2.3 The term "Covered Activities" shall mean the continued operation of the total conservation capacity at Horseshoe Reservoir that corresponds to a maximum surface elevation of 2,026 feet, and the continued operation of the total conservation capacity at Bartlett Reservoir that corresponds to a maximum surface elevation of 1,798 feet, as described in Subchapter I.B.2 of the HCP, by the Permittee or any successor-in-interest to the Permittee.

2.4 The term "Covered Species" shall mean the species identified in Section 1.0 of this Agreement and covered by the HCP and the Permit.

2.5 The term "Effective Date" shall mean the date as of which FWS issues the Permit.

2.6 The term "ESA" shall mean the Endangered Species Act, 16 U.S.C. § 1531 et seq. Terms defined and utilized in the ESA and implementing regulations shall have the same meaning when utilized in this Agreement, except as specifically noted herein.

2.7 The term "HCP" shall mean the Horseshoe and Bartlett Habitat Conservation Plan, to be implemented by SRP in conjunction with the Covered Activities. Terms defined and utilized in the HCP shall have the same meaning when utilized in this Agreement, except as specifically noted herein.

2.8 The term "Party" or "Parties" shall mean one or more of the parties to this Agreement.

2.9 The term "Permit" shall mean an incidental take permit issued by FWS to SRP pursuant to Section 10(a)(1)(B) of the ESA. Terms utilized and defined in the Permit shall have the same meaning when utilized in this Agreement, except as specifically noted herein.

2.10 The term "Permit Area" shall mean: (1) the Salt River and 100-year floodplain between Granite Reef Dam and the confluence with the Verde River; (2) the Verde River and the 100-year floodplain between the confluence with the Salt River and the upstream end of Horseshoe at full pool, including the total conservation capacity at Horseshoe Reservoir that corresponds to a maximum surface elevation of 2,026 feet, and the lands within the total conservation capacity at Bartlett Reservoir that corresponds to a maximum surface elevation of 1,798 feet; (3) the Verde River between the upper end of Horseshoe at full pool and the Allen Ditch Diversion near Peck's Lake; (4) the lower 0.125 miles of all intermittent and ephemeral streams and washes tributary to the reaches listed above; and (5) the lower 6 stream miles of Lime Creek, the lower 8 stream miles of the East Verde River, the lower 3 stream miles of Fossil Creek, the lower 2 stream miles of West Clear Creek, the lower 12 stream miles of Wet Beaver Creek, and the lower 3 stream miles of Oak Creek.

2.11 The term "Permittee" shall mean SRP.

2.12 The term "Unforeseen Circumstances" shall mean changes in circumstances affecting a species or geographic area covered by the HCP, which could not reasonably have been anticipated by the Parties at the time of the HCP's negotiation and development, and which result in a substantial and adverse change in the status of Covered Species. The term "Unforeseen Circumstances" shall not include Changed Circumstances, as that term is defined in the Permit.

2.13 The term "Unlisted Covered Species" shall mean a Covered Species that is not listed as endangered or threatened under the ESA on the Effective Date. The term "Unlisted Species" includes both candidate species and other species of concern.

3.0 PURPOSES

The purposes of this Agreement are:

3.1 To ensure implementation of each of the terms of the HCP and its associated permit; and

3.2 To describe remedies and recourse should any Party fail to perform its obligations, responsibilities, and tasks as set forth in this Agreement and the HCP.

4.0 INCORPORATION OF HCP AND PERMIT; GOVERNING LAW

4.1 The HCP, the Permit, and each of their provisions are intended to be, and by this reference are, incorporated herein. In the event of any direct contradiction among the terms of this Agreement, the HCP, and the Permit, the terms of the Permit shall control. In all other cases, the terms of this Agreement, the HCP, and the Permit shall be interpreted to be supplementary to each other.

4.2 This Agreement, the HCP, and the Permit, and the Parties' compliance therewith, shall be governed by the ESA and implementing regulations.

5.0 LEGAL REQUIREMENTS

In order to fulfill the requirements that will allow FWS to issue the Permit, the HCP sets forth measures that are intended to ensure that any take occurring within the Permit Area will be incidental; that the impacts of take will, to the maximum extent practicable, be minimized and mitigated; that procedures to deal with unforeseen circumstances will be provided; that adequate funding for the HCP will be provided; and that the take will not appreciably reduce the likelihood of the survival and recovery of the Covered Species in the wild. It also includes measures that have been suggested by FWS as being necessary or appropriate for purposes of the HCP.

6.0 TERM

6.1 This Agreement shall have a duration beginning on the Effective Date, and continuing in full force and effect for a period of 50 years thereafter, or until revocation or surrender and cancellation of the Permit as provided for therein, whichever occurs earlier.

6.2 Unless the Permit is revoked or surrendered and cancelled as provided for therein, the provisions of the HCP and this Agreement requiring the acquisition and management of Compensation Lands as habitat for the Covered Species shall, if permitted by law, be permanent and extend beyond the term of this Agreement. If the Permit is revoked or surrendered and cancelled, the extent, if any, of the Permittee's continuing obligations under the HCP and this Agreement shall be determined in accordance with Subparagraph 6.3 hereof.

6.3 In the event that the Permit is revoked or surrendered and cancelled as provided for therein, the provisions of the HCP and of this Agreement requiring the acquisition and management of Compensation Lands as habitat for the Covered Species shall be permanent and extend beyond the term of this Agreement if permitted by law, but only to the extent necessary to mitigate for take of Covered Species that occurred pursuant to the terms of the Permit, before its revocation or surrender and cancellation, as determined by FWS in collaboration with the Permittee.

7.0 FUNDING

The Permittee commits to fully meeting the actual costs of implementing the HCP, even if actual costs exceed estimates in the HCP. For the first five years that the Permit is in effect, the Permittee shall include in its annual budget such funds as are necessary to carry out the Permittee's obligations under the HCP and this Agreement. No later than five years after the Permit is issued, the Permittee shall ensure that funding is available to meet its continuing obligations under this Agreement and the HCP through an account or accounts solely designated for this purpose. The account or accounts may be in the form of a trust account, irrevocable letter of credit, insurance, or surety bond. The account or accounts must be acceptable to FWS and must be in an amount agreed to by FWS and the Permittee that is sufficient to meet the Permittee's continuing obligations under this Agreement and the HCP.

8.0 RESPONSIBILITIES OF PARTIES IN MITIGATION PROGRAM; IMPLEMENTATION AND MONITORING RESPONSIBILITIES

8.1 Responsibilities of the Permittee

a. The HCP will be deemed properly implemented if the commitments and provisions of the HCP, this Agreement, and the Permit have been or are being implemented in accordance with their terms.

b. The Permittee shall undertake all activities set forth in the HCP in order to meet the terms of the HCP and comply with the Permit, including the adaptive management procedures described in the HCP, if required.

c. As required by Subchapter V.E.3 of the HCP, for each year that the Permit is in effect, the Permittee shall submit an annual report to FWS containing a description of its activities and an analysis of whether the terms of the HCP were met for the reporting period. The report shall be submitted to FWS on or before each February 1 for the previous calendar year and shall provide all reasonably available data regarding impacts to habitat of and effects on the Covered Species and, where requested by FWS, changes to the overall population of Covered Species that occurred in the Permit Area by

the Permit during the reporting period. The report shall also include the following certification from a responsible company official of the Permittee who supervised or directed the preparation of the report:

> Under penalty of law, I certify that, to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of this report, the information submitted is true, accurate, and complete.

d. The Permittee will provide, within 30 days of being requested by FWS, any additional information in its possession or control related to implementation of the HCP that is requested by FWS for the purpose of assessing whether the terms and conditions of the Permit and the HCP, including the HCP's adaptive management plan, are being fully implemented.

8.2 Responsibilities of FWS

a. Upon execution of this Agreement by all Parties, and satisfaction of all applicable legal requirements, FWS shall issue the Permittee a Permit authorizing the incidental take by the Permittee of threatened or endangered Covered Species resulting from the Covered Activities.

b. After issuance of the Permit, FWS shall monitor the implementation of the terms of the Permit, this Agreement, and the HCP in order to ensure compliance by the Permittee. FWS may conduct inspections and monitoring in connection with the Permit in accordance with 50 C.F.R. § 13.47.

c. Provided that the Permittee has complied with its obligations under the HCP, this Agreement, and the Permit, FWS may require measures of the Permittee in addition to those required by the HCP only in accordance with the terms and conditions of the Permit governing Unforeseen Circumstances.

9.0 REMEDIES

9.1 Enforcement of Agreement, Remedies for Breach

Except as provided in Subparagraph 9.2 hereof, each Party shall be entitled to pursue legal action, including the filing of a suit for specific performance, declaratory or injunctive relief, to enforce the terms of this Agreement, the Permit, and the HCP, and to seek remedies for any breach hereof.

9.2 No Monetary Damages, Effect of Agreement on Pre-existing Liabilities, Enforcement Authority of FWS

a. No Monetary Damages. No Party shall be liable in monetary damages to any other Party or other person for any breach of this Agreement, any performance or failure to perform a mandatory or discretionary obligation imposed by this Agreement, or any other cause of action arising from this Agreement.

b. Retain Liability. Except as otherwise provided in Subparagraphs 4.2 and 9.2.e hereof, the Parties shall retain whatever liability they would possess for their present and future acts or failure to act in the absence of this Agreement.

c. Land Owner Liability. All Parties shall retain whatever liability they would possess as an owner of interests in land in the absence of this Agreement.

d. Enforcement of the ESA and Other Applicable Laws by FWS. Except as otherwise provided in Subparagraphs 4.2 and 9.2.e hereof, nothing contained in this Agreement is intended to limit the authority of FWS to seek civil or criminal penalties or otherwise fulfill its enforcement responsibilities under the ESA and other applicable laws.

e. Exception. Notwithstanding Subparagraphs 9.2.b and 9.2.d hereof, as long as the HCP is being properly implemented and the terms and conditions of the Permit are being met, FWS shall not be permitted to seek civil or criminal penalties or otherwise enforce the take prohibitions of the ESA and other applicable laws against the Permittee for incidental take of Covered Species that is in accordance with the terms of the Permit.

10.0 SEVERABILITY

The provisions of this Agreement shall be deemed severable, and if any portion of this Agreement shall be held invalid, illegal, or unenforceable by a federal court, after exhaustion of all available appeals, the remainder shall continue to be effective and binding upon the Parties. Notwithstanding the foregoing, in the event that any portion of this Agreement shall be held invalid, the Parties shall use their best efforts to agree upon amendments to this Agreement that are consistent with the law then existing.

11.0 PRIVATE PROPERTY RIGHTS AND LEGAL AUTHORITIES UNAFFECTED

Except as otherwise specifically provided herein, nothing in this Agreement shall be deemed to restrict the rights of the Permittee to engage in the Covered Activities, or the Permittee's use or development of those lands or water rights, or interests in lands or water rights, constituting the Permit Area; provided, however, that nothing in this Agreement shall absolve the Permittee from such other limitations as may apply to the Covered Activities, or to such lands or water rights, or interests in lands or water rights, under other laws of the United States and the State of Arizona.

12.0 AMENDMENTS TO THE AGREEMENT

12.1 In General

This Agreement may be amended consistent with the ESA and with the written consent of each of the Parties hereto.

12.2 Minor Modifications

Any Party may propose minor modifications to this Agreement by providing written notice to all other Parties. Minor modifications to this Agreement may include, but are not limited to, corrections of typographic, grammatical, and similar editing errors that do not change the intended meaning. The notice of proposed minor modifications provided for in this Subparagraph shall include a description of the proposed minor modification and a statement of the reasons therefor. The Parties will use reasonable efforts to respond to proposed minor modifications to this Agreement within 60 days of

receipt of such notice. Proposed minor modifications to this Agreement will become effective only upon all other Parties' written approval.

13.0 MISCELLANEOUS PROVISIONS

13.1 No Partnership

Except as otherwise expressly set forth herein, neither this Agreement nor the HCP shall make or be deemed to make one Party hereto the agent for or the partner of another Party.

13.2 Successors and Assigns

This Agreement and each of its covenants and conditions shall be binding on and shall inure to the benefit of the Parties hereto and their respective successors and assigns.

13.3 Notice

Any notice permitted or required by this Agreement shall be in writing and shall be delivered personally to the persons set forth below or shall be deemed given five (5) days after deposit in the United States mail, certified and postage prepaid, return receipt requested and addressed as follows or at such other address as any Party may from time to time specify to the other Parties in writing:

Assistant Regional Director, Ecological Services
United States Fish and Wildlife Service
P.O. Box 1306
Albuquerque, New Mexico 87103-1306

Field Supervisor
United States Fish and Wildlife Service
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021

Associate General Manager, Water
Salt River Project
P.O. Box 52025
Phoenix, Arizona 85072-2025

13.4 Entire Agreement

This Agreement, together with the HCP and the Permit, constitute the entire Agreement between the Parties. It supersedes any and all other agreements, either oral or in writing, among the Parties with respect to the subject matter hereof and contains all of the covenants and agreements among them with respect to said matters, and each Party acknowledges that no representation, inducement, promise, or agreement, oral or otherwise, has been made by any other Party or anyone acting on behalf of any other Party that is not embodied herein.

13.5 Elected Officials Not To Benefit

No member of or delegate to Congress shall be entitled to any share or part of this Agreement, or to any benefit that may arise from it.

13.6 Availability of Funds

Implementation of this Agreement and the HCP by FWS is subject to the requirements of the Anti-Deficiency Act and the availability of appropriated funds. Nothing in this Agreement will be construed by the Parties to require the obligation, appropriation, or expenditure of any money from the U.S. Treasury. The parties acknowledge that FWS will not be required under this Agreement to expend any federally appropriated funds unless and until an authorized official of FWS affirmatively acts to commit to such expenditures as evidenced in writing.

13.7 Duplicate Originals

This Agreement may be executed in any number of duplicate originals. A complete original of this Agreement shall be maintained in the official records of each of the Parties hereto.

13.8 Third-Party Beneficiaries

Without limiting the applicability of the rights granted to the public pursuant to the provisions of 16 U.S.C. § 1540(g), this Agreement shall not create any right or interest in the public, or any member thereof, as a third-party beneficiary hereof, nor shall it authorize anyone not a Party to this Agreement to maintain a suit for personal injuries or property damages pursuant to the provisions of this Agreement. The duties, obligations, and responsibilities of the Parties with respect to third parties shall remain as imposed under existing federal or Arizona law.

IN WITNESS WHEREOF, THE PARTIES HERETO have executed this Implementing Agreement to be in effect as of the date last signed below.

BY _____ Date _____

Deputy Regional Director
United States Fish and Wildlife Service
Albuquerque, New Mexico

SUBSCRIBED AND SWORN TO BEFORE ME THIS ___ DAY OF _____, 2008.

_____
Notary Public

BY _____ Date _____

John M. Williams, Jr., President
Salt River Project
Phoenix, Arizona

SUBSCRIBED AND SWORN TO BEFORE ME THIS ___ DAY OF _____, 2008.

_____

APPENDIX 11
DRAFT INCIDENTAL TAKE PERMIT TERMS AND CONDITIONS

(Terms and Conditions Proposed by SRP for Inclusion in the Incidental Take Permit)

Note: Terms A through D are standard FWS conditions and authorizations under Section 11 of the permit form.

E. DEFINITIONS

The following terms as used in this Permit shall have the meanings set forth below:

E.1. The term "Agreement or IA" shall mean the Implementing Agreement by and among Salt River Project Agricultural Improvement and Power District and Salt River Valley Water Users' Association (SRP), and the U.S. Fish and Wildlife Service (FWS) to establish a mitigation program for Covered Species executed by the parties thereto concurrent with the issuance of this Permit. Terms identified and utilized in the IA shall have the same meaning when utilized in this Permit, except as specifically noted herein.

E.2. The term "Changed Circumstances" shall mean the changes in circumstances affecting a species or geographic area covered by the Horseshoe and Bartlett Habitat Conservation Plan (HCP) that are identified in subparagraph O.1 hereof and in the HCP. The term "Changed Circumstances" shall not include Unforeseen Circumstances, as that term is defined in subparagraph E.13 hereof.

E.3. The term "Compensation Lands" shall mean the 200 or more acres of land acquired and managed by SRP or its designated agent pursuant to the terms of the HCP.

E.4. The term "Covered Activities" shall mean the continued operation of the total conservation capacity at Horseshoe Reservoir that corresponds to a maximum surface elevation of 2,026 feet, and the continued operation of Bartlett Reservoir that corresponds to a maximum surface elevation of 1,798 feet, as described in Subchapter I of the HCP, by the Permittee or any successor in interest to the Permittee.

E.5. The term "Covered Species" shall mean the species covered by the HCP and this Permit, as fully set forth herein.

E.6. The term "Effective Date" shall mean the date herein above, as of which FWS issued this Permit.

E.7. The term "ESA" shall mean the Endangered Species Act, 16 U.S.C. § 1531 et seq. Terms defined and utilized in the ESA and implementing regulations shall have the same meaning when utilized in this Permit, except as specifically noted herein.

E.8. The term "HCP" shall mean the Horseshoe and Bartlett Habitat Conservation Plan, to be implemented by SRP in conjunction with the Covered Activities. Terms defined and used in the HCP shall have the same meaning when used in this Permit, except as specifically noted herein.

E.9. The term "Parties" shall mean SRP and the FWS.

E.10. The term "Permit" shall mean this incidental take permit, issued by FWS to SRP pursuant to Section 10(a)(1)(B) of the ESA.

E.11. The term "Permit Area" shall mean: (1) the Salt River and 100-year floodplain between Granite Reef Dam and the confluence with the Verde River; (2) the Verde River and the 100-year floodplain between the confluence with the Salt River and the upstream end of Horseshoe Reservoir at full pool, including the total conservation capacity at Horseshoe Reservoir that corresponds to a maximum surface elevation of 2,026 feet, and the lands within the total conservation capacity at Bartlett Reservoir that corresponds to a maximum surface elevation of 1,798 feet; (3) the Verde River between the upper end of Horseshoe Reservoir at full pool and the Allen Ditch Diversion near Peck's Lake; (4) the lower 0.125 miles of all intermittent and ephemeral streams and washes tributary to the reaches listed above; and (5) the lower 6 stream miles of Lime Creek, the lower 8 stream miles of the East Verde River, the lower 3 stream miles of Fossil Creek, the lower 2 stream miles of West Clear Creek, the lower 12 stream miles of Wet Beaver Creek, and the lower 3 stream miles of Oak Creek.

E.12. The term "Permittee" shall mean SRP.

E.13. The term "Unforeseen Circumstances" shall mean changes in circumstances affecting a species or geographic area covered by the HCP, which could not reasonably have been anticipated by the Parties at the time of the HCP's negotiation and development, and which result in a substantial and adverse change in the status of Covered Species. The term "Unforeseen Circumstances" shall not include Changed Circumstances, as that term is defined in subparagraph E.2 hereof.

E.14. The term "Unlisted Covered Species" shall mean a Covered Species that is not listed as endangered or threatened under the ESA as of the Effective Date. The term "Unlisted Covered Species" includes both candidate species and species of special concern.

F. EXTENT OF INCIDENTAL TAKE; ADHERENCE TO IMPACT ANALYSIS MODEL TO DETERMINE COMPLIANCE

F.1. The Permittee is authorized to "Take" (kill, harm, harass) the southwestern willow flycatcher (*Empidonax traillii extimus*) (flycatcher), bald eagle (*Haliaeetus leucocephalus*, if subsequently listed), yellow-billed cuckoo (*Coccyzus americana*, if subsequently listed) (cuckoo), razorback sucker (*Xyrauchen texanus*), Colorado pikeminnow (*Ptychocheilus lucius*), Gila topminnow (*Poeciliopsis occidentalis occidentalis*), spikedace (*Meda fulgida*), loach minnow (*Tiaroga cobitis*), roundtail chub (*Gila robusta*, if subsequently listed), longfin dace (*Agosia chrysogaster*, if subsequently listed), Sonora sucker (*Catostomus insignis*, if subsequently listed), desert sucker (*C. clarki*, if subsequently listed), speckled dace (*Rhinichthys osculus*, if subsequently listed), lowland leopard frog (*Rana yavapaiensis*, if subsequently listed), northern Mexican gartersnake (*Thamnophis eques megalops*, if subsequently listed), and narrow-headed gartersnake (*T. rufipunctatus*, if subsequently listed), to the extent described and specified in subparagraphs F.2 through F.6 herein and in the HCP, incidental to the operation of

Horseshoe and Bartlett Reservoirs, as described in the Permittee's application and supporting documents, and as conditioned herein.

F.2. Incidental Take of Flycatcher. During the life of this Permit, as long as the HCP is being properly implemented, the Permittee may, in carrying out Covered Activities, incidentally take within the Permit Area (a) in the form of harm, flycatcher nestlings and eggs as a result of nest tree fall or nestlings falling and drowning due to high reservoir levels, and (b) in the form of harm or harassment, indirect impacts on occupied flycatcher habitat that is unavailable, modified, or lost due to inundation, desiccation, and associated effects in an average annual amount not to exceed 200 acres (or up to 400 acres annually on average with adaptive management). The Parties shall adhere to the impact analysis method set forth in Subchapter IV.B.1 of the HCP, or other method mutually agreed to by the Parties, to determine the average annual amount of occupied habitat of the flycatcher within the Permit Area that is unavailable, modified, or degraded as a result of Covered Activities.

F.3. Incidental Take of Bald Eagle. During the life of this Permit as long as the HCP is being properly implemented, the Permittee may, in carrying out the Covered Activities, incidentally take, in the form of harm or harassment, no more than 10 eggs, nestlings, or fledgling bald eagles over the life of the Permit in conjunction with the Covered Activities resulting from a maximum of 5 nest inundations over the life of the Permit. The Parties shall adhere to the adaptive management measures set forth in Subchapter V.C.4.d of the HCP, or other measures mutually agreed to by the Parties, to ensure that the amount of incidental take of bald eagles authorized by this subparagraph is not exceeded.

Should the bald eagle be de-listed again, within the life of this Permit, protection for the species would be provided by the Bald and Golden Eagle Protection Act and/or the Migratory Bird Treaty Act described in section M.

F.4. Incidental Take of Cuckoo. During the life of this Permit, as long as the HCP is being properly implemented, the Permittee may, in carrying out the Covered Activities, incidentally take within the Permit Area (a) in the form of harm, cuckoo nestlings and eggs as a result of nest tree fall or nestlings falling and drowning due to high reservoir levels, and (b) in the form of harm or harassment, indirect impacts on occupied cuckoo habitat that is unavailable, modified, or lost due to inundation or desiccation and associated effects in an average annual amount not to exceed 200 acres (or up to 400 acres annually on average with adaptive management). The Parties shall adhere to the impact analysis method set forth in Subchapter IV.B.1 of the HCP, or other method mutually agreed to by the Parties, to determine the annual amount of occupied habitat of the cuckoo within the Permit area that is unavailable, modified, or degraded as a result of the Covered Activities. This Permit shall become effective for the cuckoo as specified in part F.1 above.

F.5. Incidental Take of Razorback Sucker, Colorado Pikeminnow, Gila Topminnow, Spikedace, and Loach Minnow. During the life of this Permit, as long as the HCP is being properly implemented, the Permittee may, in carrying out the Covered Activities, incidentally take razorback sucker, Colorado pikeminnow, Gila topminnow,

spikedace, and loach minnow within the Permit Area resulting from: (a) stranding in pools or passage through the outlet works of Horseshoe or Bartlett Reservoirs; or (b) impacts to habitat in an amount not to exceed 33.9 river miles (or up to 38.6 river miles with adaptive management) attributable to predation and competition from nonnative fish directly or indirectly produced by future reservoir operations. The parties shall adhere to the analysis in Subchapter IV.B.4.b of the HCP and the monitoring provisions of Subchapter V.D.4.f. of the HCP in determining the effects of the Covered Activities on the species listed in this subparagraph F.5 and the need for adaptive management or Permit amendment.

F.6. Incidental Take of Roundtail Chub, Longfin Dace, Sonora Sucker, Desert Sucker, Speckled Dace, Lowland Leopard Frog, Northern Mexican Gartersnake and Narrow-headed Gartersnake. During the life of this Permit, as long as the HCP is being properly implemented, the Permittee may, in carrying out the Covered Activities, incidentally take roundtail chub, Longfin dace, Sonora sucker, desert sucker, speckled dace, lowland leopard frog, northern Mexican gartersnake, and narrow-headed gartersnake within the Permit Area resulting from: (a) stranding in pools or passage through the outlet works of Horseshoe or Bartlett Reservoirs; or (b) impacts to habitat in an amount not to exceed 33.9 river miles (or up to 38.6 river miles with adaptive management) attributable to predation and competition from nonnative fish directly or indirectly produced by future reservoir operations. The parties shall adhere to the analysis in Subchapter IV.B.4.b of the HCP and the monitoring provisions of Subchapter V.D.4.f of the HCP in determining the effects of the Covered Activities on the species listed in this subparagraph F.6 and the need for adaptive management or Permit amendment. This Permit shall become effective for the species listed in this subparagraph F.6 as specified in subparagraph F.1 above.

G. INCORPORATION OF HCP AND AGREEMENT; GOVERNING LAW

G.1. The HCP, the Implementing Agreement (IA), and each of their provisions are intended to be, and by this reference are, incorporated herein. In the event of any direct contradiction among the terms of the IA, the HCP, and this Permit, the terms and conditions of this Permit shall control. In all other cases, the terms of the IA, the HCP, and this Permit shall be interpreted to be supplementary to each other.

G.2. This Permit, the HCP, and the IA, and the Parties' compliance therewith, shall be governed by the ESA and implementing regulations.

H. PROPER IMPLEMENTATION OF HCP

H.1. The HCP will be deemed properly implemented if the commitments and provisions of the HCP, IA, and this Permit have been or are being implemented and met in accordance with their terms. The Permittee shall timely and completely comply with and perform its obligations under the HCP and the IA.

H.2. Transfer of mitigation property to a third-party management entity acceptable to the FWS, shall in no way affect the Permittee's responsibility to fully implement management and monitoring of the transferred or any other such property as

described in the HCP. The management obligations will be incorporated into conservation easements placed on the mitigation property in question.

H.3. The Permittee shall submit an annual report detailing implementation of the HCP, as described at Subchapter V.E.3 of the HCP. Annual reports will be submitted by February 1 of each year (detailing accomplishments in the previous calendar year) to the U.S. Fish and Wildlife Service, 2321 West Royal Palm Road, Suite 103, Phoenix, Arizona 85021, and to the U.S. Fish and Wildlife Service, P.O. Box 1306, Albuquerque, New Mexico 87103.

I. ACCESS TO MITIGATION PROPERTIES

Upon reasonable notification to the Permittee (50 C.F.R. 13.47), the FWS will be allowed access to mitigation properties to inspect the condition of the properties and to ensure that the HCP is being implemented according to its terms and conditions for the benefit of the listed species.

J. TERM

This Permit shall have a duration beginning on the Effective Date, and continuing in full force and effect for a period of 50 years thereafter, or until revocation or surrender and cancellation of this Permit as provided for in subparagraphs N.2 and N.3 hereof, whichever occurs earlier.

K. PERMIT IN EFFECT FOR LISTED SPECIES ON EFFECTIVE DATE; PERMIT TO BECOME EFFECTIVE FOR UNLISTED COVERED SPECIES UPON LISTING

This Permit will take effect for Covered Species federally listed as threatened or endangered at the time this Permit is issued. Subject to the Permittee's compliance with all other terms of this Permit, the HCP, and the IA, this Permit will take effect for Unlisted Covered Species upon the listing of such species as threatened or endangered by FWS.

L. DISPOSITION OF DEAD, INJURED, OR SICK INDIVIDUALS OF LISTED SPECIES

Upon locating a dead, injured, or sick individual of a Covered Species listed in subparagraphs F.2 through F.6 above, within the Permit Area and Compensation Lands, the Permittee is required to contact the FWS Law Enforcement Office, 2450 West Broadway Road, #113, Mesa, Arizona 85202, 480/967-7900, for care and disposition instructions. Extreme care should be taken in handling sick or injured individuals to ensure effective and proper treatment. Care should also be taken in handling dead specimens to preserve biological materials in the best possible state for analysis of cause of death. In conjunction with the care of sick or injured endangered/threatened species, or preservation of biological materials from a dead specimen, the Permittee and its

contractor/subcontractor have the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

M. SATISFACTION OF PERMITTING REQUIREMENTS UNDER MIGRATORY BIRD TREATY ACT AND BALD AND GOLDEN EAGLE PROTECTION ACT

M.1. Migratory Bird Treaty Act Special Purpose Permit for Listed Species Other Than Bald Eagles. This Permit shall constitute a Special Purpose Permit under 50 C.F.R. § 21.27 for take of the southwestern willow flycatcher, and, in the event it is listed by FWS as threatened or endangered, the yellow-billed cuckoo, in the amount and subject to the terms and conditions specified in this Permit, the IA, and the HCP.

M.2. Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act Provisions Pertaining To Eagles. The following enforcement policy pertaining to bald eagles provides direction to the Permittee during the continued operation of Horseshoe and Bartlett Reservoirs as long as the HCP is being properly implemented. The FWS believes the measures required to cover the bald eagle under this Permit, its IA, and the HCP are sufficient to protect the species relative to the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act. Thus, take authorized under this Permit is inherently "compatible with the preservation of the bald and golden eagle" as required by the Bald and Golden Eagle Protection Act. The FWS realizes that some eagles may be "taken" even if all reasonable measures to protect them are used (take is defined in the Bald and Golden Eagle Protection Act as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb). The FWS Office of Law Enforcement carries out its mission to protect migratory birds through investigations and enforcement, as well as by fostering relationships with individuals, companies, and industries that have enacted programs to minimize their impacts on migratory birds, and by encouraging others to enact such programs. Unless a taking is specifically authorized, it is not possible to absolve individuals, companies, or agencies from liability even if they implement avian mortality avoidance or similar conservation measures. However, the Office of Law Enforcement focuses its resources on investigating and presenting for prosecution individuals and companies that take migratory birds without regard for their actions or without following agreements such as those described above.

M.3. Covered Activities Requiring Migratory Bird Permit. The Permittee *IS NOT* authorized to move eggs or fledgling bald eagles under this Permit. The Permittee must contact the Regional Migratory Bird and Eagle Permit Office for additional information at: 505/248-7884 or <http://www.fws.gov> to seek authorization under the Bald and Golden Eagle Protection Act (see Bald and Golden Eagle Protection Act (16 U.S.C. 668a) and 50 C.F.R. 22) and/or the Migratory Bird Treaty Act (see 50 C.F.R. 10, Migratory Bird Treaty Act (16 U.S.C. 703 et seq.) and implementing Regulations at 50 C.F.R. 21) before conducting adaptive management activities described in the HCP for bald eagles and their nests within the Covered Area.

N. PERMIT SUSPENSION, REVOCATION, AND SURRENDER

N.1. Permit Suspension

(a) FWS may suspend this Permit if the Permittee is not in compliance with the conditions of this Permit, or with any applicable federal laws or regulations governing the conduct of the Covered Activities. The suspension shall remain in effect until FWS determines that the Permittee has corrected the deficiencies. Notwithstanding the foregoing, FWS shall not suspend this Permit without first: (1) notifying the Permittee in writing that this Permit may be subject to suspension pursuant to this subparagraph N.1(a), including a statement of the deficiencies that must be corrected by the Permittee; and (2) providing the Permittee with a period of 30 days after the date of notice of deficiencies in which to correct the deficiencies.

(b) A partial suspension of this Permit may apply only to specified Covered Species, or to only a portion of the Permit Area or Covered Activities. In the event of a partial suspension, the portion of this Permit not subject to the suspension shall remain in full force and effect.

N.2. Permit Revocation

(a) FWS shall not revoke this Permit for any reason except those listed in 50 C.F.R. 13.28(a)(1)-(4), or unless the Covered Activities would be inconsistent with the criteria set forth in 16 U.S.C. § 1539(a)(2)(B)(iv) and this inconsistency has not been remedied. Notwithstanding the foregoing, this Permit will only be revoked if FWS and the Permittee have not been successful in remedying any such inconsistency through other means.

(b) A partial revocation of this Permit may apply only to specified Covered Species, or to only a portion of the Permit Area or Covered Activities. In the event of a partial revocation, the portion of this Permit not subject to the revocation shall remain in full force and effect.

(c) All minimization and mitigation measures in the HCP and the IA that are continued in effect after revocation of the Permit shall be taken into account by FWS and credited toward any future efforts by the Permittee or other responsible entities to ensure that the operation of Horseshoe and Bartlett Reservoirs satisfies the requirements of the ESA. This provision shall survive the revocation of this Permit and remain in full force and effect thereafter.

N.3. Surrender and Cancellation of Permit. In the event that the Permittee, or any successor in interest to the Permittee, permanently discontinues the Covered Activities, the Permittee or successor-in-interest shall return this Permit to FWS within 30 calendar days of the discontinuance with a written statement surrendering this Permit for cancellation. This Permit will be deemed cancelled only upon a determination by FWS, in collaboration with the Permittee, that sufficient measures have been implemented by the Permittee to mitigate for take of Covered Species that occurred pursuant to the terms of this Permit, before its surrender. Upon surrender of this Permit, no further take of the Covered Species by the Permittee shall be authorized.

O. LIMITATION ON IMPOSITION OF ADDITIONAL CONSERVATION MEASURES

O.1. Changed Circumstances, Notice of Changed Circumstances, and Implementation of Response

(a) Changed Circumstances. The following are Changed Circumstances, and corresponding conservation and mitigation measures, if any, that the Permittee shall implement in response to such Changed Circumstances, should they occur during the life of this Permit:

Changed Circumstance	Conservation, Mitigation, or Management Measures (as described in the HCP)
Channel shifts on mitigation lands such that riparian habitat is no longer anticipated to be available.	Acquire and permanently manage replacement riparian habitat (see Subchapter V.F.1.a).
Habitat acquisition and management in target geographic area is infeasible.	Acquire and permanently manage other suitable riparian habitat (see Subchapter V.C.2).
Decline of flycatcher or cuckoo populations at mitigation sites.	Implement additional monitoring and management (see Subchapter V.C.3 and Appendix 7).
Invasion of exotic species at mitigation sites.	Implement eradication or control efforts (see Appendix 7).
Cowbird parasitism exceeds threshold rate at mitigation sites.	Implement cowbird management strategies (see Subchapter V.C.4.c).
More than 200 acres of occupied habitat are predicted to be unavailable on average to flycatchers due to Horseshoe operations.	Acquire and permanently manage other riparian habitat and implement other conservation efforts (see Subchapter V.C.4.a).
Reversion of mitigation land title to Arizona or the United States with loss of ability to achieve HCP goal.	Acquire and permanently manage replacement habitat (see Subchapter V.F.1.b).
Planning and fund-raising efforts to improve and expand the Bubbling Ponds Native Fish Hatchery are not successful.	SRP will provide remaining funds and fund-raising support for improvements and operation of another native fish hatchery, or such other measure(s) designated by FWS in coordination with AGFD (see Subchapter V.D.4).
Minimization and mitigation actions prove to be ineffective in achieving the desired result of mitigating for native fish, frog, and gartersnake species.	SRP will provide remaining funds for nonnative fish control efforts or such other measure(s) designated by FWS in consultation with AGFD (see Subchapter V.D.4).
Construction of Lime Creek fish barrier is infeasible.	SRP will redirect funds to another location in consultation with FWS, AGFD, and other interested agencies (see Subchapter V.D.4).
Monitoring efforts find nonnative fish in Lime Creek or its replacement above the barrier.	SRP will fund rehabilitation of Lime Creek or contribute like funding to rehabilitation of another tributary (see Subchapter V.D.4).
A bald eagle establishes a nest below the high water mark of Horseshoe or Bartlett.	SRP will work with AGFD and FWS to rescue eggs or chicks, and will construct and maintain an alternative nest structure in the immediate area (see Subchapter V.C.4.d).

Changed Circumstance	Conservation, Mitigation, or Management Measures (as described in the HCP)
Flycatcher and cuckoo habitat loss from fire or scouring floods at Horseshoe or mitigation sites that causes long-term riparian habitat loss (i.e., natural recruitment is likely to be delayed due to environmental changes).	SRP will work with FWS, AGFD, and other agencies to restore habitat using HCP funds, if deemed necessary (see Subchapter V.F.1.c).
In Reach 5, more than 1 Horseshoe-tagged fish is found in one year or 1 tagged fish is found in successive years.	Additional fish mitigation measures (see Subchapter IV.D.4).
Critical habitat designation for species covered by the HCP.	No additional measures by SRP.
New nonnative aquatic species are found in the Action Area.	No additional measures by SRP as part of the HCP because SRP is not responsible for these introductions and the life histories of new introductions benefiting from reservoir operations are likely to be adversely affected by Optimum reservoir operations. Also, HCP mitigation measures may be redirected to other locations or activities in consultation with FWS and AGFD.
Additional stocking of nonnative fish occurs in the Action Area, or construction of a fish barrier in the Verde River watershed for management of native fish.	No additional measures by SRP; FWS should be consulted by AGFD or the project proponents regarding listed species. HCP mitigation measures may be redirected to other locations or activities by FWS in consultation with AGFD.
Downlisting or delisting the HCP species due to recovery.	No changes in measures implemented by SRP.
New or modified dams or diversions on the Verde River or its tributaries.	No additional measures by SRP (addressed by permitting of those facilities).
Toxic or hazardous spills into the Verde River or its tributaries.	No additional measures by SRP (clean-up and mitigation of impacts are the responsibility of the person(s) causing the spill). SRP will cooperate with other agencies to pursue funding and timely clean-up. HCP funding may be redirected to monitoring and emergency measures if requested by FWS.
Future listing of a nonlisted, covered species.	FWS will automatically authorize take of such newly listed, covered species as prescribed by regulation (63 FR 35, February 23, 1998).

As long as the terms of the HCP are being properly implemented, FWS shall not require the implementation of any conservation and mitigation measures by the Permittee in response to Changed Circumstances, other than those measures specified in this subparagraph O.1(a).

(b) Notice of Changed Circumstances & Implementation of Response

i) Permittee-initiated Response to Changed Circumstances. The Permittee shall give written notice to FWS within 30 days after

learning that any of the Changed Circumstances listed in the HCP and subparagraph O.l(a) hereof has occurred. As soon as practicable thereafter, but no later than 90 days after learning of the Changed Circumstances, the Permittee shall modify its activities in the manner and to the extent required by the HCP and subparagraph O.1(a) hereof and report to the FWS on its actions. The Permittee shall make any such required modifications without awaiting notice from FWS.

ii) FWS-initiated Response to Changed Circumstances. If FWS determines that Changed Circumstances have occurred and that the Permittee has not responded in accordance with the HCP and subparagraph O.1(a) hereof, FWS shall so notify the Permittee in writing and direct the Permittee to make the required changes. Within 90 days after receiving such notice, the Permittee shall make the required changes and report to FWS on its actions.

(c) Effect of Changed Circumstances on Permit and HCP

i) In General. Changed Circumstances are provided for in the HCP and, hence, do not constitute Unforeseen Circumstances or require amendment of this Permit, the HCP, or the IA. Changed Circumstances do not constitute "new information" under 50 C.F.R. § 402.16(b), and, hence, the occurrence of Changed Circumstances does not require the reinitiation of formal consultation by FWS under Section 7 of the ESA.

ii) Critical Habitat. FWS shall consider the HCP in its preparation of any proposed designation of critical habitat concerning any Covered Species. Consistent with 50 C.F.R. § 424.12, the HCP incorporates special management considerations necessary to conservation of the Covered Species. If critical habitat is designated for any Covered Species, and as long as the HCP is being properly implemented, FWS shall not require, through the formal consultation process of Section 7 of the ESA or otherwise, the commitment by the Permittee of additional land, water, financial compensation, or other measures beyond those already provided for in the HCP.

O.2. Unforeseen Circumstances

(a) No Surprises Assurances. The "Covered Species" listed in subparagraphs F.2. through F.6 above, are considered adequately addressed under the HCP and are, therefore, covered by no surprises rule assurances. In the event that it is demonstrated by FWS that Unforeseen Circumstances exist during the life of this Permit, and additional conservation and mitigation measures are deemed necessary to respond to Unforeseen Circumstances, FWS may require additional measures of the Permittee where the HCP is being properly implemented, but only if such measures are limited to modifications within the Compensation Lands conserved pursuant to the terms of the HCP, or to the HCP's operating conservation program for the Covered Species, and maintain the original terms of the HCP to the maximum extent possible. Notwithstanding the foregoing, FWS shall not:

i) Require the commitment of additional land, water, or financial compensation by the Permittee without the consent of the Permittee; or

ii) Impose additional restrictions on the use of land, water, or

natural resources otherwise available for use by the Permittee under the original terms of the HCP, including additional restrictions on the Covered Activities and restrictions on the Permittee's operation of other dams outside the Permit Area to mitigate the effects of the Covered Activities.

(b) Effect of Unforeseen Circumstances on Permit. Except as provided in subparagraph N.2 hereof, notwithstanding the occurrence of Unforeseen Circumstances, as long as the Permittee continues to properly implement the provisions of the HCP and any additional measures required by FWS in accordance with subparagraph O.2(a) hereof, this Permit will remain in full force and effect.

(c) Notice of Unforeseen Circumstances. FWS shall notify the Permittee in writing of any Unforeseen Circumstances of which FWS becomes aware that may affect the obligations of the Permittee under this Permit, the HCP, or the IA.

P. AMENDMENT OF THE PERMIT

P.1. This Permit may be amended in accordance with the provisions of 50 C.F.R. § 13.23. The proponent of the amendment shall provide a written statement of the reasons for the proposed amendment and an analysis of its environmental effects to the other parties, including its effects on operations under the HCP and on Covered Species.

P.2. If this Permit requires an amendment because of change of ownership, the FWS will process that amendment without the requirement of the Permittee preparing any new documents or providing any mitigation over and above that required in the original permit. The activities proposed or in progress under an original permit may not be interrupted provided the required terms and conditions of an issued permit are being followed.

P.3. If, during the life of this Permit, the Covered Activities and/or the extent of the impact of the Covered Activities described in the HCP is altered, such that there may be an increase in the anticipated take of the Covered Species, the Permittee is required to contact the FWS and obtain authorization and/or amendment of this Permit before commencing any construction or other activities that might result in take beyond those described in the HCP and IA.

Q. RENEWAL OF PERMIT

The Permittee may apply for the renewal of the Permit prior to its expiration date in accordance with the provisions of 50 C.F.R. § 13.22.

R. SUCCESSORS AND ASSIGNS

The terms and conditions of this Permit shall be binding on and shall inure to the benefit of the Permittee and FWS, and their respective successors and assigns, as provided in 50 C.F.R. §§ 13.24 and 13.25.

S. SEVERABILITY

The terms and conditions of this Permit shall be deemed severable, and if any term or condition of this Permit shall be held invalid, illegal, or unenforceable by a federal court, after exhaustion of all available appeals, the remainder shall continue to be effective and binding upon FWS and the Permittee. Notwithstanding the foregoing, in the event that any portion of this Permit shall be held invalid, FWS and the Permittee shall use their best efforts to agree upon amendments to this Permit, consistent with paragraph P above.

— END OF PERMIT —