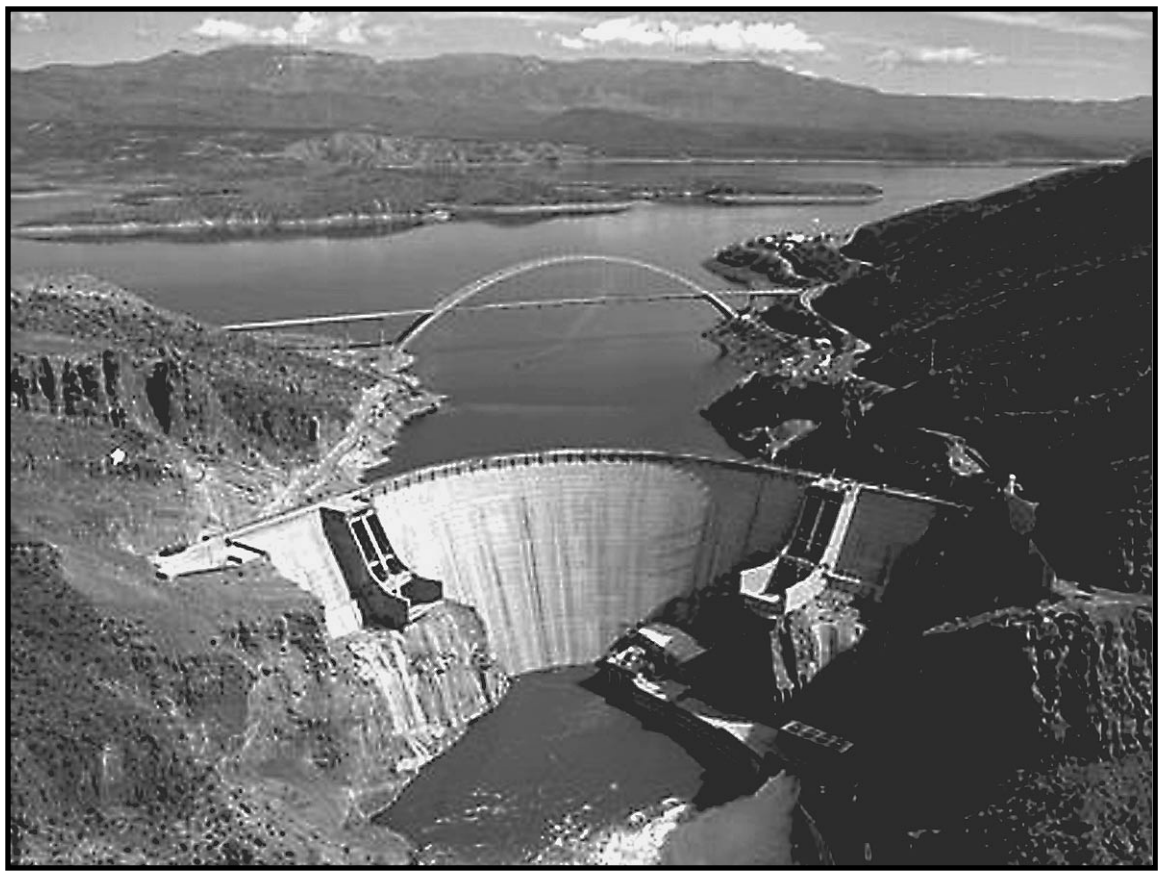
# Roosevelt Habitat Conservation Plan
# Gila and Maricopa Counties, Arizona

## Volume II of the FEIS



Submitted to:
U.S. FISH AND WILDLIFE SERVICE

By:
SALT RIVER PROJECT

**December 2002**

# Roosevelt Lake
# Habitat Conservation Plan

**Submitted Pursuant to**

**Section 10(a)(1)(B) of the**
**Endangered Species Act**

**December 2002**

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## LIST OF ACRONYMS AND ABBREVIATIONS USED IN THIS DOCUMENT

| | |
|---|---|
| AF | Acre-Feet |
| AGFD | Arizona Game and Fish Department |
| AMA | Active Management Area |
| Association | Salt River Valley Water Users' Association |
| BMP | Best Management Practice |
| BO | Biological Opinion |
| CAP | Central Arizona Project |
| CFR | Code of Federal Regulations |
| Cfs | Cubic Feet Per Second |
| Cities | Chandler, Glendale, Mesa, Phoenix, Scottsdale, and Tempe |
| Corps | U.S. Army Corps of Engineers |
| Cuckoo | Yellow-billed Cuckoo |
| DBH | Diameter at breast height |
| EIS | Environmental Impact Statement |
| EO | Executive Order |
| ERO | ERO Resources Corporation |
| ESA | Endangered Species Act |
| Flycatcher | Southwestern willow flycatcher |
| FMYN | Fort McDowell Yavapai Nation |
| Forest Service | U.S. Forest Service |
| FPO | Forest Protection Officer |
| FR | Federal Register |
| FWS | U.S. Fish and Wildlife Service |
| GIS | Geographic Information System |
| GRUSP | Granite Reef Underground Storage Project |
| IA | Implementing Agreement |
| ITP | Incidental Take Permit |
| Listed Species | Species listed as threatened or endangered under the ESA |
| M&I | Municipal and Industrial |
| Modified Roosevelt | Roosevelt Dam as modified by construction in the 1990s |
| NCS | New Conservation Space |
| NEPA | National Environmental Policy Act |
| NRHP | National Register of Historic Places |
| Reclamation | U.S. Bureau of Reclamation |
| RHCP | Roosevelt Habitat Conservation Plan |
| Roosevelt | Roosevelt Dam and Lake ("reservoir") |
| RPA | Reasonable and Prudent Alternative |
| RPM | Reasonable and Prudent Measure |
| RWCD | Roosevelt Water Conservation District |
| Salt Arm | Salt Arm of Roosevelt Lake |
| SHPO | State Historic Preservation Office |
| Southeast Valley | Mesa, Chandler, and Gilbert areas |
| SROG | Sub-regional Operating Group (operators of 91st Avenue Wastewater Treatment Plant) |
| SRP | Salt River Project (Salt River Valley Water Users' Association [Association] and the Salt River Project Agricultural Improvement and Power District [District]) |
| SRPMIC | Salt River Pima-Maricopa Indian Community |
| SRPSIM | SRP Simulation (SRP reservoir operation model) |
| SRRD | Salt River Reservoir District |
| Take | Incidental take of a federally listed species |
| TCRU | Tonto Creek Riparian Unit |
| TNC | The Nature Conservancy |
| Tonto Arm | Tonto Creek arm of Roosevelt Lake |
| USFS | U.S. Forest Service |
| WSCA | Wildlife of Special Concern in Arizona |

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Appendix 7: Draft Implementing Agreement

Appendix 8: Draft Incidental Take Permit Terms and Conditions

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# Roosevelt Lake
# Habitat Conservation Plan

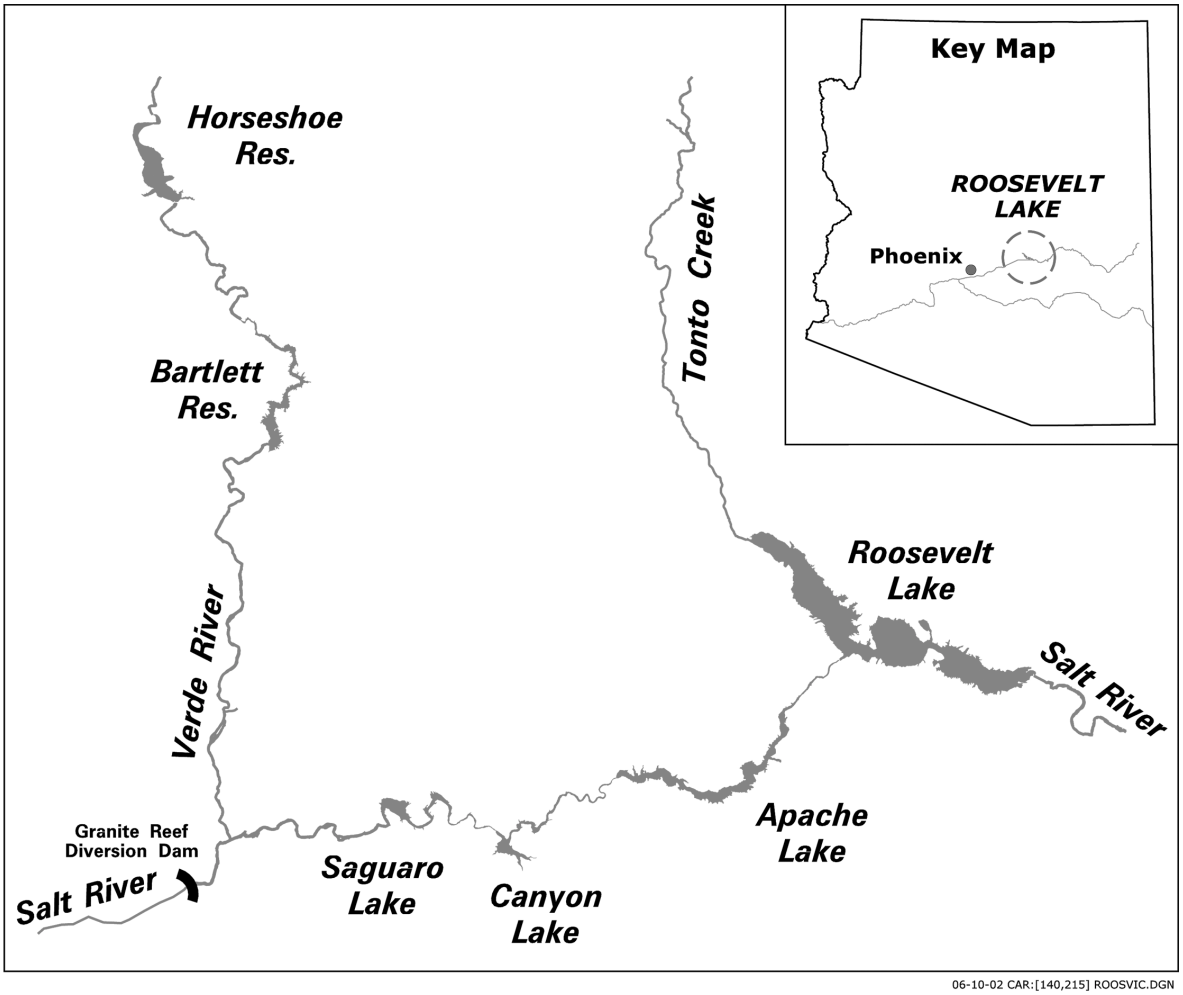
## Executive Summary

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. The application is for an incidental take permit (permit or ITP) of the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) (flycatcher) and Yuma clapper rail (*Rallus longirostris yumanensis*), and threatened bald eagle (*Haliaeetus leucocephalus*). The candidate yellow-billed cuckoo (*Coccyzus americanus*) (cuckoo) also is addressed should it be listed in the future. The activity that would be covered by the permit is the continued operation by SRP of Roosevelt Dam and Lake (Roosevelt) near Phoenix, Arizona (Figure ES-1). The area covered by the permit would include Roosevelt up to an elevation of 2,151 feet. The requested duration of the permit is 50 years. To meet the requirements of a Section 10(a)(1)(B) permit, SRP has developed and will implement the Roosevelt Habitat Conservation Plan (RHCP), which specifies measures to minimize and mitigate incidental take of flycatchers, Yuma clapper rails, bald eagles, and cuckoos 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.

Efforts to store water at Roosevelt were initiated in 1893 when the original plan was developed to construct a reservoir at that location. The construction of Roosevelt Dam began in 1903 and was completed in 1911 by the U.S. Bureau of Reclamation (Reclamation). Water was first stored behind the dam in 1910. Pursuant to a contract dated September 6, 1917 between SRP and the United States (the "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 Roosevelt Dam is an integral component. SRP continues to operate these facilities pursuant to the 1917 contract. Since its completion in 1911, Roosevelt Dam has continuously provided stored water for irrigation, municipal and industrial uses, and hydroelectric power generation. Roosevelt also provides a variety of recreational uses and environmental benefits such as wildlife habitat and "clean" energy.

Roosevelt Lake accounts for 71 percent of the total storage capacity in the SRP reservoir system. Roosevelt is the cornerstone of SRP's system of reservoirs that function to supply water and power to the Phoenix metropolitan area. SRP's flexibility in operating Roosevelt is affected by, among other things: 1) SRP's legal obligations to deliver water stored at Roosevelt 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.

**Figure ES-1. Vicinity Map, Roosevelt Lake near Phoenix, Arizona.**




The amount of runoff entering Roosevelt, and subsequent storage and release of that water for downstream delivery and hydropower generation, result in fluctuating lake levels. Over time, fluctuating lake levels at Roosevelt have resulted in the growth of varying amounts of riparian vegetation (primarily salt cedar) along the two major watercourses that feed the lake—the Salt River and Tonto Creek. Lake levels and occasional scouring floods affect the amount and distribution of vegetation. Following large scouring floods, sediment deposition, and high lake levels, which occurred frequently in the period between the late 1970s and early 1990s, riparian vegetation has grown at the inlets of the Salt River and Tonto Creek to Roosevelt. Low water levels resulting from recent years of drought have allowed increasingly larger amounts of riparian vegetation to grow on the exposed lakebed.

No information is available about the presence of flycatchers, Yuma clapper rails, or cuckoos in the immediate area prior to construction of Roosevelt in the early 1900s,

although bald eagles were present. Beginning in 1993, flycatchers were found nesting in portions of the tall dense vegetation that had grown on the lakebed.

The riparian vegetation at Roosevelt also provides habitat for Yuma clapper rails, bald eagles, and cuckoos. The RHCP is unusual because the Proposed Action—issuance of an ITP for the continued operation of Roosevelt by SRP along with habitat mitigation—is expected to result in the presence of varying amounts of habitat suitable for flycatchers, Yuma clapper rails, bald eagles, and cuckoos in the future, just as those operations have resulted in varying amounts of riparian habitat in the past. Continued operation of Roosevelt would periodically result in increased water levels following normal or above normal precipitation. Increased water levels would flood the riparian vegetation that has become established on the lakebed and would temporarily render portions of the habitat unsuitable for use by flycatchers, Yuma clapper rails, bald eagles, and cuckoos. Conversely, extended drought and releases of water for downstream use will dry out habitat at upper elevations on the lakebed. Because the cycle of lake levels due to normal reservoir operation includes occasions when varying amounts of vegetation occupied by listed species are temporarily unavailable or destroyed by inundation or drying, SRP has applied for an incidental take permit under Section 10 of the ESA. Mitigation in the form of Habitat Acquisition and Management and Additional Habitat Conservation measures (see below) that are provided by the RHCP will compensate for this periodic loss of habitat at Roosevelt.

As discussed below under Satisfaction of Permit Criteria, the RHCP includes measures to be undertaken by SRP to mitigate potential effects on listed and candidate species. The RHCP measures also complement mitigation being implemented by Reclamation as a result of previous Biological Opinions (BOs) issued pursuant to Section 7 of the ESA. These BOs were issued based on Reclamation's modifications of Roosevelt Dam, which increased the water conservation storage space from elevation 2,136 to 2,151 feet and provided flood control space up to 2,218 feet.

The RHCP is intended to cover SRP's operation of all conservation space in Roosevelt including the New Conservation Space created by Reclamation's construction of modifications because, over time, the bird species of concern may utilize available habitat throughout the reservoir. The operation of Roosevelt flood control space above elevation 2,151 feet is not covered by the RHCP because it is subject to Section 7 of the ESA (see Chapter III introduction and Subchapter IV.A).

**Satisfaction of HCP Policy**

FWS has adopted a "five point policy" to improve the habitat conservation plan process. Satisfaction by the RHCP of the five guidelines outlined in the policy is summarized below.

***1. Biological Goals and Objectives***. The biological goals of the RHCP are to minimize and mitigate incidental take (due to the continued operation of Roosevelt) of flycatchers, Yuma clapper rails, bald eagles, and cuckoos to the maximum extent practicable, and to not appreciably reduce the likelihood of the survival and recovery of flycatchers, Yuma clapper rails, bald eagles, and cuckoos in the wild. These goals will be achieved by implementation of the following measures: 1) creating and managing riparian habitat at Roosevelt; 2) acquiring and managing riparian habitat in several river

basins in central Arizona to provide a diversity of geographic locations that have developed, or will develop, riparian habitat such as exists at Roosevelt; and 3) focusing acquisition of riparian land in locations that birds are expected to occupy, i.e., in proximity to existing populations of flycatchers, Yuma clapper rails, and cuckoos.

***2. Monitoring.*** The RHCP proposed permit terms and conditions and Implementing Agreement (IA) require comprehensive monitoring of habitat and populations of flycatchers, Yuma clapper rails, bald eagles, and cuckoos for permit compliance, effects, and effectiveness. Long-term biological monitoring is provided at Roosevelt and at each mitigation site.

***3. Adaptive Management.*** Adaptive management allows for on-going monitoring and evaluation of management actions with adjustments made as necessary to meet project objectives. The RHCP employs adaptive management to address potential changes of circumstances involving unpredicted growth and subsequent loss of flycatcher, Yuma clapper rail, and cuckoo habitat at Roosevelt and certain human-caused impacts to mitigation properties such as invasions of exotic species. Additional mitigation habitat will be acquired and managed, and other habitat conservation measures will be implemented, if occupied habitat exceeds 750 acres for flycatchers, 5 acres for Yuma clapper rails, and 313 acres for cuckoos. Adaptive management measures for mitigation properties are outlined in the RHCP and will be refined as part of the monitoring and management plans.

***4. Permit Duration.*** The 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 RHCP, 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 RHCP through public scoping. Comments at the public scoping meeting, comments submitted in writing, and periodic meetings with an advisory group were used to help formulate the RHCP.

**Satisfaction of Permit Criteria**

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

***The RHCP Must Specify the Impact That Will Likely Result From Such Taking.*** The continued operation of Roosevelt is predicted to result in a maximum temporary loss of 750 acres of occupied flycatcher habitat in one or more years in the future. The maximum temporary loss of occupied Yuma clapper rail habitat is estimated to be 5 acres. Continued operation of Roosevelt may have a limited effect on bald eagles if new cottonwoods or willows on the lakebed grow into nesting or perching sites and are subsequently lost due to inundation, or if reduced bald eagle productivity results from low lake levels. The maximum temporary loss of occupied cuckoo habitat is estimated to be about 313 acres, which substantially overlaps the potential loss of flycatcher habitat.

If circumstances change and additional habitat is occupied at Roosevelt, adaptive management will be implemented to address temporary impact on: 1) up to 1,250 acres of occupied flycatcher habitat; 2) up to 10 acres of occupied Yuma clapper rail habitat; and 3) up to 1,113 acres of occupied cuckoo habitat. If the temporary loss of occupied habitat is expected to exceed one of these totals, a permit amendment would be required.

***The RHCP 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 RHCP and the IA describe measures that will be implemented by SRP to minimize and mitigate to the maximum extent practicable incidental take from the continued operation of Roosevelt on flycatchers, Yuma clapper rails, bald eagles, and cuckoos 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:

- Habitat Acquisition and Management in perpetuity of at least 1,500 acres of riparian habitat along the Verde, San Pedro, Gila and other rivers in central Arizona, and establishing 20 or more acres of riparian habitat near Roosevelt. Included within this total are 403 acres already acquired by Reclamation and an estimated 200 acres that will be acquired by Reclamation within the next three years as mitigation for construction of Roosevelt modifications.
- Implementing Additional Habitat Conservation measures equivalent to at least 750 acres of riparian habitat including: 1) managing and protecting riparian habitat at and near Roosevelt; 2) acquiring and retiring water rights in locations that will benefit protected riparian habitat; and 3) providing buffers between protected riparian habitat and adverse adjacent land uses. Included within this total are water diversions already retired by Reclamation equivalent to water use on 220 acres of riparian habitat.

Because flycatchers and cuckoos rely on similar riparian habitat, most of the mitigation measures will serve both of these species. However, additional habitat will be acquired if necessary to fully mitigate the impact on occupied cuckoo habitat at Roosevelt. Yuma clapper rail mitigation habitat will be created as part of a riparian establishment project to be implemented by SRP on the Salt arm of Roosevelt.

As summarized above, additional habitat will be acquired and managed, and Additional Habitat Conservation measures will be implemented, if additional occupied habitat is impacted by operation of Roosevelt:

- For flycatchers, up to 500 acres of additional impact will be mitigated by acquiring riparian habitat at a 2:1 ratio (up to 1,000 acres) and managing these acres in perpetuity, and implementing Additional Habitat Conservation measures at a 1:1 ratio (up to the equivalent of 500 acres of riparian habitat).
- For cuckoos, up to 800 acres of additional impact will be mitigated by acquiring riparian habitat at a 2:1 ratio (up to 1,600 acres) and managing these acres in perpetuity, and implementing Additional Habitat Conservation measures at a 1:1 ratio (up to the equivalent of 800 acres of riparian habitat).

- For Yuma clapper rails, up to 5 acres of additional impact will be mitigated by acquiring or developing up to 5 additional acres of marsh habitat at or near Roosevelt and managing these acres in perpetuity.

The RHCP and IA provide deadlines to ensure that elements of the RHCP are implemented in a timely manner. Funding for implementation of the RHCP 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 RHCP is $15 M to $30 M but SRP commits to ensure that the actual cost of mitigation will be fully funded. Actions to be taken if unforeseen events occur are also described in the RHCP.

***The RHCP Must Specify What Alternative Actions SRP Considered and Why Such Alternatives Are Not Adopted.*** In addition to the preferred alternative (Full Operation), two major alternatives, operation of Roosevelt without an incidental take permit (No Permit) and operation of Roosevelt to maintain long-term lake levels below the full capacity of the reservoir (Re-operation), were considered in detail. Both alternatives were rejected because neither would allow Roosevelt to be used for the purposes for which it was built, would have significant socioeconomic impacts through loss of water supplies and power generation, and would raise significant legal issues with water rights and water delivery contracts. Furthermore, although both alternatives would attempt to avoid (No Permit) or reduce (Re-operation) short-term impacts to listed and candidate species, it is unlikely over the long term that either alternative would provide greater conservation of these species and the habitats upon which they depend than the Proposed Action.

SRP also considered many other alternatives that were eliminated from further consideration because they are infeasible, would not meet project purposes, or are minor variations of the alternatives considered in detail. These alternatives included consultation between Reclamation and FWS pursuant to Section 7 of the ESA, other changes in operation of SRP's Salt and Verde reservoirs, and other measures to minimize or mitigate impacts on listed species, water supply, and power generation.

***The RHCP Must Specify Such Other Measures That FWS May Require as Necessary or Appropriate, Including Reporting.*** SRP has worked closely with FWS in developing the RHCP and has included all measures required as necessary or appropriate (the measures described above). SRP will submit an annual report to FWS describing the results of monitoring and compliance with all terms and conditions of the permit.

***The Take of Listed Species Must Be Incidental.*** The take of endangered flycatchers and Yuma clapper rails, threatened bald eagles, and candidate cuckoos (should they be listed) will be associated with periodic impacts on their habitat, which are incidental to SRP's continued operation of Roosevelt.

***The Incidental Take Will Not Appreciably Reduce the Likelihood of the Survival and Recovery of the Species in the Wild.*** The RHCP provides for substantial conservation of habitat for endangered flycatchers and Yuma clapper rails, threatened bald eagles, and cuckoos (if listed) in central Arizona. SRP believes that these conservation measures will ensure that the incidental take resulting from the permitted

activity—the continued operation of Roosevelt—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 enhance the long-term survival and recovery of these species.

# Roosevelt Lake
# Habitat Conservation Plan

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

The Salt River Project (SRP) submits this habitat conservation plan to the U. S. Fish and Wildlife Service (FWS) as part of the application package for an incidental take permit (ITP or permit) under Section 10 of the Endangered Species Act (ESA) (16 U.S.C. § 1539). The permit is to address the incidental take of federally listed species, and the impacts on candidate species associated with SRP's continued operation of Theodore Roosevelt Dam and Lake (Roosevelt) to store and release water (Figure ES-1 and Figure I-3).[1] The issuance of a permit to SRP would authorize the incidental take of listed species from SRP's continued operation of Roosevelt pursuant to Section 10(a)(1)(B) of the Endangered Species Act (ESA) of 1973, as amended. The Roosevelt Habitat Conservation Plan (RHCP) provides measures to minimize and mitigate, to the maximum extent practicable, the effects of the potential impact on listed and candidate species and their habitat and 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. If the permit is granted, SRP will implement this RHCP, as required by Section 10 of the ESA.

## I. Project Description and Background

Chapter I describes the purpose and need for the RHCP, the goals and objectives of the RHCP, and the scope of the RHCP. SRP (the applicant) and other beneficiaries are identified, and a description of Roosevelt Lake including its history and storage operations, as well as a profile of the entire SRP reservoir system, are provided for context. Chapter I also summarizes prior compliance with the ESA at Roosevelt.

### A. Project Description and Need for the Roosevelt Habitat Conservation Plan

The activity covered by this permit application is the continued operation of Roosevelt Dam and Lake, which is the cornerstone of SRP's system of reservoirs that functions to supply water and power to the Phoenix metropolitan area. The area covered by this permit application includes Roosevelt Lake up to an elevation of 2,151 feet.

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[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)). "Candidate" species 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). In the event that a candidate species covered by an HCP is listed, the permit would authorize impact on the habitat and potential incidental take of the species.

Operation of Roosevelt Dam to store water and generate power has resulted in a fluctuating lake level since it began operation in 1911. Lake levels have typically fluctuated seasonally with stored winter runoff being gradually used in spring and summer, and annually depending on the amount of runoff entering the lake from rainfall events and releases to meet water demands. Lake levels can only be controlled operationally by the amount of water released through the dam outlets and spillway.

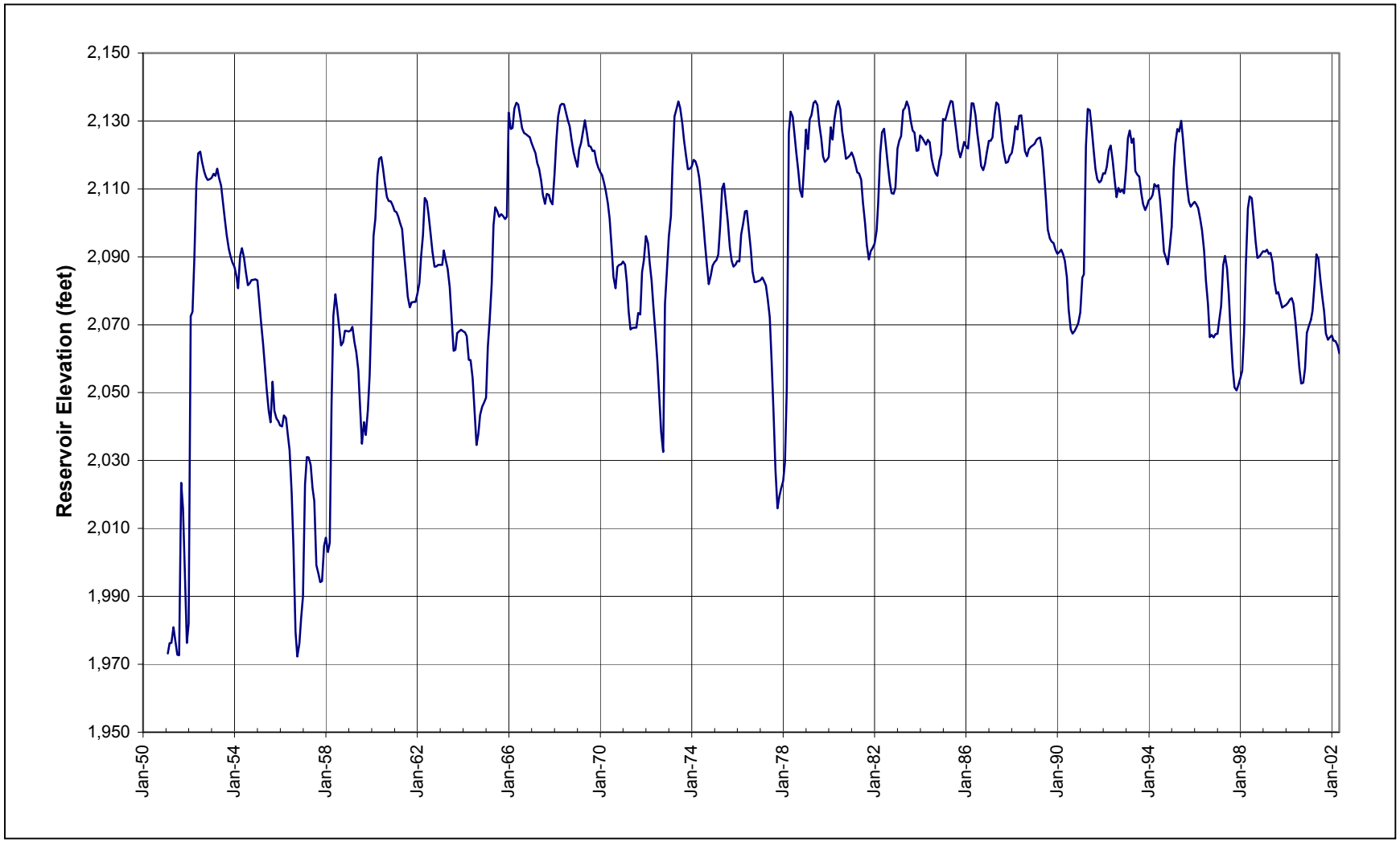
Over time, the fluctuating lake level at Roosevelt and occasional scouring floods have resulted in varying amounts of riparian vegetation along the two major watercourses that feed the lake, the Salt River and Tonto Creek. Following large scouring floods and high lake levels between the late 1970s and early 1990s, riparian vegetation became established at the inlets of the Salt River and Tonto Creek. Since the mid-1990s, low water levels caused by recent years of drought (Figures I-1 and I-5) have resulted in larger amounts of riparian vegetation on the exposed lakebed. In 1993, southwestern willow flycatchers (*Empidonax traillii extimus*) (flycatchers), a species listed as endangered in 1995, were discovered at Roosevelt Lake. The population of this species has increased in the area every year since 1993. The riparian vegetation around Roosevelt also provides habitat for Yuma clapper rails (*Rallus longirostris yumanensis*), bald eagles (*Haliaeetus leucocephalus*), and yellow-billed cuckoos (*Coccyzus americanus*) (cuckoos). An incidental take permit is needed because continued operation of the lake will eventually result in increased water levels following normal or above normal precipitation. Increased water levels will flood the riparian vegetation that has recently become established along the lake and will periodically render portions of it unsuitable for use by flycatchers, Yuma clapper rails, bald eagles, and cuckoos (covered species). In addition, reservoir releases during extended droughts may subsequently result in the loss or modification of occupied habitat through drying. To the extent that large woody vegetation dies from inundation or drying, the permit would allow SRP to clear dead trees to alleviate safety and operational concerns (see Chapter III).

### B. Purpose of the Roosevelt Habitat Conservation Plan

The RHCP is part of SRP's application for a permit for incidental take of the federally listed endangered southwestern willow flycatcher, endangered Yuma clapper rail, and threatened bald eagle resulting from SRP's continued operation of Roosevelt. If listed, the permit also will authorize incidental take of the yellow-billed cuckoo, which is currently a candidate species for listing. Other species for which SRP is not seeking permit coverage also may benefit from the conservation measures provided in the RHCP.

Section 9 of the ESA prohibits the "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. Regulations governing permits for listed species are 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 modifications or degradation where it actually kills or injures wildlife by significantly impairing behavioral patterns such as breeding, feeding, or sheltering (50 CFR §17.3).

**Figure I-1. Historical Roosevelt Elevations, 1951 through April 2002. Note: Historical elevations dating back to 1911 are shown in Figure 4 of Appendix 3.**



As discussed in depth in Subchapter III, "take" of listed species from Roosevelt operations would primarily occur as a result of harm to habitat occupied by the covered species. The proposed permit would allow approved incidental take associated with SRP's filling of the reservoir space and continued operation of Roosevelt, consistent with its purpose to store and release water and to generate power.

Section 10(a)(1)(B) of the ESA and regulations at 50 CFR 17.22 and 17.32 contain provisions for issuing permits to non-federal entities for the 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.

The RHCP was developed to satisfy these criteria.

### C. Scope of the Roosevelt Habitat Conservation Plan

The RHCP addresses continued operation of conservation storage space at Roosevelt Dam by SRP. The species, geographical area, environmental baseline, time period, and impacts covered by the RHCP are summarized in this section.

#### *1. Species Covered*

This RHCP covers certain species listed under the ESA as endangered or threatened, and candidates for listing that might be affected by continued operation of Roosevelt. The species covered are the: endangered southwestern willow flycatcher and Yuma clapper rail; threatened bald eagle; and a candidate yellow-billed cuckoo. The listing and status of these species is described in detail under Subchapter II.B.

#### *2. Geographical Area Covered*

The RHCP covers the area within Roosevelt Lake up to an elevation of 2,151 feet. SRP has authority over and responsibility for operation of the water storage space in Roosevelt Lake up to an elevation of 2,151 feet pursuant to its 1904, 1917, and 1993 contracts with the United States (see Subchapters I.G. and V.N.1).

#### *3. Environmental Baseline*

For purposes of Section 7 of the ESA, the environmental baseline is "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 previous consultations and other activities that form the environmental baseline for the RHCP are described in Subchapter I.H.

#### *4. Time Period Covered*

SRP is applying for an incidental take permit for a period of 50 years extending from the date that a permit is issued, which is anticipated near the end of 2002. The decision to pursue a permit for a 50-year period is based on several considerations. First, 50 years will provide SRP with adequate certainty of future water supplies to allow them to commit to the funding required for the proposed conservation measures in the RHCP. Second, the implementation of proposed mitigation measures including habitat acquisition, management, and monitoring are long-term commitments to protect and preserve riparian habitat for the covered species. Third, the analyses of impacts in the RHCP are predicated on the long-term pattern of fill and release for the reservoir and the effects that continued reservoir operations would have on the habitat available to the listed and candidate species and their long-term survival (see Chapter III). As discussed in Chapter III, analysis of historical runoff in the Salt River watershed 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*

The RHCP specifies measures to minimize and mitigate effects of incidental take of listed and candidate species from future SRP operations of Roosevelt. These impacts will result from harm through periodic inundation and drying of habitat occupied by flycatchers, Yuma clapper rails, cuckoos, and bald eagles and resulting loss of productivity. Effects will include those to existing occupied habitat as well as to habitat that may develop and be occupied in the future. Since future conditions are difficult to predict, the approach in the RHCP is to predict the maximum likely impacts in any given year and to provide contingent mitigation to reduce the possibility that take will exceed permitted levels. The maximum anticipated take as a result of harm to occupied habitat is 1,250 acres for flycatchers, 10 acres for Yuma clapper rails, and 1,113 acres for cuckoos. The maximum anticipated take of bald eagles is 18 fewer fledglings over the 50-year life of the permit due to reduced productivity as a result of low reservoir levels.

### D. Goals and Objectives of Roosevelt Habitat Conservation Plan

The goal of the RHCP is to provide for the conservation of federally listed and candidate species that inhabit Roosevelt while allowing the continued operation of Roosevelt. The biological goals of the RHCP 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 flycatchers, Yuma clapper rails, bald eagles, and cuckoos due to the continued operation of Roosevelt. The inclusion of cuckoos in the ITP is pending its listing, but the mitigation and minimization measures would be implemented as part of the RHCP. These goals will be achieved by meeting the following objectives:

- Managing suitable riparian habitat at and near Roosevelt;

- Creating or restoring, and maintaining additional riparian and marsh habitat near Roosevelt;
- Acquiring and managing riparian habitat in several river basins in central Arizona to provide a diversity of geographic locations that are as near to Roosevelt as practicable;
- Focusing acquisition of riparian land in locations that birds are expected to occupy, i.e., in proximity to existing populations of flycatchers and cuckoos;
- Acquiring mitigation habitat that is similar to Roosevelt in terms of vegetation composition and patch sizes;
- Continuing assistance with monitoring, maintenance, and protection of bald eagle nest sites near Roosevelt; and
- To the maximum extent practicable, ensuring that these objectives are compatible with the goals and objectives of the March 2001 Southwestern Willow Flycatcher Recovery Team's recommendations, which was the best available information during the development of the RHCP. The RHCP also is consistent with the August 2002 Flycatcher Recovery Plan (FWS 2001b and FWS 2002, respectively).

Information on the minimization and mitigation measures to be implemented as part of the RHCP is provided in Chapter IV.

### E. Public Involvement in the Roosevelt Habitat Conservation Plan

Public involvement in development of the RHCP was initiated with the establishment of an Advisory Group. Invitations to participate in the Advisory Group were sent to representatives of state and federal agencies, Indian tribes, cities, recreational groups, and environmental groups in March 2001. Meetings of the Advisory Group were held on April 20, August 21, and November 13, 2001 to solicit input on all aspects of the RHCP and EIS. Additional meetings were held on January 15 and April 2, 2002 to review information to be submitted in the draft RHCP and solicit comment. 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
- City of Phoenix
- City of Tempe
- Fish and Wildlife Service
- Forest Service
- Maricopa Audubon Society
- Salt River Pima-Maricopa Indian Community
- Sierra Club

Public involvement in scoping of the RHCP and Environmental Impact Statement (EIS) also was solicited through public notice in the Federal Register (66 FR 45690, August 29, 2001), mailing of approximately 300 scoping announcements in September 2001, and a FWS news release dated October 16, 2001. On September 17, 2001, legal advertisements of the scoping process ran in the Scottsdale and East Valley Tribunes, The Arizona Republic, and the Arizona Business Gazette. A public scoping meeting was held on October 22, 2001 from 6 P.M. to 8 P.M. at the offices of SRP.

Following publication of the draft RHCP and draft EIS in July 2002, a public hearing held on August 27, 2002, and receipt of comments, SRP revised the RHCP in cooperation with the FWS. Copies of the comments that were received and responses to those comments are provided in a separate Volume III, which accompanies Volume I, the final EIS, and Volume II, the final RHCP.

### F. Description of Applicant and Beneficiaries

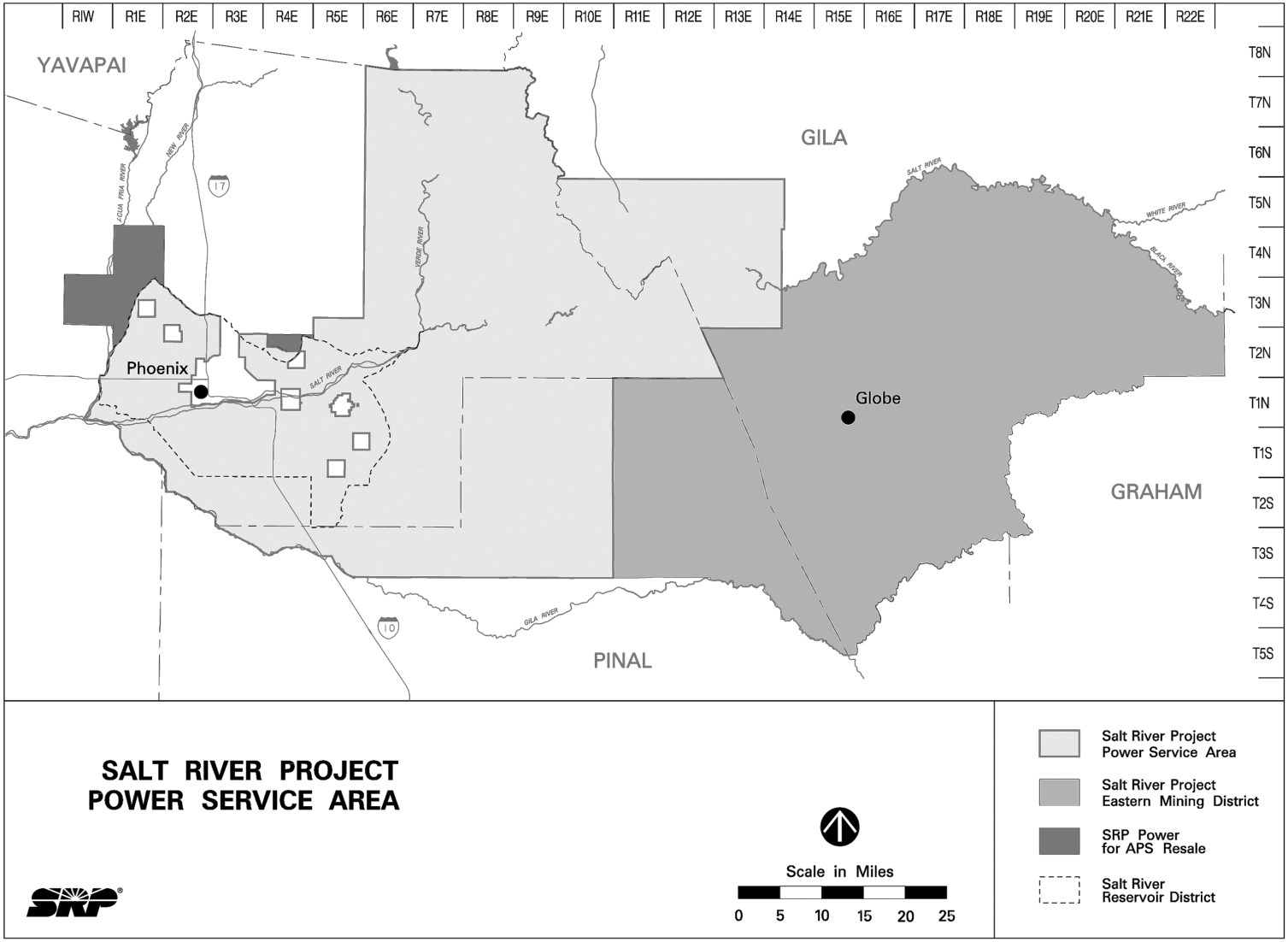
SRP refers to the Salt River Valley Water Users' Association and the Salt River Project Agricultural Improvement and Power District. SRP was authorized in 1903 under the 1902 Reclamation Act.[2] Formed as an Arizona Territorial Corporation on February 9, 1903, the Salt River Valley Water Users' Association (Association) consists of shareholders owning lands within Salt River Reservoir District boundaries.

The Salt River Project Agricultural Improvement and Power District (District) was formed by SRP in 1937. Under contract with the Association, the District assumed the obligations of the Association for the overall operation, care, and maintenance of the SRP facilities; thus, the District is applying for the ITP from FWS. The Association continues to operate the irrigation system as an agent of the District. The District owns and operates the electric and power system. The power system operated by SRP includes eight hydroelectric units on the Salt River dams with an installed generating capacity of about 260 megawatts. SRP supplies power to more than 700,000 customers from a combination of hydroelectric, thermal, and nuclear resources (SRP 2000, p. i). The area served power by SRP is shown in Figure I-2.

SRP shareholder lands have vested rights to water stored in SRP's reservoirs (see Appendix 2). SRP shareholder lands subscribed to the Association, entitling those lands to delivery of a share of the water stored behind SRP's reservoirs, including Roosevelt Dam. 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 predate the construction of SRP's reservoirs (see Appendix 2).

[2] 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.

**Figure I-2. Regional Map Showing Power Service Area.**



Water from Roosevelt 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, and individual water users having water rights to the Salt and Verde rivers. The cities of Avondale, Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, Scottsdale, Tempe, and Tolleson have rights to water stored, pumped, and delivered by SRP. In addition, the cities of Chandler, Glendale, Mesa, Phoenix, Scottsdale, and Tempe and the Salt River Pima-Maricopa Indian Community have rights to storage and delivery of water from Modified Roosevelt. Water also is delivered from the SRP reservoir system to the Salt River Pima-Maricopa Indian Community, Fort McDowell Yavapai Nation (formerly Fort McDowell Indian Community), Gila River Indian Community, Buckeye Irrigation Company, Roosevelt Water Conservation District, and others in satisfaction of their independent water rights. 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-3. The entities entitled to SRP water deliveries, and the settlements, agreements, and water rights that set forth the entitlements of those entities and SRP's delivery obligations are listed in Table I-1 and summarized in Appendices 1 and 2. In addition, exchange agreements between a number of entities and SRP are facilitated by stored water. These entities and their locations are provided in Table I-2. The purpose of the discussion of settlements, agreements, and water rights in the RHCP, including Chapter I, Appendix 1, and Appendix 2, is to describe the components of SRP's long-standing obligation to operate the conservation storage space at Roosevelt 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.

**Table I-1. 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 known as 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 | Contract for Pumping Water for Maricopa Indians on Gila River Indian Reservation, 1936. |
| 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 USC § 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. |

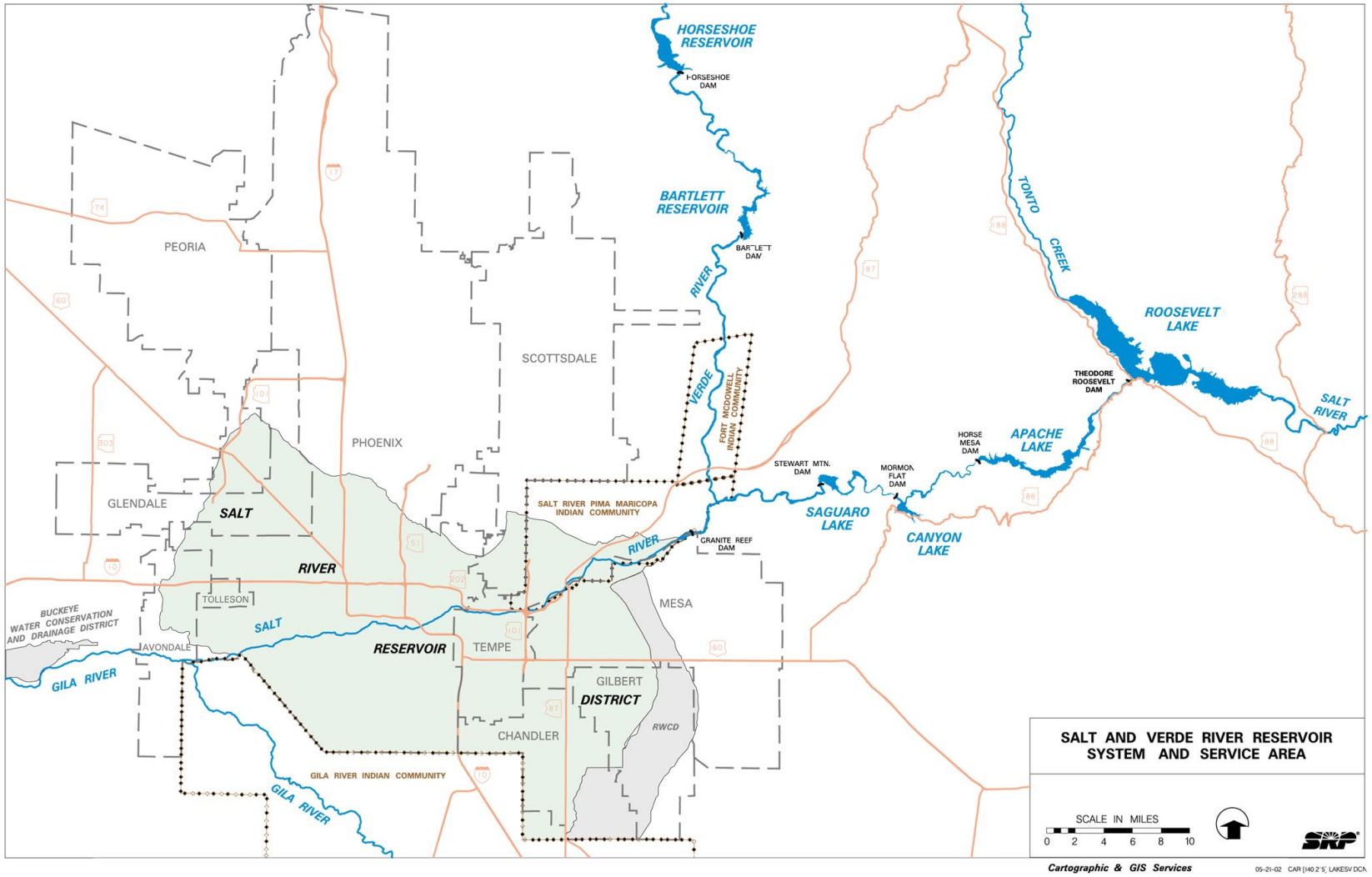
†In general, only the initial document is listed. However, many of these settlements or agreements have been supplemented or amended and, where applicable, those modifications are incorporated herein.

**Table I-2. Entities with 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 |
| Phelps Dodge Corporation | Black River, 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 |
| Cities of Chandler, Glendale, Mesa, Phoenix, Scottsdale, Tempe, Gilbert, Peoria, Tolleson, and Avondale | Various locations in the Salt River Valley (see Appendix 1 for list of exchange agreements) |
| 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.

**Figure I-3. SRP Reservoir System and Water Service Area in the Vicinity of Phoenix, Arizona.**



## G. Description of Roosevelt Lake and Storage Operations

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 (SRP 2000, p. i). Most of SRP's deliveries are to cities and urban irrigation uses and form a large portion of the total water supply to the Phoenix metropolitan population of more than 2.6 million (SRP 2000, p. 8). 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, p. 78).[3]

### *1. Overview*

The use of the entire capacity of Roosevelt Dam is fundamental to the ability of SRP and cities to meet the water demand in the Phoenix metropolitan area. The other reservoirs in the system are too small to store enough water for extended droughts. The process of filling Roosevelt to capacity and slowly drawing it down year after year to nearly empty has occurred eight times in SRP's history. Without Roosevelt's large capacity to buffer drought conditions, the Phoenix metropolitan water supply would be in jeopardy. Roosevelt's operation is intertwined with the operations of all six surface water storage reservoirs as well as ground water pumping. 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 use of ground water is being increasingly restricted by the Arizona Groundwater Management Act (A.R.S. § 45-401 et seq.).

### *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.[4] The Salt River, from Phoenix to its headwaters in the White Mountains, and the Verde River, the Salt River's major tributary, were surveyed to determine the best location for a major storage structure. One of these investigations concluded that the confluence of the Salt River and Tonto Creek appeared to be an ideal site for a storage reservoir with a capacity exceeding 1 million AF of water (Smith 1986, pp. 1-14).

The construction of Roosevelt Dam began in 1903 and was completed in 1911 by the U.S. Bureau of Reclamation (Reclamation). Water was first stored behind the dam in 1910. In 1917, the United States turned over to and vested in SRP the authority to care

[3] 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.

[4] The key impetus to construct Roosevelt 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).

for, operate, and maintain SRP facilities, of which Roosevelt Dam is an integral component.[5] SRP continues to operate SRP facilities pursuant to that contract.

Since its completion in 1911, Roosevelt Dam has continuously provided water for irrigation, municipal and industrial uses, and hydroelectric power generation. Roosevelt also provides a variety of recreational uses in central Arizona.[6]

SRP stores, diverts, uses, and delivers water from the Salt and Verde Rivers and their tributaries pursuant to various water rights. Appendix 2 summarizes water rights held by SRP and the cities of Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, Scottsdale, and Tempe. The efforts to store water at Roosevelt were initiated in 1893 when the original plan was developed to construct a reservoir at that location (Smith 1986, pp. 8, 9).

The original water conservation storage space behind Roosevelt is on land that was withdrawn from the public domain in 1903 by Reclamation for purposes of the Salt River Project.[7] Additional land was withdrawn in 1999 in the area that could be inundated as a result of the modifications to Roosevelt Dam (64 FR 67929, December 3, 1999). The withdrawn land surrounding the reservoir is managed under a three-way agreement between SRP, Reclamation, and the U.S. Forest Service (Forest Service), with the Tonto National Forest being responsible for management of recreation and other public land uses.[8]

#### *3. Salt River Reservoir System*

Located at the confluence of Tonto Creek and the Salt River about 60 miles northeast of Phoenix in Gila and Maricopa Counties (Figure I-3), Roosevelt Lake filled to capacity for the first time in 1916. Three additional dams, Horse Mesa, Mormon Flat and Stewart Mountain, were constructed on the Salt River downstream of Roosevelt in the 1920s and 1930s to complete the reservoir system on the Salt River. On the Verde River, Bartlett Dam was constructed in the 1930s and Horseshoe Dam, upstream from Bartlett, was completed in 1945. A profile view of the SRP reservoir system is presented in Figure I-4.

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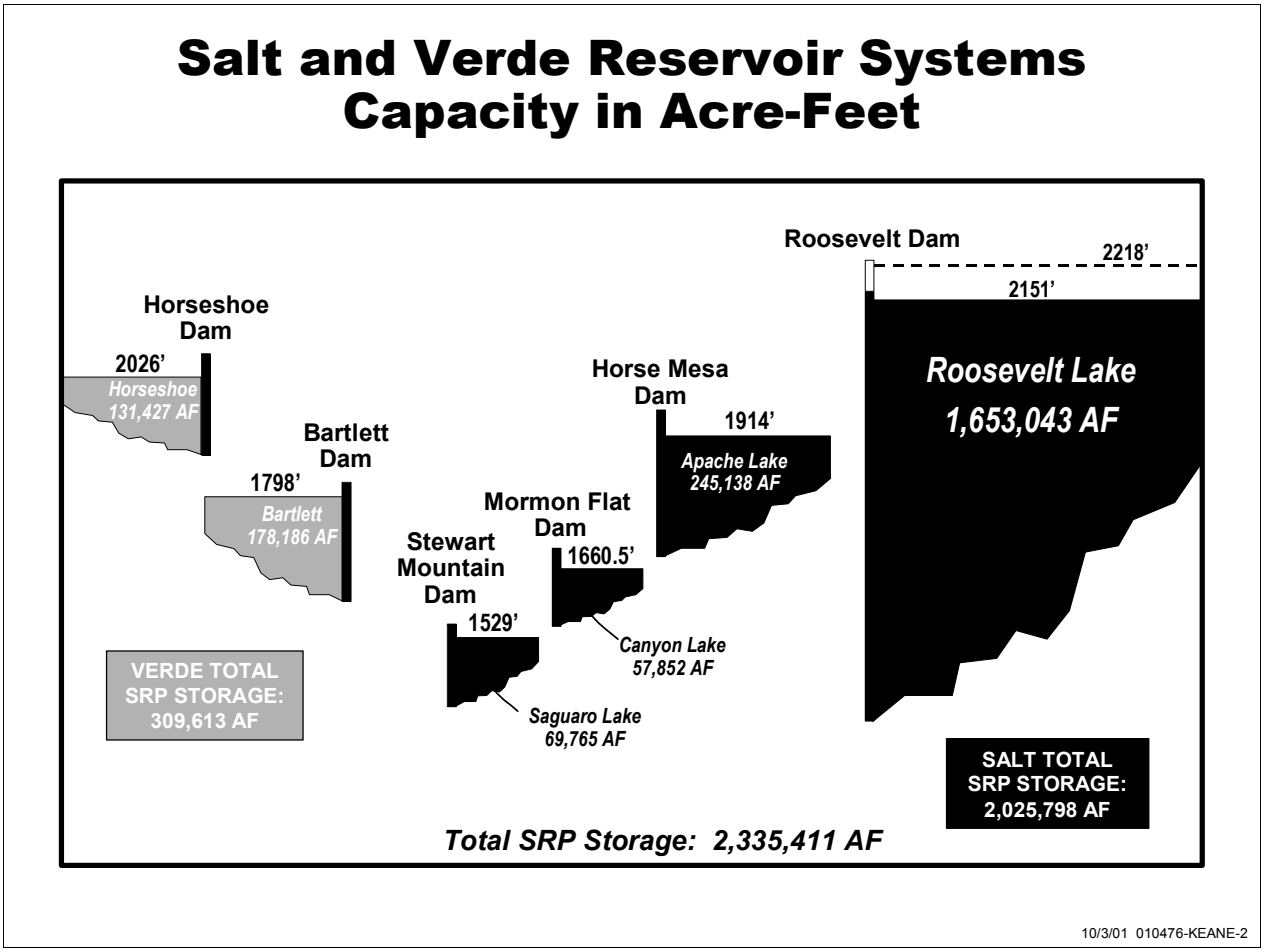
[5] See contract dated September 6, 1917 between the Salt River Valley Water Users' Association and the United States; 43 U.S.C. § 499.

[6] 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.

[7] See letter from E.A. Hitchcock, Secretary of Interior to The Commissioner of the General Land Office, March 9, 1903.

[8] 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.

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




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

Roosevelt remains the cornerstone of SRP's storage system. The storage capacity in Roosevelt (1,653,043 AF) represents 71 percent of the total surface water storage in the SRP system. Roosevelt and the other five reservoirs on the Salt and Verde Rivers are operated as integral features of SRP's water system. SRP also operates Granite Reef Diversion Dam located just below the confluence of the Salt and Verde rivers, about 250 wells, and an interconnection to the Central Arizona Project (CAP) to deliver water through nearly 1,300 miles of canals, lateral ditches and pipelines.[9]

As originally constructed, Roosevelt Dam was 280 feet high and had a water storage capacity of 1,284,205 AF. Capacity slightly increased and decreased over time as the spillway was modified and silt accumulated. From 1989 through early 1996, Roosevelt Dam was subjected to extensive modifications by Reclamation to provide additional

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

conservation storage capacity and to address safety concerns identified under the Reclamation Safety of Dams Act of 1978 (43 USC § 506 et seq.). The modified dam (Modified Roosevelt) provides for additional water conservation, dam safety, and for the first time, dedicated flood control space.[10] The top of SRP's original conservation storage space is at about elevation 2,136 feet.[11] This elevation represents the existing storage capacity held by SRP in 1995 when modifications to the dam were completed to add additional conservation storage and flood control space to Roosevelt. The rights to use water stored in the additional conservation capacity in Modified Roosevelt (New Conservation Space, NCS) are vested in the six Salt River Valley cities of Chandler, Glendale, Mesa, Phoenix, Scottsdale, and Tempe (see Appendix 2). The Salt River Pima-Maricopa Indian Community is entitled to use a portion of the NCS pursuant to the Salt River Pima-Maricopa Indian Community Water Rights Settlement Act (102 Stat. 2549). The top of the NCS capacity is at elevation 2,151 feet (Figure I-4). The uppermost increment of storage behind Modified Roosevelt, from elevation 2,151 feet up to elevation 2,218 feet, is reserved for flood control and dam safety purposes (Reclamation 1999, p. 2 and Figure 4).

#### *4. Roosevelt Operations*

SRP continues to be responsible for operation of all the conservation storage space at Roosevelt under the 1917 contract, the Plan 6 Funding Agreement, and the Modified Roosevelt Operating Agreement.[12] The Modified Roosevelt Operating Agreement provides guidelines for reservoir operations and states that SRP shall manage the SRP reservoir system to minimize releases of water over, around, or downstream of Granite Reef Diversion Dam in accordance with the following SRP conservation storage

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[10] While the original storage capacity of the dam did much to reduce the damage to valley farms from the pre-dam flooding that ravaged the farms of the settlers of the 1890s, continued growth of water demand in central Arizona, the extreme flood events of the late 1970s and early 1980s, and concerns about dam safety convinced planners that additional reservoir space was needed.

[11] The top elevation of SRP's storage space in Modified Roosevelt varies over time as sediment accumulates behind Roosevelt, beginning at slightly less than 2,137 feet in 1995 and declining to an estimated 2,136 feet in 2040.

[12] 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 (Plan 6 Funding Agreement); and Operating Agreement for Additional Active Conservation Capacity at Modified Theodore Roosevelt Dam Among the Salt River Project Agricultural Improvement and Power District, Salt River Valley Water Users' Association, United States Bureau of Reclamation, Flood Control District of Maricopa County, and the Arizona Cities of Chandler, Glendale, Mesa, Phoenix, Scottsdale and Tempe, December 14, 1993 (Modified Roosevelt Operating Agreement).

objectives (in order of priority) and, above elevation 2,151, in accordance with the flood control operating criteria established by the U.S. Army Corps of Engineers. The objectives for storage are:

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 groundwater pumping given reservoir storage and projected runoff and demand.
6. Maximize hydrogeneration.
7. Operate to permit necessary facility maintenance."

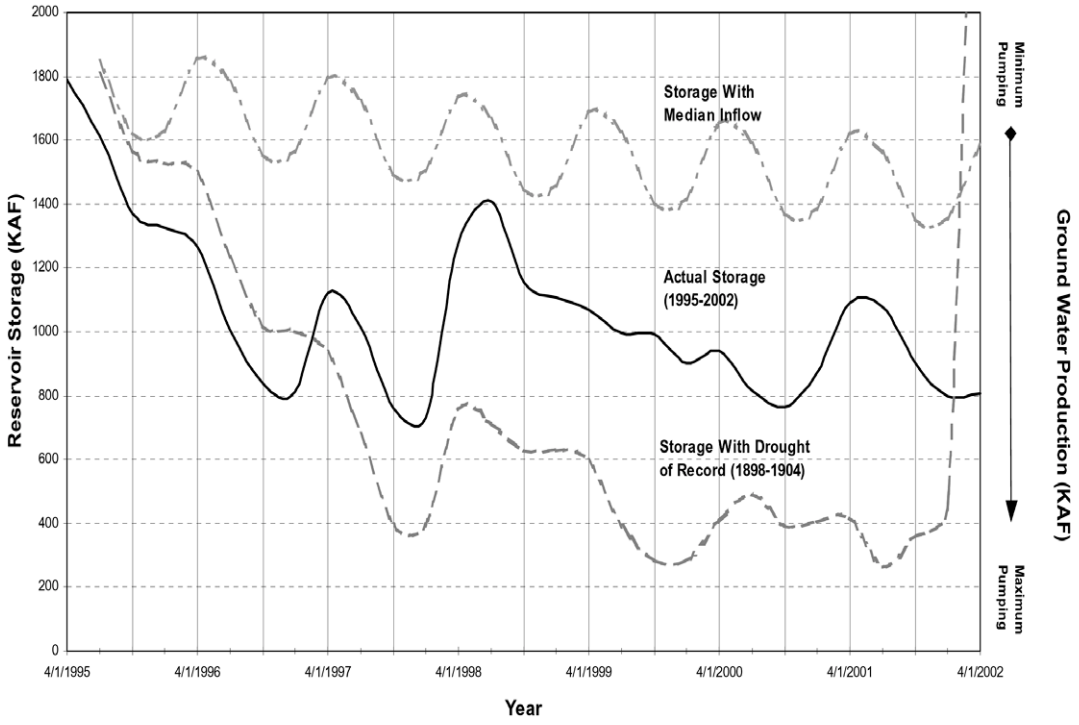
(Modified Roosevelt Operating Agreement)

SRP's operation of Roosevelt is best understood in the larger context of SRP's conjunctive operation of all six SRP reservoirs on the Salt and Verde rivers. The SRP reservoir system is operated as a cohesive unit providing much of the water used in the Phoenix metropolitan area. Roosevelt is the key SRP water storage facility because of its large capacity in relation to the other reservoirs. The reservoir space behind Roosevelt Dam is greater than twice the capacity of all the other reservoirs combined. Because of its size, Roosevelt provides protection from drought. The reservoir often goes from completely full one year to nearly empty after several years of low runoff. The role of Roosevelt as drought protection is the basis of much of SRP's water supply planning, which is summarized graphically in Figure I-5 and described below.

In order to supply the water delivery obligations described above, the policy behind SRP's planning is to extend reservoir storage through at least 7 years of below normal runoff conditions, the length of long-term sustained drought conditions experienced historically. Each year, SRP sets an annual water allocation available to SRP shareholder lands based on existing and projected reservoir storage conditions. The allocation is provided by a mix of water from two general sources: 1) surface water from the reservoir system; and 2) ground water from deep wells within the Salt River Reservoir District (see Figure I-3).

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 60 percent is supplied by storage in Roosevelt (Ester, pers. comm. 2001). Ground water is used to supplement the available surface water supplies throughout each cycle of drought (compare Figure I-1 and Figure I-6). SRP's ground water resources alone are insufficient to meet its water delivery obligations. 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

**Figure I-5. SRP's Storage and Pumping Planning Diagram.**

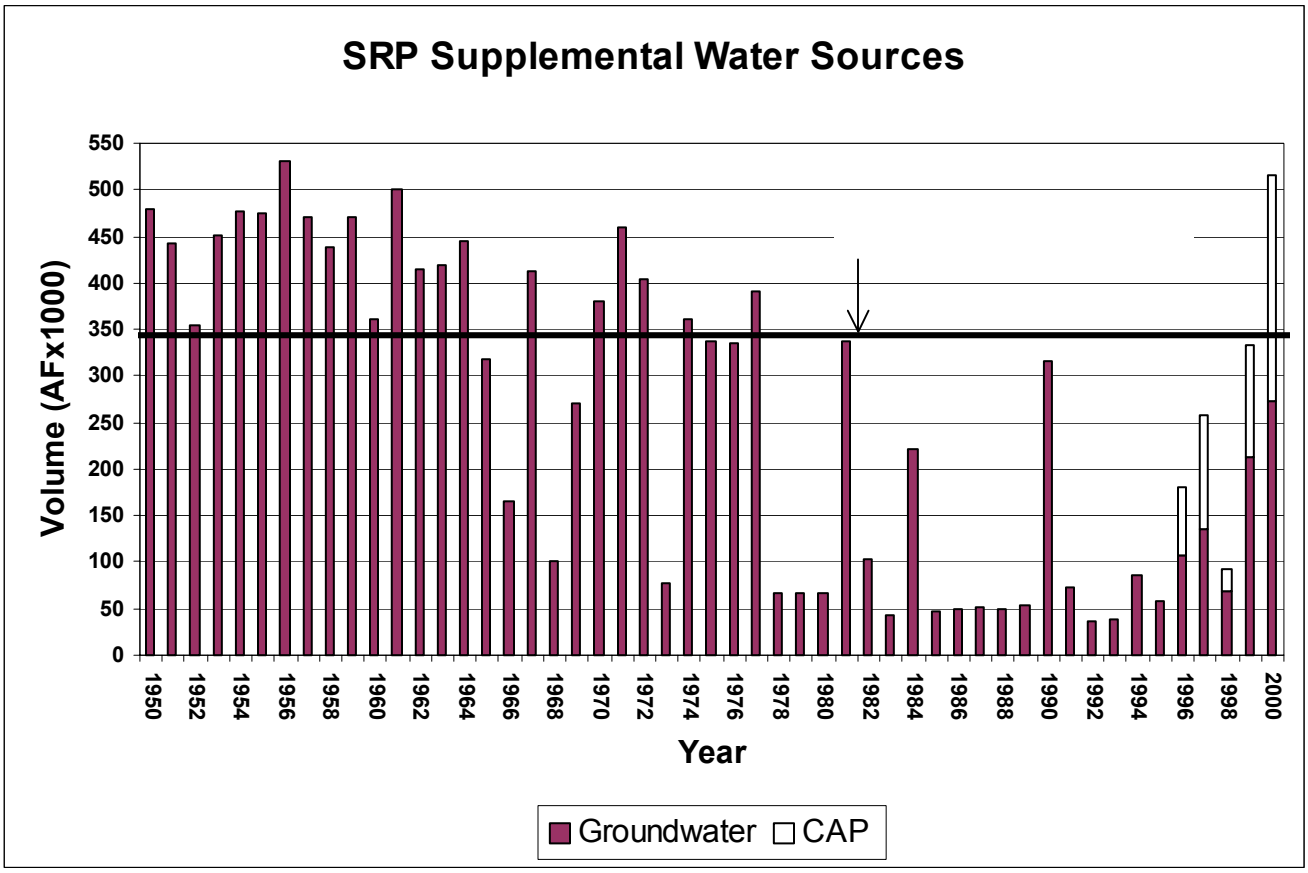



Notes:
1) The graph's Y-axis scale stops at 2,000,000 AF. This represents only SRP's water storage space within the reservoir system, not the storage space held by others and operated by SRP under agreements.
2) The drought of record after 6 years ended with enough runoff to fill SRP's current storage space.

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. As shown in Figure I-6, SRP's current ground water pumping capacity is about 350,000 AF/yr. In a further effort to reduce reliance on ground water, SRP has supplemented its declining surface water supplies in recent years with surplus CAP water rather than relying entirely on additional pumping (Figure I-6). However, 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 (see Subchapter V.N.6.d).

The annual mix of SRP water sources is determined, in part, through use of the Storage and Pumping Planning Diagram shown in Figure I-5. Under the most basic interpretation of the Planning Diagram, reservoir storage drops (see vertical scale) as water is released for use and subsequent runoff is insufficient to replace those releases.

**Figure I-6. Annual Ground Water Pumping and CAP Water Use.**




As a result, an inversely related pumping regime is implemented (right vertical scale). Depending on how low total storage drops, the annual allocation to SRP shareholders will be reduced below the normal amount of 3 AF/acre provided when storage is about average. SRP's goal in planning water deliveries is for total reservoir storage not to drop below the "Drought of Record" line. This line reflects the modeled storage levels that would have occurred had the existing reservoirs been full just prior to the start of the 1898-1904 drought of record. The trace of recent reservoir storage is shown by the Actual Storage line. The Median Inflow line represents the storage levels if average runoff had occurred between 1995 and 2001.

In 1995, the reservoir system nearly filled to historical capacity (elevation 2,136) in the last truly wet year of recent times. Since then, reservoir storage has been declining except for a minor recovery in the spring of 1997 and a slightly greater recovery in the El Niño spring of 1998. During the last 6 years, SRP's water storage in Roosevelt has declined from 92 percent full in late spring of 1995 to just 17 percent full in the late fall of 2000. At the same time, ground water pumping and short-term CAP purchases accounted for an increasingly large share of total SRP water supplies as can be seen in Figure I-6. Some recovery of storage occurred during the spring of 2001 but the winter was not abundantly wet and the watershed, after so many years of drought, quickly

soaked up most of the precipitation that fell and limited runoff. The drought has continued through the winter of 2002 and Roosevelt was only 21 percent full on April 25, 2002.[13] The reservoir level is anticipated to be as low as 10 percent of capacity or less by October 2002.

Historically, Roosevelt Lake levels have large annual and long-term variations (Figure I-1). Reservoir fill during the winter and early spring is highly variable, with the water level rising by a few feet in some years to more than 100 feet in other years. However, annual releases are more uniform and typically lower the reservoir by about 15 to 25 feet from late spring through summer. Figure I-1 also shows a long-term pattern of 3 to 7 years of low runoff and decreasing reservoir levels followed by a runoff season that fills or nearly fills the lake. Another long-term pattern is decades of below- or above-average runoff, e.g., the relatively dry period of the 1950s and the relatively wet period of the 1980s.

#### *5. Verde Reservoirs*

SRP operates two reservoirs on the Verde River formed by Bartlett and Horseshoe Dams. Although used in conjunction with each other, the Salt River reservoirs and Verde River reservoirs differ in their operations. Physically, 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. Also, the Verde River reservoirs' capacity of 309,000 AF (including the space behind the Phoenix spillway gates[14] on Horseshoe Dam) is only about two-thirds of the annual average flow of the Verde River. 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 creates an annual water supply juggling act at SRP.

SRP constantly strives, and is contractually committed under the Modified Roosevelt Operating Agreement (see Subchapter I.G.4 above), to operate the entire reservoir system to minimize the risk of spilling water over Granite Reef Dam because any water spilled downstream of Granite Reef Dam is unavailable for meeting annual water demands. During the winter and spring months (October 1 through April 30), water is delivered from the Verde River dams in order to keep Verde storage levels low and minimize 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. As a practical matter, Verde storage could not meet summer demand because releases sufficiently large to meet demand would quickly drain the Verde River reservoirs completely.

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[13] See http://www.srpnet.com/water/daily/report.asp?rptdate=4/25/02.

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

Hydropower generation is another reason for minimizing releases of Salt River storage during the winter months.[15] 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 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 recent agreement between SRP and the Fort McDowell Indian Community stipulates that a 100 cfs flow will be maintained from Bartlett Dam except in extreme drought or emergency.[16] This minimum flow is to help maintain fish habitat and riparian vegetation along the Verde River below Bartlett Dam.

#### *6. Roosevelt Recreation*

Roosevelt Lake is the largest body of water in the chain of reservoirs on the Salt River. It provides the greatest amount of water-based recreational opportunities in central Arizona, including fishing and boating. Roosevelt's distance from Arizona's major metropolitan centers dictates that most visitors camp there at least one night. The peak recreation season is April 1 to October 1, although usage is year-round (Reclamation 1984).

Roosevelt provides camping at developed areas near the southern shore and at undeveloped sites around much of its 80 miles of shoreline. The recreational facilities, including campgrounds, marinas, interpretive sites, picnic grounds, and Ranger and Aid Stations, were moved to higher ground, upgraded, and expanded by Reclamation under Plan 6, the development alternative chosen in 1984 for modification of Roosevelt Dam under the Central Arizona Water Control Study (Reclamation 1984). A thorough recreation planning process resulted in the design and construction of the new recreational facilities (Id.). With some modifications (including a reduction of 18 percent in capacity), the recreation facilities were built between 1991 and 1995 at a cost of more than $30 million (Reclamation 1990, p. 16). These facilities are listed in Table I-3 and shown on Figure I-7.

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

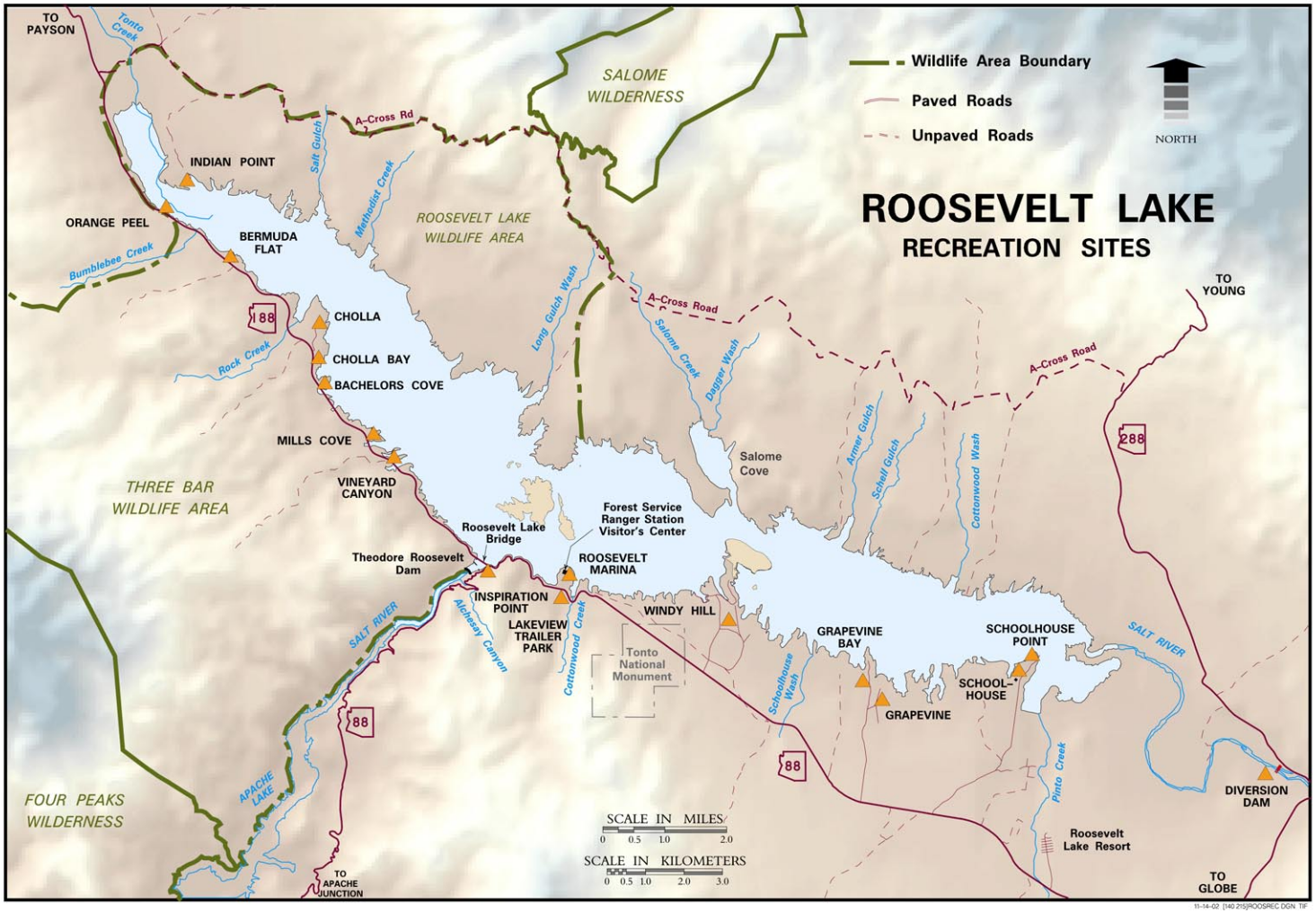
[16] The 100 cfs minimum flow is in addition to reservoir releases to meet water orders along the Verde River and is part of the diversion at Granite Reef Dam (see Table I-1).

**Table I-3. Roosevelt Lake recreation site capacities.**

| Site Name | Type | 2001 Operation | Capacity (persons/day) |
|---|---|---|---|
| Bachelors Cove | Family Campground | Open | 150 |
| Bermuda Flat | Family Campground | Open | 1,000 |
| Bermuda Flat | Group Campground | Open | 1,000 |
| Bermuda Flat | Family Picnic | Open | 375 |
| Blevins Cemetery | Interpretive Site | Open | 15 |
| Cholla | Family Campground | Open | 1,225 |
| Cholla | Boating | Open | 675 |
| Cholla Bay | Family Campground | Open | 250 |
| Diversion Dam North | Fishing Site | Open | 500 |
| Diversion Dam South | Fishing Site | Open | 1,250 |
| Grapevine | Group Campground | Open | 900 |
| Grapevine | Group Campground | Open | 800 |
| Grapevine Bay | Family Campground | Closed | 200 |
| Indian Point | Family Campground | Closed | 1,195 |
| Indian Point | Boating | Closed | 330 |
| Inspiration Point | Observation Site | Open | 50 |
| Lakeview Trailer Park | Family Campground | Open | 1,000 |
| Mills Cove | Family Campground | Closed | 50 |
| Orange Peel | Family Campground | Open | 100 |
| Roosevelt Cemetery | Interpretive Site | Open | 15 |
| Roosevelt Cemetery | Trailhead | Open | 15 |
| Roosevelt Dam Overlook | Interpretive Site | Open | 75 |
| Roosevelt Lake Aid Center | Information Site | Open | 15 |
| Roosevelt Lake Marina | Private Lodge | Open | 150 |
| Roosevelt Visitor Center | Interpretive Site | Open | 300 |
| Schoolhouse | Boating | Closed | 555 |
| Schoolhouse | Family Campground | Closed | 1,330 |
| Schoolhouse Point | Family Campground | Closed | 100 |
| SR288 Bridge | Boating | Open | 50 |
| Vineyard Canyon | Family Picnic | Open | 200 |
| Windy Flat | Family Campground | Closed | 50 |
| Windy Hill | Family Campground | Open | 2,255 |
| Windy Hill | Group Campground | Open | 2,650 |
| TOTAL | | | 18,825 |

*Source:* Killibrew, pers. comm. 2001.

**Figure I-7. Recreation Sites at Roosevelt Lake (lake elevation shown is 2,151 feet).**



Some of the new facilities were built to reflect the new, higher level of conservation storage (elevation 2,151 feet), while some were built above the new flood management pool behind Modified Roosevelt (elevation 2,218 feet). The new facilities at Roosevelt were constructed to accommodate visitors in modern facilities when the old shoreline is covered by higher water levels. When Roosevelt is filled to the top of the NCS, the new shoreline will be too steep to allow dispersed recreation on the south shore (Killibrew, pers. comm. 2001). During flood events, some or all of the facilities would be temporarily closed (Reclamation 1999, p. 11). Due to recent dry conditions and the resulting low lake levels, some of the new recreation facilities have been closed and others have been sparsely used (Table I-3; Michaels, pers. comm. 2001). However, most of the new facilities are open, including three boat ramps that have been extended onto the exposed lakebed. Dispersed camping and boat launching continue to occur along the shoreline, with temporary sanitary facilities provided through fees paid to the Forest Service (Killibrew, pers. comm. 2001).

The new recreation facilities at Roosevelt have a total daily capacity for 18,825 people per day (Table I-3). Reclamation calculates that this capacity will yield 867,796 recreation days annually for the various activities at the lake (Reclamation 1990, Table A1).

Although available visitor use information is incomplete for the 1990s, the Forest Service and Reclamation used visual estimates to tally visitation until 1996. The Forest Service estimated that visitation to the Tonto Basin Ranger District increased about 7 percent per year for 1992-1996, a period during which the lake was nearly full as shown in Appendix 3, Figure 4. Reclamation estimated about 350,000 visitor days at Roosevelt in 1996, approximately 30 percent more than the number of visitors at any other Reclamation impoundment in central Arizona.

Reclamation suspended informal collection of visitor use information after 1996 (Woods, pers. comm. 2001). The Forest Service stopped collecting data for the Tonto Forest in 1997. When the reservoir fills, it is assumed the new recreation facilities will fill to capacity (Killibrew, pers. comm. 2001).

### H. History of ESA Compliance at Roosevelt Lake

Prior ESA compliance at Roosevelt Lake involved the construction and funding of modifications to Roosevelt in the 1990s by Reclamation, and Forest Service consultation on grazing uses. Reclamation's planning for Roosevelt modifications began in the 1980s and construction occurred in the 1990s. Reclamation's construction and funding of these modifications were federal actions under Section 7 of the ESA, which required compliance with Section 7(a)(2)'s interagency consultation requirements. Below is a list of Reclamation consultations related to Roosevelt. A summary of Forest Service consultations at and near Roosevelt is also provided.

#### *1. 1983/1984*

Under the authority of the Central Arizona Project Act (the Colorado River Basin Project of 1968, 82 Stat. 886, 43 USC § 1501 et seq.) and the Safety of Dams Act (43 U.S.C. § 506 et seq.), Reclamation evaluated a number of options for construction of new water storage facilities and safety modifications to dams in central Arizona. As part

of that process, a final environmental impact statement was completed on the Central Arizona Water Control Study (Reclamation 1984). The Record of Decision selecting the preferred alternative, known as Plan 6, was issued on April 3, 1984. Although other components of Plan 6 were later modified, the plan for construction of modifications to Roosevelt remained basically unchanged from 1984. FWS issued its BO for Plan 6, including Roosevelt modifications, on March 8, 1983 (FWS 1990, p. 1). Possible impacts of Roosevelt modifications on the Pinal bald eagle breeding area were part of the basis for an opinion that the project would likely jeopardize the continued existence of the bald eagle population in the Southwest (Id.). The reasonable and prudent alternative (RPA) for the Pinal bald eagles identified by FWS to avoid jeopardy was to modify the extent and timing of borrow excavation at Meddler Point near the nest and to restrict recreation access to the area (Reclamation 1992, p. 3). This alternative was implemented by Reclamation (Id.).

#### *2. 1989/1990*

Following issuance of the BO in 1983, two new bald eagle breeding areas were discovered near Roosevelt, the Sheep breeding area and the Pinto breeding area. On July 20, 1989, Reclamation requested re-initiation of consultation on Roosevelt modifications as a result of new information on bald eagle activities at the reservoir (Id.).

Reclamation's 1989 Biological Assessment concluded that there was not likely to be an impact on the Sheep breeding area centered 15 miles upstream from the lake on Tonto Creek. As to the Pinto breeding area, the BA concluded: "the increased conservation pool may affect the Pinto Creek territory by killing the trees in the nesting area, and that the 100 year flood event may affect this territory by inundating the nest tree during the breeding season. In addition, the proposed recreation developments may affect the bald eagles" (Id.). Following the reinitiation of consultation requested by Reclamation on July 20, 1989, FWS issued a BO analyzing the effects of modifications to Roosevelt on the Sheep and Pinto breeding areas. The 1990 BO also addressed bald eagle use of a large cottonwood gallery at the mouth of Tonto Creek (FWS 1990, pp. 2, 4). FWS concluded that the Roosevelt modifications were not likely to jeopardize the continued existence of bald eagles in the Southwest (FWS 1990, p. 1). The BO describes the eventual loss of all or a portion of the cottonwoods, including nesting trees, below elevation 2,151 but describes the offsetting benefits of additional shallow water habitat and fringe wetland areas created by higher reservoir levels, and the improvement of riparian habitat in the Tonto Creek Riparian Unit established by Reclamation as mitigation for Modified Roosevelt Dam (FWS 1990, pp. 4, 5). FWS proposed, and Reclamation agreed to implement, two measures to minimize incidental take to the Pinto nest: 1) construction of a bald eagle nesting platform in the Pinto nest area at least 4 years before the nest tree is anticipated to collapse due to death by inundation; and 2) closure of the Pinto nest area to

recreation use during the breeding season if it becomes active (Reclamation 1992, p. 3).[17] In addition, three conservation measures were identified: 1) winter surveys for bald eagles along the shores of Roosevelt; 2) construction of additional nesting and perching platforms to replace cottonwoods killed by inundation in the Pinto breeding area; and 3) purchase of Rockhouse Farm property near the Salt River inlet to create riparian habitat (Reclamation 1992, p. 4). Reclamation supports winter bald eagle surveys at Roosevelt and subsequently purchased the irrigated fields and floodplain portions of the Rockhouse Farm (Messing, pers. comm. 2001, 2002a).[18]

#### *3. 1992/1993*

In 1992, Reclamation again reinitiated consultation with FWS following the discovery of a new bald eagle nest at the mouth of Tonto Creek in a grove of cottonwoods located below elevation 2,151 feet. Reclamation prepared a Biological Assessment to address the impacts of Roosevelt modifications on this new breeding area and to address new information regarding the importance of reservoir inflow areas to bald eagles (Reclamation 1992, p. 5). The Biological Assessment concluded that there might be an impact on the Tonto bald eagles because trees in the vicinity would be killed by inundation of the NCS and eventually lost for perching or nesting, and recreation use at new facilities planned nearby might affect the bald eagles (Reclamation 1992, p. 23). At the conclusion of the reinitiated consultation with Reclamation, however, FWS concluded that the Roosevelt modifications were not likely to jeopardize the continued existence of bald eagles in the Southwest (FWS 1993a, p. 2).

The 1993 BO prepared by FWS described the eventual loss of the existing nest trees and nests as a result of inundation, and the subsequent impact to trees, nests, productivity, eggs, and fledglings from inundation and recreation impacts over the next 50 years (FWS 1993a, pp. 11, 12). The BO also noted that there will be long-term offsetting effects as higher reservoir levels support cottonwoods farther upstream and as habitat improves in the Tonto Creek Riparian Unit (FWS 1993a, pp. 9, 10). FWS provided three measures to minimize incidental take to the Tonto nest: 1) seasonal closure around the breeding area; 2) annual monitoring support for the Tonto breeding area; and 3) notification of FWS and assistance in rescue efforts if inundation of eggs or nestlings may occur (FWS 1993a, p. 12). The terms and conditions for the Tonto BO were: for the life of the Indian Point recreation facility; or until the bald eagle is delisted; or until such time as it can be clearly demonstrated that the Tonto bald eagle breeding area has been abandoned; or until

[17] The 1990 BO was skeptical that the Pinto breeding area (occupied by a single female at the time) would ever become viable due to its close proximity to the Pinal breeding area. However, the higher lake levels caused by the modifications to Roosevelt were anticipated to provide benefits to eagles in the form of additional shallow water and lake fringe habitat. In turn, it was hoped that this improved habitat might provide sufficient production of prey to support a viable pair at both the Pinto and Pinal breeding areas (FWS 1990, p. 5). Subsequently, the Pinto female attracted a mate and the breeding area has become productive (see Subchapter II.B.2).

[18] Reclamation purchased the Rockhouse Farm property in order to reduce liability from flood control operations (Messing, pers. comm. 2002).

Reclamation can demonstrate that there have been no recreation-related incidents reported by nest watchers that resulted in abandonment of the nest or loss of young at the Tonto breeding area for 10 consecutive years (Messing, pers. comm. 2002a). These measures are being implemented by Reclamation. In addition, four conservation measures were identified: 1) relocation of the Indian Point Campground; 2) seasonal closure of the Indian Point Cultural Resource site; 3) establishment and maintenance of future potential nesting habitat along Tonto Creek including pole plantings of cottonwoods if necessary; and 4) construction and staffing of a bald eagle viewing station for public viewing and education (FWS 1993a, p. 14).

#### *4. 1995/1996*

In 1993, southwestern willow flycatchers were discovered nesting at the reservoir. The species was listed as endangered on March 29, 1995. Reclamation again requested Section 7 consultation with FWS on September 14, 1995 to consider the effect of modifications to Roosevelt Dam on flycatchers. The Biological Assessment prepared by Reclamation addressed the impact of the increased height of the dam, and the indirect effects of the inundation of the NCS and flood control space, on flycatcher habitat (Reclamation and SWCA 1995, p. 1).[19] On July 23, 1996, FWS issued a BO on the construction of Modified Roosevelt and its effects on the endangered flycatcher. FWS anticipated in the BO that up to 90 flycatchers would be taken annually, which was based on the assumption that inundation of the flycatcher habitat would permanently eliminate all flycatchers at the lake. The BO identified a Reasonable and Prudent Alternative (RPA) to avoid jeopardy to the species and Reasonable and Prudent Measures (RPMs) and Terms and Conditions to minimize incidental take. Reclamation is responsible for implementing the RPA and RPMs subject to the Terms and Conditions of the BO through October 1, 2006. Those measures and their status are listed in Table I-4.

**Table I-4. Reclamation RPA measures for the flycatcher and status of implementation.**

| RPA Measures | Status |
|---|---|
| **1.a. No fill of NCS until after 9/1/96 and completion of 1.b.** | NCS not yet used due to drought.<br>Habitat acquisition for 1.b. complete. |
| **1.b. Flycatcher Habitat Protection.** Acquisition, operation, and maintenance. | Acquisition: $1,460,563 for 865 acres. About $100,000/yr in perpetuity for operation and maintenance. Site conservation plan completed in 1999 following review by FWS and Reclamation. Site conservation plan to be revised as needed. Perimeter fence completed in 1999. |
| **1.c. Management Fund of $1.25M. Reclamation will use the rest of the fund for land acquisition.**<br>FWS 11/18/97 memo clarifies use of management fund. | A small amount of this fund was used for cowbird trapping on upper San Pedro River, but was discontinued after 2 years because no flycatchers were found. The remainder of the fund will be used for land acquisition and habitat improvements along the San Pedro River. |

[19] See memorandum to David Harlow, U.S. Fish and Wildlife Service, from Carol Erwin, U.S. Bureau of Reclamation, dated January 5, 2000, p. 1.

| RPA Measures | Status |
|---|---|
| **1.d Reclamation Flycatcher Coordinator**. 10/1/1996-10/1/2006. | Prepares annual work plan. Conducts coordination meetings among Reclamation, FWS, USGS, AGFD, quarterly or as needed. Assists FWS with coordination, interpretation, use of flycatcher research. Is an advocate for improving status of flycatcher: disseminates information, generates interest and seeks funding, accomplishes on-the-ground conservation actions. Identifies conservation strategies in cooperation with FWS and other federal, state, and Tribal entities for incorporation into a recovery plan; assists in assessing flycatcher distribution, site-specific conditions, habitat and population trends, and potential management actions. Evaluates potential management conflicts, develops management opportunities and partnerships within occupied and unoccupied habitat. Coordinates with appropriate FWS staff to provide information for Section 7 consultation. Assists FWS in preparing management agreements with agencies, local management entities, and private landowners. |
| **1.e.1 and 3. Research and monitoring of nests and dispersal**. Monitoring at Roosevelt Lake and vicinity, lower San Pedro River, Gila River. Nest monitoring: 10 years at 5 sites. Dispersal monitoring (surveying): 5 years. Annual report. | Dispersal monitoring will continue beyond 5-year end date (2000-2002 depending on when surveys in a particular area began) because the lake has not yet risen and need to document change in flycatcher numbers when it does. In 2001, strategy was changed to monitor a predetermined subset of nests. The subset represents a variety of habitat cover gradations and distribution at Roosevelt Lake and San Pedro/Gila rivers and will provide statistically valid data. |
| **1.e.2. Research and monitoring of demographic data.** Banding and dispersal at Roosevelt Lake, lower San Pedro, and Gila River populations for 5 years at 5 sites, 1996-2000. Annual report. | Banding will continue beyond 5-year end date (2000) because Lake has not yet risen and need to document change in flycatcher numbers when it does. Decision made jointly by FWS and Reclamation during discussions in 2000. In 2001, strategy changed at San Pedro/Gila rivers. USGS will focus on banding birds used for nest monitoring at Roosevelt Lake. AGFD will band on the San Pedro/Gila rivers but will band only those individuals at monitored nests. |
| **1.e.4. Genetic Sampling**. 1996, 1997. | Report completed in 1997. |
| **1.e.5.a and b. Aerial Photos and Reports**. Photos to be taken in 1996, 1998, 2000. | Color and infrared photos taken in the fall of 1996 and 2000. Reclamation scanned and rectified photos. SWCA completed report on 1996 aerial photos and 1996/97 vegetation mapping in 1999. SWCA vegetation mapping has been compared with ERO Resources habitat mapping. |
| **1.e.5.c. Vegetation Sampling Report.** Reports due 1997, 2000, and 2006. | Report will document changes in habitat extent, vegetation composition, and structure for each cover type. 1997 vegetation sampling report not completed because the draft report was unacceptable. FWS and AGFD agreed to substitute AGFD vegetation sampling at use and nonuse areas, as well as continuation of the AGFD habitat suitability model using 2000 satellite imagery and field truthing habitat status statewide. This work will also determine changes in habitat at Roosevelt Lake in 5-year increments beginning in approximately 1981. |

| RPA Measures | Status |
|---|---|
| **1.f. Cowbird trapping** at 5 locations on lower San Pedro River for 10 years (1997- 2006). | Kearny, Indian Hills, San Pedro River Preserve, PZ Ranch, and Cooks Lake trapped through 2000. In 2001, traps moved from PZ Ranch to the mouth of Aravaipa Canyon on TNC property. Annual report is prepared. |
| **RPMs, Terms and Conditions** | **Status** |
| **1. Restrict fill of NCS through 9/1/96.** | Complete. |
| **2. Reduce cowbird parasitism.** | Ongoing; see RPA 1.f. |
| **3. Use skilled personnel for research and monitoring.** | Ongoing. AGFD and USGS are conducting the research and monitoring. |
| **4. Reduce take; provide coordination and management.** | Ongoing; see RPA 1.d. |

*Source:* Reclamation 2001; FWS 1996.

### *5. Summary of Reclamation's ESA Compliance*

Reclamation's Section 7 consultations addressed the federal action of "raising the dam's crest height 77 feet to increase the structural integrity of the dam and to allow for additional storage capacity and emergency flood control" (FWS 1996, p. 4). The 1983, 1990, and 1993 BOs addressed impacts on bald eagles, and the 1996 BO addressed impacts to flycatchers and authorized the incidental annual take of up to 90 flycatchers (FWS 1996, p. 43). After 2006 when Reclamation's intensive monitoring of flycatcher populations ceases, Reclamation's continued responsibilities under existing BOs will be limited to specific RPA measures for flycatchers and bald eagles described above unless changed circumstances occur related to the modifications of Roosevelt, or unless there is a new Reclamation action.

### *6. Relationship of RHCP to Previous Reclamation ESA Compliance*

The RHCP addresses the effects of SRP's ongoing operation of all conservation storage space at Roosevelt Dam, including the NCS created by Reclamation's modification of the dam. Through SRP's 1917 contract with the Secretary of the Interior, and the 1993 Modified Roosevelt Operating Agreement authorizing SRP to operate the NCS constructed by Reclamation, SRP has the authority to operate conservation storage at Roosevelt Dam. As the actions at issue in this RHCP are SRP's actions taken pursuant to its authority to operate the dam, FWS has concluded that the effects of dam operations are properly considered through SRP's application for an incidental take permit under Section 10 of the ESA.[20] This RHCP also will integrate Reclamation's ongoing implementation of the RPAs accepted pursuant to Section 7 of the ESA in order to provide a comprehensive program for conservation of listed species at Roosevelt (see Subchapter IV.A).

[20] Letter to John F. Sullivan, Associate General Manager, Salt River Project, from David Harlow, U.S. Fish and Wildlife Service, dated March 2, 2000, p. 1.

### *7. Forest Service Consultations*

The Tonto National Forest requested formal consultation by FWS in 1995 for the Tonto Basin Allotment (including the Tonto Creek Riparian Unit) and the Eastern Roosevelt Lake Watershed Analysis Area (comprised of five separate grazing allotments).[21] These two project areas contained the entire known occupied flycatcher habitat at Roosevelt Lake at that time. BOs for each of these projects were issued by the FWS in December 1995. The BOs contained RPAs requiring cowbird trapping and flycatcher monitoring. Currently, livestock grazing is excluded in areas within 5 miles of occupied flycatcher habitat; therefore, the Tonto National Forest is no longer trapping cowbirds. This elimination of cowbird trapping if livestock are excluded conforms to the conditions of the BOs.

The Tonto National Forest has recently initiated NEPA compliance on issuance of grazing permits for the Tonto Basin, Poison Springs and Sierra Ancha Allotments, all of which contain occupied flycatcher habitat, and which were included in the 1995 consultation. It is anticipated that consultation with FWS under the ESA will occur for these allotments in late 2002 or early 2003. The Forest also anticipates consulting on the remaining allotments that could potentially affect the flycatcher or its habitat between 2002 and 2004.

[21] The Tonto National Forest provided this information on recent consultations at Roosevelt (Smith, pers. comm. 2002).

# II. Roosevelt Vegetation and Wildlife

Chapter II describes vegetation and wildlife in the vicinity of Roosevelt Lake. This information forms the foundation for the biological impact analysis in Chapter III. Historical riparian vegetation at Roosevelt is described in addition to recent vegetation mapping, categorization, and trends. Wildlife descriptions focus on flycatchers, Yuma clapper rails, bald eagles and cuckoos, but other listed species and species of concern also are addressed.

## A. Vegetation

As discussed further below, operation of Roosevelt is similar to a natural riparian ecosystem with cycles of riparian habitat and loss.[22] Riparian vegetation grows along the watercourses feeding the reservoir and the margin of the lake near those inflows. Lake levels are primarily driven by the amount of precipitation falling on the watershed. The quantity of water released from the reservoir also strongly affects lake levels. Changing lake levels that accompany normal operation of the reservoir result in constantly changing amounts and distribution of riparian vegetation. At times, higher lake levels destroy some vegetation due to inundation but also create conditions favorable for establishment of new vegetation or rejuvenation of existing vegetation. At other times, lower lake levels expose newly deposited sediment and allow for riparian vegetation establishment. This dynamic cycle of disturbance and regeneration creates and then periodically inundates and destroys habitat used by flycatchers, Yuma clapper rails, bald eagles, and cuckoos. If it were possible to maintain more static lake levels at Roosevelt, riparian vegetation below the static level would completely die from inundation and riparian vegetation more than about 15 feet above the water level would die or become decadent. All that would remain would be a narrow band of vegetation around the lake and streams.

### *1. Historical Vegetation*

Riparian vegetation at Roosevelt used by flycatchers occurs on large deltas of sediment formed in recent years at the two inflow points to the lake. Before construction of Roosevelt in 1911, cottonwoods and willows were present along the channels of the Salt River and Tonto Creek within the reservoir area. However, based on analysis of photographs, topography and hydrology, this riparian vegetation was concentrated in relatively small areas and narrow bands along the streams (Figure II-1). Farming and intensive grazing throughout the Salt River and Tonto Creek watersheds in the late 1800s likely reduced the amount of riparian vegetation within the reservoir area prior to construction of Roosevelt Dam (FWS 1996, p. 14). In addition, this vegetation was subjected to scouring from natural flood events, which were exacerbated by the removal of watershed vegetation due to grazing (Croxen 1926). Additional riparian vegetation may have been present prior to grazing and between periodic scouring events.

[22] Under normal reservoir operations, this cycle of riparian habitat growth and loss occurs more frequently than in natural systems where riparian vegetation is lost due to large flood events or fire.

Following the completion of construction of the original Roosevelt Dam in 1911, the reservoir bed was frequently dry or scoured by large inflow events, which limited the acreage of riparian vegetation through the late 1970s (Reclamation and SWCA 1995, p. 4).[23] Salt cedar (*Tamarix* spp.) (also known as tamarisk) invaded the watershed at an unknown date following construction of the dam. Large, consecutive flood events in 1978-1980 resulted in substantial sediment deposition where the Salt River and Tonto Creek enter the lake. Also, from 1978 through the early 1990s, a series of wet years created favorable conditions for the future growth of larger amounts of riparian vegetation at Roosevelt.[24] High lake levels expanded these deltas and kept them saturated (see Figure I-1). Those conditions combined to favor the growth of riparian vegetation in the 1990s as lake levels receded.

Riparian vegetation at Roosevelt is also affected by streamflow conditions. The Salt River is perennial in this reach. However, Tonto Creek near and at Roosevelt is intermittent in some years with no surface flow in most reaches during summer months.

#### *2. Vegetation Mapping*

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 Roosevelt Dam and to identify changes in vegetation over time in order to assess the effects of lake levels that have been lower than average since 1995. As part of the effort, detailed topographic information was incorporated into the analysis.

In the spring and summer of 2001, ERO updated vegetation mapping conducted in 1997 by SWCA, Inc. on the Tonto Creek and Salt River arms of Roosevelt Lake (SWCA 1999).[25] Reclamation provided color and infrared aerial photography taken on September 9, 2000 (Salt River) and September 20, 2000 (Tonto Creek). Using the SWCA mapping from 1997 as a base, ERO examined the newer photography and conducted fieldwork to evaluate changes in vegetation.

Initial fieldwork was conducted in April 2001 to identify potential changes in vegetation from the 1997/1998 study. The fieldwork consisted of on-ground visits to selected sites, especially those known as willow flycatcher breeding areas. General species composition and height of vegetation at representative sites were noted on copies of aerial photographs, and changes in vegetation from the SWCA study were documented. The fieldwork included helicopter flyovers to gain a closer view of areas not easily accessible by foot or four-wheel drive vehicle. The initial fieldwork was used to match certain signatures of vegetation types on the aerial photographs with actual

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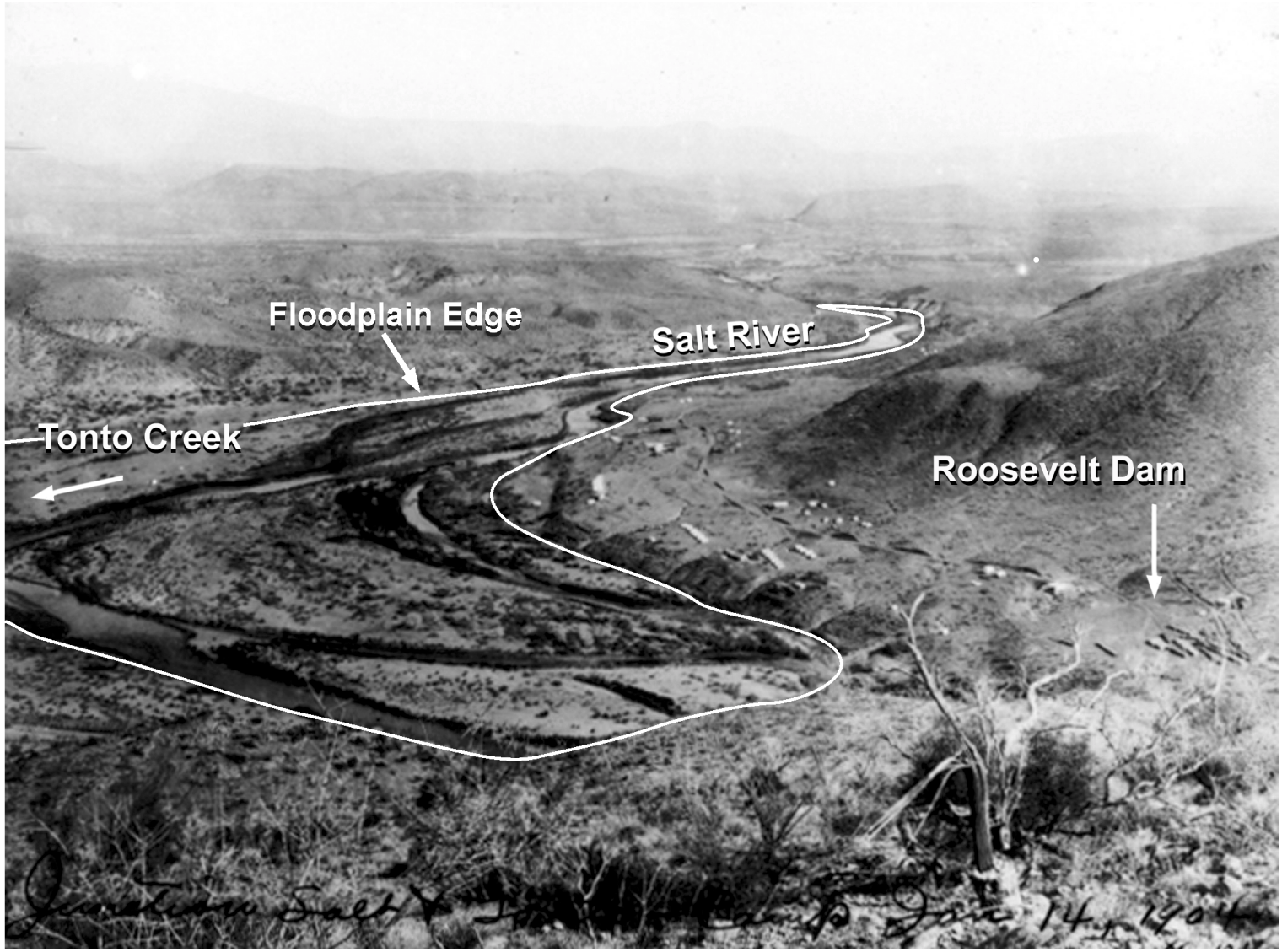
[23] Ohmart (1979) identified about 100 acres of cottonwood community, about 500 acres of salt cedar, and about 500 acres of honey mesquite near the Salt River inlet using 1978 aerial photos. Based on subsequent aerial photos, about one-half of the cottonwood and salt cedar was scoured by floods in the late 1970s and early 1980s.

[24] Large inflows occurred in 1978, 1979, 1980, 1983, 1991 and 1993.

[25] ERO Resources Corporation (ERO) is the consulting firm hired by SRP to prepare the RHCP.

**Figure II-1. Confluence of Tonto Creek and Salt River, January 4, 1904. Looking east up the Salt River from the Roosevelt Dam site.**



vegetation types on the ground and was not intended to ground truth each individual mapping unit. No quantitative vegetation data were collected.

The SWCA study identified the following vegetation types in the study area: cottonwood/willow, mixed riparian, salt cedar, non-woody/salt cedar, mesquite, non-woody, densely vegetated strand, and sparsely vegetated. Based on examination of aerial photographs and the initial fieldwork, ERO identified a new vegetation type—dying salt cedar—to identify areas where most salt cedar are dead or so decadent that inundation may not revive the vegetation. Several of the vegetation types identified by SWCA were also divided into additional types based on height characteristics and density in order to better identify areas that might actually provide habitat for flycatchers. ERO's riparian vegetation classification types for the 2001 study are shown in Table II-1.

**Table II-1. Vegetation classification types for Roosevelt Lake.**

| Type | Definition | Tall Dense Vegetation |
|---|---|---|
| Cottonwood/willow | More than 80% cottonwood/willow | Yes |
| Mixed riparian > 15 feet | No single species (cottonwood/willow/salt cedar) comprises more than 80%, trees generally more than 15 feet in height | Yes |
| Mixed riparian > 15 feet, low density, | No single species (cottonwood/willow/salt cedar) comprises more than 80%, trees generally more than 15 feet in height, but noticeably more open with more spacing between trees | No |
| Mixed riparian < 15 feet | No single species (cottonwood/willow/salt cedar) comprises more than 80%, trees generally less than 15 feet in height | No |
| Salt cedar > 15 feet | More than 80% salt cedar, trees generally more than 15 feet in height | Yes |
| Salt cedar > 15 feet, low density | More than 80% salt cedar, trees generally more than 15 feet in height but noticeably more open with more spacing between trees | No |
| Salt cedar < 15 feet | More than 80% salt cedar, trees generally less than 15 feet in height | No |
| Dying salt cedar | More than 80% salt cedar, most trees dead or decadent | No |
| Non-woody/salt cedar < 15 feet | Mix of woody salt cedars generally less than 15 feet in height and non-woody vegetation | No |
| Salt cedar/mesquite | Mixture of salt cedar and mesquite, generally less than 80% mesquite | No |
| Mesquite | More than 80% mesquite | No |
| Non-woody | Densely vegetated but few woody plants; mostly cocklebur and salt cedars less than about 10 feet in height | No |
| Densely vegetated strand | Areas supporting a high cover (more than 50%) of woody strand vegetation such as *Hymenoclea monogyra* | No |
| Strand | Areas with sparse vegetation including narrow strands of woody and non-woody plants, stream channels, and gravel bars | No |
| Sparsely vegetated | Areas with less than 30% vegetative cover, including agricultural fields and developed areas | No |

*Source:* SWCA 1999; ERO 2001.

Vegetation mapping using aerial photography was conducted after the initial fieldwork. The SWCA vegetation mapping on 1996 aerial photos in its 1997/1998 study formed the basis of the maps, and changes were made only where obvious differences in the vegetation or discrepancies were observed. Changes to the SWCA mapping were made in three circumstances:

- Previously mapped vegetation polygons were divided into smaller polygons on the basis of differences in height or density. For example, SWCA's salt cedar vegetation map unit was divided into salt cedar > 15 feet; salt cedar > 15 feet, low density; salt cedar < 15 feet; and dying salt cedar.
- Previously mapped vegetation polygons were reclassified due to apparent changes in vegetation since the 1997/1998 study. For example, some areas that had been previously mapped as strand in 1997/1998 are covered by salt cedar and mixed riparian vegetation in 2001 as a result of prolonged drought that has allowed riparian vegetation to colonize and expand in low lying areas closer to the recent lake levels.
- A few previously mapped areas were reclassified because 2001 field investigation and interpretation of aerial photography differed significantly from the 1997/1998 study, even though it is unlikely that the mature vegetation actually changed in these areas.

Where necessary, vegetation patches were delineated based on signatures identified from infrared and color aerial photography. Patches of apparently similar vegetation were delineated and assigned to a vegetation class.

After initial vegetation classification, the areas considered to be "tall dense vegetation" (possible flycatcher habitat) were compared to a map of areas of "predicted suitable" flycatcher habitat produced by Arizona Game and Fish Department (AGFD) (Hatten et. al. 2001). The AGFD map was produced using spectral data from 1999 satellite imagery to examine associations between "predictor variables" and nest-site occurrence at different scales of analysis using multiple logistic regression. Comparison of the AGFD map and ERO maps revealed some areas where ERO's preliminary mapping had not identified tall dense vegetation that was predicted to be suitable by AGFD and vice versa. As a result, several areas were reclassified. The most significant changes were to reclassify some areas from salt cedar > 15 feet to salt cedar > 15 feet, low density.

ERO conducted a second field visit in July 2001 to look for potential errors in the mapping and double check areas that were difficult to interpret from aerial photography. Several vegetation patches were reclassified as a result of this second field visit.

A meeting was held with Alex Smith, Roosevelt field crew leader for AGFD in 2001, on August 29, 2001 to discuss the draft vegetation maps in relation to 2001 field observations of territory locations and vegetation growth. Several changes to vegetation patches were made on the map of the Salt River arm as a result of this meeting.

### *3. Recent Changes in Vegetation*

On the Salt River arm of Roosevelt (Salt arm), most of the vegetation changes between 1997 and 2001 occurred downstream of the confluence with Pinto Creek. New vegetation now occurs on the reservoir floor below elevation 2,100. Some of this new vegetation has developed into patches of tall dense salt cedar and willow nesting habitat that flycatchers occupy, but most of the new vegetation remains relatively short or sparse. Conversely, some vegetation at higher elevations along the Salt inflow to the lake is drying out and some patches currently occupied by flycatchers may become unsuitable as nesting habitat in the near future if current low lake levels persist or decrease further.

On the Tonto Creek arm of Roosevelt (Tonto arm), many of the vegetation changes have occurred downstream of Indian Point (Figure I-7). Like the Salt arm, more vegetation now occurs on the reservoir floor downstream of Indian Point than was evident in 1997. Again, most of the new vegetation is not suitable flycatcher nesting habitat because it is short or sparse at this time, but flycatchers are occupying some new areas of tall dense salt cedar and willow. Relatively large areas of the reservoir bed along Tonto Creek at higher elevations or more distant from the stream are drying out, as evidenced by dead and dying salt cedar in the center of an island just upstream of Indian Point and degrading cottonwood/willow and mixed riparian patches upstream of that island.

### *4. Tall Dense Vegetation*

The vegetation types at Roosevelt have been grouped into two categories: 1) tall dense vegetation, some of which is currently used as nesting habitat by flycatchers; and 2) other vegetation types. Tall dense vegetation is composed of three vegetation types: cottonwood/willow; mixed riparian greater than 15 feet in height; and salt cedar greater than 15 feet in height (Table II-2).[26] Some patches of tall dense vegetation are currently occupied by flycatchers or are currently suitable nesting habitat. However, other areas of tall dense vegetation are not currently suitable nesting habitat because they do not have the appropriate hydrological setting.[27] A rise in lake levels causing inundation of the vegetation for not more than one year or a higher ground water table is believed to be necessary in order to transform unsuitable tall dense vegetation into suitable nesting habitat when the vegetation has been dry for several years (see Subchapter II.A.7 below). On the other hand, when tall dense vegetation is unsuitable nesting habitat because it has

[26] The threshold height of 15 feet is based on data collected by AGFD at Roosevelt (McCarthey et al. 1998, p. 73; Paradzick et al. 1999, p. 97; Paradzick et al. 2000, p. 92; Paradzick et al. 2001, p. 82). The average nest tree or shrub height is about 23 feet with a standard deviation of about 6 feet. Thus, over 70 percent of nests are estimated to be located in trees or shrubs with a height greater than 17 feet. "Dense" means a predominately closed canopy as viewed from aerial photographs.

[27] In this context, "Appropriate hydrological setting" means an area that is not inundated for extended periods of time but where the ground water table is close to or at the ground surface for most of the growing season.

been (or still is) inundated, lower lake levels would be necessary to transform it into suitable nesting habitat.

The patches of tall dense vegetation in 2001 for the Salt and Tonto arms of Roosevelt are shown on Figure II-2 and Figure II-3. Table II-2 and Figure II-4 show the cumulative acres of tall dense vegetation by elevation in 2001.

#### *5. Other Woody Vegetation*

A significant amount of woody vegetation that currently occupies 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. Other areas consist primarily of young salt cedar with some willow, which lack the density and height to be flycatcher nesting habitat. The tall dense riparian vegetation interspersed with open areas used as nesting habitat for flycatchers is described in Subchapters II.B.1.g and II.B.1.i.

As described in Subchapters II.A.3 above and II.A.7 below, comparison of 1997 and 2001 vegetation reveals that some new areas of salt cedar and willow have grown into tall dense vegetation since 1997. An increase of about 360 acres of tall dense vegetation has occurred since 1997.

#### *6. Drying Vegetation*

In contrast to the vegetation at lower elevations that has grown into tall dense salt cedar and willow, other patches of tall dense vegetation farther upstream have dried or are drying out and may no longer be suitable habitat for breeding flycatchers. For example, about 70 acres of tall dense vegetation within patches occupied by flycatchers at some time between 1993 and 2000 were not occupied in 2001. These patches are primarily on the Tonto arm at higher elevations or more distant from water.[28] Also, as described above in Subchapter II.A.3, there are about 50 acres of dying salt cedar, and about 150 acres of degrading cottonwood/willow and mixed riparian vegetation just upstream of the island near Indian Point on the Tonto arm. Based on field observations, a similar trend is also evident in some of the mixed riparian habitat along the Salt River. During ERO field investigations in 2001, about 40 acres of tall dense vegetation near currently occupied habitat appeared to be quite dry. In total, about 310 acres of tall dense vegetation has dried out at Roosevelt since 1997.

Drying of vegetation, which may subsequently become unsuitable for flycatchers, is consistent with typical patterns exhibited by natural riparian habitats. As stated in the Flycatcher Recovery Plan, "Historically, these 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 2002, pp. 33, 34).

[28] Unlike perennial flows in the Salt River, Tonto Creek in the vicinity of currently occupied habitat is mostly dry during low flow periods resulting from drought conditions except for a few short reaches.

**Figure II-2. 2001 Tall Dense Vegetation, Salt Arm.**

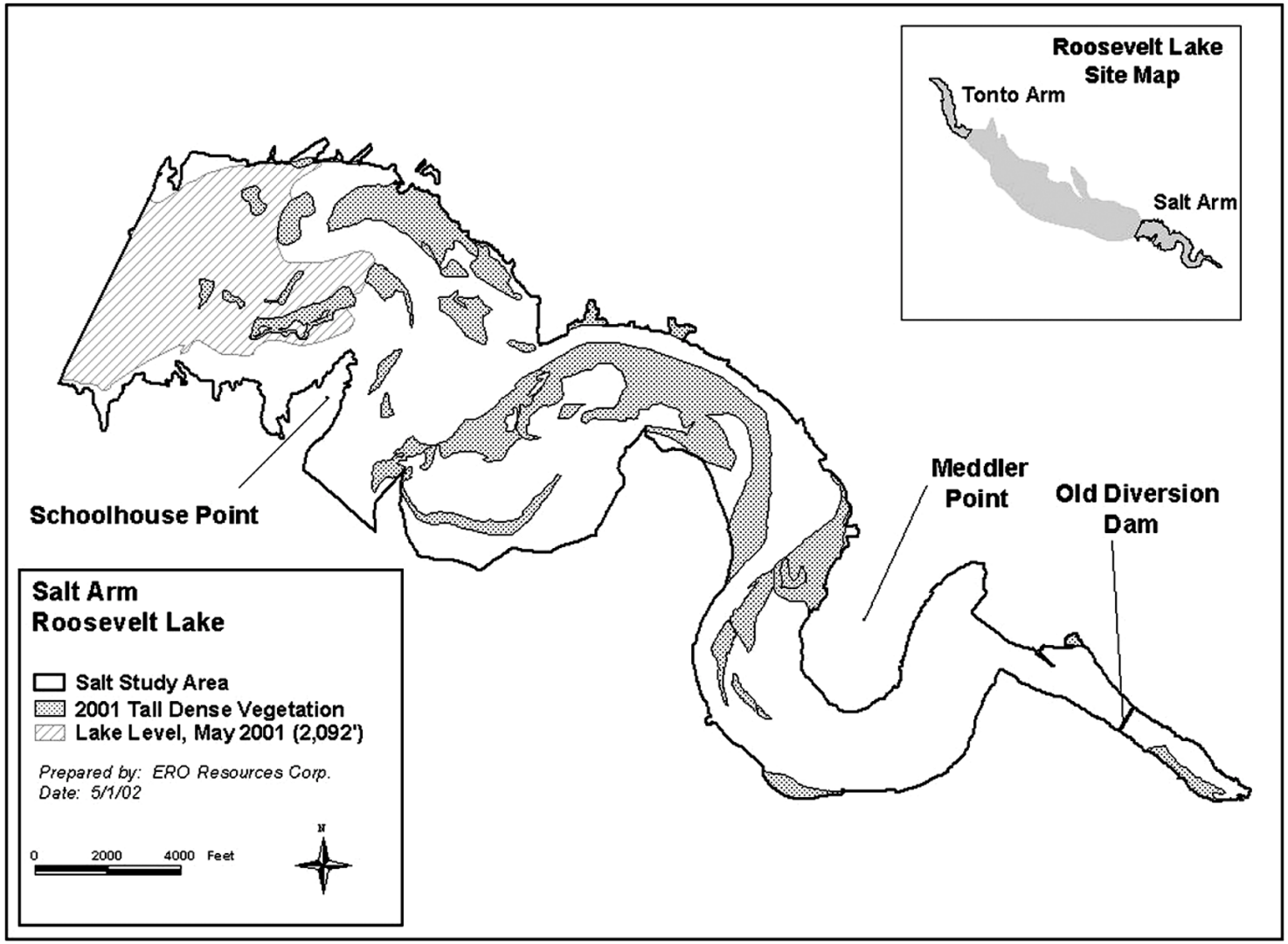


**Figure II-3. 2001 Tall Dense Vegetation, Tonto Arm.**

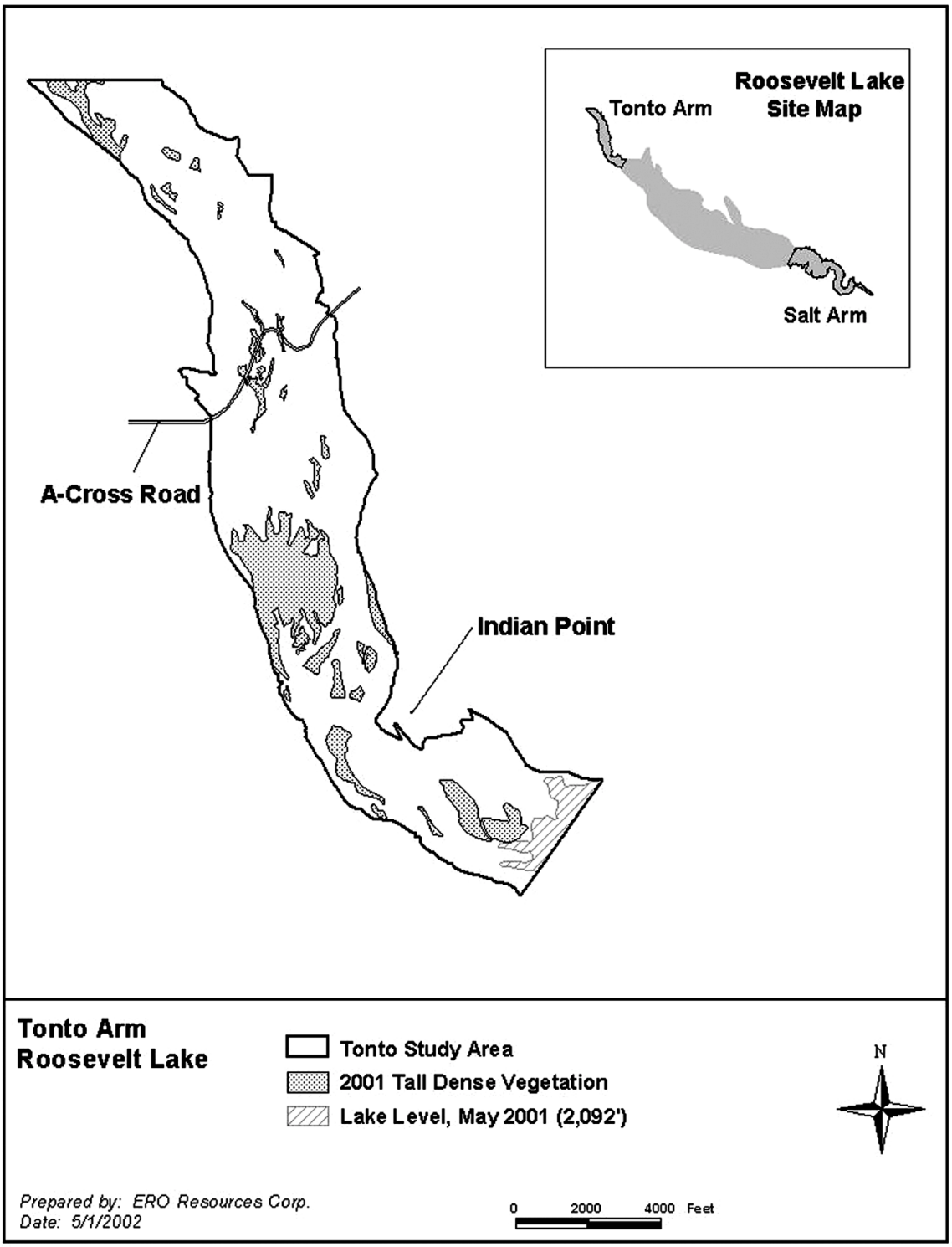
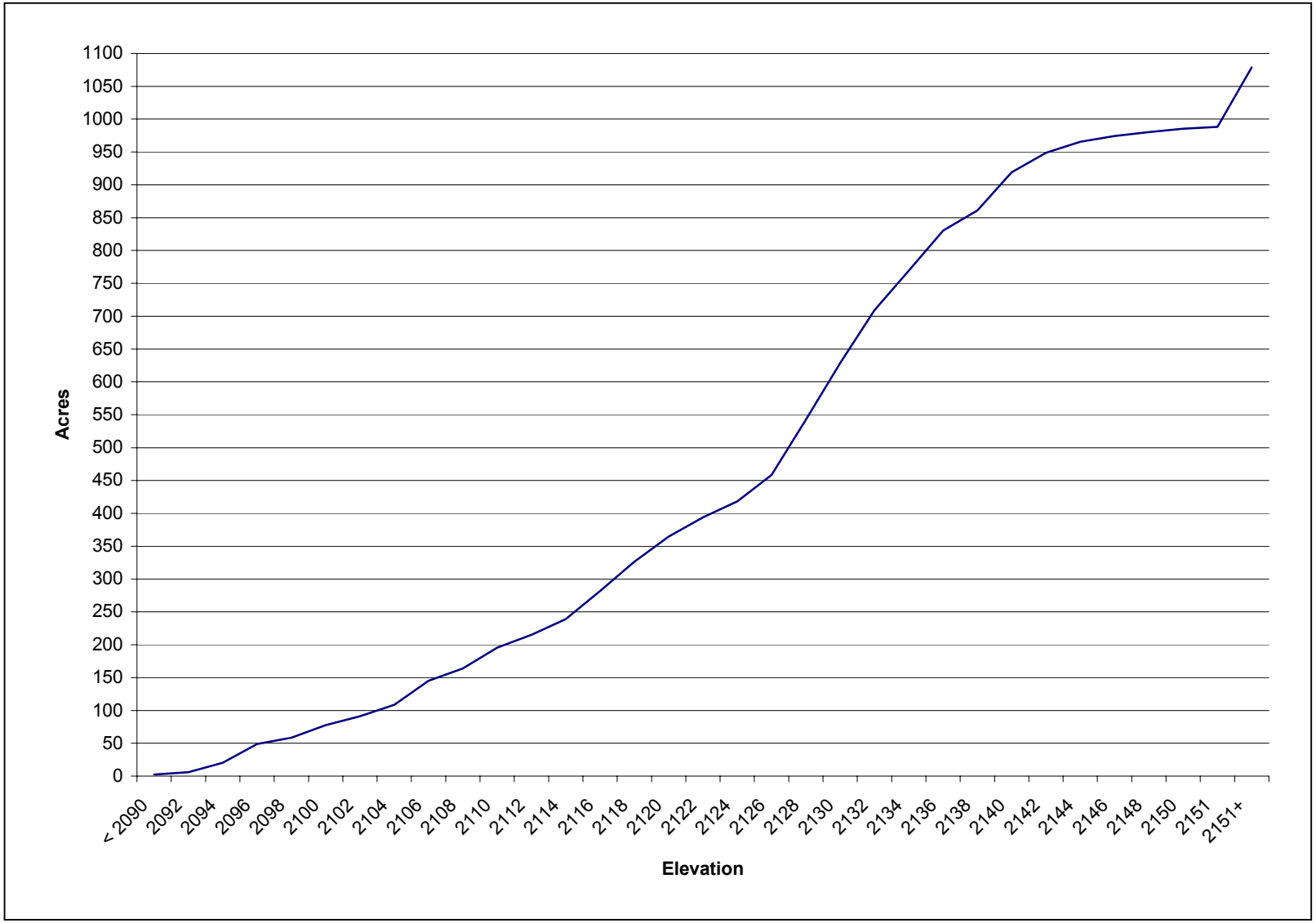


**Table II-2. Cumulative acres of 2001 tall dense vegetation at Roosevelt by elevation.**

| Elevation | Vegetation Type | | | Total Acreage |
|---|---|---|---|---|
| | Cottonwood/Willow | Mixed Riparian > 15 | Salt Cedar > 15 | |
| **< 2090** | 0.00 | 2.10 | 0.08 | 2.2 |
| **2092** | 0.00 | 5.27 | 0.84 | 6.1 |
| **2094** | 0.06 | 17.70 | 2.71 | 20.5 |
| **2096** | 0.16 | 44.99 | 3.71 | 48.9 |
| **2098** | 0.28 | 53.14 | 5.06 | 58.5 |
| **2100** | 0.41 | 66.11 | 11.16 | 77.7 |
| **2102** | 0.53 | 70.85 | 19.72 | 91.1 |
| **2104** | 0.65 | 71.73 | 36.02 | 108.4 |
| **2106** | 0.77 | 72.17 | 72.40 | 145.3 |
| **2108** | 0.88 | 72.32 | 90.70 | 163.9 |
| **2110** | 0.99 | 72.42 | 122.26 | 195.7 |
| **2112** | 1.09 | 72.74 | 141.16 | 215.0 |
| **2114** | 4.89 | 75.36 | 158.45 | 238.7 |
| **2116** | 20.49 | 89.48 | 170.67 | 280.6 |
| **2118** | 24.95 | 114.39 | 183.91 | 323.3 |
| **2120** | 25.31 | 141.68 | 194.16 | 361.2 |
| **2122** | 25.43 | 157.44 | 207.63 | 390.5 |
| **2124** | 25.55 | 162.79 | 226.14 | 414.5 |
| **2126** | 26.09 | 167.20 | 261.49 | 454.8 |
| **2128** | 28.26 | 183.49 | 326.18 | 537.9 |
| **2130** | 29.58 | 211.50 | 383.49 | 624.6 |
| **2132** | 30.33 | 243.97 | 430.63 | 704.9 |
| **2134** | 33.46 | 272.88 | 458.69 | 765.0 |
| **2136** | 48.43 | 291.94 | 485.86 | 826.2 |
| **2138** | 51.26 | 293.12 | 512.27 | 856.7 |
| **2140** | 57.97 | 296.27 | 560.72 | 915.0 |
| **2142** | 58.10 | 296.92 | 589.67 | 944.7 |
| **2144** | 58.54 | 297.33 | 605.27 | 961.1 |
| **2146** | 59.63 | 297.95 | 612.58 | 970.2 |
| **2148** | 59.83 | 298.77 | 617.61 | 976.2 |
| **2150** | 59.83 | 300.23 | 621.08 | 981.1 |
| **2151** | 60.60 | 300.67 | 622.67 | 983.9 |
| **2151+** | 99.00 | 312.97 | 662.62 | 1074.6 |

**Figure II-4. 2001 Acreage of Tall Dense Vegetation at Roosevelt.**



#### *7. Future Vegetation Dynamics*

If drought conditions and current low lake levels persist or decrease, the trends described in the preceding two sections indicate that new tall dense vegetation will continue to develop at lower elevations in the lakebed and older tall dense vegetation will continue to dry out and lose structural characteristics at higher elevations. Some tall dense vegetation is likely to eventually become so dry and degraded that short-term inundation or rising ground water elevations would not revive it. At that point, the severely dry and degraded tall dense vegetation would have to undergo the entire cycle of extended inundation and death, or be scoured by a flood, in order to enter the successional cycle again. Figure II-5 summarizes the cycle of vegetation and habitat over time at Roosevelt and identifies short-term and long-term trends. One of the important points to be gleaned from Figure II-5 is that riparian vegetation at Roosevelt is not static. Because fluctuations in lake levels are ultimately caused primarily by fluctuations in precipitation in the watersheds of the Salt River and Tonto Creek, changes in riparian vegetation are analogous to those in natural ecosystems. The following descriptions of the relationship between flycatcher habitat and natural processes are taken from the Recovery Plan (FWS 2002,):[29]

- "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 2002, 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 2002, p. 33, 34).

### B. Covered Species

The biology of the listed and candidate species is discussed in the following pages.

#### *1. Southwestern Willow Flycatcher*

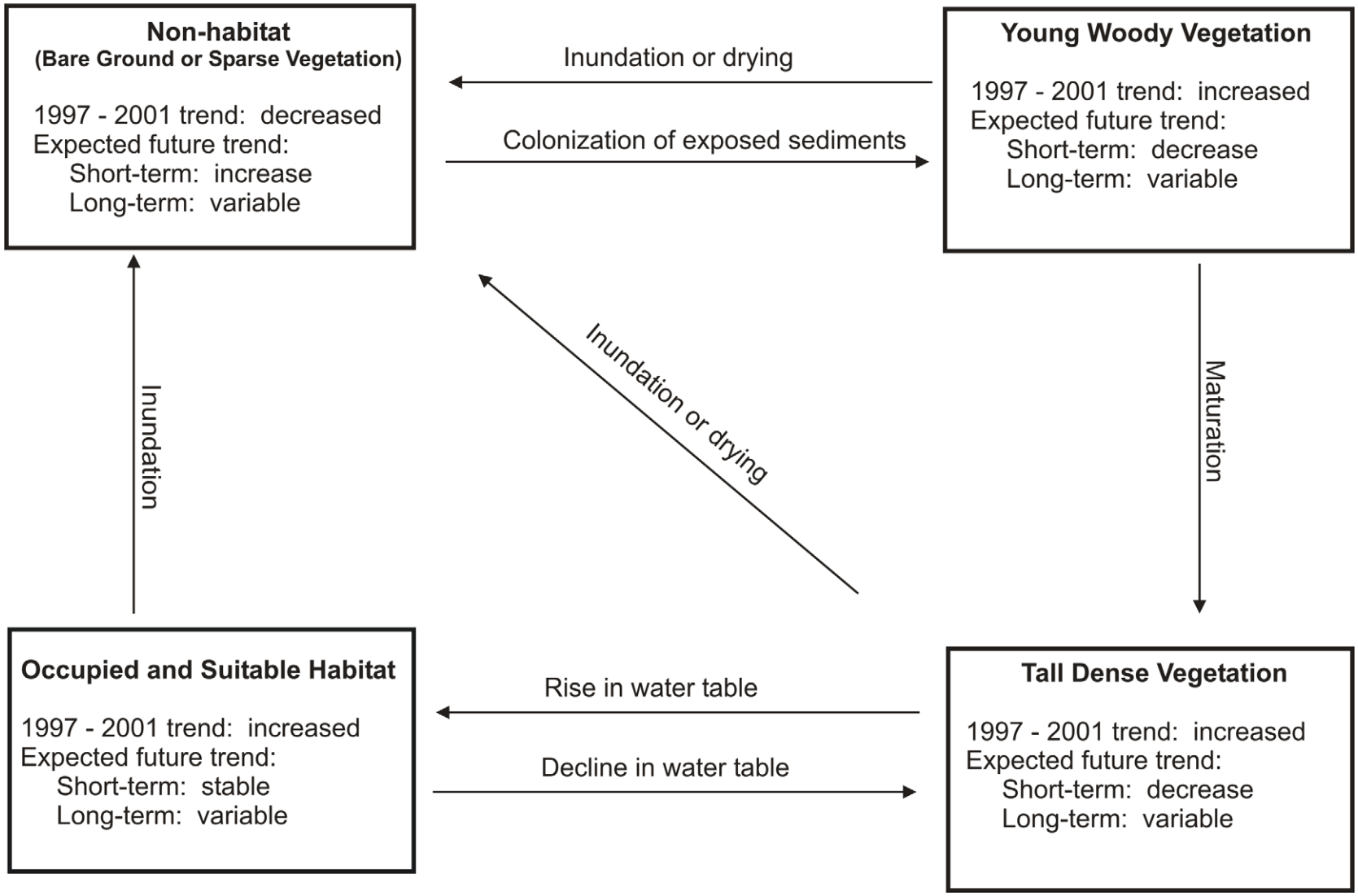
##### a. Subspecies and Distribution

The southwestern willow flycatcher (*Empidonax traillii extimus*) (flycatcher) is a riparian obligate species, approximately 5.75 inches long, with a light olive-green back and wings, a whitish throat, a lighter olive-green breast, pale yellowish belly, two indistinct wing bars, a faint eye-ring, and a beak that is dark on the upper mandible and lighter on the lower mandible, becoming dark at the tip.

There are four currently recognized subspecies of *E. traillii* distributed throughout North America as summer residents (Phillips 1948; Unitt 1987; Browning 1993). According to the Flycatcher Recovery Plan (FWS 2002), "the historical breeding range of *E.t. extimus* included southern California, southern Nevada, southern Utah, Arizona, New Mexico, western Texas, southwestern Colorado, and extreme northwestern Mexico." The

[29] See Subchapter IV.B for further discussion of the Flycatcher Recovery Plan.

**Figure II-5. Cycle of Vegetation and Habitat Over Time at Roosevelt.**



other three subspecies are *E.t. brewsteri, E.t. adastus, and E.t. traillii*. Morphological differences can be used to distinguish *E.t. extimus* (Aldrich 1951; Unitt 1987) as well as song type, habitat use, structure and placement of nests (Aldrich 1953; Gorski 1969), eggs (Walkinshaw 1966), ecological separation (Barlow and McGillivray 1983), and differences in genetics (Seutin and Simon 1988; Winker 1994; Paxton and Keim unpubl. data). The flycatcher is confirmed by its "fitz bew" song during nesting season. "Willow flycatchers are considered territorial (or resident within a site) if they were detected between June 15th and July 25th, regardless of whether a possible or known mate is observed" (Smith et al. 2002, p. 3). The flycatcher winters in southern Mexico, Central America, and probably South America (see II.B.1.e).

#### b. Threats to the Species

Phillips (1948) expressed concerns over population declines of flycatchers. Loss and modification of riparian habitat due to urban and agricultural development, water diversion and impoundment, channelization, ground water pumping, livestock grazing, invasion by non-native plant species, off-road vehicle and other recreational uses, as well as brown-headed cowbird (*Molothrus ater*) parasitism, have been identified as factors that contributed to the decline of flycatchers (FWS 1993b, FWS 2002). The loss of non-native salt cedar habitat due to fire is another threat. Appendix J of the 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 2002). 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."

#### c. Listing History

The flycatcher was designated as a category 2 candidate species in 1989 by the U.S. Fish and Wildlife Service (FWS 1989). The species was upgraded to a candidate category 1 species in 1991 (FWS 1991). In 1993, the FWS proposed to list *E.t. extimus* as endangered (FWS 1993b), and a final ruling listing it as endangered became effective March 29, 1995 (FWS 1995a). Critical habitat designation of a linear distance of 599 miles of riparian habitat was finalized on July 22, 1997, and corrected on August 20, 1997 (FWS 1997a and 1997b). On June 25, 2001, the 10th Circuit Court of Appeal set aside critical habitat designated within its jurisdiction, and subsequently the FWS set aside designation of all critical habitat for flycatchers until it can re-assess the economic analysis (FWS 2001a). The flycatcher is listed as Wildlife of Special Concern in Arizona (WSCA) (AGFD 1996 in prep.).

#### d. Flycatcher Breeding Biology

Flycatchers can be found on their breeding range at elevations ranging from near sea level to over 7,000 feet in elevation. Most flycatchers arrive at their breeding areas from early May to early June and depart in late July and August after nesting (FWS 2002).

Female flycatchers build an open cup-shaped nest approximately 3.15 inches high and 3.15 inches wide of grass, leaves, fibers, feathers, animal hair and coarser materials in a

fork of branches (Bent 1940). Nest height can range from 1.6 to 60 feet above the ground. Willow flycatchers lay 3 to 4 eggs and the young fledge approximately 25 days after the last egg is laid. Up to four nesting attempts may be made per season (Smith et al. 2002). Subsequent clutches are usually smaller than the first (Holcomb 1974; McCabe 1991; Whitfield and Strong 1995). "Some flycatchers may move hundreds of meters or … up to 30 km (18.6 mi) to renest" (Netter et al. 1998). Little is known about the dispersal of the young after fledging. They appear to remain in the area around the nest for two weeks or longer (Sogge et al. 1997). 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 2002).

#### e. Wintering Habitat

Flycatchers 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; Koronkiewicz et al. 1998; Unitt 1999). 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 semi-open areas (Koronkiewicz et al. 1998; Koronkiewicz and Whitfield 1999; FWS 2002).

#### f. Prey and Diet of Flycatchers

Flycatchers glean prey from foliage, or catch them on the ground (SWCA 2000a; FWS 2002). At the Camp Verde, Arizona nesting site, willow 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 above ground. 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 2000a). Flycatchers eat a variety of insects including wasps and 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 non-flying species, particularly Lepidoptera larvae."

#### g. Breeding Habitat

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. In most cases, this dense vegetation occurs within the first 10 to 13 feet above ground…These dense patches are often interspersed with small openings, open water, or shorter, sparser vegetation, creating a mosaic that is not uniformly dense" (FWS 2002, p. 11 and Appendix D). Canopy density at nests generally ranges from 75 to 90 percent, with a high percentage of vertical cover in the first 13 feet or more above ground. 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). Thin strands of dense

vegetation are generally not suitable, and patch size, arrangement of patches, and open areas appear to influence whether an area is occupied.

Flycatchers are found in three basic habitat types: 1) native-dominated vegetation; 2) exotic-dominated vegetation; and 3) mixed native and exotic plants (FWS 2002). 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.), and buttonbush (*Cephalanthus occidentalis*). 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 (FWS 2002). In almost all cases, slow-moving or still surface water and/or saturated soil is present at or near breeding sites during wet or non-drought years" (Id., p. 11). 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 (FWS 2002). Sites dominated by exotic species such as salt cedar and Russian olive (*Eleagnus angustifolia*) usually form a dense closed canopy with high vertical foliage and stem density (FWS 2002). According to the Flycatcher Recovery Plan, "… among sites with tamarisk, suitable flycatcher breeding habitat usually occurs where the tamarisk is tall and dense, with surface water and/or wet soils present, and where it is intermixed with native riparian trees and shrubs" (FWS 2002, p. 14). This exotic-dominated habitat type is typical of many of the willow flycatcher nesting areas at Roosevelt Lake. Breeding areas with mixed native and exotic plants often contain an overstory canopy of native cottonwoods and willows, with a dense midstory and understory of salt cedar or Russian olive or constitute an early successional single age-class stand.

FWS describes areas with the potential for restoring suitable breeding habitat as:

> "… those areas that could have the appropriate hydrological and ecological characteristics to develop into suitable habitat if not for one or more key stressors, and which may require active abatement of stressors in order to become suitable. Potential habitat occurs where the flood plain conditions, sediment characteristics, and hydrological setting provide potential for development of dense riparian vegetation. Stressors that may be preventing regenerating and restorable habitats from becoming suitable include, but are not limited to, de-watering from surface diversion or groundwater extraction, channelization, mowing, recreational activities, over-grazing by domestic livestock or native ungulates, exotic vegetation, and fire" (FWS 2002, pp. D-14, D-15).

In contrast, unsuitable habitats are:

> "… those riparian and upland areas which do not have the potential for developing into suitable habitat, even with extensive management. Examples of unsuitable habitat are found far outside of flood plain areas, along steep walled and heavily bouldered canyons, at the bottom of very narrow canyons, and other areas where physical and hydrological conditions could not support the dense riparian shrub and tree vegetation used by breeding flycatchers even with all potential stressors removed" FWS 2002, p. D-15).

### h. Statewide Status

As of the year 2001, flycatchers have been documented along 12 drainages in Arizona, with most flycatchers being found at Roosevelt and along the San Pedro and Gila rivers near Winkleman. The drainages where willow flycatchers nest include portions of the Big Sandy River, Bill Williams River, Colorado River, Gila River, Hassayampa River, Little Colorado River, San Francisco River, San Pedro River, Santa Maria River, Tonto Creek, Salt River, and Verde River (McCarthey et al 1998; Paradzick et al. 1999, 2000, 2001; Smith et al. 2002). In 2001, the greatest concentration (40 percent) of flycatchers in Arizona was found at Roosevelt Lake, with 32 percent located at the Salt River inflow and 8 percent at the Tonto inflow (Smith et al. 2002). Refer to the AGFD map delineating the 2000 nesting areas in Figure II-6.

In 2002, flycatchers were found at Horseshoe Reservoir, the uppermost dam operated by SRP on the Verde River (Willard, pers. comm. 2002). During the 2002 field season surveys, five territories were identified, with at least two nesting pairs (Id.). No nests were confirmed, but breeding is suspected given the frequency, path, and location of entry into the vegetation. All of the territories were located in the upper end of Horseshoe Reservoir in trees with a base at approximately 1,985 to 1,995 feet in elevation.

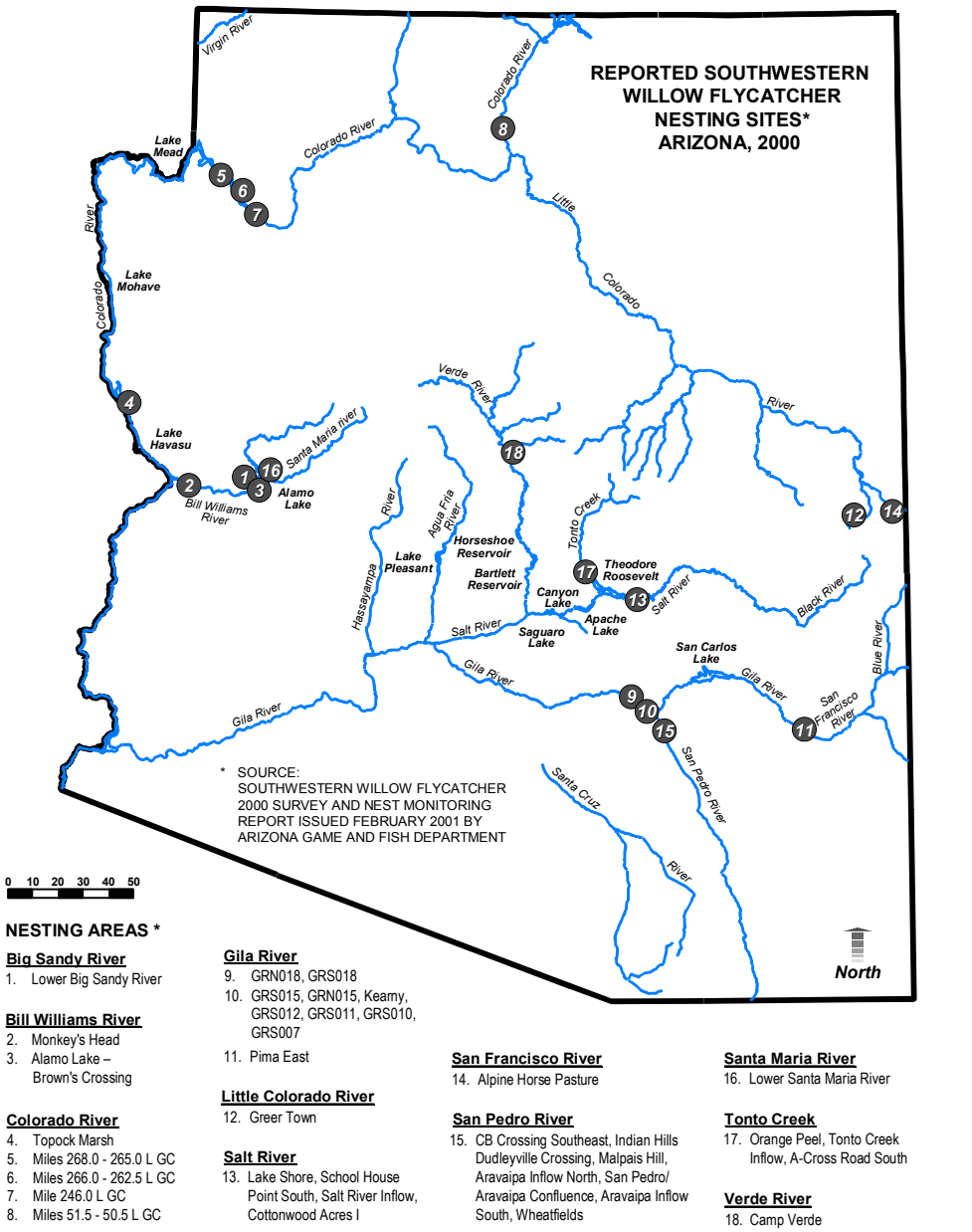
### i. Flycatcher Habitat at Roosevelt Lake

The historical patterns of riparian vegetation at Roosevelt are described in Subchapter II.A.1. In recent years, vegetation at the Salt River inflow to Roosevelt Lake occupied by flycatchers has varied from predominantly dense, monotypic stands of salt cedar to willow or salt cedar-dominated patches with an overstory of willows or cottonwoods. Additional stands of riparian habitat have become established on the reservoir bed as water levels in the lake have receded during the past 5 years (Paradzick et al. 2001; Smith et al. 2002), and an increasing number of mixed riparian patches have developed into suitable and occupied breeding habitat.

Riparian vegetation along Tonto Creek occupied by flycatchers occurs in several distinct patches, some of which are mixed riparian with a cottonwood/willow overstory and salt cedar understory, while other areas are composed almost entirely of salt cedar. New patches occupied by flycatchers have developed nearer Roosevelt Lake as the water level has receded over the past 5 years, including areas of mixed riparian and exotic salt cedar-dominated vegetation (Paradzick et al. 2001; ERO 2001; Smith et al. 2002).

The average canopy height at Tonto Creek inflow to Roosevelt Lake is approximately 24 feet for the entire site. At the Salt River inflow, monotypic salt cedar patches averaged 27 feet in height and salt cedar mixed with Goodding willow averaged 17 feet in height (Paradzick et al. 2001, p. 7). In 2001, mean nest height at the Tonto Creek inflow was 17 feet (standard deviation = $\pm$ 6) and mean nest height at the Salt River inflow was 13 feet (standard deviation = $\pm$ 4) (Smith et al. 2002, p. 63).

**Figure II-6. Reported Southwestern Willow Flycatcher Nesting Sites in Arizona, 2000.**



A habitat characterization study conducted in 1995 by the Arizona Game and Fish Department determined that percent canopy density ranged from an average of 89 percent at all Arizona salt cedar nest sites to 93 percent for all mixed riparian nest sites (Spencer et al. 1996), which are the two vegetation types predominantly used by flycatchers at Roosevelt Lake. Vertical foliage density was also high, averaging 67.3 percent (standard deviation = ± 11.1) in salt cedar and 62 percent (standard deviation = ± 13.4) in mixed riparian vegetation at 4.9 feet from the nest. Vertical foliage density also increased with increased height above ground (Spencer et. al 1996).

### j. Status of Flycatchers at Roosevelt Lake

Roosevelt Lake was not surveyed for flycatchers until 1993; their presence or absence until that time is uncertain. However, a review of aerial photographs from the 1940s through the 1980s indicates that large patches of vegetation suitable for flycatcher habitat were not present. There is no information on flycatcher presence near the confluence of the Salt River and Tonto Creek prior to construction of Roosevelt in the early 1900s.

The number of flycatcher territories for 1993 through 2001 is listed in Table II-3. For 2001, 255 individuals and 141 territories were identified at the Salt River and Tonto Creek inflows to Roosevelt Lake (Smith et al. 2002). The distribution of flycatcher nests and territories at Roosevelt by elevation in 2000 and 2001 is shown in Figure II-7.

The number of individuals has increased each year from 1995 to 2001. Some of this increase can be attributed to increased survey effort and some can be attributed to the increasing number of flycatchers at Roosevelt Lake (Smith et al. 2002). Although there was a slight decrease in the number of territories in 1995 and 1997, the total number of territories has increased over 10-fold from 1993 to 2001, as shown in Figure II-8.

**Table II-3. Number of flycatcher territories and individuals for 1993-2001.**

| Year | Number of Territories† | Number of Individuals‡ |
|---|---|---|
| 1993 | 10 | NR |
| 1994 | 38 | NR |
| 1995 | 30 | 38 |
| 1996 | 45 | 62 |
| 1997 | 43 | 74 |
| 1998 | 51 | 91 |
| 1999 | 77 | 140 |
| 2000 | 116 | 210 |
| 2001 | 141 | 255 |

† Data from 2000 and 2001 AGFD annual reports (Paradzick et al. 2001; Smith et al. 2002).

‡ Data from individual AGFD annual reports (Muiznieks et al 1994; Sferra et al 1995; Spencer et al 1996; Sferra et al 1997; McCarthey et al 1998; Paradzick et al 1999, 2000, 2001; Smith et al. 2002).

NR = not recorded.

**Figure II-7. Distribution of flycatcher nests and territories at Roosevelt by elevation, 2000 and 2001.**

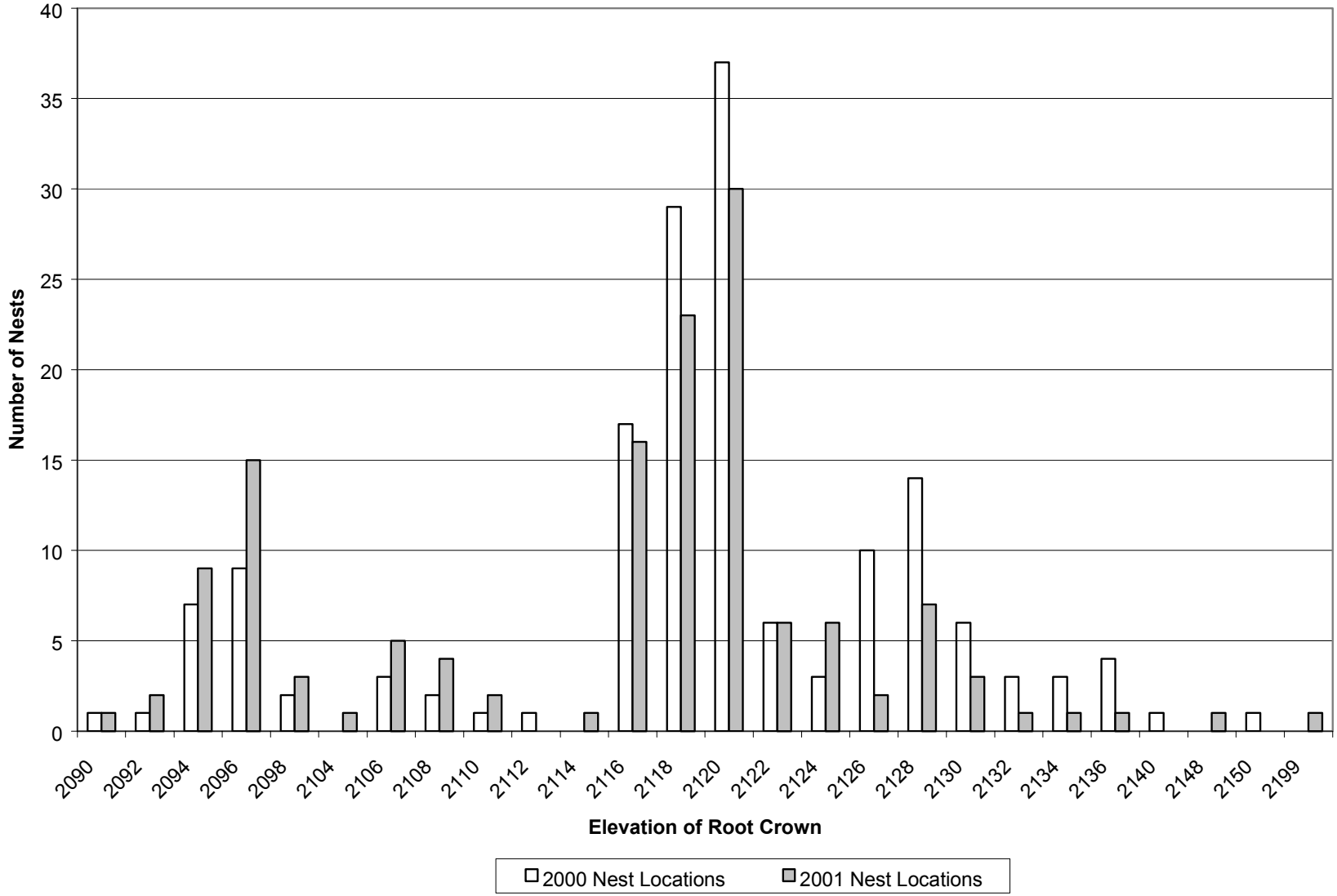
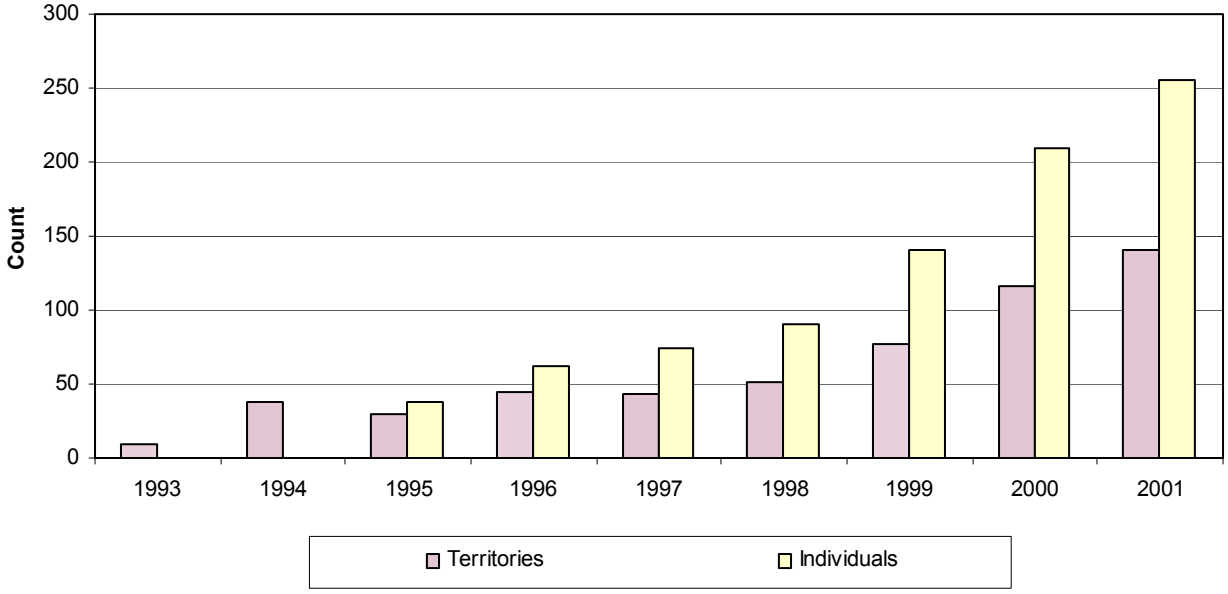


**Figure II-8. Flycatcher Territories and Individuals at Roosevelt Lake, 1993 to 2001.**




### k. Nesting Success at Roosevelt Lake

At the Tonto Creek inflow, 19 of 35 nests were successful, and at the Salt River inflow, 42 of 76 nests were successful during the year 2000 (Paradzick et al. 2001). There were four successful double clutches at Roosevelt Lake during 2000. The mean numbers of young fledged per successful nest were 2.17 (standard deviation = $\pm$ 0.79, n =18) and 2.31 (standard deviation = $\pm$ 0.66, n = 39) at the Tonto Creek inflow and the Salt River inflow respectively. This compares with an average of 2.29 (standard deviation = $\pm$ 0.72, n = 99) for nests monitored throughout the state for the year 2000 (Paradzick et al. 2001).

In 2001, 24 of 33 nests with known outcomes were successful at the Tonto Creek site, and 43 of 60 nests with known outcomes were successful at the Salt River site (Smith et al. 2002). Five double brood successes occurred at Roosevelt in 2001. In 2001, Roosevelt had a mean number of 2.79 young fledged per successful nest, the highest in Arizona. Four female flycatchers at Tonto Creek nested twice, and 14 females nested twice at the Salt River inflow (Id.). The Salt River inflow had the highest productivity (two young fledged per nest) in the history of AGFD's surveys and nest monitoring project (Id.). Nest success for the years 1996-2001 are provided in Table II-4 for comparison.

**Table II-4. Percent nest success (number of successful nests per nests with known outcome) at Roosevelt Lake for the years 1995-2001.**

| Year† | Percent Nest Success | Total Number of Nests |
|---|---|---|
| 1995 | 73 | 15 |
| 1996 | 38 | 26 |
| 1997 | 50 | 46 |
| 1998 | 64 | 58 |
| 1999 | 63 | 91 |
| 2000 | 55 | 111 |
| 2001 | 72 | 93 |

†Data from AGFD annual reports (Muiznieks et al. 1994; Sferra et al. 1995; Spencer et al. 1996; Sferra et al. 1997; McCarthey et al. 1998; Paradzick et al. 1999, 2000, 2001; Smith et al. 2002).

### l. Brown-headed Cowbird Parasitism at Roosevelt Lake

Cowbird parasitism can result in flycatcher nesting failure. Cowbirds are associated with cattle and the use of adjacent land by cattle has been shown to provide feeding sources that increase and concentrate the number of cowbirds in the area, resulting in an increase in brood parasitism (Rothstein and Stevens 1980; Verner and Ritter 1983). Of the 15 parasitized nests monitored in 2001 throughout the state, one nest fledged a flycatcher chick only, and three other nests fledged both flycatcher and brown-headed cowbird young. The remainder of parasitized nests were unsuccessful in producing flycatcher fledglings (Smith et al. 2002). In 2000, all monitored flycatcher nests in Arizona that were parasitized by cowbirds were unsuccessful (Paradzick et al. 2001). Brown-headed cowbird traps were placed at the Tonto Creek and Salt River inflows beginning in 1996. A total of 383 cowbirds were trapped at the Salt River site, and a total of 289 cowbirds were trapped at the Tonto Creek site that year. However, trapping results for a single season were inconclusive; at the Tonto Creek inflow, parasitism was reduced from 25 percent in 1995 when no trapping occurred, to 0 percent in 1996. In contrast, parasitism increased at the Salt River from 11 percent in 1995 to 21 percent in 1996 (Sferra et al. 1997). Initial years of trapping were not totally successful due to occasional trap failure. One factor contributing to the higher rate of parasitism at the Salt River inflow could be that the Tonto Creek Riparian Unit was fenced to keep the majority of cattle out, while cattle continued to occur on the Salt River arm until 2000. Brown-headed cowbird trapping continued at Roosevelt into 2000 and 2001, when there was one parasitized flycatcher nest at the Salt River inflow during 2000, and one parasitized flycatcher nest at the Tonto Creek inflow in 2001. Table II-5 provides a comparison of cowbird parasitized nests for the years 1995 to 2001.

**Table II-5. Percent of nests with known outcome parasitized by brown-headed cowbirds at Roosevelt Lake for the years 1995-2001.**

| Year[†] | Percent Nest Parasitism | Total Number of Nests |
|---|---|---|
| 1995 | 17 | 15 |
| 1996 | 12 | 26 |
| 1997 | 1 | 46 |
| 1998 | 0 | 58 |
| 1999 | 1 | 91 |
| 2000 | 1 | 111 |
| 2001 | 2 | 93 |

[†]Data for the years 1997-2000 provided by Paradzick, pers. comm. 2001; and data from individual AGFD annual reports (Spencer et al 1996; Sferra et al 1997; McCarthey et al 1998; Paradzick et al 1999, 2000, 2001; Smith et al. 2002). Cowbird trapping on the Tonto Creek and Salt River inflows began in 1996.

### m. Banding Results at Roosevelt Lake: Survivorship

In 1996, the U.S. Geological Survey (USGS) Colorado River Plateau Research Station began color-banding flycatchers in Arizona in coordination with Arizona Game and Fish Department's survey and monitoring efforts. From 1996 to 2000, over 450 adult and 200 nestling flycatchers were banded at Roosevelt Lake and the San Pedro/Gila River confluence areas (Luff et al. 2000). Estimated survivorship for 1999 to 2000 was 57 percent for returning banded flycatchers.

### n. Banding Results: Site Fidelity and Movement

For the banded flycatchers observed in the years 1999-2000, site fidelity was 70 percent (i.e., the birds returned to the same site as the previous year). "Of the banded flycatchers that returned in 2000 to their 1999 breeding site, 67 percent returned to or near (within 164 feet) of the same territory as in 1999, while 38 percent settled more than 164 feet away from the previous year's territory…Using calculations that include only the birds known to survive, 29 percent of the individuals moved to new sites between 1999 and 2000" (Luff et al. 2000). Most movements were 15.5 miles or less, although one flycatcher moved 42.9 miles to the Salt River inflow from the San Pedro River (Luff et al. 2000). However, movements of several banded flycatchers were recorded over distances of up to approximately 136.7 miles from the Virgin River to Topock Marsh on the Lower Colorado River in 2000 (McKernan and Braden 2001). For instance, a nestling banded in 1997 was found as a breeding male in 1999, approximately 47 miles north of its banding site, and a nestling banded in 1998 was found as a breeding male in 1999, approximately 137 miles from the original banding site (Id.). In 2001, two banded willow flycatchers moved 89.5 miles from Greer, Arizona in the White Mountains to the Salt River inflow at Roosevelt Lake, and two willow flycatchers were found to have moved 42.9 miles from Kearny, Arizona on the San Pedro River to the Salt River inflow (Sogge, pers. comm. 2001; Paxton, pers. comm. 2001). From a metapopulation perspective, this information on movement is significant. In the event that all flycatcher habitat is lost at Roosevelt, flycatchers are likely to recolonize the area once suitable habitat develops.

### *2. Yuma Clapper Rail*

#### a. Species Description and Distribution

The Yuma clapper rail (*Rallus longirostris yumanensis*) is a water bird. It is one of the smaller Yuma clapper rail subspecies with a laterally compressed body, long legs, and a short tail.[30] Males are 8 to 9 inches tall and females are slightly smaller. The Yuma clapper rail has an orange-colored beak that is long, slender, and curved downward slightly. Anteriorly, coloration is a mottled brown on a gray background. Its flanks and underside are dark gray with narrow vertical white stripes that produce a barred effect, with a subdued burnt-orange breast. Males and females are alike in plumage coloration.

Historically, this subspecies of Yuma clapper rail occurred in the marshes of the Lower Colorado River and its tributaries in Mexico and the United States. A large number of Yuma clapper rails continue to be found on the Colorado River delta in Mexico. In the United States, they are currently found primarily along the Colorado River from Lake Mead to Mexico (Yuma, La Paz, and Mohave counties, Arizona); at the Salton Sea (California); in the lower Gila River watershed west of Phoenix and at Picacho Reservoir (Maricopa and Pinal counties, Arizona) below elevation 4,500 feet. Yuma clapper rails have been found as far north as the Virgin River in Utah (Tomlinson, pers. comm. 2002). No formal surveys for Yuma clapper rails have been conducted at Roosevelt, although a single adult was documented in May 2002 (Messing 2002b).

Prior to the recent sighting at Roosevelt, the closest Yuma clapper rail sightings were approximately 60 miles downstream on the Salt River near Granite Reef Dam:

> "On June 11, 1970, Richard Todd found at least one Yuma clapper rail in the Salt River bottom near the south end of the Granite Reef Diversion Dam. He searched that area and other floodplain sites near the confluence of the Salt and Verde rivers each breeding season through 1974 without success. Then, rails were again found below Granite Reef Diversion Dam in June-July 1975 and also by the Maricopa Audubon Society in a previously unsurveyed slough 0.8 kilometers up-river from the diversion dam. Todd found rails in the general area for 10 consecutive years through 1985, although the original downstream sites had been scoured or filled in by floods during the winters of 1977-78, 1978-79, and 1979-80. In addition, the marsh below the Granite Reef Diversion Dam was temporarily destroyed in 1976 by construction of the CAP Salt River Siphon. No rails have been reported from the area between the confluence of the Salt and Verde rivers and the wetlands downstream of the diversion dam since 1985. Flood flows in 1993 scoured potential Yuma clapper rail habitat downstream of the Salt-Verde river confluence" (Reclamation 1996, p. 22; citations omitted).

[30] For more information on Yuma clapper rails, see: www.lcrmscp.org/yuma_cr.html; http://fwie.fw.vt.edu/www/esis/lists/e102002.htm; http://arizonaes.fws.gov/yuma.htm.

#### b. Threats to the Species

Loss of marsh habitat from river management activities such as channelization, dredging, bank stabilization, and fluctuating reservoir levels has reduced the habitat for Yuma clapper rails. 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, p. 106).

#### c. Listing History

The Yuma clapper rail was listed as endangered in 1967 (32 FR 4001, March 11, 1967). No critical habitat has been designated (FWS 1997c, p. 67). A recovery plan was completed in 1983.[31] The Yuma clapper rail is a WSCA-listed species (AGFD 1996 in prep.). FWS has scheduled the Yuma clapper rail for consideration of downlisting or delisting in 2005 (Fitzpatrick, pers. comm. 2002).

#### d. Yuma Clapper Rail Breeding Biology and Habitat

Yuma clapper rail breeding biology and habitat is succinctly described in the 1997 lower Colorado BO:

> "Nesting behavior commences by February; nesting begins in mid-March and runs through early July, with most eggs hatching during the first week of June. There is no evidence of more than one brood per season, despite the long breeding period. Both adults care for the eggs and young. Clutch size is usually six to eight eggs. Young are precocial and follow the adults through the marsh within 48 hours of hatching. Adults lead the young to productive feeding areas where they quickly learn to feed on their own. Young Yuma clapper rails experience high mortality from predators, usually within their first month of life. Surviving clapper rails of other subspecies fledge in 63 to 70 days. Nest bowls are built in three major microhabitats, the base of living clumps of cattail or bulrush, under wind thrown bulrush, or on the top of dead cattails remaining from the previous year's growth. Mature cattail/bulrush stands provide materials for nest building and cover for their nests. Sometimes they weave nests in the forks of small shrubs that lie just above moist soil or above water that is up to two feet deep" (FWS 1997b, p. 69; citations omitted).

Yuma clapper rails typically occupy dense marshes with cattails or bulrushes but may also be found in areas of sparser marsh vegetation. Marsh areas with a mosaic of vegetation of different ages and patches of open water result in high productivity. Yuma clapper rails need small areas of high ground within the marsh mosaic for walking and foraging, especially during the breeding season to prevent downy chicks from becoming saturated and drowning (ESIS 1998). Water levels in Yuma clapper rail habitat may be stable or vary as long as nests are not flooded (FWS 1997b, p. 69).

[31] See http://ifw2es.fws.gov/Documents/R2ES/YumaClapperRail.pdf.

Average Yuma clapper rail territory and home range size at the Salton Sea was found to be about 1.2 acres (ESIS 1998). Other sources indicate a similar minimum patch size of about 1.2 to 2.5 acres (Todd 1986; Fitzpatrick, pers. comm. 2002).

#### e. Prey and Diet

Crayfish comprise up to 95 percent of the Yuma clapper rail diet, which also includes insects, shrimp, clams, leeches, plant seeds, and small fish (FWS 1997c.). Yuma clapper rails appear to be moving into the same areas along the lower Colorado River previously invaded by crayfish (Id., p. 69).

#### f. Population Status

The Yuma clapper rail population in the United States appears stable, with about 500 to 1,100 birds surveyed annually at sites in the Lower Colorado River basin, including 9 to 55 birds identified on surveys along the Gila River west of Phoenix and at Picacho Reservoir south of Phoenix (FWS 1997c, pp. 70, 71; FWS 2001e, pp. 18, 19).[32]

#### g. Yuma Clapper Rail Habitat and Status at Roosevelt

A single Yuma clapper rail was confirmed at Roosevelt along Tonto Creek in May 2002 (Messing 2002b) near the Orange Peel campground (Figure I-7). This is the first known sighting of this species at Roosevelt. No surveys for Yuma clapper rails have been conducted previously at Roosevelt because of a lack of suitable habitat. This Yuma clapper rail was found in a strip of cattails about 20 to 60 feet wide by about 3,000 feet long with patches of standing water at an elevation of about 2,100 feet (Id.) along the main channel of Tonto Creek. Dense salt cedar borders the cattails along the western edge; the adjoining vegetation on the east side is a dense but narrow strip of willow and salt cedar with a gravel bar beyond (Spencer, pers. comm. 2002). No Yuma clapper rails were found on a subsequent visit about two weeks later.

The only other potential Yuma clapper rail habitat found at Roosevelt during a thorough helicopter survey in June 2002 was a smaller strip of cattails upstream from the Orange Peel marsh at an elevation just under 2,120 feet. This strip of marsh is currently not as suitable for Yuma clapper rails given the narrow width (about 20 to 30 feet wide by about 1,250 feet long) and lack of dense adjacent vegetation — the cattails are bordered by upland to the east and sparse salt cedar to the west (Id.).

Both cattail marshes along Tonto Creek appear to be supported by subflow brought to the surface by underground geologic barriers. Thus, it is unlikely that they would completely dry out during an extended drought.

### *3. Bald Eagles*

#### a. Species Description

Bald eagles (*Haliaeetus leucocephalus*) are large birds of prey. Throughout their range, bald eagles vary in length from 28 to 38 inches while wingspan varies from 66 to 96 inches (AGFD in prep.). In Arizona, 81 percent of adult male breeding bald eagles and 61 percent of female breeding bald eagles that were measured were smaller than

[32] 1990-2000 survey data is tabulated at: www.arizonaes.fws.gov/yuma.htm.

adult male and female breeding bald eagles measured in Alaska, California, and Wyoming (Hunt et al. 1992). Adults have white heads, necks, and tails. Their body color is brownish-black, with yellow unfeathered legs and feet, and yellow, hooked bills. Plumage of immature bald eagles is highly variable, depending on age. Typically, immature plumage is mostly dark with varying degrees of white mottling on the underwing and belly. The head undergoes progressive molts, from dark brown in juveniles to white in adults (McCollough 1989). Bald eagles usually are found along lakes, rivers, and reservoirs in Arizona.

#### b. Threats to the Species

Historically and rangewide, bald eagles have experienced significant reproductive declines caused by the use of DDT. This contaminant, which is now banned in the United States, persists in the environment and continues to affect local populations. Additionally, as recently as 1962, bounties were being paid for the killing of bald eagles in North America (Stokes and Stokes 1989). Current threats to the species are habitat loss, human encroachment into breeding habitat, entanglement in fishing line, reduction in fish populations, illegal shooting, and heavy metals (AGFD in prep.). Organochlorides also have been found to adversely affect bald eagles (Beatty, pers. comm. 2002).

#### c. Listing History

The National Emblem Law of 1940 forbade the killing of bald eagles in the lower 48 states, although killing was allowed in Alaska until 1962 with a bounty of $2.00 per pair of eagle feet (Stokes and Stokes 1989). In 1978, the bald eagle was listed as endangered by the U.S. Fish and Wildlife Service in 43 states, including Arizona, and threatened in five others (the bald eagle was not listed in Alaska and does not occur in Hawaii) (FWS 1978). For the purposes of recovery planning and management, the FWS divided the bald eagle population in the lower 48 states into five recovery regions. The recovery plan, established in 1982 for the southwest population of bald eagles, guides management of the southwestern recovery region, which includes Arizona, New Mexico, Oklahoma, and Texas west of the 100$^{th}$ Meridian, and the Colorado River along the Arizona/
California border (AGFD 1988). The species was downlisted to threatened in 1995 in all recovery regions of the lower 48 states (FWS 1995b). In 1999, FWS announced its intent to delist the bald eagle in the lower 48 states (FWS 1999), but acknowledged the southwestern region's concerns for the need to continue the Arizona Bald Eagle Nest Watch Program and other management actions such as helicopter flights to assess territory occupancy and reproduction, bald eagle winter counts, demography studies, and seasonal closures (AGFD in prep.). The bald eagle is also a WSCA-listed species (AGFD 1996 in prep.) and the Southwestern Bald Eagle Management Committee guides the conservation effort in Arizona. After federal delisting, the bald eagle will be protected by the Airborne Hunting Act, the Bald Eagle and Golden Eagle Protection Act, the Lacey Act, the Migratory Bird Treaty Act, and Arizona Revised Statute Title 17 (Driscoll and Koloszar 2001).

#### d. Bald Eagle Breeding Biology

Bald eagle breeding chronology in Arizona is described in the *Bald Eagle Conservation Assessment and Strategy* (AGFD in prep.) as follows: Arizona bald eagles

breed earlier in the year than their northern counterparts. They lay an average of two eggs (range: 1 to 3 eggs) between December and March. Eggs take 35 days to hatch, and the young bald eaglets may hatch several days apart, resulting in stiff competition between the young for food. The nestlings fledge at approximately 12 weeks of age, typically between April and June. The young are nearly completely dependent upon their parents for food for 45 days after fledging, at which time they leave their natal area to migrate north to feed on trout and salmon in Canada and the Northwest. Radiotelemetry data indicate that 2-, 3-, and possibly 4-year olds also migrate north (Hunt et al. 1992). "Breeding [bald] eagles with territories mainly stay in their territories year-round. A few summer 'vacations' have been detected for approximately 2 week intervals, i.e., [bald] eagles moving into the higher country of the White Mountains or near Flagstaff. It is not known whether itinerant Arizona adult [bald] eagles stay in Arizona year-round, or leave like the 1- to 3-year olds" (Beatty, pers. comm. 2002).

Nests often are built in the crotches of large trees or on ledges and can measure up to 6.2 feet in diameter and 4 to 10 feet in depth (Stokes and Stokes 1989). A pair of breeding bald eagles generally uses the same territory 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. Their home range varies in size depending on the water system, diversity and abundance of food available, and the proximity of other breeding areas (AGFD in prep.).

#### e. Wintering Habitat

Since 1992, 115 routes have been surveyed for wintering bald eagles and approximately 300 bald eagles are counted yearly (AGFD in prep.). Wintering bald eagles in Arizona occur in a variety of habitats, with the majority found at lakes and rivers along the Mogollon Rim and in the White Mountains in eastern Arizona including at Roosevelt Lake (AGFD in prep.).

#### f. Prey and Diet of Bald Eagles

Bald eagle prey is mainly fish, but can include waterfowl, small mammals, and carrion. The presence of fish and a diversity of fish species are important for successful breeding for bald eagles in Arizona (Hunt et al. 1992). According to Hunt et al. (1992), native suckers are a crucial prey species during the breeding season. Native suckers are more resistant to drought conditions than non-native fish such as catfish, carp, and bass and persist in rivers and replenish their numbers quickly (Rinne and Minckley 1991; AGFD in prep.). The *Conservation Assessment and Strategy for the Bald Eagle in Arizona* (AGFD in prep.) adds that "Most importantly, suckers are an accessible food source and spawn during the bald eagle's breeding cycle."

#### g. Breeding Habitat

Bald eagles primarily breed in Arizona at elevations ranging from 1,080 feet to 5,640 feet, mainly nesting in Central Arizona. Five breeding areas in Arizona are known to occur at high elevations of approximately 6,000 feet (Beatty, pers. comm. 2002). They nest in riparian and transition areas in both the Upper and Lower Sonoran Life Zones (AGFD in prep.). Typical vegetation includes Arizona sycamore (*Platanus wrightii*), blue palo verde (*Parkinsonia floridum*), cholla (*Cylindropuntia* spp.), Fremont

cottonwood (*Populus fremontii*), Goodding willow (*Salix gooddingii*), mesquite (*Prosopis* spp.), saguaro (*Carnegiea gigantea*), and salt cedar, with piñon pine (*Pinus* spp.) and juniper (*Juniperus* spp.) occurring in the transition areas (Driscoll and Koloszar 2001). Bald eagles usually place their nests within 1 mile from a creek, lake, or river, although they have been known to nest farther from water occasionally (Driscoll and Koloszar 2001).

According to the AGFD *Conservation Assessment Strategy for the Bald Eagle in Arizona* (AGFD in prep.), bald eagles nest on cliffs, rock pinnacles, in cottonwood trees, and occasionally in junipers, piñon pines, sycamores, willows, ponderosa pine (*Pinus ponderosa*), and snags. In 1980, the bald eagle pair at Horseshoe Lake nested in an artificial structure (Grubb 1980).

#### h. Statewide Status of Breeding Areas

The historical distribution in Arizona is unknown; little is known before the 1970s of the wintering or breeding population sizes in Arizona. From 1987 to 1991, the known number of Arizona bald eagle breeding areas fluctuated from 26 to 28 (Beatty, pers. comm. 2002). Since 1992, more breeding areas have been discovered. Many of these sites were reoccupied historical sites; others were remote sites that had existed for some time, but escaped detection; but most were new sites (Id.). As of 2002, there are 46 known breeding areas in Arizona. According to the *Conservation Assessment and Strategy for Bald Eagles in Arizona* "… Arizona bald eagles are not likely to increase their abundance or breeding range significantly … a small resident population with approximately 41 breeding areas occur along Cibecue, Pinal, Tangle, and Tonto Creeks; the Salt, Verde, Gila, Bill Williams, Agua Fria, Little Colorado, San Carlos, San Pedro, and San Francisco Rivers; and at Alamo, Apache, Bartlett, Becker, Horseshoe, Luna, Pleasant, Roosevelt, Saguaro, San Carlos, and Talkalai Lakes" (AGFD in prep.). Figure II-9 provides a map of the 47 bald eagle breeding areas located within 100 miles of Roosevelt Lake as of the year 2002.

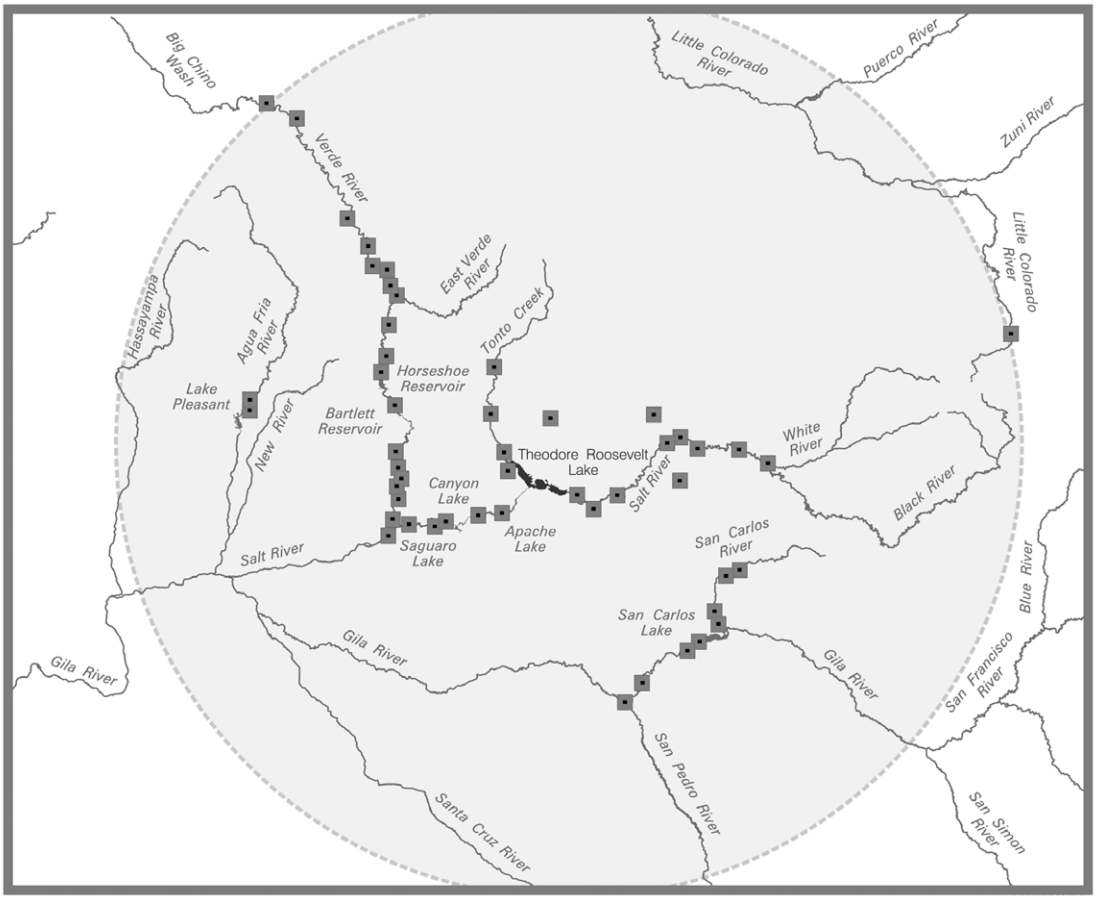
Approximately 300 bald eagles winter yearly throughout the state of Arizona. Although found in every county in Arizona, the greatest numbers of wintering bald eagles are found along the Mogollon Rim east through the White Mountains (AGFD in prep.).

#### i. Status of Bald Eagles at Roosevelt Lake

Breeding bald eagles were present in the vicinity of Roosevelt prior to construction (Hunt et al. 1992, p. A-11). In 2001, five bald eagle pairs nested within the general vicinity of Roosevelt Lake (Beatty, pers. comm. 2001). In past years, up to six breeding areas have been active at or near Roosevelt. The "Dupont" breeding area, was found in 1997 in the Sierra Ancha Mountains, approximately 14.5 miles from Roosevelt Lake. The "Dupont" bald eagles have nested in both live and dead ponderosa pines. The nest for the "Pinto" breeding area is located at the mouth of Pinto Creek. The nests for the "Pinal" breeding area are on cliffs or pinnacles near the mouth of Pinal Creek several miles upstream from Roosevelt. The nest for the "Tonto" breeding area near the mouth of Tonto Creek and the nest for the "Sheep" breeding area on Tonto Creek are located in cottonwood trees. The extent to which eagles in the "Sheep" breeding area use Roosevelt Lake for foraging

is unknown (Beatty, pers. comm. 2002; Driscoll, pers. comm. 2002b); in any event, information on this breeding area is included because it is in the vicinity of Roosevelt

**Figure II-9. Bald eagle breeding areas within 100 miles of Roosevelt Lake, Arizona.**




Lake. One new breeding area, called the "Rock Creek" breeding area, was located in 2001. This pair of bald eagles was found nesting about 6 miles from Roosevelt in a large ponderosa pine (*Pinus ponderosa*) in the Four Peaks area.

All of the bald eagle pairs at Roosevelt Lake are in the prime of their breeding years, having been born in the late 1980s or early 1990s (Beatty, pers. comm. 2002). The two pair whose ages are less certain are the "Dupont" pair and the "Rock Creek" pair. The "Dupont" pair already had two nest sites when they were discovered, and the "Rock Creek" pair's nest was located just 3 to 4 miles from where an older nest that had burned was found, so both pairs probably already had established territories for some time prior to discovery (Id.).

#### j. Bald Eagle Habitat at Roosevelt Lake

Both the Salt River and Tonto Creek inflows to Roosevelt Lake are dominated by salt cedar, interspersed with areas of cottonwood and willow trees. In 1991, Reclamation and the Tonto National Forest established the Tonto Creek Riparian Unit to manage livestock grazing on 5,900 acres with the goal of achieving recovery of the degraded Tonto Creek riparian vegetation (FWS 1996). An area of cottonwood/willows at the mouth of Tonto Creek is also used as a breeding area (Reclamation 1992). The riparian trees provide perches for bald eagles to nest, roost, loaf, preen, and/or hunt (AGFD in prep.). Non-breeding bald eagles as well as territorial pairs are known to use the area (Beatty, pers. comm. 2002). Stream inflows and the lake itself provide foraging. Hunt et al. (1992) found that inflow areas are important foraging habitat for Arizona bald eagles and that free-flowing creeks, such as Tonto Creek, had the highest nest success rates.

#### k. Nesting Success at Roosevelt Lake

Table II-6 lists 12 years of nesting results for the six nests in the Roosevelt Lake vicinity. Nesting data on the Pinal breeding area was first recorded in 1978; data on the Sheep breeding area goes back as far as 1986; the Pinto breeding area nest was first established and monitored in 1988; the Tonto breeding area nest was first established and monitored in 1992; data on the Dupont breeding area is available from 1997 although the nest is believed to have existed for at least a decade before being discovered (Beatty, pers. comm. 2002). The Rock Creek breeding area was just discovered in 2001 although this was likely the same territory that existed in the 1950s and 1960s and was probably present throughout much of the 1990s due to detection of bald eagles near Roosevelt Dam (Beatty, pers. comm. 2002).

**Table II-6. Occupancy and nesting results for bald eagles near Roosevelt Lake for the years 1996 to 2002.**

| Breeding Area | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pinal | S (1) | F | S (1) | S (1) | F | F | F | O | O | F | U | S (1) |
| Pinto | F | F | S (1) | F | S (2) | S (3) | F | O | S (2) | O | S (2) | F |
| Sheep | U | O | O | F | O | S (2) | O | O | S (1) | F | F | S (2) |
| Tonto | | F | S (2) | S (1) | S (1) | S (2) | S (2) | S (1) | S (2) | F | S (1) | S (2) |
| Dupont | | | | | | | F | S (1) | O | F | O | U |
| Rock Creek | | | | | | | | | | | O | S (1) |

U = unoccupied, O = occupied, S = successful (number fledged), F = failed

*Source:* AGFD Arizona Bald Eagle Nestwatch Program reports (Driscoll et al. 1999; AGFD in prep.); 2001 data: Beatty, pers. comm. 2002; Driscoll, pers. comm. 2002.

### *4. Yellow-billed Cuckoo*

#### a. Species Description

The yellow-billed cuckoo (*Coccyzus americanus*) is approximately 12 inches in length with a long tail that has three pairs of large white ovals on its dark underside. The

bill is long and decurved, being black on the upper mandible and yellow below. The wings are rufous on the primaries with the coverts and upper-parts being grayish-brown. The breast is white. Immature cuckoos are similar to adults, but with less pronounced white ovals under the tail and the bill may be all dark. Yellow-billed cuckoos reside in open woods, thickets, and riparian areas (Alsop 2001; Stokes and Stokes 1996). Cuckoos are summer residents throughout the United States, southern Canada, and northern Mexico.

Currently there is uncertainty as to whether the western yellow-billed cuckoo is a distinct subspecies. The western race is referred to as *C. a. occidentalis* (Finch 1992). A more complete discussion on the debate regarding the western yellow-billed cuckoo's taxonomic status can be found in the U.S. Fish and Wildlife Service's 12-month Finding for a Petition to List the Yellow-billed Cuckoo in the Western Continental United States (FWS 2001d) and in Corman and Magill (2000). The U.S. Fish and Wildlife Service, however, concluded that the western population met the discreteness criteria to be considered a distinct population segment considered for protection (FWS 2001d).

#### b. Threats to the Species

Factors contributing to the decline of cuckoos in the western U.S. include: degradation and loss of riparian habitat due to vegetation clearing, stream diversion, water management, agriculture, urbanization, over-grazing, and recreation (AGFD 1988); 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 over 70 percent nation-wide (FWS 2001b).

#### c. Listing History

The decline of the cuckoo due to loss of riparian habitat has been reported consistently (Tate and Tate 1982; Finch 1992). The western race was on The Audubon Society's blue list of species undergoing population or range reductions from 1972-1981 and in 1986 (Finch 1992) due to concerns over its decline. The species is listed in Arizona Game and Fish Department's Wildlife of Special Concern (AGFD 1996 in prep.). The FWS was first petitioned to list the yellow-billed cuckoo as endangered in California, Washington, Oregon, Idaho, and Nevada, but FWS stated in a decision dated December 29, 1988, that "the petitioned action was not warranted, finding that the petitioned area did not encompass either a distinct subspecies or a distinct population segment" (FWS 1988). The FWS was again petitioned by several groups to list the western subspecies of the yellow-billed cuckoo as endangered in February 1998 (Southwest Center for Biological Diversity 1998). On February 17, 2000, the FWS printed a Notice of 90-day Finding on the Petition to List the Yellow-billed Cuckoo as Endangered, with Critical Habitat (FWS 2000). On July 25, 2001, the FWS found that there was a distinct population segment and that there was substantial information to indicate that the listing petition action was warranted, but precluded by higher priority listing actions (FWS 2001d). SRP understands that pursuant to the FWS listing priority

guidance, FWS expects to develop a proposed rule to list the distinct population segment. At this time, this species has been added to the FWS' candidate list.

#### d. Cuckoo Breeding Biology

Western cuckoos are relatively late nesters for neotropical migrants. In Arizona, few cuckoos arrive before the last week in May, with the peak occurring in mid to late June (Corman, pers. comm. 2002). The earliest cuckoo egg date in Arizona is June 15 and nesting activities continue through August and often into September in the southeast portion of the state (FWS 2001d; Corman and Magill 2000).

Nests are built by both adults in trees or shrubs near drainages. The nests are well-hidden and are flimsy platforms of twigs lined with finer plant materials. Nests are built in trees, shrubs, and vines (Preble 1957). 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, and fledging at approximately three weeks of age (Corman, pers. comm. 2002). Yellow-billed cuckoos occasionally lay their eggs in other yellow-billed cuckoo's or other bird species' nests (FWS 2001d).

#### e. Wintering Habitat

Cuckoos over-winter from Colombia and Venezuela south to northern Argentina (Ehrlich et al. 1988; AOU 1998). It is not known whether the eastern and western cuckoos co-mingle during migration or winter in the same areas.

#### f. 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 around 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. Cottonwoods are often used in foraging (Laymon 1999).

#### g. Breeding Habitat

The western yellow-billed cuckoo breeds in large blocks of riparian habitat, particularly in cottonwood and willow stands, which they also use extensively for foraging; while the eastern cuckoo breeds in a wider range of habitats, including deciduous woodlands and parks (Ehrlich et al. 1988). Dense understory vegetation seems to be an important factor in site selection (FWS 2001d) as well as high humidity near the nest (Hamilton and Hamilton 1965). Suitable or potentially suitable habitat definitions for the purpose of surveys in 1998 and 1999 in Arizona by AGFD and the U.S. Geological Survey (USGS) Colorado Plateau Field Office included: "riparian areas with vegetation greater than 16.4 feet tall native or a mixture of native/exotic trees with a greater than 50 percent canopy cover, recognizable subcanopy layers, and moderate to dense understory" (Corman and Magill 2000). Western yellow-billed cuckoos are found mainly below 6,600 feet (FWS 2001d). Hanna (1937) described nesting habitat on the Santa Ana River in California based on examination of 24 nests, as "damp willow

thickets mixed with cottonwood trees and with heavy underbrush of nettles, wild grape vines, and cattails." Twenty-two of the 24 nests described were located in willows, one was in an alder, and one was in a cottonwood; and most of the nests were well out on a limb (Hanna 1937). Gaines and Laymon (1984) reported a home range size that included 25 acres or more of riparian habitat for cuckoos along the Sacramento River in California. Home ranges on the South Fork of the Kern River, California ranged from approximately 42 to 99 acres (FWS 2001d). In New Mexico, estimated nesting densities ranged from 1 to 15 pairs per 99 acres (Id.). In Arizona, reported nesting densities on three plots were 8.2, 19.8, and 26.5 pairs per 99 acres (Id.).

In Arizona, Corman and Magill (2000) reported percent occupancy rates in six habitat types during the breeding season (Table II-7). The largest detection of cuckoos in Arizona during 1998 through 1999 surveys occurred at the San Pedro Riparian National Conservation Area (Figure II-10).

Laymon et al. (1997) located 94 of 95 nests in Goodding's willow (*Salix gooddingii*) and red willow (*Salix lavigata*) on the South Fork of the Kern River. The average nest tree height was 30.8 feet with a range of 8.2 to 58.4 feet. The average diameter at breast height (DBH) of nest trees was 10 inches with a range of 1.2 to 35.4 inches. Average canopy closure at nest sites was 74 percent (range: 16.5 to 98 percent). Canopy closure directly over the nests averaged 93.4 percent (range: 0 to 100 percent) (Laymon et al. 1997). In Arizona, six nests were located during 1998 and 1999 surveys (Corman and Magill 2000) (Table II-8). The average nest tree height (24.6 feet) and DBH (5.7 inches) on the small sample size of nests (n = 6) in the Arizona study was less than those reported in California.

**Table II-7. AGFD's cuckoo detections by habitat type during 1998 and 1999 surveys in Arizona by AGFD and USGS.**

| Vegetation Type | Number of Sites Surveyed | Percent of Sites Occupied | Number of Sites Occupied |
|---|---|---|---|
| Cottonwood, willow, ash, mesquite | 58 | 70.7 | 41 |
| Sycamore, cottonwood | 39 | 46.2 | 18 |
| Cottonwood, willow, mesquite, < 75% salt cedar | 28 | 60.7 | 17 |
| Sycamore, alder, cottonwood, willow, ash, walnut | 12 | 33.3 | 4 |
| Mesquite bosque, hackberry | 5 | 60.0 | 3 |
| > 75% salt cedar | 3 | 33.3 | 1 |

*Source:* Corman and Magill 2000.

**Figure II-10. Detections of yellow-billed cuckoo in Arizona, 1998 and 1999 breeding seasons.**

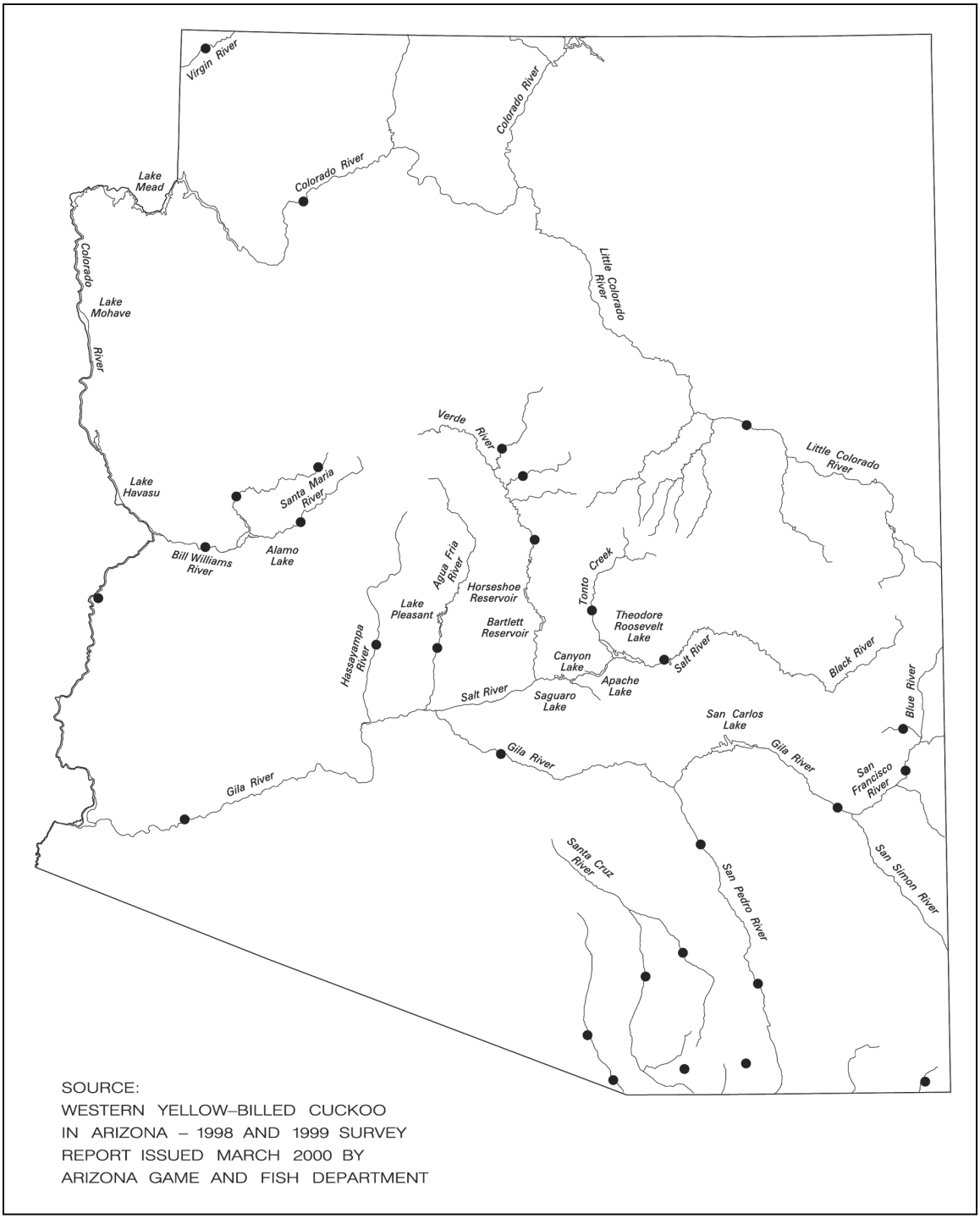


**Table II-8. Nest site characteristics for nests located during 1998 and 1999 surveys in Arizona by AGFD and USGS.**

| Drainage | Tree Species | Tree Height (ft) | Nest Height (ft) | DBH (in) | Distance to Water (ft) |
|---|---|---|---|---|---|
| Gila River | Salt cedar | 24.6 | 13.1 | 4.0 | 98.4 |
| Oak Creek | Arizona alder | 27.9 | 8.2 | 5.2 | 52.5 |
| San Pedro River | Fremont cottonwood | 29.5 | 15.1 | — | — |
| Sonoita Creek | Goodding willow | 8.2 | 5.2 | 1.8 | 0.0 |
| Sonoita Creek | Goodding willow | 32.8 | 21.3 | 11.9 | 0.0 |
| Verde River | Fremont cottonwood | — | 40.0 | — | — |
| Mean | | 24.6 | 17.1 | 5.7 | 37.7 |

*Source:* Corman and Magill 2000.

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 10 to 100 acres in size. Habitat patches less than about 10 acres are generally considered unsuitable.[33] 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. Long, narrow areas have more edge in relation to the area of habitat, and are considered less suitable. In one study, desirable habitat strips were found to be typically greater than 325 feet wide, and 1,950 feet was the most favorable (Laymon 1998a).

### h. Statewide Status

According to the FWS 12-Month Finding for a Petition to List the Yellow-billed Cuckoo in the Western Continental United States: "Arizona probably has the largest remaining yellow-billed cuckoo population among states west of the Rocky Mountains…Losses have been greatest at elevations below 900 m (3,000 ft) along the Lower Colorado River and its major tributaries…Following high water levels of 1983 to 1984 and 1986, cuckoo numbers decreased by 70 to 75 percent on the Bill Williams River delta and although habitat has since improved, the numbers of cuckoos have not correspondingly rebounded" (FWS 2001d, citations omitted). Corman and Magill (2000) report that prior to 1998, cuckoos were reported along 25 drainages throughout Arizona, mainly occurring below 4,921 feet. The authors reported 172 pairs and 81 unmated adults during 1999 surveys along 221 miles of riparian habitat. Cuckoos were mainly located along the San Pedro, Verde, and Agua Fria rivers, and Cienega and Sonoita creeks (Corman and Magill 2000). These survey numbers reflect surveys completed

[33] 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).

mainly on public lands and do not include work on many private or tribal lands; therefore, a statewide population estimate is not available at this time. See Figure II-10 for a map of the drainages where cuckoos were found by AGFD and the U.S. Geological Survey (USGS) during the 1998 and 1999 surveys.

#### i. Status of the Cuckoo at Roosevelt Lake

Incidental sightings of cuckoos were reported during 1995 and 1996 at the Tonto Creek inflow (Spencer, pers. comm. 2001). Surveys performed during 1998 and 1999 (Corman and Magill 2000) resulted in no detections at Tonto Creek in 1998 and two pairs in 1999. Surveys on the Salt River resulted in one pair and one single adult during 1999 (the Salt River inflow was not surveyed during 1998).[34] No other formal surveys have been conducted at the inflows to Roosevelt Lake. Incidental sightings of cuckoos by the AGFD willow flycatcher field crew were reported for the Salt River inflow in 2001, but none were reported for the Tonto Creek inflow (Smith, pers. comm. 2001). Three cuckoos were observed at Roosevelt in 2002 (fewer than in 2001) but they "probably did not breed" (Paxton, pers. comm. 2002).

#### j. Cuckoo Habitat at Roosevelt Lake

Riparian cottonwood/willow galleries and mixed riparian stands that appear suitable for cuckoos exist at both the Salt River and Tonto Creek inflows to Roosevelt Lake. However, cuckoos were not sighted in 2001 on the Tonto Creek inflow, possibly due to the drying out of the cottonwood/willow stand they once occupied. At both inflows, the dense understory consists mainly of salt cedar. Based on the results of the 1998-1999 surveys (Table II-7), monotypic salt cedar sites appear to be the least preferential nesting locations. Habitat that appears suitable at Roosevelt Lake inflows includes cottonwood/willows and mixed riparian patches. Some areas of tall dense vegetation are not currently suitable habitat because they occur in patches less than 10 acres in size. Although patches of mesquite are present at Roosevelt, these patches are not close to water and the density of this mesquite is not high enough to be good cuckoo nesting habitat.

### C. Other Listed and Rare Species

#### *1. Listed and Rare Plants*

Through AGFD's Heritage Data Management System, five plants were identified that may occur within 1 mile of the Salt River, Tonto Creek, or Roosevelt that have been listed by FWS under the ESA or by a federal agency as needing protection. These plants and their status are listed in Table II-9.

[34] It is not known whether the small number of cuckoos detected was a result of lack of survey thoroughness or low population.

**Table II-9. Listed and rare plants near Roosevelt.**

| Scientific Name | Common Name | ESA | USFS | BLM | NPL | Riparian or Upland |
|---|---|---|---|---|---|---|
| *Abutilon parishii* | Pima Indian mallow | | S | | SR | Upland |
| *Agave delamateri* | Tonto basin agave | | S | | HS | Upland |
| *Agave murphyei* | Hohokam agave | | S | S | HS | Upland |
| *Mabrya acerfolia* | Mapleleaf false snapdragon | | S | | | Upland |
| *Perityle saxicola* | Fish Creek rock daisy | | S | | | Upland |

KEY: ESA=Endangered Species Act as amended, 1973
USFS=United States Forest Service (S=Sensitive Species)
BLM=United States Bureau of Land Management (S=Sensitive Species)
NPL=Arizona Native Plant Law (1993) (HS=Highly Safeguarded, no collection; SR=Salvage Restricted, collection with permit)

All five of the plant species listed in Table II-9 are upland species. As such, they are unlikely to be impacted by any of the reservoir operation alternatives considered in the RHCP.

The two agaves, *Agave delamateri* and *Agave murphyei*, are known to exist on open slopes near major drainages in the area. One plant of *Agave murphyei* was found in the Roosevelt area in the early nineties, and was relocated as part of the mitigation for the modification of Roosevelt Dam (Reclamation 1990, pg. 23). The 1989 survey done in conjunction with the Environmental Assessment for Modified Roosevelt revealed no other agaves of concern.

*Agave delamateri* is a rare, recently identified agave with only 90 known plants.[35] Reproduction is limited to clones, as seed production is unknown in this plant. As noted in the previous paragraph, *Agave delamateri* was not found in surveys conducted prior to the construction of Modified Roosevelt. Therefore, none of the actions proposed in the RHCP would have any impact on this species.

### *2. Other Listed Wildlife and Species of Concern*

AGFD's Heritage Data Management System also was used to identify wildlife species listed by FWS under the ESA or by another federal or state agency as needing protection that may occur within 1 mile of the Salt River, Tonto Creek, or Roosevelt. These species and their status are listed in Table II-10.

The lowland leopard frog has been found in numerous drainages near Roosevelt Lake and at Roosevelt as recently as 1995. However, it probably does not maintain breeding populations at Roosevelt, Salt River, or Tonto Creek due to the presence of exotic predators. Frogs in these areas are likely transients from adjacent areas. These individuals and populations in adjacent drainages would not be affected by varying water levels or other habitat changes caused by operation of Roosevelt.

[35] See http://www.dbg.org/2/agave_delamateri.

Many of the native fishes listed in Table II-10 are not thought to exist in large numbers in Roosevelt, or in Tonto Creek or the Salt River near the lake due to habitat degradation and competition from and predation by introduced game fish. Longfin dace, desert sucker, and Sonora sucker are fairly common in Tonto Creek downstream from Gun Creek. To the extent that they exist in these areas, they are unlikely to be significantly affected by the reservoir operations contemplated in the RHCP because they are aquatic species.

Habitat that appears to be suitable for the cactus ferruginous pygmy-owl exists in the desert scrub and, possibly, riparian woodlands around Roosevelt Lake (Reclamation 1999, p. 12). However, the area is outside the known historical range of the species. The area around Roosevelt was not designated as critical habitat for this species (63 FR 71 820, since remanded).

The other upland species in Table II-10 would be unaffected by alternative reservoir operations considered in the RHCP. As these species are not known to exist within the active conservation space at Roosevelt and are not riparian obligates, they would be unaffected by periodic inundation of that space.

**Table II-10. Other listed wildlife and species of concern near Roosevelt.**

| Scientific Name | Common Name | ESA | USFS | BLM | AGFD | Critical Habitat Designated | Upland, Riparian or Aquatic |
|---|---|---|---|---|---|---|---|
| *Agosia chrysogaster* | Longfin dace | | | S | | | Aquatic |
| *Catostomus clarki* | Desert sucker | | | S | | | Aquatic |
| *Catostomus insignis* | Sonora sucker | | | S | | | Aquatic |
| *Gila robusta* | Roundtail chub | | S | | WSCA | | Aquatic |
| *Glaucidium brasilianum cactorum* | Cactus ferruginous pygmy-owl | LE | | | WSCA | Yes | Upland |
| *Gopherus agassizii* | Sonoran Desert tortoise | | | | WSCA | | Upland |
| *Myotis velifer* | Cave myotis | | | S | | | Upland |
| *Nyotinomops femorosaccus* | Pocketed free-tailed bat | | | S | | | Upland |
| *Phyllorhynchus browni lucidus* | Maricopa leafnose snake | | S | | | | Upland |
| *Poeciliopsis occidentalis occidentalis* | Gila topminnow | LE | | | WSCA | | Aquatic |
| *Rana yavapaiensis* | Lowland leopard frog | | S | | WSCA | | Riparian |
| *Xantusia vigilis arizonae* | Arizona night lizard | | S | | | | Upland |

KEY: ESA=Endangered Species Act as amended, 1973 (LE=Listed Endangered)
USFS=United States Forest Service (S=Sensitive Species)
BLM=US Bureau of Land Management (S=Sensitive Species)
AGFD=Arizona Game and Fish Dept (WSCA=Wildlife of Special Concern in Arizona)

# III. Analysis of Impacts From the Full Operation Alternative (Proposed Action)

Chapter III describes the impact of SRP's continued operation of conservation storage space at Roosevelt (Full Operation alternative or Proposed Action) on listed and candidate species as well as the effects on certain other resources. The Proposed Action (or the Full Operation alternative) reflects SRP's current operation of Roosevelt. The first subchapter provides a description of the models and other tools used in the analysis. The subsequent subchapters contain the approach and general information used for each component of impact that is evaluated, and describe the effects associated with each alternative including direct and indirect impacts. Cumulative impacts are addressed at the end of the chapter. The process leading to selection of the RHCP as the Proposed Action is set forth in Chapter V.

As discussed throughout this plan, the emphasis of the RHCP is on the flycatcher population because it is endangered and occupies a relatively large amount of habitat at Roosevelt. Thus, the focus of the analysis of biological impacts is on the effect of reservoir operations on riparian habitat occupied by flycatchers. The emphasis of the analysis of non-biological impacts is on the significant impacts from Roosevelt operation on water supply, power generation and recreation. Other non-biological impacts from reservoir operation are briefly summarized below and are described in more detail in Chapter 4 of the EIS.

The Full Operation alternative would involve issuance of an ITP by the FWS allowing the continued full operation of Roosevelt with the implementation of the RHCP, consistent with pre-permit objectives set forth below. The intent of this alternative is to minimize the biological, environmental, and socioeconomic impacts from future reservoir operations, continue water storage and power generation at Roosevelt, and satisfy the criteria of Section 10(a) of the ESA. SRP believes that this alternative best minimizes the 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 Chapter V.

In summary, under the Proposed Action, Roosevelt would continue to be operated by SRP as part of its reservoir system in a manner consistent with its purpose as a water storage and power generation facility. As discussed in Subchapter I.G, SRP operates Roosevelt 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."

(Modified Roosevelt Operating Agreement, see Appendix 1)

SRP's operation of Roosevelt in future years may require periodic removal of dead trees that result from inundation. Clearing of dead vegetation may be required in order to permit effective operation of spillways and outlet works, or to minimize safety issues with recreational use of the lake by boaters. If these operational or safety concerns necessitate removal of dead trees, SRP would meet with FWS to agree on the specific method (e.g., controlled burns or mechanical clearing) and the specific areas for vegetation clearing (e.g., areas near occupied habitat would be avoided).

In conjunction with the Proposed Action of Full Operation of Roosevelt, measures to minimize and mitigate the potential take of federally listed species would be implemented by SRP. Minimization measures would include:

- Protection, enhancement, or restoration of riparian habitat near Roosevelt above elevation 2,151 feet.
- Management of riparian habitat within and near Roosevelt.

Mitigation measures would include acquisition and management of riparian habitat at and near Roosevelt, along the Verde River, along the San Pedro River, and elsewhere in Arizona. These measures for the RHCP are described in more detail in Chapter IV.

SRP operates the flood control space above 2,151 feet in accordance with the criteria established in the Modified Roosevelt Water Control Manual (Corps 1997, p. vii). Any action above elevation 2,151 feet that may affect listed species is a Federal action subject to consultation under Section 7 of the ESA. Flood control operation is therefore not covered by the RHCP.

### A. Models and Other Tools Used in the Analysis

The RHCP's analysis of the impacts of future reservoir operations at Roosevelt involves three primary components: 1) impacts on vegetation that is used as habitat for listed and candidate species, 2) impacts on water and power that can be supplied by reservoir storage, and 3) impacts on recreation at Roosevelt.

With respect to biological impacts, future operation of Roosevelt by SRP would involve the periodic inundation of habitat used by listed and candidate species. Changes in the future operation of Roosevelt in an attempt to minimize impacts on listed and candidate species would result in significant impacts to water supplies, power production, and recreation (see Chapter V). Because of the complex variation in runoff, lake levels, and vegetation over time (see Chapters I and II), models were developed and used to evaluate long-term impacts from reservoir operations. As discussed below, the models and relationships of hydrologic conditions and riparian vegetation were constructed based on ecological principles, historical data, and empirical evidence in order to estimate future impacts.

### *1. Reservoir Operation Model*

SRP uses a long-term planning model to evaluate reservoir operation alternatives. This model, called SRPSIM, simulates reservoir operations using a monthly time step. The program was originally written in 1979 by Reclamation and has been refined by SRP a number of times to better reflect current and future operations as well as new demands (such as NCS demand). The 1995 version of the model, the same model used in Reclamation's consultation on modifications to Roosevelt Dam, is used in the analysis of impacts for the RHCP to provide results that are comparable to the information used in the 1996 BO issued by FWS. 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 3.

### *2. Vegetation Model*

A "vegetation" model was developed to simulate cycles of growth and inundation of vegetation based on reservoir levels over time. This model estimates the total amount of tall dense vegetation that may be present at any given time by focusing on the length of time that increments of reservoir elevation are exposed or inundated. Exposure of the lakebed for five continuous years is assumed to allow tall dense vegetation to grow at that elevation; inundation of the root crown for three continuous months (young vegetation) or 12 months (tall dense vegetation) is assumed to result in the death or degradation of the vegetation at that elevation. Because this model does not include a ground water component, it does not address riparian vegetation at higher elevations that becomes dried out as the reservoir is lowered. Therefore, the vegetation model is used primarily to predict the maximum amount of vegetation that may be suitable as habitat at full reservoir levels. It also provides reasonable estimates of the frequency and duration of vegetation that may be suitable as habitat at average and above average reservoir levels.

#### a. Assumptions

Key assumptions in the vegetation model and their rationale are described below.

- **Future inflows will reflect historical inflows** — Monthly reservoir elevation data from reservoir simulation using historical inflows from October 1889 through September 1994 are used as inputs. These historical inflows are used with current dam operational rules to model reservoir levels. Of course, the pattern of future inflows (and thus, reservoir levels) will not be exactly the same as historical inflows and resulting reservoir levels. However, regardless of the exact pattern of future reservoir levels, the future percentage of time that reservoir levels impact tall dense vegetation at Roosevelt is expected to be similar to historical percentages of time over a period of 40 or more years.
- **Vegetation growth and inundation** — The model considers the time that land surrounding the reservoir has been inundated or exposed in order to calculate the amount of tall dense vegetation that is present. If the reservoir elevation has been inundated for more than 12 continuous months, then any vegetation is considered to be dead or severely degraded. If the reservoir elevation drops and exposes the reservoir bed, tall dense vegetation can then recover. Full recovery after extended inundation is assumed to take 5 continuous years (60 months) based on

observations of growth of new riparian vegetation at Roosevelt from 1997 to 2001. If the new vegetation is flooded again for more than 3 consecutive months during the first 2 years of recovery, the recovering vegetation is assumed to die.[36] The basis for the modeled periods of vegetation death with respect to inundation (3 months for recovering vegetation and 12 months for tall dense vegetation) is described in Appendix 4.

- **Distribution of vegetation —** The 2001 acreage and elevations of tall dense vegetation surrounding the reservoir are used as inputs to the model. The vegetated acreage in each 2-foot elevation interval is divided in two to generate 1-foot increments for use in the spreadsheet model. The assumption is made that the future distribution of tall dense vegetation will be similar to the current distribution of that vegetation. Because future scouring, sediment deposition and hydrological conditions will undoubtedly alter the distribution of vegetation at various elevations, it is not possible to exactly simulate the future distribution. However, two considerations support the use of this assumption: 1) over the long term, sediment scouring and new deposition will offset each other to some extent; and 2) it is possible that using the current vegetation distribution will overestimate the amount of future impact because the new reservoir fringe near elevation 2,151 feet may support more vegetation in the future than exists now because higher reservoir elevations could periodically stimulate vegetation growth at the inflows near this elevation.

### b. Hydrologic and Topographic Input Data

Monthly reservoir elevation data from SRPSIM output for the period 1889-1994 are used as inputs. The reservoir simulation model has considered maximum water storage elevations of 2,095 feet, 2,125 feet, and 2,151 feet. The data for the maximum storage elevation of 2,095 were not used for vegetation modeling because that alternative avoids impacts from inundation on vegetation currently used by flycatchers.

The Bureau of Reclamation generated topographic contour lines at 2-foot intervals using 1:10,000 color photography. First order stereoplotters were used to collect elevations on 100-foot grid points, breaklines, additional mass points and spot elevations. Mass points are points added where the grid and breaklines do not adequately show the terrain. Spot elevations are high spots and low spots such as depressions or hilltops. In the process of generating contour lines, overlapping occurred in steep areas, which is caused by distortion in the aerial photography. To correct these overlaps, the contours were edited in Arc/Info by ERO after Reclamation provided the draft data. Nodes were removed or adjusted to eliminate the overlap.

ArcView and ArcInfo software programs were used to manage the map data for this project. Maps of vegetation types and topographic contours for the Salt and Tonto arms of Roosevelt Reservoir were generated at a scale of 1:12,000 (1 inch = 1,000 feet).

[36] This may be a worst-case assumption that errs on the side of flycatchers and cuckoos because 3 months of inundation may stimulate growth of some young woody vegetation such as willows.

#### c. Initial Conditions and Algorithm

Each run of the spreadsheet model requires a set of initial conditions that the algorithm uses to calculate vegetated acres for the subsequent months. The initial conditions are the beginning values of vegetated acres and indicate if a certain elevation is flooded. The implications of these initial values are evident only in the subsequent few months of data. Afterwards, the trends in the actual data are reflected in the vegetated acreage calculations. This means that the spreadsheet model is influenced by the initial values for only a short period of time before it begins to reflect the actual data. The impact of the initial values to the summary statistics and graphs is negligible.

The spreadsheet model considers the land surrounding the reservoir to be vegetated if it has not been inundated for more than 12 months. If it has been inundated for more than 12 months, then the vegetation is considered to have died. If the reservoir elevation drops and exposes the elevation of the dead vegetation, the vegetation can then recover. Full recovery is assumed to take 5 years (60 months). If the root crown of the vegetation is flooded again for more than 3 consecutive months during the first 2 years of recovery, the recovering vegetation is assumed to die. These decisions are summarized in Figure III-1.

#### d. Model Operation

The vegetation model operates by comparing monthly reservoir elevation to the status of tall dense vegetation on the land being inundated or exposed. Each 1-foot increment elevation between 2,090 (base reservoir elevation in the model) and 2,151 (maximum conservation storage) is evaluated to determine if the root crown of the vegetation at that elevation is inundated, recovering from inundation, or not affected. Acreage of tall dense vegetation as a percentage of the modeled period of years is shown on Figure III-2. Based on the model results for two periods of record, about 230 to 280 acres of tall dense vegetation would be present in all years and about 500 to 650 acres would be present in about 50 percent of the years.

#### e. Period of Record

Two periods of record, 1889-1994 and 1951-1990, are shown on Figure III-2. The period 1951-1990 is representative of the average runoff during the past four centuries (1580-1995) for the Salt and Verde watershed (Stockton 1996). The slightly greater amount of vegetation that occurs during the period 1951-1990 reflects that the reservoir is lower on average during that period of years than during the longer modeling period of 1889-1994. Thus, the period 1889-1994 represents a larger amount and frequency of inflow and higher reservoir levels than the extended record. This means that the extent and duration of vegetation inundation may be overestimated by the 1889-1994 record.

**Figure III-1. Decision Tree for Modeling Vegetated Acres at Roosevelt. Elevation refers to the root crown of vegetation.**

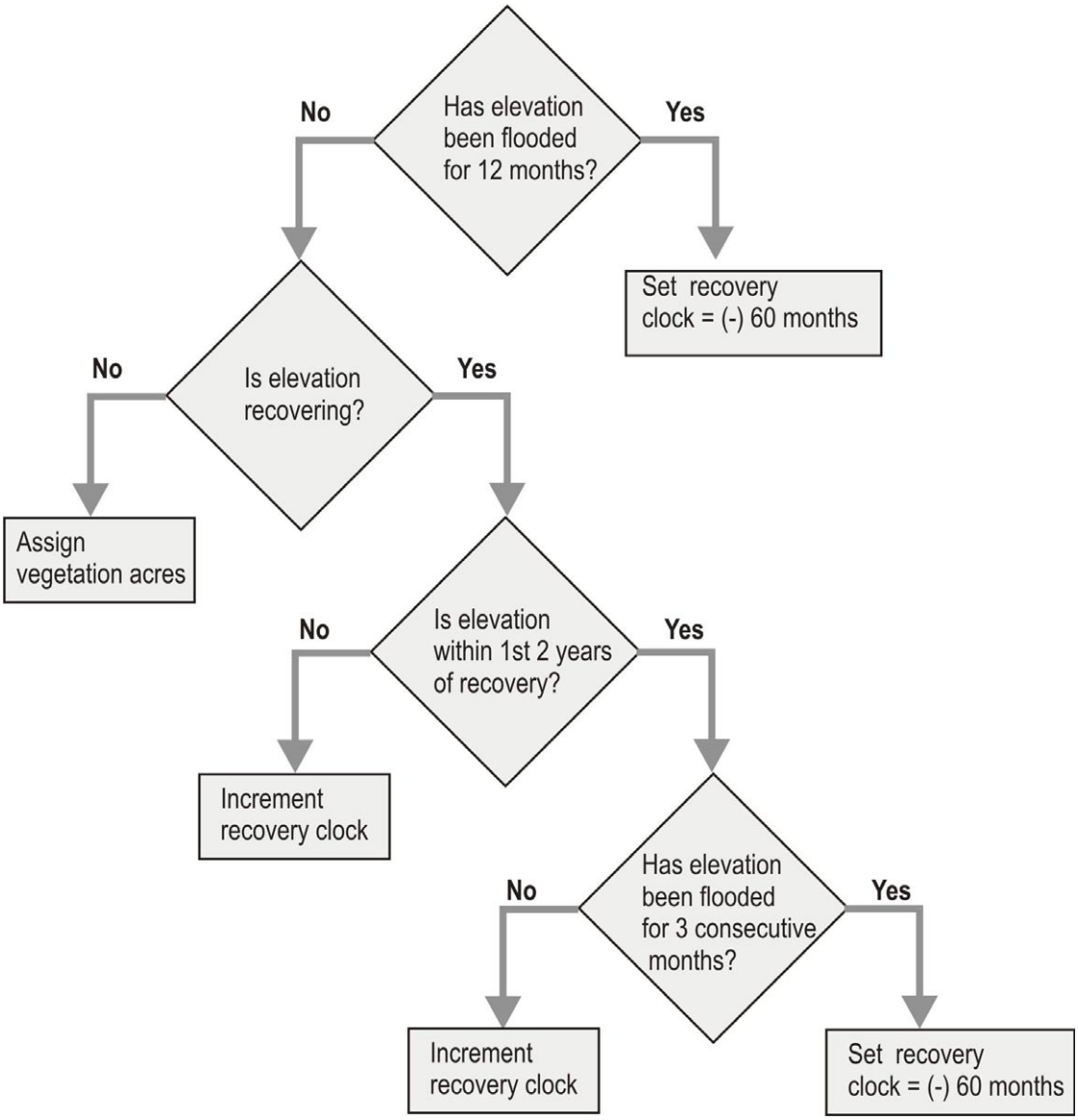
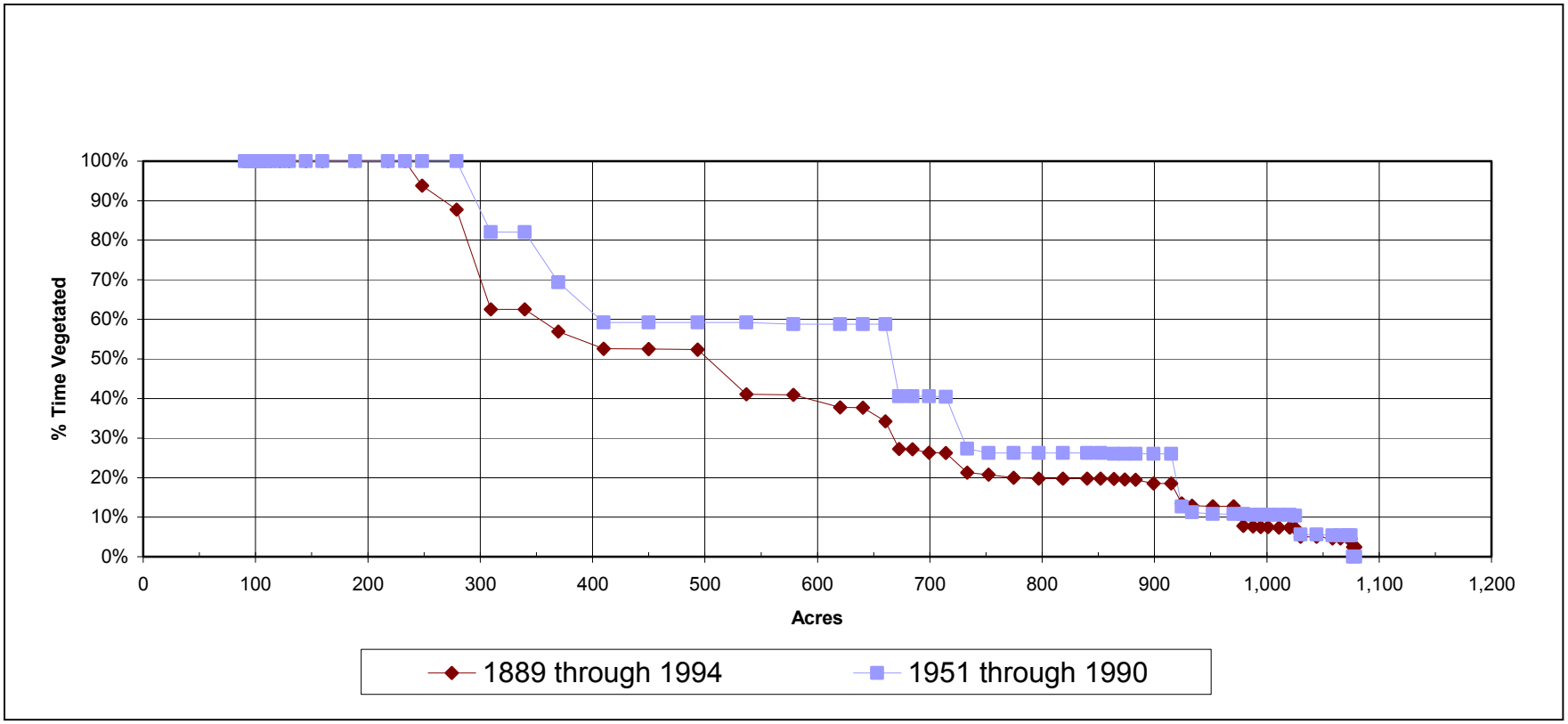


**Figure III-2. Percent of Time the Lakebed is Vegetated vs. Acreage of Tall Dense Vegetation.**



### *3. Flycatcher Nesting Model*

A second model was developed based on the vegetation model. This flycatcher "nesting" model examines reservoir elevation at the beginning of the nesting season to see if the vegetation may be suitable for nesting in a particular year. This model is used to predict the minimum amount of vegetation available for nesting. As described in the previous subchapter (III.A.2), inundation of the root crown for more than 12 months is expected to kill or severely reduce the viability of vegetation to support flycatcher habitat for one or more breeding seasons. A more immediate short-term impact from inundation would occur when vegetation is not available for nesting during a particular season due to high water levels even if the vegetation survives inundation and may be available for nesting in future years. In order to determine the acres available for nesting at various reservoir levels, a modification of the vegetation model is used. Vegetation for nesting is considered available if the tall dense vegetation is alive and not recovering from inundation and if inundated, is not inundated by more than 10 feet on May 1.

#### a. Assumptions

The 10-foot maximum level of inundation on May 1 is the primary assumption in the nesting model in addition to the assumptions in the vegetation model on which it is based. That assumption is based on the following factors:

- Reservoir levels begin to drop in May and are typically several feet lower by early June when most of the nesting occurs (see Figure I-1). Thus, during nesting, actual inundation would be about 6 to 8 feet or less and during fledging 25 days later, several feet lower.
- "Dense vegetation and surface water may function to reduce nest predation and cowbird nest parasitism" (Sogge and Marshall 2000, p. 54). At Roosevelt, although the trees and shrubs used by flycatchers are densely branched from the ground up, there is typically little live foliage below 9 to 12 feet in the occupied patches and virtually no herbaceous ground cover (Id., p. 50).
- Flycatchers typically breed where "slow-moving or still water and/or saturated soil is present in wet or normal precipitation years" (Id., p. 54).
- At Roosevelt, nest height is typically 10 to 20 feet from the root crown of vegetation that is 16 to 30 feet tall (Sferra et al. 1995; Spencer et al. 1996; Sferra et al. 1997; McCarthey et al. 1998; Paradzick et al. 1999-2001; Smith et al. 2002). Even if 6 to 8 feet of water is present under the nest trees, roughly 8 to 24 feet of canopy remain for nesting.

#### b. Conditions

Vegetation for nesting is considered available if the vegetation is not dead or in recovery mode and if inundated, is not inundated by more than 10 feet on May 1. The 10-foot condition is based on data from annual AGFD reports showing the mean nest height at Roosevelt to be 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. Based on information from research along the Lower Colorado River, birds appear to be more willing to nest at a lower level above water than land. With these considerations, the

model assumes that if the vegetation is inundated by no more than 10 feet on May 1, then the trees and shrubs are available for nesting that season. The determination as to whether vegetation is alive follows the same algorithm as used for determining vegetated acres (described in the preceding subchapter regarding the vegetation model).

#### c. Model Operation

The nesting model uses the same input data as the vegetated acres model. Similarly, the table of vegetation/nesting acres for each 2-foot elevation interval is the same. The difference between the models is the additional check to determine if the vegetation is inundated by more than 10 feet of water on May 1 (see Figure III-3). If the vegetation is inundated by no more than 10 feet, then based on average tree and shrub height, approximately 6 to 16 feet of tree or shrub is above water on average and available for nesting. The model calculates available nesting vegetation for the entire year, but the primary nesting period is May through July. May is the focus of the nesting model because June and July reservoir levels are always lower than May levels and therefore if nesting habitat is available in May, it is available in June and July as well.

**Figure III-3. Decision Tree for Determining Available Nesting Vegetation at Roosevelt. Elevation refers to the root crown of vegetation.**

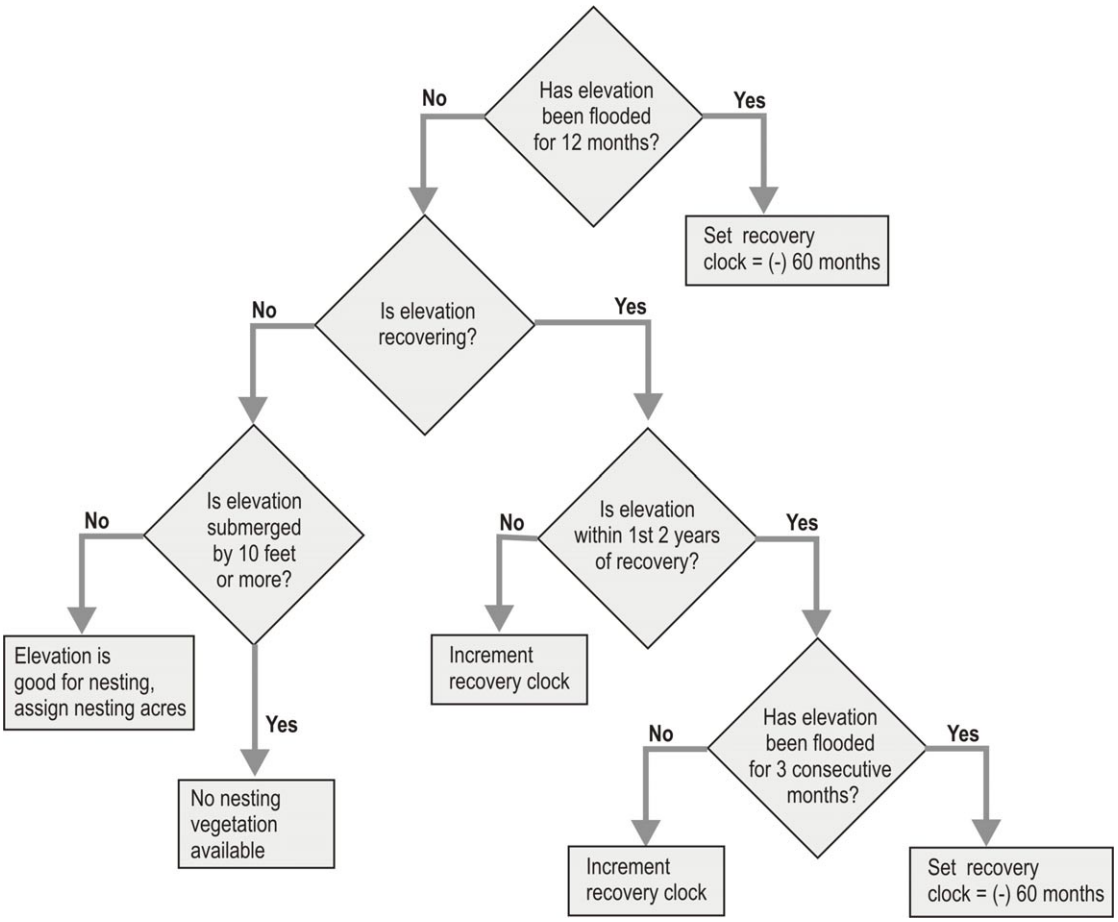


**Figure III-4. Acres Available for Nesting in May vs. Time, Full Operation Alternative (results using 1900 to 1995 inflow data).**

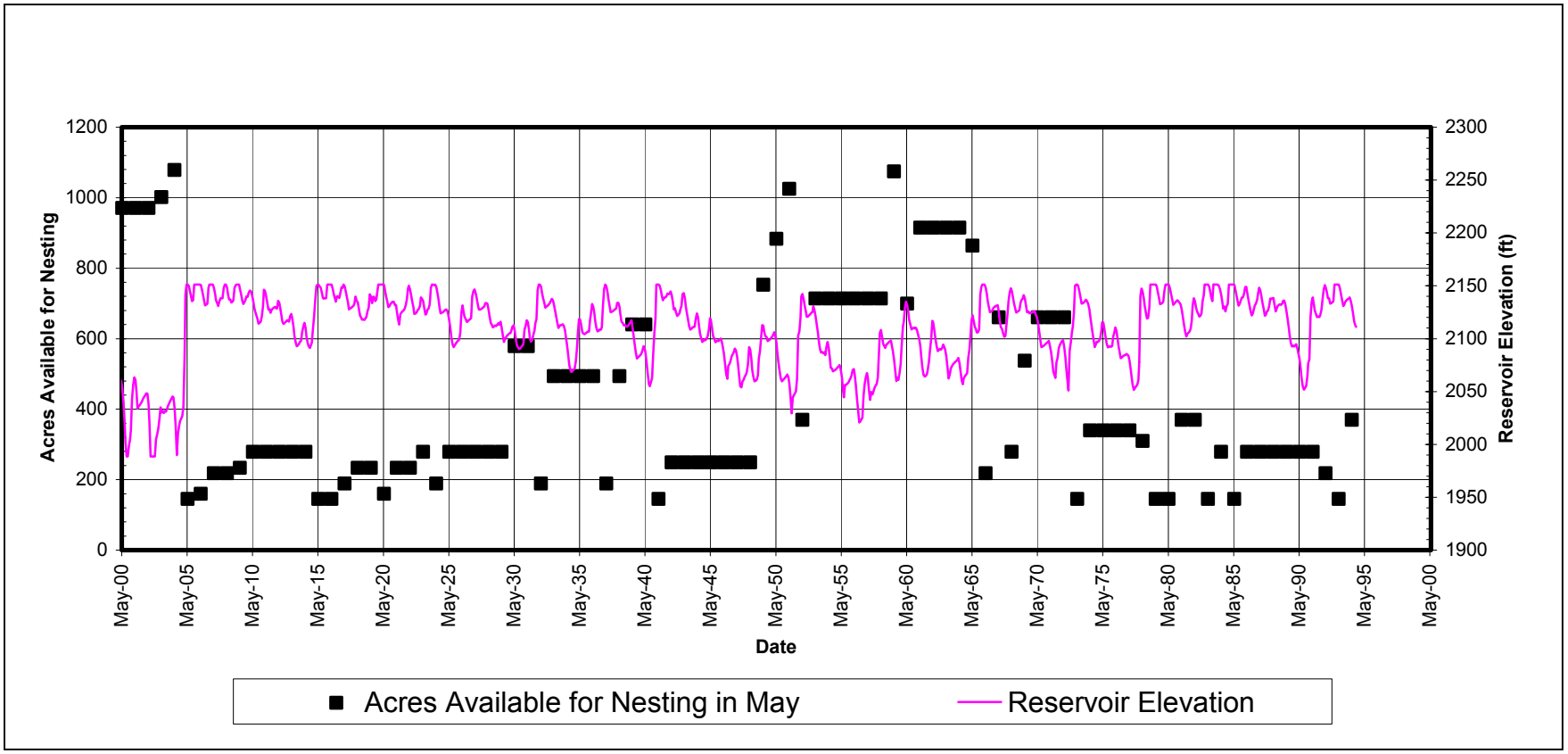
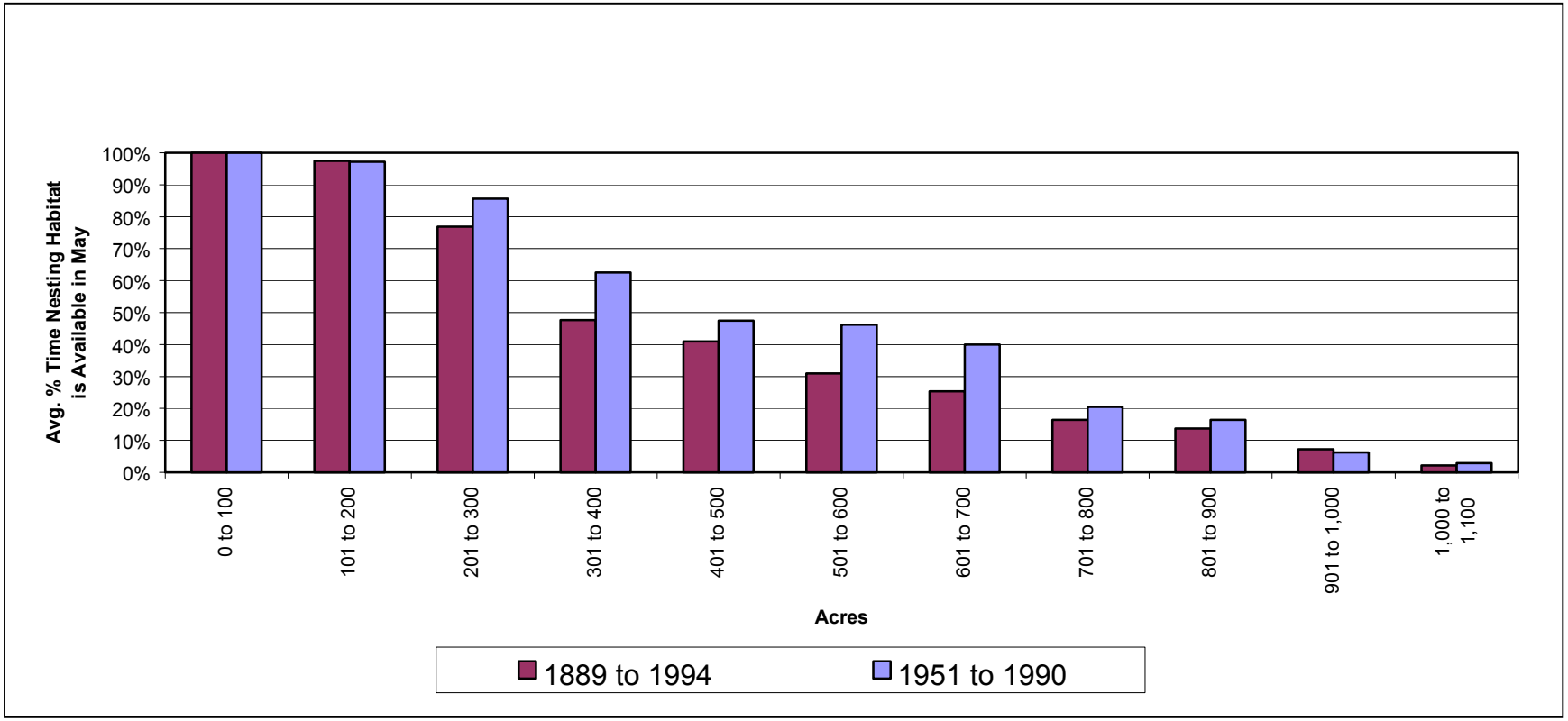


**Figure III-5. Average Percent Time that Acres are Available for Nesting in May vs. Acreage Increments, Full Operation Alternative**



#### d. Model Output

The output of the nesting model is similar to the vegetated acres model output. Figure III-4 and Figure III-5 show the acres available for nesting over time and the percentage of time that various quantities of nesting vegetation are available on May 1 for the 2,151 (Full Operation) alternative.

### *4. AGFD Model*

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 2001, cited with permission). The model uses a Geographic Information System (GIS) along with satellite images, digital elevation models, field data on the presence of flycatchers, GIS variables, and multiple logistic regression analysis to predict breeding activity. 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 that are the 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, biologists with AGFD believe this area is the best available estimate of the amount of habitat needed by adult and juvenile flycatchers for refuge, dispersal, and foraging in the vicinity of nests and territories (Hatten and Paradzick 2001; McCarthey et al., pers. comm. 2002).

The AGFD model was developed and tested using 1999 satellite imagery of Roosevelt, the San Pedro/Gila river confluence, and Alamo Lake (Hatten and Paradzick 2001). In response to a request by SRP, FWS and Reclamation, AGFD obtained a satellite image of Roosevelt from July 2001 and analyzed that data with the model. Initial results indicate that the acreage in the top three classes of breeding site density shifted to new habitat at lower elevations in the lakebed (Hatten, pers. comm. 2001).[37] These results are consistent with ERO field observations that tall dense vegetation was drying out at higher elevations and more distant locations from the streams and declining reservoir levels (see Subchapter II.A). However, flycatchers continue to occupy many more mature patches in the upper portions of the reservoir.

### *5. Other Models Considered*

Development of a ground water model to predict the drying out of vegetation at low reservoir levels was considered but rejected. It was determined that a credible ground water/vegetation model would be extremely difficult to develop given the complex topography on the inflow deltas, highly variable alluvial hydrogeology, and future effects of scouring floods. Instead, comparisons of vegetation mapping in 1997 and 2001, field observations, and trends in flycatcher occupation of vegetation patches were used to estimate the effects of lower ground water levels on vegetation and habitat.

[37] These results are subject to further review and modeling.

### B. Overview of Impacts

Impacts resulting from incidental take of listed and candidate species will primarily occur from effects on occupied vegetation resulting from changes in the duration of water levels in Roosevelt. Direct take of individuals is unlikely, but could occur from nest tree fall following inundation or drying, or fledglings possibly drowning where nest trees are located over standing water. Effects are expected to be temporary but their specific occurrences cannot be predicted because water levels partially depend on the amount and duration of natural inflows into the lake. However, average frequencies and durations can be predicted based on historical patterns. Although continued operation of the lake is likely to result in impacts to habitat occupied by listed species that constitutes take, continued operation of the lake is also expected to result in the long-term existence of varying amounts of habitat suitable for flycatchers, Yuma clapper rails, bald eagles, and cuckoos in the future, just as past operation has resulted in varying amounts of suitable habitat for these species.

As discussed elsewhere in this document, much of the emphasis in the RHCP is on flycatchers because of the endangered status of this species and the number of birds occupying habitat at Roosevelt. The impacts of continued operation of Roosevelt on Yuma clapper rails, bald eagles, and cuckoos are described in later subchapters.

### C. Effects on Flycatchers

This subchapter begins with the approach used for the impact analysis of continued Roosevelt operations on the flycatchers. Background for the analysis of impacts on flycatcher habitat is provided, including the environmental baseline, before evaluating the effect of the Proposed Action on the occupied habitat of this species.

#### *1. Approach*

The analysis of the impact of future reservoir operations focuses on riparian vegetation occupied by flycatchers. This is because the lake level directly affects vegetation while the direct impact on flycatchers is uncertain. Future operation of Roosevelt by SRP could involve the periodic inundation and drying of habitat occupied by flycatchers. This inundation and drying will result in a modification of that habitat, which is expected to result in an incidental "take" of flycatchers through harm. 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).

Assessment of impacts on flycatchers from the continued operation of Roosevelt differs from a typical biological impact analysis. In this case, impacts do not occur as a single, permanent event and the amount of impact cannot be precisely predicted for any specific future event. 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.[38] Roosevelt lake levels always peak in late April or early May and are steadily drawn down during the flycatcher nesting season. Thus, impacts are primarily expected through habitat modification or loss caused by periodic inundation or drying. These occasional impacts will vary over time and, in many years, continued reservoir operation is not expected to adversely impact any flycatcher habitat at all or will benefit habitat by stimulating the growth of riparian vegetation (see Subchapter II.A). Under current and future operation, the amount of flycatcher habitat around Roosevelt is expected to wax and wane similar to many natural southwestern riparian ecosystems. However, in some years, operation of Roosevelt will result in the degradation and modification of some flycatcher habitat. Such modification and degradation is expected to result in "take" under the ESA.

Because of the unique situation described above, the most reasonable way to assess impacts to the southwestern willow flycatcher is by assessing impacts to occupied flycatcher habitat rather than numbers of flycatchers. In addition, the quantity of physical take of individual flycatchers from future Roosevelt operations is difficult to estimate for several reasons:

- Physical take of adult flycatchers is unlikely because the birds are mobile.
- Physical take of flycatcher eggs or unfledged young from direct inundation is unlikely because an increase in reservoir levels during the nesting season has never occurred. However, prior inundation might occasionally result in tree fall during the breeding season causing direct take. Also fledglings may die occasionally from drowning if standing water remains under nest trees when the young are learning to fly.
- Take of flycatchers primarily would be a result of effects on breeding and nesting success, or other indirect impacts from not being able to nest in habitat that would otherwise exist at Roosevelt in the absence of refilling or drawing water out of the reservoir. The magnitude and results of these indirect effects on individual flycatchers or flycatcher numbers are not possible to accurately quantify but the potential range of effects is described below.
- Future changes in population size are difficult to estimate because population dynamics, and the relationship between population size and area of suitable habitat, are not well understood (FWS 2002, p. 18). In addition, the flycatcher is subject to substantial stresses during migration and in its wintering range, which lead to mortality independent of habitat suitability at breeding areas such as Roosevelt (FWS 2002, p. 42).

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

Given that habitat modification is the primary impact that would eventually result in the anticipated incidental take of flycatchers at Roosevelt and the precise quantity of that take is difficult to estimate, the alternative of quantifying incidental take in terms of harm to acreage of occupied habitat is used in this analysis (FWS 1996, p. 3-14). However, a range of estimated impact on flycatcher productivity is provided in Subchapter III.C.3.

Because the amount and distribution of flycatcher habitat is expected to change with changes in lake levels, the impact analysis is based on an approach that estimates the maximum amount of occupied habitat in the future rather than just the existing habitat in 2001. As described above, Roosevelt lake levels are expected to continue to fluctuate as they have for the past 90 years, only with a slightly higher maximum elevation because the dam was raised in 1995. In the absence of severe natural events that destroy the riparian vegetation, the average amount of future habitat resulting from reservoir operations over the long term is expected to be similar to the average in recent decades. Although the average would remain about the same, there would be a periodic reduction in habitat when the reservoir fills or is drawn down.

The approach used to prepare this impact analysis is to evaluate the long-term dynamics of hydrologic conditions and riparian vegetation as they relate to habitat occupied by flycatchers. The first step was to conduct fieldwork to update previous vegetation mapping and observe current conditions (see Subchapter II.A). Then, an estimate of the amount of habitat currently occupied by flycatchers was developed. This vegetation and occupied habitat information was compared to data collected at Roosevelt over the past 8 years. Finally, models and relationships of hydrologic conditions, riparian vegetation, and occupied habitat were constructed based on ecological principles, historical data and empirical evidence in order to estimate future impacts to flycatcher habitat (see Subchapter III.A above).

### *2. Background*

#### a. Existing Flycatcher Habitat

The development of riparian vegetation at Roosevelt, some of which is used as habitat by flycatchers, is described in Subchapter II.A.1. In summary, cottonwoods and willows were present in relatively small areas and narrow bands along the channels of the Salt River and Tonto Creek within the reservoir area prior to the construction of Roosevelt in 1911 in part due to the effects of grazing and scouring from flood events. Wet years from the late 1970s through the early 1990s deposited sediment on the Salt River and Tonto Creek deltas in Roosevelt and maintained high lake levels, creating favorable conditions for the growth of large amounts of riparian vegetation at Roosevelt, predominantly salt cedar.

Precise characterization of flycatcher habitat has eluded analysis to date (Sogge and Marshall 2000; McKernan and Braden 2001). No comprehensive model has been developed that defines flycatcher habitat; because flycatcher habitat varies so widely across its range, it is difficult to produce a precise habitat characterization or model (FWS 2002). In general, occupied flycatcher breeding habitat consists of nest trees, male-defended territory space, and adjacent areas used for feeding and other activities (see Appendix D in FWS 2002). Despite uncertainty over precise habitat characterization,

most flycatchers at Roosevelt clearly prefer to nest close together in tall dense patches of salt cedar and willow relatively close to water. However, some flycatchers at Roosevelt nest at lower densities and more distant from open water.

Various approaches were evaluated to estimate the specific amount of habitat occupied by flycatchers at Roosevelt.[39] Two meetings were held with Arizona biologists active in flycatcher research and management to discuss methods to quantify future occupied habitat.[40] The consensus was that the methodology should have certain attributes — it should be scientifically based, objective, accurately reproducible, easy to measure, and correlated to the number and distribution of flycatchers. The majority of the biologists were of the view that the amount of habitat used by flycatchers at Roosevelt is larger than the area defended as territories, including nearby areas used for foraging and other activities and that the AGFD model should be used to develop the estimate of occupied habitat (see Subchapter III.A.3.d above for a summary of the AGFD model). In January 2002, discussions with AGFD flycatcher biologists led to a proposal to use the 11.1-acre neighborhood, which was a significant factor in the AGFD breeding habitat model, as a reasonable estimate of occupied habitat (McCarthey et al., pers. comm. 2002), i.e., the area used by flycatchers for breeding, feeding, and other activities. The 11.1-acre neighborhood and the AGFD model are described in more detail in Subchapter III.A.3.d. After review of this proposal by the biologists and FWS, nearly all agreed that this was the best available method to approximate occupied habitat. In 2001, occupied habitat was estimated at about 500 acres (Figure III-6). Appendix 5 describes the models considered and the reasons for acceptance of the AGFD model.

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 1995 to 2001 were mapped with the 394-foot radius using GIS analysis. Overlapping neighborhoods around nests and territories were joined into one polygon. The results of the analysis for 1995 to 2001 are shown in Figure III-6. Figure III-6 also shows a three-year extrapolation of the occupied habitat trend. It is important to recognize that not all tall dense vegetation at Roosevelt is occupied habitat. For example, in 2001 about 500 acres of habitat were occupied at Roosevelt (Figure III-6), of which about 50 percent or approximately 250 acres were tall dense vegetation (Table III-1). This compares to a total of 1,075 acres of tall dense vegetation (Table II-2). Although the extent and location of tall dense vegetation that is part of the occupied habitat is expected to vary in the future, just as it has in the past, it is unlikely that all of it would ever be occupied.

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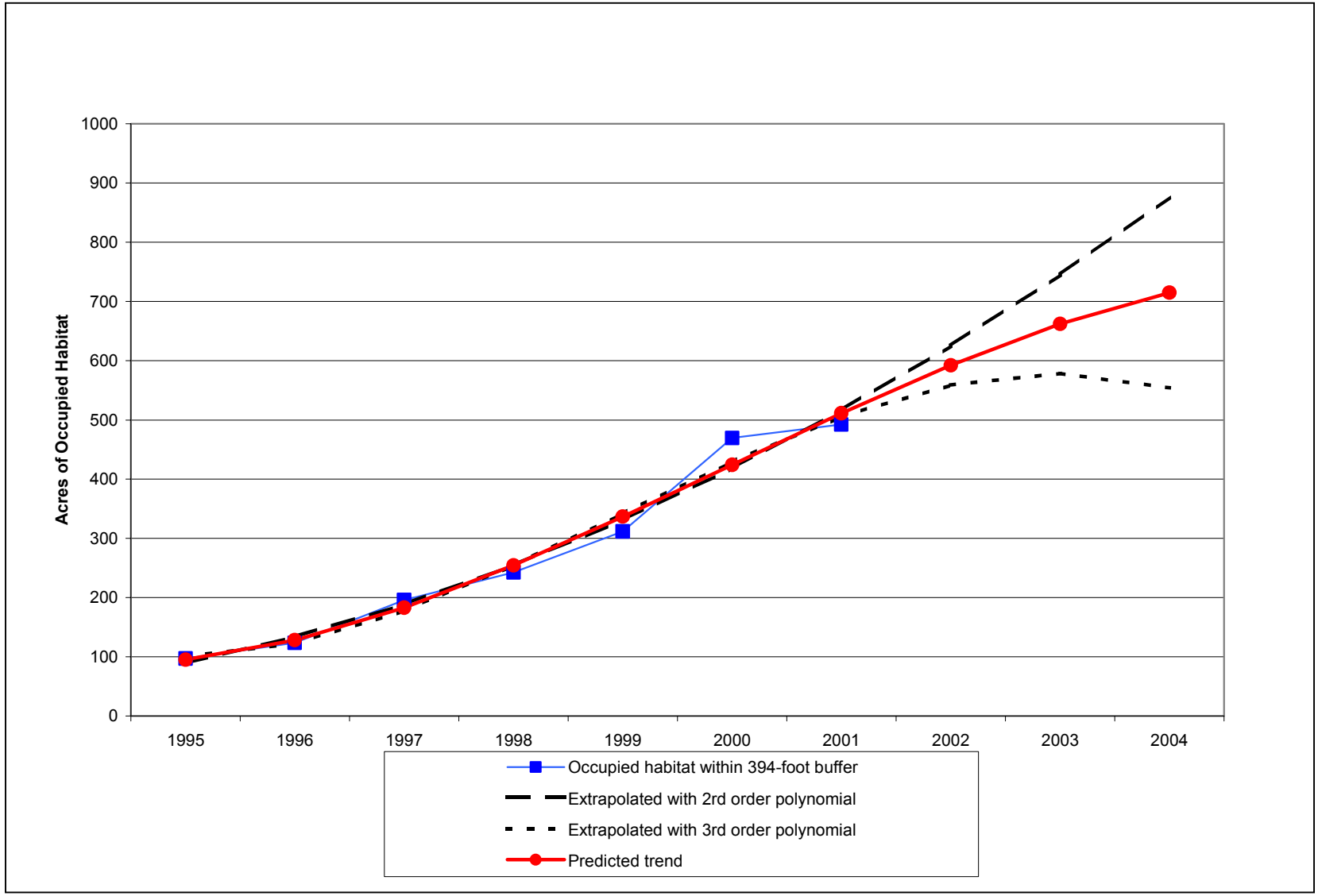
[39] The focus on occupied habitat is based on the definition of harm, which "may include significant habitat modification or degradation where it actually kills or injures wildlife…" 50 C.F.R. § 17.3 (emphasis added, see Babbitt v. Sweet Home Chapter of Communities for a Great Oregon, 115 S.Ct. 2407).

[40] These meetings were held at FWS offices on November 27 and December 17, 2001. Attendees included: Tracy McCarthey, Jim Hatten, Chuck Paradzick and Alex Smith, AGFD; Sherry Barrett, Greg Beatty and Jim Rorabaugh, FWS; Henry Messing and Susan Sferra, Reclamation; Mark Sogge and Eben Paxton, USGS; Scott Mills, SWCA; Steve Dougherty and Craig Sommers, ERO; and Janine Spencer, consulting biologist to SRP.

**Figure III-6. Acres of Occupied Habitat Extrapolated to 2004.**



The categories of vegetation mapping units within the areas delineated as occupied habitat for the years 1999 through 2001 are listed in Table III-1. Tall dense vegetation is composed of three vegetation types: cottonwood/willow, mixed riparian greater than 15 feet in height, and salt cedar greater than 15 feet in height, see Table II-1. Other mapping units within the occupied area are primarily strand (areas with sparse vegetation including stream channels and gravel bars), non-woody, or short salt cedar. The average percentage of tall dense vegetation to the total of all mapping units within the occupied habitat (58 percent) was used to develop the criteria for mitigation land (see Subchapter IV.C.1). The combination of tall dense vegetation and other riparian land is referred to as a "riparian habitat" in the RHCP when discussing impacts on flycatchers at Roosevelt and the characterization of mitigation sites.

**Table III-1. Categories of vegetation mapping units within occupied habitat areas 1999-2001.**

| Year | Acreage of Tall Dense Vegetation (% of Total) | Acreage of Other Mapping Units (e.g., channels, bars, or short and sparse vegetation) | Total Acreage |
|---|---|---|---|
| 1999 | 200.2 (64%) | 111.4 | 311.6 |
| 2000 | 271.3 (58%) | 198.2 | 469.5 |
| 2001 | 249.2 (51%) | 243.0 | 492.2 |
| Average % | (58%) | — | — |

### b. Historical Consultations for Flycatchers at Roosevelt

The environmental baseline is "the past and present impacts of all federal, state or private actions and other human activities in an 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 construction of modifications to Roosevelt Dam was the subject of Section 7 consultation in 1996 (FWS 1996). This consultation involved the indirect effect on flycatchers from higher reservoir levels associated with dam construction. The previous consultation is described in Subchapter I.H and is summarized below (citations are provided in Subchapter I.H).

In 1993, southwestern willow flycatchers were discovered nesting at the reservoir. The species was listed as endangered in 1995, and Reclamation requested Section 7 consultation with FWS in 1995 for the effect of modifications to Roosevelt Dam on flycatchers. The Biological Assessment prepared by Reclamation addressed the impact of the increased height of the dam, and the indirect effects of the inundation of the additional reservoir space on flycatcher habitat. The 1996 BO issued by FWS addressed impacts to flycatchers and authorized the annual incidental take of up to 90 birds per year. The BO identified an RPA that would avoid jeopardy to the species. The RPA measures and their status are listed in Table I-4. Two of the most important RPA measures in the 1996 BO with respect to mitigation of impacts in the RHCP are:

- **RPA 1.b. Flycatcher Habitat Protection** — Acquisition and maintenance of habitat on the San Pedro River and
- **RPA 1.c. $1.25M Management Fund** — Nearly all of the fund will be used for land acquisition and habitat improvements along the San Pedro River.

Under RPA 1.b., Reclamation subsequently acquired a large parcel of land encompassing habitat, irrigated land (since retired), ponds (all but one of which have been retired), and uplands along the lower San Pedro River (see Subchapter IV.C.6 for a description of the San Pedro Preserve). Reclamation is pursuing the acquisition of other property along the river under RPA 1.c.

The RHCP addresses all of the current and future occupied flycatcher habitat at Roosevelt that could be affected by SRP operations, including habitat addressed in the 1996 BO. Similarly, the mitigation resulting from that BO is being subtracted from the total mitigation considered under this analysis (see Subchapter IV.C.1). In doing so, the RHCP has included both the effects of inundation in the NCS to flycatchers and the mitigation for those effects as described in the RPA, RPMs, and Terms and Conditions from the BO issued to Reclamation.

#### *3. Impact on Flycatchers*

As discussed in the approach to the flycatcher impact analysis (Subchapter III.C.1 above), habitat modification is the primary impact of reservoir operation, not direct take of flycatchers. Thus, the potential incidental take that could occur is quantified in terms of the estimated acreage of occupied habitat that will be affected by the full operation of Roosevelt. In summary, the maximum predicted quantity of occupied habitat (comprised of approximately 60 percent tall dense vegetation and 40 percent other riparian areas) that would be lost from reservoir operations in any one year is about 750 acres. Below, estimates of impacts on flycatcher productivity from that habitat loss are addressed.

**Impacts on Flycatcher Habitat.** The amount of riparian habitat affected by full reservoir operations would vary in the dynamic system created by Roosevelt; as reservoir levels rise or recede, the amount and location of suitable habitat changes (see Subchapter II.A). Inundation of habitat is likely to be balanced by establishment of new habitat as the water level recedes. There will be a natural succession of habitat following inundation and draw-down cycles at the reservoir, so that some suitable flycatcher habitat would always likely be present.

In order to estimate the maximum amount of future habitat that might be occupied by flycatchers at Roosevelt, the 1995 to 2001 trend of occupied habitat was extrapolated using two curves fitted to the historical data. Three additional years, for a total of 10 years, were selected as a conservative length of time for the extrapolation because Roosevelt has a very high probability of filling or almost filling every 6 to 8 years or less (see Appendix 3, Figure 1). Two curves were fitted to the historical data to estimate the future trend of occupied habitat, using second order and third order polynomial equations

to establish the probable outer limits of occupied habitat.[41] The second order equation represents a simple exponential population growth curve, which is typical of early colonization of empty habitats (McCallum 2000). The third order equation reflects a logistic growth pattern (also known as a Verhulst or Sigmoid model) where population growth is constrained at some point (Id.). Both curves fit the data well with correlation coefficients of 0.97 and 0.98 for the second and third order equations, respectively. As noted above, the second order equation is based on the assumption that habitat is not a limiting factor, and the third order equation assumes that the 2001 observation of increasing density of flycatchers will continue, which suggests that habitat or some other factor may be limiting.[42] The trend in habitat quantity and quality at Roosevelt is not clear (see Subchapters II.A and III.A.2), but there appears to be potentially suitable habitat that is unoccupied. Thus, the assumption that habitat is currently a limiting factor at Roosevelt is not well supported. On the other hand, unexplained variation in model results (likely caused by demographic and environmental variables not included in the model) and population growth trends in other animal populations indicate that constant exponential growth is unlikely. Therefore, the most probable trend lies somewhere between the two curves, which represent the probable range of occupied habitat. The results of the historical data for 1995 to 2001 and the extrapolations through 2004 are shown in Figure III-6. Based on the trend in occupied habitat, recent observations, and modeling of long-term conditions, the maximum amount of habitat predicted to be occupied in the future with full operations at Roosevelt is estimated to be less than 750 acres as shown by the solid line in Figure III-6.

Sound science supports the conclusion that no more than 750 acres is likely to be occupied and potentially affected by SRP's operations at any one time; nevertheless, this is an estimate, and there remains some uncertainty regarding the actual maximum future impact. Future hydrological conditions, changes in population dynamics, or other factors could possibly combine to result in greater quantities of occupied habitat at Roosevelt. Because it is not feasible to estimate the amount of additional occupied habitat that might be present above the maximum predicted level of 750 acres, adaptive management (discussed further in Chapter IV) will 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 500 acres in order to provide a finite estimate of habitat impact for the take statement.[43] Thus, the upper limit of occupied flycatcher habitat addressed by the RHCP is 1,250 acres (750 + 500), or approximately 2.5 times the

[41] The 2nd order regression equation is Acres = $5.41(\text{year})^2 + 27.95(\text{year}) + 56.05$. The 3rd order regression equation is Acres = $1.85(\text{year})^3 + 27.64(\text{year})^2 + 48.02(\text{year}) + 122.75$.

[42] Flycatcher density in occupied habitat increased from about 0.38 flycatchers per acre in 1995 to about 1.96 flycatchers per acre in 2001 (see Table II-3 and Figure III-6).

[43] Additional occupied habitat would be determined using the same methodology used to estimate the maximum predicted impact on habitat (394-foot buffer around nests and territories with overlaps deleted). The estimate of 500 acres is based on extrapolation of the 2nd order polynomial equation in Figure III-6 over about 12 years before reservoir refill.

amount of occupied habitat at Roosevelt in 2001. If the occupied habitat were to exceed 1,250 acres, a permit amendment would be necessary.

As described above, the maximum amount of habitat predicted to be impacted by Roosevelt operations in the future is 750 acres. SRP will implement a number of conservation measures as part of the RHCP in order to minimize and mitigate that impact. These measures are described in detail in Subchapter IV.C.

**Impacts on Flycatcher Productivity at Roosevelt.** Although suitable flycatcher habitat would be present at Roosevelt on average, periodic reservoir fills are likely to reduce flycatcher productivity in years when large amounts of habitat are inundated. The temporary loss of nesting habitat during periods of inundation may result in site abandonment or delayed breeding by flycatchers. Short-lived species such as the flycatcher are vulnerable to short-term adverse effects, such as the reduction or loss of reproduction during one or more years. The result would be reduced recruitment into the regional population in subsequent years and the accompanying loss of reproduction. The net effect to the species would be a reduction in population potential regardless of the flycatcher's emigration and immigration patterns.

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. However, destruction or degradation of occupied habitat directly reduces the capacity of an area to support flycatchers. Habitat loss, modification, and fragmentation are believed to be the primary factors involved in the decline of the flycatcher (FWS 1993b, 1995). Following a loss of habitat from inundation at Roosevelt, some flycatchers may successfully relocate to other areas of suitable habitat, but the periodic loss of habitat and limited amount of habitat currently available nearby may reduce the size of a viable population of flycatchers at Roosevelt because searching for alternative nesting sites leaves individuals vulnerable to mortality from competition, starvation, or predation and can lead to a loss of breeding opportunities. The degree to which the Roosevelt population would disperse to the San Pedro, Verde, or other rivers is difficult to predict although banding studies have indicated some movement between these population centers (FWS 2002).

Periodic modification or elimination of Roosevelt habitat would likely result in delayed or lost breeding attempts, decreased productivity and survivorship of dispersing adults in search of suitable breeding habitat, and decreased productivity of adults that attempt to breed at Roosevelt. At current levels of flycatcher density at Roosevelt, about 400 birds would occupy the 750 acres of maximum predicted habitat and would be affected by a complete refill of the reservoir in that situation. If circumstances change and occupied habitat increased to 1,250 acres, about 640 birds could be present at current densities and would be affected by filling the lake to elevation 2,151. At higher or lower densities, the number of birds occupying a given amount of habitat could vary above or below the numbers of birds listed above. Similarly, the amount of occupied habitat affected by higher reservoir levels would vary from a few acres to all of the occupied acres depending on the extent of habitat that has developed, the relative amount of habitat occupied by birds, and the degree of refill in a particular year. The longer the period of low reservoir levels that precede a refill, and the larger the refill event, the more occupied

habitat that is likely to be affected. Based on historical hydrology, the predicted frequency of inundation resulting in substantial effect to occupied flycatcher habitat and flycatcher productivity is shown in Figure III-4, Figure III-5, and Figures 1 and 4 in Appendix 3. A complete or nearly complete fill of Roosevelt after an extended period of low lake levels is expected to occur about twice in 50 years.[44] In addition, a partial fill after an extended period of low lake levels is expected to occur about three times in 50 years.[45] Other reservoir fills would affect relatively small amounts of habitat. Despite these frequency and magnitude estimates, it is not possible to precisely determine the number of flycatchers that may be affected by future reservoir fills because of the factors described above: 1) future hydrology may differ from historical conditions; 2) densities of flycatchers may differ; 3) there is not a 1:1 correlation between tall dense vegetation at Roosevelt and occupied habitat; and 4) the relative productivity after dispersal is not known.

The large uncertainties described above — in reservoir hydrology, extent of habitat modification, 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.

The impacts of Full Operation of Roosevelt on flycatcher productivity will be offset by the minimization and mitigation measures described in Subchapter IV.C.1. Acquisition of off-site mitigation habitat may provide sites for Roosevelt flycatcher relocation during periods of full reservoir levels. However, the primary purpose of the off-site mitigation is to provide additional habitat for flycatcher populations to expand to offset any take of flycatchers at Roosevelt.

Concern has been expressed by some scientists that Full Operation of Roosevelt will result in a population sink for flycatchers (i.e., a location with conditions resulting in regional population decreases or reduced breeding success). Overall productivity of the Roosevelt population has been high from 1993 through 2001 (Subchapter II.A). In the future, if the FWS issues an ITP to SRP for the full operation of Roosevelt, periods of reduced productivity due to inundation of habitat or extended droughts likely would be interspersed with periods of high productivity when the reservoir is drawn down. Thus, the best available science suggests that continued operation of Roosevelt is unlikely to result in a long-term sink for flycatchers. Moreover, the implication of Roosevelt as a population sink is that there is little or no value for habitat that will be created and maintained by future reservoir operations because it will be periodically lost or reduced.

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[44] Based on historical inflows with the current reservoir system and demand, complete reservoir fill after an extended period of reservoir draw down is expected to occur about three times in 100 years based on inflows in the periods 1898-1905, 1945-1952, 1961-1966, and 1995-2002 (see Figure III-4, and Figures 1 and 4 in Appendix 3).

[45] Based on historical inflows with the current reservoir system and demand, partial fills after an extended period of reservoir draw down are expected to occur about six times in 100 years based on inflows in the periods ending in 1932, 1937, 1960, 1967, 1973, and 1979 (see Figure III-4, and Figures 1 and 4 in Appendix 3).

However, this species inhabits ephemeral habitat throughout its range (FWS 2002, pp. 18, 33-34, 80). Ephemeral riparian habitat is constantly changing in response to streamflow conditions, moisture availability, channel scouring, and other disturbances. Riparian habitat at Roosevelt also is dynamic and the quantity of flycatcher habitat is expected to fluctuate annually, similar to a natural riparian ecosystem. Flycatcher populations and breeding success also will fluctuate with available habitat. Roosevelt is not expected to be a population sink more than other riparian habitats occupied by flycatchers in the region.

Another concern expressed by some persons is that take of a substantial portion of the Roosevelt population may result in jeopardy to survival of the species in the wild (see Comment Letter No. 3 in Volume 3 enclosed with the FEIS). The reason most often mentioned for potential jeopardy is the large size of the Roosevelt population in relation to the total known population utilizing habitat in Arizona and other southwestern states. To provide perspective in the relative size of the Roosevelt population over time, Table III-2 lists the reported Roosevelt and Arizona flycatcher territories in recent years. The numbers of territories reported in Arizona likely reflect the level of survey effort as well as actual population changes. In terms of potential jeopardy to the species, the 1996 BO for modifications to Roosevelt found that jeopardy could be avoided through implementation of RPAs even though FWS assumed that the entire population would be permanently lost at Roosevelt (FWS 1996) and the percentage of known Arizona territories at Roosevelt was about 35 percent.[46]

Full implementation of the RHCP would continue to avoid jeopardy to flycatchers. In the 1996 BO, FWS assumed the permanent loss of Roosevelt flycatchers from filling of the reservoir. However, subsequent reservoir and vegetation modeling, and increased understanding of flycatcher movements (see Subchapter II.B.1.n) indicate that flycatchers are likely to be present at the reservoir in the future. Additionally, given flycatcher movements, birds displaced from Roosevelt are likely to relocate, which could bolster populations in other areas if they breed. The environmental baseline at Roosevelt includes mitigation for the annual take of 90 flycatchers through Reclamation's 1996 BO on modifications of Roosevelt, which reduces the incremental impact of continued reservoir operations. The RPA implemented by Reclamation removes the jeopardy due to construction and operation of the NCS. Increases in the Arizona flycatcher population reduce the impact of potential loss of birds at Roosevelt. For example, total elimination of the Roosevelt population in 1996 would have left 106 known territories in Arizona (151 - 45), whereas total elimination of the population at Roosevelt in 2001 would have left 205 known territories in Arizona (346 - 141).

[46] In Table III-2, the percentage of Roosevelt territories to total reported Arizona territories in 1995 was 35.3%, compared to 35.4% in 2000 and 40.8% in 2001.

**Table III-2. Flycatcher territories at Roosevelt and in Arizona.**

| Year | Roosevelt | Arizona | Percent at Roosevelt |
|---|---|---|---|
| 1995 | 30 | 85 | 35.3% |
| 1996 | 45 | 151 | 29.8% |
| 1997 | 43 | 204 | 21.1% |
| 1998 | 51 | 218 | 23.4% |
| 1999 | 76 | 297 | 25.6% |
| 2000 | 116 | 328 | 35.4% |
| 2001 | 141 | 346 | 40.8% |

### D. Effects on Yuma Clapper Rails

This subchapter begins with the approach and background used for the impact assessment of full Roosevelt operations on Yuma clapper rails and concludes with the description of impacts on habitat and productivity from this Proposed Action.

#### *1. Approach*

Little information is known on the use of habitat by this species at Roosevelt because prior to May 2002, Yuma clapper rails were not known to occur at this location. The individual Yuma clapper rail confirmed along the Tonto Creek inflow was found in a cattail marsh, which is the typical habitat for this species (see Subchapter II.B.2).

The number of individual Yuma clapper rails that might be periodically lost due to future Roosevelt operations cannot be precisely estimated for several reasons:

- The future population size is difficult to estimate because Yuma clapper rails are not known to have been present at Roosevelt before 2002 and the single Yuma clapper rail found at Roosevelt in 2002 may not be a permanent resident.[47]
- Direct loss of adult Yuma clapper rails is unlikely because the birds are mobile.
- Potential direct loss of Yuma clapper rail eggs or unfledged young is uncertain because the timing of nesting, if any, at Roosevelt is unknown.
- Additional habitat will be established for Yuma clapper rails near Roosevelt as part of the RHCP; however, there is uncertainty in the degree of future utilization of this habitat by these birds.
- The primary loss of Yuma clapper rails would be a result of effects on breeding success, nesting success, fecundity, or other indirect impacts from not being able to utilize habitat that would otherwise exist at Roosevelt in the absence of refill of the reservoir. It is not possible to accurately quantify the magnitude and results of these indirect effects.

[47] After the initial confirmation of the presence of a single Yuma clapper rail, it was not found again on a later visit (Messing, pers. comm. 2002).

Given that the direct loss of Yuma clapper rails at Roosevelt cannot be precisely estimated, the alternative of quantifying effects solely in terms of impacts on potentially occupied habitat (i.e., cattail marshes) is being used in this analysis (FWS 1996, p. 3-14). Full operation of Roosevelt by SRP would involve the periodic inundation of cattail marshes and affect any Yuma clapper rails occupying those habitats.

#### *2. Background*

As described in Subchapter II.B.2, an aerial survey of Roosevelt in early June 2002 found only two cattail marshes below elevation 2,151 feet, both along Tonto Creek. These marshes are relatively narrow strips totaling about 4 acres along the current channel.

Due to periodic scouring inflows on Tonto Creek and the Salt River, it is not certain that these marshes would persist over the long term even without changes in lake level. The same is true for marshes that may develop in the future along other reaches of the Salt River and Tonto Creek. However, it is possible that these marshes and any Yuma clapper rails nesting in them could be impacted from continued operation of Roosevelt through periodic modification or loss caused by inundation. The frequency and extent of impact on habitat from rising lake levels would depend on the magnitude and timing of scouring inflows. In addition to possible habitat loss, direct impacts to Yuma clapper rail nests or eggs could occur if nesting occurs in the early spring while lake levels are still rising. These habitat and potential nesting impacts are not expected to occur at Roosevelt every year and, in many years, continued reservoir operation would not adversely impact any habitat or nesting at all.

#### *3. Impact on Yuma Clapper Rails*

Impact of the Proposed Action, Full Operation of Roosevelt, is described below in terms of habitat. Estimates of potential impacts on productivity are also provided.

**Impacts on Yuma Clapper Rail Habitat at Roosevelt.** It is unlikely that more than the 4 acres of existing cattail marsh would occur at Roosevelt in any one year because: 1) scouring inflows are likely to frequently destroy any cattail marshes that become established, and 2) current conditions of an extended period of very low reservoir levels have allowed near maximum amounts of marsh to develop along the Tonto Creek and Salt River channels within the storage space. Thus, the maximum amount of cattail marsh below elevation 2,151 estimated to be impacted in any one year at Roosevelt is 5 acres or about one more acre than currently present.

Variations in hydrological conditions and changes in vegetation dynamics could combine to result in greater quantities of habitat occupied by Yuma clapper rails at Roosevelt than the predicted maximum amount of 5 acres. Because it is not possible to estimate the amount of occupied habitat that might be present above the predicted maximum level, adaptive management (discussed further in Chapter IV) will be employed to address such increases if they occur. If occupied habitat increases at Roosevelt, adaptive management (discussed further in Chapter IV) will be employed to address effects up to an additional 5 acres of occupied habitat. In total, the upper limit of occupied Yuma clapper rail habitat at Roosevelt addressed by the RHCP is 10 acres

(5 + 5). If future occupied habitat exceeds 10 acres, a permit amendment would be required.

Mitigation measures for Yuma clapper rail habitat are described in Subchapters IV.C.1.b and IV.C.2.

**Impacts on Yuma Clapper Rail Productivity.** It is difficult to forecast the periodic lost productivity for Yuma clapper rails because there is no known breeding activity at Roosevelt. Better estimates are likely to be available after surveys are conducted by SRP following permit issuance. In the meantime, using territory and home range sizes reported in the literature of about 1 to 20 acres, it appears unlikely that more than a single pair would occupy each small marsh of 1 to 3 acres (see Subchapter II.B.2). Based on that assumption, two pairs could occupy the maximum predicted 5 acres of suitable habitat in two separate marshes. If occupied habitat increased to 10 acres, two more marshes might be present and four pairs could occupy the habitat.

Periodic modification or elimination of Yuma clapper rail habitat from inundation likely would result in delayed or lost breeding attempts, decreased productivity and survivorship of adults that disperse, and decreased productivity at Roosevelt. However, the number of birds affected cannot be accurately estimated because of large uncertainties in: 1) Yuma clapper rail use of Roosevelt for breeding; 2) inundation extent, duration, and frequency; 3) the current and future amount of occupied habitat; and 4) reproductive success after dispersal.

### E. Effects on Bald Eagles

This subchapter begins with the approach used for the impact analysis of full Roosevelt operations on threatened bald eagles. Background for the analysis of impacts on bald eagles is provided and the effect of the Proposed Action on bald eagles and their habitat is described.

#### *1. Approach*

The analysis of the impact of future reservoir operations on bald eagles at Roosevelt focuses on nesting and perching habitat, prey productivity and selection, and the effects on productivity from interspecific competition. Continued operation of Roosevelt by SRP may involve the periodic inundation of nesting and perching habitat used by bald eagles and may affect prey production and bald eagle productivity.

The approach used in analysis of impacts from reservoir operations begins with an analysis of the existing habitat used by bald eagles at and near Roosevelt. Because impacts on bald eagles from modifications to Roosevelt were the subject of extensive consultation between Reclamation and FWS in the 1980s and 1990s, the environmental baseline forms an important foundation for the evaluation of potential future effects from continued reservoir operation. Finally, the approach relies on information with respect to the future availability of nesting and perching habitat, the effect of fluctuating lake levels on prey production and selection, and the impacts on productivity from interspecific competition at reduced lake levels.

### *2. Background*

#### a. Existing Bald Eagle Habitat

As discussed in Subchapter II.B.3, two of the breeding areas have nests in cottonwood trees at or near Roosevelt, one near the mouth of Pinto Creek (Pinto breeding area), and one near the mouth of Tonto Creek (Tonto breeding area). The breeding area near the mouth of Pinal Creek contains nests on cliffs or pinnacles. Several other bald eagle breeding areas are nearby: 1) the Sheep breeding area on Tonto Creek north of Punkin Center; 2) the Dupont breeding area, which is located north of Roosevelt near the headwaters of Salome Creek in the Sierra Ancha Wilderness; and 3) the newly discovered Rock Creek breeding area near Buckhorn Mountain in the Four Peaks Wilderness.

It is not known if the Rock Creek bald eagles utilize Roosevelt for foraging, but it is assumed in this analysis that they may occasionally feed at the lake. Similarly, the more distant Dupont bald eagles are assumed to forage at the lake at least occasionally. The three pairs at Roosevelt are known to forage extensively over the lake (Hunt et al 1992). However, the Pinal pair may be excluded from Roosevelt by the Pinto pair, at least during low lake levels in Roosevelt (Hunt et al. 1992, p. A-50).

The mature cottonwoods in which the existing bald eagle nests are located occupy the fringe of the historical maximum Roosevelt Lake level at elevations of about 2,125 to 2,135 feet (FWS 1990, p. 4; FWS 1993a, p. 19). The development of riparian vegetation at Roosevelt, some of which is used as nesting habitat by bald eagles, is described in Subchapter II.A.1.

As discussed in Subchapter II.A, Roosevelt is a dynamic system. In some ways similar to a natural stream system, it is 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 close to the streams and lake. As a result, these flow cycles create and maintain riparian vegetation, some of which is used as nesting and perching habitat by bald eagles.

Recent vegetation mapping and changes in vegetation are described in Subchapter II.A. The most important vegetation types for bald eagles in the study area are cottonwood/willow and mixed riparian because mature cottonwood and willow trees potentially can serve as nesting and perching sites for bald eagles although occasional large cottonwood or willow trees may occur in any vegetation type. However, most of the woody vegetation that currently occupies the reservoir bed is dense salt cedar thickets or relatively sparse areas of various riparian species, which are unsuitable for bald eagle nesting and perching.

#### b. Historical Consultation for Bald Eagles at Roosevelt

The environmental baseline for bald eagles is "the past and present impacts of all federal, state or private actions and other human activities in an 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). Bald eagles in the vicinity of Roosevelt have been the subject of extensive prior

consultation by Reclamation during the planning and construction of Modified Roosevelt Dam. The potential take of all bald eagle nest sites within the three known breeding areas near Roosevelt, associated with the indirect effect of higher reservoir levels from dam construction, have been previously addressed and mitigated pursuant to Section 7 of the ESA. These previous consultations are described in Subchapter I.H and are summarized below (citations are provided in Subchapter I.H).

In 1983, FWS issued the initial BO on the Central Arizona Water Control Study, which included potential modifications to Roosevelt Dam. Reclamation implemented the RPA for the pair of bald eagles occupying the Pinal breeding area by modifying the extent and timing of borrow excavation at Meddler Point near the nest and by restricting recreation access to the area.

In 1990, FWS issued a BO that addressed the Sheep and Pinto breeding areas as well as bald eagle use of a large cottonwood gallery at the mouth of Tonto Creek. The BO found that higher lake levels made possible by the modifications to Roosevelt would result in the eventual loss of all or a portion of the cottonwoods, including nesting trees, below elevation 2,151 but also found that there would be offsetting benefits of additional shallow water habitat and fringe wetland areas created by higher reservoir levels. In addition, FWS found that the bald eagles would benefit from the improvement of riparian habitat in the Tonto Creek Riparian Unit (TCRU) established by Reclamation and the Tonto National Forest as mitigation for Modified Roosevelt Dam (the TCRU is described in Subchapter V.N.5). FWS concluded that the Roosevelt modifications were not likely to jeopardize the continued existence of bald eagles in the Southwest. Pursuant to the 1990 BO, Reclamation will implement two measures to minimize incidental take to the Pinto nest: 1) construction of an bald eagle nesting platform in the Pinto nest area at least 4 years before the nest is anticipated to collapse due to inundation, and 2) closure of the Pinto nest area to recreation use during the breeding season if it becomes active (Reclamation 1992, p. 3).[48] In addition, Reclamation implemented one of the conservation measures identified by FWS — purchase of the Rockhouse Farm property near the Salt River inlet to potentially create riparian habitat. A pilot project to establish riparian habitat on a portion of the formerly irrigated fields of the Rockhouse property is part of the RHCP (see Subchapter IV.C.2).

In 1993, FWS again consulted with Reclamation following the discovery of a new bald eagle nest at the mouth of Tonto Creek. As in the 1990 BO, FWS concluded that the Roosevelt modifications were not likely to jeopardize the continued existence of bald eagles in the Southwest. The 1993 BO describes the eventual loss of the existing nest trees and nests as a result of inundation, and the subsequent loss of trees, nests, productivity, eggs and fledglings from inundation and recreation impacts over the next

[48] As discussed in Subchapter II.B.2, the Pinto nest has become productive since 1990. Reclamation has not yet implemented either of these two measures. The nest trees do not appear to be in danger of collapse within 4 years and the area has not needed closure due to limited access and closure of the area for flycatchers. When lake levels rise, Reclamation will work with the Forest Service to place buoys around the nest tree to keep boaters out of the area. The buoys have already been purchased by Reclamation.

50 years. As in the 1990 BO, FWS notes that there will be long-term offsetting effects as higher reservoir levels support cottonwoods further upstream and as habitat improves in the TCRU. Reclamation implemented the three measures proposed by FWS to minimize incidental take to the Tonto nest: 1) seasonal closure around the breeding area, 2) annual monitoring support for the Tonto breeding area, and 3) notification of FWS and assistance in rescue efforts if inundation of eggs or nestlings may occur.[49]

#### c. General Discussion of Potential Impacts on Bald Eagles

Bald eagle breeding areas, wintering areas and foraging areas (both winter and summer) are dynamic, changing with prey availability, nest site suitability, interspecific competition, human disturbance, and other factors. These dynamics at Roosevelt are expected to continue to be influenced by rising and falling water levels. The primary change in reservoir fluctuations from the past 90 years will be a slightly higher maximum elevation of reservoir level. The fluctuation of reservoir levels over the past 50 years, the period of time in which all of the SRP reservoirs on the Salt and Verde have been in use, is shown in Figure I-1.

Concerns have been raised by FWS over the potential indirect impacts of SRP's continued reservoir operations on the six breeding areas in the vicinity of Roosevelt Reservoir including:

1. Possible impacts on the availability of nesting and perching habitat
2. Possible impacts of fluctuating water levels on prey productivity/selection
3. Possible impacts on the productivity of the existing nest sites from increased interspecific competition with reduced water levels

Direct impacts of inundation from filling Modified Roosevelt on existing nest trees were previously addressed in Reclamation BOs.

#### d. Availability of Nesting and Perching Habitat

Given the dynamics of Roosevelt lake levels, mature cottonwoods that form the primary bald eagle nesting and perching habitat would typically be confined to the shoreline areas near the maximum elevation of the lake. Most, if not all, young cottonwoods and willows that may periodically grow on the lakebed likely will be inundated periodically and will be killed before becoming mature.[50] A review of end-of-month reservoir elevations based on normal operations with releases above elevation

[49] Reclamation provides funding for the Tonto breeding area nestwatch. Reclamation has worked with SRP to develop a protocol to be implemented in case rising lake levels threaten eggs or nestlings. The Tonto National Forest is responsible for implementing the closure of the Tonto breeding area. The Forest Service has erected signs in the area and nestwatchers are posted at the breeding area. Also, Reclamation has provided buoys to the Forest Service to be used when the lake levels rise (Messing, pers. comm. 2002).

[50] Cottonwoods seedlings are highly sensitive to inundation with mortality occurring within weeks of inundation; mature cottonwoods tolerate inundation for several months (Appendix 4).

2,151 revealed that trees growing on the lake bed would have been typically inundated every 3 to 8 years given inflow patterns that are similar to those that occurred between 1893 and 1994. Given historical inflows, there have been two long stretches of low lake levels when trees would have been able to grow on the lakebed for periods of about 15 to 20 years. However, even during these droughts, there were interim periods of high reservoir levels that would have inundated most of the lakebed for short periods. Assuming that a few trees could survive short periods of inundation, some cottonwoods could attain relatively large size and may provide perches; however, in a period of 15 to 20 years, they are not likely to have developed the large stout horizontal branching characteristics of trees large enough to support an eagle nest. However, it is possible that some cottonwoods or willows could mature during an extended drought or at a particular reservoir elevation into trees that would be utilized by bald eagles as nesting habitat.

On the other hand, if the reservoir were prevented from filling in order to protect young trees from inundation, the existing mature trees at higher elevations would likely die from lack of water (see Subchapter II.A).

#### e. Effect of Fluctuating Water Levels on Prey Productivity and Selection

A study of prey remains collected below nest sites in Arizona in the early 1970s (Rubink and Podborny 1976) found catfish was the most abundant prey item (68.2 percent numerically), followed by carp (14.4 percent), American coots (4.8 percent), suckers (3.2 percent) and a small percentage of mammals, reptiles and amphibians. Hildebrandt (1981) and Hildebrandt and Ohmart (1978) found similar results from collecting prey remains at nest sites. Although mammals make up a small percentage numerically of prey taken by bald eagles, the available biomass of mammals, such as jackrabbits, and their caloric contribution may be essential to fulfill the energy demands of bald eagles breeding in Arizona (Hayward and Ohmart 1986). Hildebrandt and Ohmart (1978) further noted that mammalian prey, primarily cottontails, were important to bald eagles during periods of high and/or turbid water. Hunt et al. (1992) found that prey selection of nesting bald eagles on Roosevelt Reservoir consisted largely of fish, primarily catfish and carp. Table III-3 lists the percentage of prey items observed at individual nest sites near Roosevelt Reservoir. Detailed data is not available for the Tonto breeding area because it is relatively new.

Most (75 percent) of the fish obtained by eagles at Roosevelt consists of carrion (Hunt et al. 1992). Future fluctuations of water levels should have little impact on the number of carrion fish available to breeding bald eagles and the overall productivity of the lake will likely fluctuate in a manner similar to historical and existing conditions.

**Table III-3. Percentage of prey taken by bald eagles nesting near Roosevelt Reservoir.**

| Prey Item | Pinto† | Pinal† | Sheep‡ |
|---|---|---|---|
| Carp | 13% | 12 to 26% | |
| Catfish | | 13 to 63% | |
| Crappie | 12% | 8% | |
| Bass | 16% | 4% | |
| Sucker | | | 7.1% |
| Unknown fish | 19% | 4 to 36% | |
| Lagomorphs | | | 21.3% |
| Javelina | | | 7.1% |
| Rodents | | | 7.1% |
| Other mammals | | | |
| Waterfowl | 31% | 21 to 26% | 7.1% |
| Other waterbirds (gulls, waders, shorebirds) | | | 14.2% |
| Waterfowl Carrion | | 10% | |
| Passerines | | | 28.4% |
| Carrion | 9% | 14% | 7.1% |

†Based on observations of prey deliveries
‡Based on prey remains collected near the nest
*Source:* Hunt et al. (1992).

Bald eagles are opportunistic and will change prey based on the most readily available prey sources both seasonally and annually. Waterfowl comprise a major portion of the bald eagle's winter diet at Roosevelt. The total number of available wintering waterfowl would be expected to remain relatively constant and should not be significantly affected by water elevation in the reservoir. Typically, Roosevelt water levels are lowest during winter months and low water levels may concentrate waterfowl in winter increasing their vulnerability to bald eagles. During low water levels, Hayward and Ohmart (1986) concluded that mammalian prey is essential to satisfy energy demands of bald eagles breeding in Arizona. Mammalian prey may become a more important component of bald eagle prey during low water years.

As noted above, these studies of bald eagles nesting near Roosevelt and the Arizona population in general indicate that resident and breeding bald eagles at and near the reservoir are likely very opportunistic feeders and readily adapt to dynamic food resources and prey availability. Fish carrion appears to be the primary prey resource during spring and summer breeding seasons and will be little impacted by fluctuating water levels and the operation of the reservoir. Spawning fish foraged from streams and rivers may be important during short periods during various spawning seasons, which are little affected by fluctuating reservoir levels.

During periods of high water, the primary productivity of the lake would be expected to increase as fish take advantage of food resources and cover provided by vegetation on inundated beaches. At high reservoir levels, the aerial extent of shallow water will likely increase, providing additional breeding and foraging areas for carp and catfish and increasing their susceptibility to predation.

As reservoir water levels fall, fish resources may be concentrated and susceptible to predation over the short-term. Waterfowl also will tend to concentrate and would likely be more susceptible to bald eagle predation, particularly during winter. Bald eagles will also likely switch to more mammalian prey during low-water periods. The pair at the Sheep breeding area already forage on a large percentage of mammal and bird prey and their food habits are likely to be relatively unaffected by reservoir operation and fluctuating water levels, although the extent to which the eagles in the Sheep breeding area utilize Roosevelt is not documented.

According to Hunt et al. (1992), given the importance of fish carrion to the diet of Roosevelt bald eagles, fluctuating water levels should have little impact on the foraging opportunities for bald eagles. Water levels may be deeper in Roosevelt bays during high water years; however, much of the prey historically taken within the bays at Roosevelt was carrion and water depths were not a factor in forages for floating dead fish (Hunt et al. 1992). Further, the periodic increases and decreases in reservoir area, as have historically occurred, will simply affect a greater area, which is not likely to have an adverse affect on bald eagles (Hunt et al. 1992). Overall, it would be expected that bald eagles breeding at and/or foraging on and near Roosevelt Reservoir will change their food habits and foraging strategies based on prey availability related to fluctuating reservoir levels, but the overall fitness of the bald eagles should remain relatively stable. However, as noted in the next subchapter, productivity may be affected in some years due to extended periods of lake drawdown.

#### f. Impacts on the Productivity of the Existing Breeding Areas from Increased Interspecific Competition with Reduced Water Levels

Foraging areas and home ranges of bald eagles are also dynamic, shifting annually, seasonally, and even daily depending on prey resources, weather and inter- and intra-species competition (Hunt et al. 1992). Studies conducted by Hunt et al. (1992) found that the bald eagles from the Pinal pair foraged primarily over the Salt River. With the establishment of a breeding area near Pinto Creek, aggression between the Pinto and Pinal females restricted the Pinal female's foraging area almost exclusively to the Salt River.

Adult bald eagles from the Pinto breeding area forage largely over the eastern half of Roosevelt (Hunt et al. 1992; Driscoll, pers. comm. 2001). This pair frequently forages in shallow inflow areas such as Pinto Creek and the Salome Cove and occasionally forages upstream on the Salt River (Hunt et al. 1992).

The Tonto breeding area was established in 1992 and little detailed information is available on the foraging area for this pair. Prior to the establishment of the Tonto breeding area, subadult and non-breeding bald eagles frequently foraged in the inflow

area of Tonto Creek and upstream along the Tonto Creek riparian area (Hunt et al. 1992). It seems reasonable to assume that the bald eagles from the Tonto breeding area continue to frequently forage along Tonto Creek and its inflow area and widely over the western half of Roosevelt Reservoir including some overlap with the foraging area used by the Pinto breeding area in the vicinity of Salome Cove. The Dupont breeding area located near the headwaters of Salome Creek may also forage in Salome Cove and compete with the Pinto and Tonto adults (Driscoll, pers. comm. 2001). Bald eagles from the Rock Creek breeding area also may utilize Salome Cove and compete with eagles from other breeding areas. Use of the relatively more productive inflow areas is likely restricted by the Tonto and Pinto breeding areas. The extent that the Rock Creek eagles use the Salt River downstream of Roosevelt Dam versus Roosevelt Lake is unknown.

Percent nesting success for bald eagle territories at or near Roosevelt (percent occupied nests successful) has declined from 0.78 from 1993 through 1995 to 0.45 from 1996 through 1998, and to 0.33 from 1999 through 2001 as listed in Table III-4 (Beatty, pers. comm. 2002). Looking at the nest success in more detail, Table III-5 indicates that the productivity of the Pinto and Tonto breeding areas remained constant from 1993 through 2001 (Messing, pers. comm. 2002a). Thus, the decline in productivity shown in Table III-4 reflects reductions from the Pinal and Dupont breeding areas during that time period.

**Table III-4. Bald eagle productivity summary from breeding areas using Roosevelt Lake in 3-year increments, 1993 to 2001 (Dupont, Pinal, Pinto, and Tonto breeding areas).**

| Productivity Summaries | 1993-1995 | 1996-1998 | 1999-2001 |
|---|---|---|---|
| Total nest years | 9 | 11 | 12 |
| Total occupied nest years | 9 | 11 | 11 |
| Total active nest years | 9 | 9 | 7 |
| Total failed nest years | 2 | 4 | 3 |
| Total successful nest years | 7 | 5 | 4 |
| Total occupied nest years, no eggs laid | 0 | 2 | 4 |
| Total unoccupied nests | 0 | 0 | 1 |
| Total number of fledglings | 9 | 9 | 7 |
| Mean brood size (young per successful nest) | 9/7 = 1.3 | 9/5 = 1.8 | 7/4 = 1.8 |
| Young per active nest | 9/9 = 1.0 | 9/9 = 1.0 | 7/7 = 1.0 |
| Nest success (% occupied nest successful) | 7/9 = 0.8 | 5/11 = 0.5 | 4/11 = 0.4 |
| Productivity or reproductive rate (mean brood size x nest success) | 1.0 | 0.8 | 0.6 |

**Table III-5. Bald eagle nest success, mean brood size and productivity, Pinto and Tonto breeding areas, 1993-2001.**

| | Nest Success | Mean Brood Size | Productivity |
|---|---|---|---|
| 1993-1995 | 0.8 | 1.4 | 1.2 |
| 1996-1998 | 0.7 | 2.0 | 1.3 |
| 1999-2001 | 0.7 | 1.8 | 1.2 |

The overall trend of reduced productivity associated with lower lake levels is evident at other reservoirs in Arizona as shown in Table III-6 (Beatty, pers. comm. 2002). These productivity trends, at least for more "marginal" breeding areas may be due in part to the effect of increased competition and reduced prey availability from lower lake elevations in the past few years (Keane, pers. comm. 2001). These data should be interpreted with caution because sample sizes are small and the bald eagle ecology at each lake may be different.

**Table III-6. Bald eagle reproductive performance on regulated reservoirs in Arizona with greater than one territory in 3-year increments, 1993 to 2001.**

| Productivity Summaries | 1993-1995 | 1996-1998 | 1999-2001 |
|---|---|---|---|
| Total nest years | 19 | 23 | 28 |
| Total occupied nest years | 19 | 23 | 27 |
| Total active nest years | 19 | 20 | 17 |
| Total failed nest years | 3 | 10 | 9 |
| Total successful nest years | 16 | 10 | 8 |
| Total occupied nest years, no eggs laid | 0 | 3 | 9 |
| Total unoccupied nests | 0 | 0 | 1 |
| Total number of fledglings | 23 | 16 | 15 |
| Mean brood size (young per successful nest) | 23/16 = 1.4 | 16/10 = 1.6 | 15/8 = 1.9 |
| Young per active nest | 23/19 = 1.2 | 16/20 = 0.8 | 15/17 = 0.9 |
| Nest success (% occupied nest successful) | 16/19 = 0.8 | 10/23 = 0.4 | 8/27 = 0.3 |
| Productivity or reproductive rate (mean brood size x nest success) | 1.2 | 0.7 | 0.6 |

### *3. Impact on Bald Eagles*

The potential direct take that could occur that has not already been addressed by prior consultation is loss of future nesting or perching trees used by bald eagles due to inundation of trees that may grow on the lakebed of Roosevelt during an extended drought in the future (see Subchapter III.E.2.d above). Additional direct take of bald eagles from any breeding areas at or in the vicinity of Roosevelt will not occur as a result of the long-term reservoir operations under the Full Operation alternative. However,

indirect take of bald eagles may occur due to the death and/or removal of perching trees below elevation 2,151 feet within the reservoir. All other potential direct take on bald eagles has already been addressed by prior Reclamation consultation and is being integrated into the RHCP (see Subchapters I.H and IV.A).

Reduced productivity of bald eagles near Roosevelt appears to be associated with low reservoir levels, although the exact cause and effect may be the result of several interrelated factors such as lake level, heat, and reduced mammal productivity. For the RHCP, "low" reservoir levels are defined as less than elevation 2,100 (about 50 percent of capacity). Table III-4 indicates that productivity ranged from 1.0 to 0.6 in the 3-year periods from 1993 to 2001. Average May 1 lake levels for the periods in Table III-4 are: 1) about 2,121 feet for 1993 to 1995 (slightly less than the predicted long-term average of 2,123 feet); and 2) about 2,092 feet for 1996 to 2001 (about 30 feet below the long-term average). Based on the data in Table III-4, productivity may be reduced by 20 to 40 percent during low reservoir years such as 1996 to 2001, or about 30 percent on average. As can be seen from Figure 1 in Appendix 3, reservoir levels below elevation 2,100 are expected to occur about 40 percent of the time. Based on that prediction, 20 years out of the 50-year permit life would have lower bald eagle productivity. Using an average reduction in productivity of 0.3, times an average of 3 young per year produced near the reservoir during average lake levels, times 20 out of 50 years, results in about 18 fewer fledglings produced at Roosevelt in comparison to maintaining the reservoir at average levels or above.[51]

The dynamics of individual bald eagle breeding areas, wintering areas, and foraging areas will change seasonally and annually, depending on a complex variety of environmental and ecological influences, including fluctuating reservoir levels, but the overall health and fitness of the bald eagles near Roosevelt should remain stable.

In order to minimize and mitigate the potential impact on bald eagle habitat and any resulting indirect take of bald eagles, SRP will implement the measures described in Subchapter IV.C.1.c.

### F. Effects on Cuckoos

This subchapter begins with the approach used for the impact analysis of full Roosevelt operations on cuckoos. Background for the analysis of impacts on cuckoos is provided before describing the effect of the Proposed Action on this species and its habitat.

[51] The average of 3 young per year is based on the total of 9 young produced in the 3-year period 1993-1995 (Table III-4). Using another approach to estimate productivity impacts: an average reduction of 2.5 successful nests over a 3-year period in low reservoir years or an average annual reduction of 0.83 successful nests, times an average 1.0 young per active nest, times 20 years of below average water levels, results in a reduction of 16.6 birds over the 50-year period (see Table III-4).

### *1. Approach*

The analysis of the impact of future reservoir operations on cuckoos at Roosevelt focuses on riparian vegetation communities that are occupied by this species. Full operation of Roosevelt by SRP would involve the periodic inundation and drying of this riparian vegetation, which is anticipated to result in the incidental take of cuckoos through harm, should they be listed in the future. The analysis begins with a description of the existing habitat available for cuckoos at Roosevelt, recent changes in that habitat, and estimates of the maximum amount of habitat that may be occupied in the future. The assessment of impacts follows.

As with flycatchers, assessment of impacts from the continued operation of Roosevelt on cuckoos differs from a typical biological impact analysis. In this case, impacts do not occur as a single permanent event and the amount of impact cannot be accurately predicted for a specific future event. Direct impacts to cuckoos, their nests or eggs are not expected but could occur if tree fall due to inundation or drying occurs affecting nests with eggs or fledglings, or a fledgling falls out of a nest over water and drowns.[52] Impacts are primarily expected through periodic habitat modification or loss caused by inundation or drying. These impacts are not expected to ever impact all cuckoo habitat at Roosevelt and, in many years, continued reservoir operation will not adversely impact any habitat at all or will benefit habitat by stimulating riparian growth (see Subchapter II.A). Under current and future operation from the Proposed Action, the amount of cuckoo habitat around Roosevelt is expected to increase and decrease in much the same way as other natural southwestern riparian ecosystems. However, periodically, fluctuations in water levels due to reservoir operations are expected to modify suitable habitat, with subsequent impacts to cuckoos.

Because of this unique situation, the most reasonable way to assess impacts to the cuckoos is by assessing impacts to occupied habitat rather than numbers of cuckoos. The number of individual cuckoos lost from future Roosevelt operations is difficult to estimate for several reasons:

- Physical take of adult cuckoos is unlikely because the birds are mobile.
- Physical take of cuckoo eggs or unfledged young from direct inundation is unlikely because an increase in reservoir levels during the nesting season has never occurred; however, prior inundation might occasionally result in tree fall during the breeding season causing direct take. Also, fledglings may die occasionally from drowning if standing water remains under nest trees when fledglings are learning to fly.
- Future changes in population size are difficult to estimate because population dynamics are not well understood.

[52] Direct take may occur from recreation use at high lake levels (e.g., boat or jet ski disturbance to nesting flycatchers). However, recreation use at Roosevelt is subject to Forest Service management, which is outside of SRP control. As a federal action, recreation impacts on listed species are addressed as a cumulative impact under NEPA in the EIS.

- It is projected that there would always be some available habitat at Roosevelt, and additional habitat created for flycatchers and bald eagles as part of the RHCP would benefit cuckoos. However, there is uncertainty in the estimates of the exact amount of habitat that would be available at any given time and the degree of utilization by cuckoos.
- Any take of cuckoos would be a result of effects on breeding success, nesting success, fecundity, or other indirect impacts from not being able to utilize habitat that would otherwise exist at Roosevelt in the absence of operating the reservoir. The magnitude and results of these indirect effects are not possible to accurately quantify, but the potential range of effects is described below.

Given that reservoir operations modify habitat and the direct loss of cuckoos at Roosevelt is difficult to estimate, the alternative of quantifying effects solely in terms of impacts on habitat is being used in this analysis (FWS 1996, p. 3-14).

### *2. Background*

#### a. Existing Cuckoo Habitat

The development of riparian vegetation at Roosevelt, some of which is used as habitat by cuckoos, is described in Subchapter II.A.1. As summarized previously, prior to the construction of Roosevelt, cottonwoods and willows were present in relatively small areas and narrow bands along the channels of the Salt River and Tonto Creek. In the late 1970s, 1980s and early 1990s, a series of wet years created favorable conditions for growth of large amounts of riparian vegetation at Roosevelt.

As discussed in Subchapter II.B.4, little information is available that defines use of Roosevelt Reservoir riparian habitat by cuckoos. Therefore, no estimates of habitat currently occupied by cuckoos are available. Instead, vegetative and patch requirements for cuckoos are applied to 2001 vegetation mapping in order to identify riparian vegetation that may be occupied or suitable habitat for cuckoos.

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). Orchards also may be used for nesting if they are adjacent to riparian areas. 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. Nests have been documented in a wide variety of vegetation, including willow, cottonwood, mesquite, salt cedar, hackberry, soapberry, alder, and cultivated fruit trees such as prune, walnut, and almond. While other trees may be used for nesting, willows appear to be preferred (Laymon 1998a, 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 1998a, 1999). Foraging habitat for cuckoos tends to be less dense than nesting habitat, with cottonwood trees being an important component. Cuckoos feed primarily on large insects such as caterpillars,

katydids, cicadas, grasshoppers, moths, beetles, and crickets (Poole and Gill 1999; Laymon 1998b).

In addition to vegetative characteristics, the size and shape of patches of riparian habitat are important in determining their usefulness to cuckoos. In general, breeding cuckoo pairs require habitat patches that are 10 to 100 acres in size (see Subchapter II.B.4).

ERO vegetation mapping in 2001 is described in Subchapter II.A. ERO identified a number of vegetation types in the study area and subdivided the salt cedar and mixed riparian vegetation types based on height characteristics and density in order to group the vegetation into two categories: 1) tall dense vegetation, some of which is currently used as habitat by cuckoos; and 2) other vegetation types. As described in Subchapter II.A, vegetation was placed in the "tall" category if canopy heights were greater than 15 feet, and "dense" if canopy cover was greater than 80 percent. Tall dense vegetation is composed of three vegetation types: cottonwood/willow, mixed riparian greater than 15 feet in height, and salt cedar greater than 15 feet in height, see Table III-7. Cuckoos have been observed in some patches of tall dense vegetation at Roosevelt (A. Smith, pers. comm. 2001) and other patches appear to be suitable habitat. However, other areas of tall dense vegetation are probably not currently suitable habitat because the patches are less than 10 acres in size. Cuckoos may forage in patches of suitable habitat that are smaller than required for nesting, cottonwood/willow in particular, if the patches are adjacent to their core habitat. Patches of tall, dense forested habitat 10 to 20 acres or greater, with predominately native vegetation, are generally necessary for nest locations.

**Table III-7. Tall dense vegetation classification types at Roosevelt (modified from SWCA 1999).**

| Type (ERO 2001) | Definition |
|---|---|
| Cottonwood/willow | More than 80% cottonwood/willow |
| Mixed riparian > 15 feet | No single species (cottonwood/willow/salt cedar) comprises more than 80%, trees generally more than 15 feet in height |

Using the vegetation mapping and size of patches, patches of potentially suitable cuckoo habitat at Roosevelt Reservoir were identified. Patches composed of cottonwood/willow or mixed riparian > 15 feet were identified as potentially suitable. Although patches less than 10 acres are generally unsuitable for cuckoo territories, patches as small as 5 acres were retained in the impact analysis because they may expand into 10-acre patches within a few years.[53] Patches above elevation 2,136 are likely to survive seasonal inundation from reservoir fills under the Proposed Action because Roosevelt is drawn down 15 feet or more each summer. Table III-8 summarizes potentially suitable cuckoo habitat that is currently available at Roosevelt Reservoir.

[53] A "patch" is defined as an individual vegetation polygon.

**Table III-8. Potentially suitable cuckoo habitat at Roosevelt.**

| Salt River Arm | Acres |
|---|---|
| < 2,090 feet | 0 |
| 2,091 – 2,110 feet | 60 |
| 2,111 – 2,136 feet | 100 |
| > 2,136 feet | 7 |
| *Total Salt River Arm* | 167 |
| **Tonto Creek Arm** | **Acres** |
| < 2,110 feet | 0 |
| 2,111 – 2,136 feet | 153 |
| > 2,136 feet | 34 |
| *Total Tonto Creek Arm* | 187 |
| **Roosevelt Reservoir Totals** | **Acres** |
| ***Total 2,091 – 2,110 feet*** | 60 |
| ***Total 2,111 - 2,136 feet*** | 253 |
| ***Total > 2,136 feet*** | 41 |
| **Grand Total** | 354 |

### b. Recent Changes in Cuckoo Habitat

Roosevelt reservoir levels have steadily dropped between 1997 and 2001. Shifts in the location of potentially suitable habitat for the cuckoo on both the Salt River and Tonto Creek arms of Roosevelt have resulted from vegetation changes in response to water availability.

On the Salt River arm of Roosevelt (Salt arm), most of the vegetative changes between 1997 and 2001 occurred downstream of the confluence with Pinto Creek. New vegetation now occurs on the lakebed below elevation 2,110. Some of this new vegetation has developed into patches of tall dense willow that may be suitable for cuckoos to occupy, but most of the new vegetation remains relatively short or sparse. Conversely, some vegetation at higher elevations along the Salt inflow to the reservoir is drying out and some patches are likely to become unsuitable as habitat in the near future if current low reservoir levels persist. Approximately 160 acres of potentially suitable habitat is available on the Salt arm below elevation 2,136.

On the Tonto Creek arm of Roosevelt (Tonto arm), many of the vegetative changes have occurred downstream of the Indian Point recreation site. Like the Salt arm, more vegetation now occurs on the reservoir floor downstream of Indian Point than was evident in 1997. Again, most of the new vegetation is not suitable cuckoo habitat at this time, but there are some new areas of tall dense willow. Relatively large areas of the lakebed along Tonto Creek at higher elevations or more distant from the stream are drying out, as evidenced by degrading cottonwood/willow and mixed riparian patches upstream of Indian Point. The Tonto arm supports about the same amount of suitable cuckoo habitat as the Salt arm. There are approximately 153 acres of potentially suitable

habitat on the Tonto arm below elevation 2,136. About 34 acres of potentially suitable habitat exists within the study area above elevation 2,136.

#### *3. Impact on Cuckoos*

As discussed in the approach to cuckoo impact analysis (Subchapter III.F.1 above), the potential direct incidental take of cuckoos from the Full Operation alternative is uncertain. Thus, the potential incidental take that could occur is addressed in terms of harm to cuckoos through effects to occupied habitat in the next subchapter.

**Impacts on Cuckoo Habitat at Roosevelt.** As described in Subchapter II.A, the amount of riparian habitat affected by reservoir operations would vary in the dynamic system created by Roosevelt; as reservoir levels rise or recede, the amount and location of suitable habitat changes as well. Inundation of habitat is likely to be balanced by establishment of new habitat as the water level declines. There will be a natural succession of habitat following inundation and drawdown cycles at the reservoir, so that some suitable cuckoo habitat always will be present.

Because cuckoo habitat is generally older riparian vegetation, it is less dynamic than flycatcher habitat. Thus, it is assumed that current potentially suitable habitat represents the maximum that is likely to be occupied in the future.

On both the Tonto Creek and Salt River arms, there is a total of approximately 354 acres of potentially suitable habitat (Table III-8). When the reservoir is full, all but approximately 40 acres of habitat would be inundated for an extended period of time. Because the reservoir typically is drawn down 15 to 20 feet each summer, these 40 acres are expected to be available for nesting and to survive inundation.[54] In addition, inundation is expected to result in growth of new habitat. Thus, the maximum net amount of habitat impacted in any one year is estimated to be about 313 acres (354 acres minus the 41 acres remaining for nesting). In the future, the maximum amount of habitat impacted will be determined by the actual amount of occupied habitat as defined by territory size.

Variations in hydrological conditions, uncertainties in the current quantity of occupied habitat and survival of cottonwoods following inundation, and changes in population and vegetation dynamics could combine to result in greater quantities of occupied habitat at Roosevelt than the predicted maximum level of 313 acres. Because it is not possible to estimate the amount of occupied habitat that might be affected above the predicted maximum level, adaptive management (discussed further in Chapter IV) will be employed to address such increases if they occur. The additional occupied habitat to be addressed through adaptive management is 800 acres based on a total of about 1,100 acres of tall dense vegetation that is about the maximum expected to exist at Roosevelt (see Subchapter III.A). In total, the upper limit of occupied cuckoo habitat at Roosevelt addressed by the RHCP is 1,113 acres (313 + 800). If future occupied habitat exceeds 1,113 acres, a permit amendment would be required.

[54] However, it is possible that cottonwood trees within this 40 acres may not survive inundation.

Mitigation measures for cuckoo habitat are described in Subchapter IV.C.1.d.

**Impacts on Cuckoo Productivity.** As discussed for flycatchers in Subchapter III.C.3, periodic modification or elimination 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 Roosevelt. In addition, estimates of periodic lost productivity for cuckoos at Roosevelt are difficult to derive because little is known about the population. Better estimates are likely to be available after surveys are conducted by SRP. In the meantime, assuming an average territory size of about 50 acres based on the reported range of 10 to 100 acres in the literature (see Subchapter II.B.4.g), about 6 pairs could occupy the predicted 313 acres of potentially suitable habitat. If occupied habitat increased to 1,113 acres and the territory size is 50 acres, about 22 pairs could be present.

### G. Impacts to Water Supply, Power Generation, Recreation, and Water Rights

There would be no impact on SRP water supply, power generation, recreation, or water rights as a result of the Full Operation alternative. The Full Operation alternative constitutes the basis for evaluation of the impacts from the other reservoir operation alternatives (see Chapter V).

### H. Effects on Listed and Rare Plants and Other Listed Wildlife and Species of Concern

As discussed in Subchapter II.C.1, listed and rare plants in the vicinity of Roosevelt are upland species that would not be impacted by the Full Operation alternative. Similarly, other listed wildlife and species of concern would not be impacted by the Full Operation alternative considered in the RHCP (see Subchapter II.C.2).

### I. Effects on Critical Habitat

As summarized in Subchapter II.B.1.c, critical habitat was designated for flycatchers in 1997 but was set-aside in 2001 due to a court ruling that the economic analysis incorporated in the designation needs reassessment. In the 1997 rule, the area at and in the vicinity of Roosevelt was not considered to be critical habitat (FWS 1997a). Given that critical habitat was not designated at Roosevelt in 1997 and the set-aside of the designation in 2001, there would be no effect on designated critical habitat from the Full Operation alternative.

If critical habitat at or near Roosevelt is designated in the future for flycatchers, it would not affect the RHCP. Above elevation 2,151, reservoir operations would not affect critical habitat. Below elevation 2,151, the effects of reservoir operations on flycatcher habitat are being fully addressed by the RHCP.

Critical habitat has not been proposed or designated for Yuma clapper rails, bald eagles, or cuckoos. If such habitat is designated in the future, the RHCP will have addressed any effects of Roosevelt operations on this habitat.

### J. Downstream Flood and Water Quality Impacts

No flood or water quality effects would occur under the Full Operation alternative.

### K. Cumulative Effects on Covered Species Under the ESA

Cumulative effects under the ESA are those effects of future non-federal (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 that are 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 RHCP, the federal action is issuance of an ITP that permits continued operation of Roosevelt Dam for water conservation.

Within the conservation space at Roosevelt, no future non-federal activities that may affect the covered species are likely to occur.

Adjacent to Roosevelt, numerous private parcels occur on Tonto Creek upstream of the project area. 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, wildfires, changes in water quality, etc. FWS has documented numerous unauthorized actions involving manipulation of the active channel on Tonto Creek that directly threaten maintenance or establishment of riparian habitat. FWS also has documented trespass livestock in the Tonto Creek Riparian Unit, the mitigation area for the original Plan 6 consultation associated with the Modified Roosevelt Dam (FWS 1996).[55]

Elsewhere in central Arizona, increasing development along rivers may have significant effects on the covered species. Effects may be directly on individuals or on 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 off-highway vehicles or river floaters, may also adversely affect riparian habitat. Wildfires started by humans 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.

Rangewide, FWS has documented similar cases of intentional and unintentional riparian habitat destruction in California and New Mexico. These activities and violations are persistent throughout the range of the covered species, and FWS anticipates that these types of activities will continue legally and illegally on both private and federal lands.

A statewide and regional loss or degradation of suitable habitat for flycatchers, bald eagles, and cuckoos is likely to continue. Under the Full Operation alternative, a periodic inundation of habitat at Roosevelt would result in occasional loss of habitat and productivity. Over the long-term, habitat is likely to be maintained by periodic inundation. Cumulative effects of the Full Operation alternative in addition to other past,

[55] Since 1996, livestock trespass has been reduced (Garcia and Associates 2001, p. 2-41).

present, and future actions are difficult to predict because of the uncertainties in how riparian vegetation will respond to changes in reservoir operation and climatic conditions. The periodic loss of habitat under the Full Operation alternative in addition to regional impacts on habitat could increase cumulative impacts. However, the acquisition and management of suitable riparian habitat at several locations provided for in the RHCP is intended to compensate for this periodic loss of habitat. With full implementation of these conservation measures, the Full Operation alternative would not add appreciably to the regional cumulative effect when mitigation measures are implemented.

Cumulative effects on resources other than covered species are evaluated in the EIS. These other resources include water quantity, flood control, water quality, vegetation, wildlife, cultural resources, land use, and socioeconomics.

### L. Summary of Indirect Effects on Covered Species Under the ESA

Indirect effects are "caused by the Proposed Action and are later in time or farther removed in distance, but are still reasonably foreseeable" (40 CFR 1508.8). The Proposed Action in this context of the RHCP is issuance of an ITP for continued operation of Roosevelt conservation space.

As discussed above in this chapter, the primary indirect effects of the Full Operation alternative are likely losses in productivity of covered species at Roosevelt. For flycatchers, Yuma clapper rails, and cuckoos, these productivity losses would occur when habitat is lost due to changes in reservoir levels. These productivity losses at Roosevelt will be offset by potential productivity at mitigation sites. For bald eagles, periodic losses of productivity at Roosevelt may result from extended periods of reservoir drawdown.

Indirect effects on resources other than covered species are evaluated in the EIS.

# IV. Actions to Minimize, Mitigate, and Monitor the Effects of Full Operation of Roosevelt

Chapter IV begins with a discussion of how the RHCP integrates prior Section 7 consultations between Reclamation and FWS for construction of Modified Roosevelt Dam. The chapter continues with a discussion of the relationship of the RHCP to the recovery recommendation for flycatchers (FWS 2001b) and the final flycatcher Recovery Plan (FWS 2002), and SRP's funding assurances for implementation of the minimization and mitigation measures. This chapter also describes the RHCP's minimization and mitigation measures, including measures to be undertaken as part of an adaptive management program. Monitoring of the measures undertaken in the RHCP, and future conditions at Roosevelt including compliance with the ITP, are described in detail. Chapter IV concludes with a discussion of the additional assurances (No Surprises) requested from FWS and the treatment of changed and unforeseen circumstances.

## A. Integration With Prior Section 7 Consultations for Modified Roosevelt

The most recent Section 7 consultation between FWS and Reclamation, completed in 1996, addressed Reclamation's modifications to Roosevelt Dam, and the effects of the eventual inundation of the new conservation, flood control and flood surcharge space made possible by the modifications.[56] The 1996 BO, prepared by FWS at the conclusion of the consultation process, estimated that inundation of the NCS would destroy riparian vegetation used for nesting by southwestern willow flycatchers, resulting in the take of as many as 90 flycatchers annually. FWS concluded that, absent the implementation of the RPA set forth in the BO, the Proposed Action was likely to jeopardize the continued existence of the flycatcher. With the implementation of the RPA, which required, among other things, the purchase and management in perpetuity of substitute habitat for the flycatcher, FWS determined that construction of Roosevelt modifications could go forward without violating Section 7(a)(2) of the ESA. As part of its BO, FWS issued an Incidental Take Statement permitting the annual take of up to 90 flycatchers at Roosevelt resulting from inundation of the NCS.

The RPA set forth in the 1996 BO also required Reclamation to monitor the population of flycatchers at Roosevelt for a 10-year period. In accordance with this requirement, Reclamation, through agreements with the Biological Resources Division of

[56] In 1996, the effect of inundation of the flood control and flood surcharge space (i.e., above elevation 2,151 feet) resulting from modifications to Roosevelt was determined to have no significant impact on biological resources, including listed species, that had not already been addressed under Section 7 of the ESA (Reclamation 1996, pp. 2, 28, 29). SRP is not aware of any change of circumstance or new information that would alter that conclusion. The flood control and flood surcharge space is not part of the RHCP. Although the geographic coverage of the RHCP only extends up to elevation 2,151, data also are provided for the area between 2,151 and elevation 2,218, the top of the flood control pool, in order to provide information to FWS for use in evaluation of whether consultation on federal actions may be required for effects on listed species from operation of the flood control space.

the U.S. Geological Survey and the Arizona Game and Fish Department, has conducted banding studies, annual surveys, and nest monitoring of the population of flycatchers at Roosevelt. The results of these studies and surveys reveal that, since 1996, the total number of flycatchers at Roosevelt has increased to well over 90 birds. The nesting locations of the flycatchers at Roosevelt have also changed. Due to drought conditions in Central Arizona over the last five years, water levels in the reservoir have declined and riparian vegetation has grown into intermittently dewatered areas of the reservoir, at elevations below the NCS. In the spring of 2001, there were few flycatchers nesting in riparian vegetation in the NCS; instead, the nests were located lower down in the reservoir, closer to the surface elevation of the lake, which in the spring of 2001 reached approximately 2,092 feet.[57]

As with flycatchers, previous Section 7 consultations addressed the effects of Reclamation's actions to modify Roosevelt Dam on bald eagles (see Subchapters I.H and III.E.2.b). Reclamation's implementation of the RPAs in those BOs addresses any incidental take of bald eagles resulting from construction of the modifications.

Both the current RHCP and the previous BOs address the effects of inundation of riparian vegetation in the NCS on the flycatcher and bald eagle. These BOs considered these effects as an eventual result of Reclamation's action of constructing the NCS at Roosevelt Dam. The RHCP considers these effects as an integral aspect of SRP's long-term operation of all of the conservation storage space at Roosevelt. The effects of inundation and drying of flycatcher habitat in both the NCS and the original conservation space, as well as the effects of inundation of bald eagle nest trees and impacts of reservoir drawdown on bald eagle productivity resulting from the storage of water by SRP, are considered and addressed as part of the RHCP. Moreover, the RHCP, together with the RPAs and reasonable and prudent measures (RPMs) developed by FWS in its previous BOs and implemented by Reclamation, will minimize and mitigate, to the maximum extent practicable, any "take" of listed species resulting from the operation of conservation storage at Roosevelt Dam. These measures have been incorporated into the RHCP. Furthermore, SRP believes the RHCP will ensure that continued operation of Roosevelt will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. When implemented along with the existing RPAs and RPMs from prior BOs, the RHCP is intended to provide a comprehensive plan to address impacts on listed and candidate species as a result of operation of Roosevelt Dam.

On September 17, 2002, Reclamation sent a letter to FWS requesting reinitiation of formal consultation on the effects of Reclamation's action of modifying Roosevelt Dam in conjunction with FWS consideration of SRP's application for an ITP (Erwin 2002). SRP understands that the purpose of Reclamation's request is to integrate the RPAs and RPMs specified in the BO on Reclamation's Roosevelt modifications with those that will be implemented as part of the RHCP should an ITP be issued. Reclamation concludes that implementation of the RHCP would fully cover the effects of operation of Roosevelt conservation space.

[57] In 2001, the majority of nests were located in trees and shrubs with root crowns between elevations 2,095 and 2,120 feet.

> "The effects consulted on in the earlier biological opinions were anticipated to result from the inundation of the newly created conservation space made possible by Reclamation's modifications to Roosevelt Dam. These effects will now be covered by the RHCP and incidental take permit issued to SRP for its long-term operation of all the conservation storage space at Roosevelt Dam and Lake. Accordingly, Reclamation believes there is no remaining effect of the Federal Action which is not addressed in the dRHCP" (Erwin 2002).

As of the date of publication of this final RHCP, FWS is preparing a response to Reclamation's request.

### B. Relationship of the RHCP to the Flycatcher Recovery Team Recommendation

The Southwestern Willow Flycatcher Recovery Team issued its recommendation for a recovery plan ("Recommendation") to the Regional Director of the FWS in April 2001 (FWS 2001b). The Regional Director approved and signed the Recovery Plan for the Southwestern Willow Flycatcher (Recovery Plan) on August 30, 2002 (FWS 2002). The Recommendation was used as a source of information and guidance in preparation of this RHCP (FWS 2001b, p. 1). The consistency of the RHCP also was evaluated in relation to the final Recovery Plan. SRP believes that the RHCP is consistent with the Recovery Plan as discussed below.

The RHCP is required by law to ensure that the incidental take under the ITP "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). As discussed below in this subchapter, the RHCP meets this criterion by significantly 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.[58]

Management Units within broader Recovery Units are the basic geographical components of the Recovery Plan (FWS 2002, pp. 61-63). Roosevelt lies within the Roosevelt Management Unit in the Gila Recovery Unit (Id., pp. 63, 65, Figure 4, and Table 10). The Roosevelt Management Unit encompasses the Salt River watershed, from the confluence with the Gila River west of Phoenix to the Mogollon Rim at the top of the basin, except for the Verde River watershed (which was designated as a separate Management Unit).

The Recovery Plan sets recovery criteria for the entire Roosevelt Management Unit at 50 territories (or at least 50 to 80 percent of that number if the overall goal in the Gila Recovery Unit is met) unless changes are made as a result of reevaluation after 5 years (FWS 2002, pp. 78, 85). The Recovery Plan indicates that FWS believes that

[58] As noted in Chapters II and IV, operation of Roosevelt under the RHCP will maintain riparian habitat around the reservoir over the long-term. In addition, the RHCP provides for acquisition and management of additional habitat along the Salt, Verde, San Pedro, and Gila rivers in central Arizona (as well as other stream systems if necessary).

50 territories can be occupied within the Roosevelt Management Unit even if the reservoir's conservation space is filled (FWS 2002, pp. O-19 and O-20).[59] Moreover, SRP's efforts to establish, protect, and manage riparian habitat in the vicinity of Roosevelt, discussed in Subchapters IV.C.2 and IV.C.3 below, are in support of and consistent with the recovery criteria for the Roosevelt Management Unit.

Several of the factors used in developing the Recommendation provided guidance in the development of mitigation efforts in the RHCP. These factors include: 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 2001b, p. 76). These factors remain the same in the final Recovery Plan (FWS 2002, p. 75). To further the flycatcher recovery goals, the RHCP incorporates a specific effort to establish riparian habitat on the Salt River arm of Roosevelt, thereby providing refuge for the flycatcher population at Roosevelt in the event that scouring flood flows or extended periods of high lake levels prevent the flycatchers from breeding and nesting at other locations around the lake (see Subchapter IV.C.2). Also, SRP's other high priority minimization and mitigation measures focus on conserving riparian habitat for existing populations or habitat located near existing breeding sites (see Subchapters IV.C.3 to IV.C.7).

The Recommendation 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 (or at least the same Recovery Unit)"; 3) "efforts should strive to acquire habitat before project initiation"; 4) adequate funding should be provided "to ensure that habitat is managed permanently for the intended purpose"; and 5) "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 2001b, p. 81). These guidelines remain in the final Recovery Plan except that mitigation measures are to be conducted in the same Recovery Unit (FWS 2002, pp. 82 and 83). The selection of SRP's high priority minimization and mitigation measures reflects these guidelines by focusing on conservation of riparian habitat that is used or may be used by flycatchers and that is as close to Roosevelt as possible, using best efforts to conserve the mitigation sites prior to permit issuance, funding ongoing management of the conserved habitat, and focusing on priorities for acquisition outlined in existing documents (see Subchapters IV.C.2 to IV.C.7).

[59] The large number of territories within the conservation space at Roosevelt (e.g., 140 in 2001 and 148 in 2002) were not included in the goal because the "habitats probably only developed recently and are subject to inundation and possible destruction when reservoir levels are raised" (FWS 2002, p. 31), and because "the Recovery Plan does not seek to maximize flycatcher numbers in habitats" (FWS 2002, p. O-20).

In terms of specific consistency with the guidelines listed above, first, the loss of flycatcher habitat will be mitigated as a result of the RHCP by the protection of currently occupied habitat or habitat that is expected to support flycatchers in the future through improved management at and near Roosevelt, and along the Verde, San Pedro, Gila, and other rivers (see Subchapters IV.C.2, IV.C.3, IV.C.4, IV.C.6, and IV.C.7). Continued operation of Roosevelt also will prevent the long-term reduction in the average amount of habitat at Roosevelt (see Subchapter II.A.7). In addition, SRP will fund a Forest Service enforcement position to substantially increase the protection of habitat for covered species at Roosevelt and in nearby areas. Second, the RHCP will replace and permanently protect habitat in the Roosevelt Management Unit to the maximum extent practicable and most, if not all, of the mitigation will occur in the Gila Recovery Unit (see Figure IV-1 and Subchapter IV.C.1).[60] As noted above, the Recovery Plan indicates that sufficient habitat will be available in the Roosevelt Management Unit to meet recovery goals and RHCP mitigation will provide additional habitat. Third, SRP will use its best efforts to establish mitigation prior to permit issuance and is well along in the process, having initiated intensive acquisition efforts in May of 2001 (see Subchapters IV.C.4 and IV.C.6). Fourth, as discussed in greater detail in Subchapter IV.D, SRP has committed adequate funding to ensure that the habitat will be permanently managed. Fifth, the selection of mitigation sites in the Verde Valley, along the lower San Pedro, in the Safford Valley, and elsewhere in central and east-central Arizona 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 other area selected for potential habitat protection in the RHCP, the Salt arm of Roosevelt, is included because it is close to Roosevelt and offers unique opportunities for riparian area conservation (see Subchapter IV.C.2).

The Recommendation suggests that "compensation habitat should be acquired at no less than a 3:1 ratio" (FWS 2001b, p. 81). This guidance is in the context of permanent habitat loss, modification, fragmentation, or degradation (Id.). SRP is meeting the 3:1 ratio in the RHCP through acquisition and management of riparian habitat, and additional mitigation measures to conserve and improve riparian habitat. The 3:1 ratio, rather than a greater amount, is especially appropriate because the continued operation of Roosevelt will not result in the permanent loss of habitat but will, in fact, maintain riparian habitat around the lake. The breadth and extent of mitigation measures to be implemented as part of the RHCP are very robust, as described in later subchapters. The Recovery Plan states that the mitigation ratio should be based on specific analyses conducted on a project-by project basis (FWS 2002, p. 82). The amount of mitigation in the RHCP is based on specific analysis of the need to compensate for loss of habitat at Roosevelt (Subchapter IV.C.1.a).

The Recommendation and Recovery Plan suggest a number of actions that are believed to be important to flycatcher recovery <u>where feasible, legal and effective</u> (FWS 2001b, pp. 89 to 123; FWS 2002, pp. 96 to 136, emphasis added). Although the RHCP is not required to contribute to the recovery of listed species, efforts to be consistent with

[60] The schedule for mitigation is set forth in Subchapter IV.C.1.

recovery plans or recommendations and to provide benefits to the species help to ensure that the incidental take from continued operation of Roosevelt will not appreciably reduce the likelihood of survival and recovery of the species in the wild (FWS 1996, p. 3-20). The suggested potential recovery actions in the Recommendation that are relevant to the RHCP 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 RHCP and has been incorporated into the RHCP where feasible (see remainder of Chapter IV and Chapter V). As to the first suggested action, possible changes to dam operations are extensively evaluated as part of the RHCP; however, full operation of Roosevelt is determined to be the most biologically effective over the long term as well as the most feasible and legal alternative (see Chapters III and V). The second suggested action, augmenting sediment downstream of reservoirs, is evaluated in the RHCP and determined to be of uncertain effectiveness on the Verde River system and extremely costly (see Subchapter V.N.4.c). Third, the RHCP specifically contemplates providing more water to riparian areas by managing water use and acquiring water rights along the San Pedro, Gila, or other rivers in central Arizona (see Subchapters IV.C.6 and IV.C.7). Fourth, improved fire, recreation, and livestock management at Roosevelt is the specific reason for the minimization and mitigation measure described in Subchapter IV.C.3, which provides that SRP will fund personnel for habitat protection, enhancement and management activities at Roosevelt. Fifth, habitat protection is the focus of the RHCP, as summarized above and described in Subchapter IV.C. Sixth, the locations of high priority mitigation measures in the RHCP were selected in order to enhance population stability by providing or developing new habitat near existing populations (Roosevelt, Verde, San Pedro, Gila and elsewhere if needed), and increasing the populations at sites with few birds (Verde and elsewhere if needed), as described in Subchapters IV.C.2 through IV.C.7. Seventh, the RHCP incorporates monitoring measures for compliance, as well as the effectiveness of management and restoration measures, using standard protocols (see Subchapter IV.E below).

### C. Minimization and Mitigation Measures

This subchapter describes the proposed minimization and mitigation measures to be undertaken as part of the RHCP. These minimization and mitigation measures address the impacts of the Proposed Action discussed in Chapter III. As summarized in the discussion of alternatives in Subchapter V.A, the proposed minimization and mitigation measures for effects on listed and candidate species were prioritized based on: (1) maximization of benefits to listed species; (2) minimization of impacts on water delivery and power generation; (3) proximity of the mitigation sites to Roosevelt; and (4) feasibility of the proposed measures. The largest impacts from the Proposed Action, Full Operation of Roosevelt, would occur to habitat used by flycatchers (see Subchapter III.C). Thus, highest priority is given to minimization and mitigation measures that would offset impacts to flycatchers. The benefit of those measures to Yuma clapper rails, bald eagles, and cuckoos is considered below as well as specific minimization and mitigation measures for those species.

SRP will implement two forms of adaptive management as part of the RHCP (see Subchapter IV.E.7). SRP will implement program adaptive management in the event that certain thresholds of potential impact to flycatcher, Yuma clapper rail, and cuckoo habitat are exceeded at Roosevelt in the future. SRP also will implement biological adaptive management to adjust management efforts on mitigation properties. Adaptive management for potential effects on bald eagles is not necessary because the mitigation measures in the RHCP address all foreseeable changes in circumstances. The monitoring measures to determine if adaptive management measures and mitigation measures need to be implemented are provided below.

### *1. Summary of Minimization and Mitigation Measures and Sites*

This subchapter describes the minimization and mitigation measures for flycatchers, Yuma clapper rails, bald eagles, and cuckoos to be implemented as part of the RHCP. Table IV-1 provides an overview of the type and magnitude of these measures.

#### a. RHCP Mitigation Measures for Flycatchers

The maximum amount of occupied flycatcher habitat predicted to be impacted by continued full operation of Roosevelt in the future is 750 acres. SRP will implement a number of measures as part of the RHCP in order to minimize and mitigate that impact to the maximum extent practicable. These mitigation measures are described below under two general categories: Habitat Acquisition and Management and Additional Habitat Conservation measures.

Adaptive management will be employed to address increases in impacts greater than 750 acres if they occur. Increased impacts will be detected through the use of monitoring, and additional mitigation and minimization measures will be implemented for up to 500 acres of additional habitat impacted to address these changed circumstances (see Subchapter III.C.3).

The RHCP provides 3 acres of mitigation for each acre of occupied flycatcher habitat potentially impacted by the continued operation of Roosevelt. A total of 2,250 acres of mitigation is provided for the maximum predicted impact of 750 acres. The same 3:1 ratio would be provided for adaptive management to address increases in occupied habitat — 2:1 in Habitat Acquisition and Management, and 1:1 in Additional Habitat Conservation measures.

***Habitat Acquisition and Management***

One component of the mitigation encompassed in the RHCP is to acquire and manage at least 1,500 acres of riparian habitat by fee title or conservation easements to provide permanent habitat for flycatchers and other wildlife. The acquired lands will be either currently occupied flycatcher habitat or habitat that is expected to support flycatchers in the future through improved management. This component is referred to as Habitat Acquisition and Management below. In combination with the Additional Habitat Conservation measures (also described below), SRP believes that the impact on flycatchers will be fully mitigated. Thus, the criterion of "maximum extent practicable" would be entirely satisfied.

**Table IV-1. Overview of minimization and mitigation measures.**

| Species | Minimization and Mitigation Measures | Acres |
|---|---|---|
| Flycatcher | Riparian Habitat Acquisition and Management | 1,500 |
| | Additional Habitat Conservation measures | +750 |
| | Subtotal | 2,250 |
| | Reclamation mitigation measures (estimated) | -823* |
| | Net to be implemented by SRP (estimated) | 1,427 |
| | **Adaptive management (up to 500 acres of additional impact)** | |
| | • Riparian Habitat Acquisition and Management | up to 1,000 |
| | • Additional Habitat Conservation measures | up to 500 |
| | Subtotal | up to 1,500 |
| | Total with adaptive management (2,250 + up to 1,500) | up to 3,750 |
| Yuma Clapper Rail | Riparian Habitat Acquisition and Management | 5† |
| | **Adaptive management (up to 5 acres of additional impact)** | up to 5† |
| | Total with adaptive management | up to 10† |
| Cuckoo | Riparian Habitat Acquisition and Management | 626† |
| | Additional Habitat Conservation measures | + 313† |
| | Subtotal | 939† |
| | Reclamation mitigation measures (estimated) | -652† |
| | Net to be implemented by SRP (estimated) | 287† |
| | **Adaptive management (up to 800 acres of additional impact)** | |
| | • Riparian Habitat Acquisition and Management | up to 1,600† |
| | • Additional Habitat Conservation measures | up to 800† |
| | Subtotal | up to 2,400† |
| | Total with adaptive management (939 + up to 2,400) | up to 3,339† |
| Bald Eagle | Pilot project to establish cottonwoods near Roosevelt | — |
| | Maintenance of Pinto nest platform | — |
| | Habitat acquired for flycatchers may benefit eagles | — |
| | Development and implementation of bald eagle conservation measures at Roosevelt | — |
| | Continuation of support of interagency monitoring program | — |
| | Assist FMYN with riparian habitat restoration | — |

*The 823 acres comprises existing Habitat Acquisition and Management of 403 acres and Additional Habitat Conservation measures of 220 acres in the San Pedro Preserve, and 200 acres of additional mitigation to be acquired by Reclamation (see Subchapter IV.C.1.a).

†Due to habitat similarities, these acreages are expected to be partially or entirely encompassed within the minimization and mitigation measures for flycatchers; however, additional riparian habitat will be acquired if necessary (see Subchapter IV.C.1.c).

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 Subchapter IV.E.

***Amount of Acquired Riparian Habitat***

The amount of riparian land to be acquired and managed is double the amount that could be lost at Roosevelt based on a number of considerations:

- Much of the acquired habitat will be initially unoccupied and may never achieve the densities of birds found at Roosevelt.
- A lag time may exist between acquisition/easements and improvement of the suitability of the habitat through management.
- There will not be a permanent loss of habitat at Roosevelt. Over the long-term, the average annual amount of vegetation suitable for nesting at Roosevelt is estimated to be 300 to 400 acres and there will be habitat along the lake fringe near the Tonto Creek and Salt River inflow points at full reservoir levels (see Figure III-5 and associated discussion in the text). This habitat at Roosevelt is not included in the 1,500 acres of off-site mitigation.
- SRP is including additional measures such as funding staff time for habitat management at Roosevelt, and water management/water rights acquisition along the San Pedro (or elsewhere if needed) as described below.
- Unlike small projects mitigating for a few acres of impact, the scale of mitigation in the RHCP is relatively large involving hundreds of acres of riparian land, which provide better quality blocks of habitat.
- SRP is seeking to protect the highest quality riparian habitat available within proximity to Roosevelt, not marginal habitat. Moreover, SRP is pursuing properties on the Verde, San Pedro, Gila, and other rivers that create a synergism with other conservation efforts to provide a greater overall benefit to wildlife.
- SRP will be acquiring and restoring habitat along several rivers where there are already flycatchers nesting, which will increase the area along those corridors for colonization and movement and minimize the risk associated with concentration of habitat in case of fire, flood or other disaster. This is an improvement over maintaining a single population at Roosevelt where catastrophe could eliminate most or all of the habitat all at once.

Existing and on-going mitigation resulting from the 1996 Section 7 consultation for Modified Roosevelt Dam must be subtracted because it is part of the environmental baseline for this analysis of impact. The San Pedro Preserve, which was purchased by Reclamation as mitigation for the construction of Modified Roosevelt (TNC 1999, p. 28; Harris, pers. comm. 2001), contains about 403 acres of riparian habitat suitable for flycatchers (about 60 percent cottonwood/willow and about 40 percent other riparian land including the stream channel). Reclamation is pursuing acquisition of additional

mitigation properties with the remainder of the management fund established under the RPA. Reclamation estimates that it may acquire about 200 acres of additional riparian habitat (primarily cottonwood/willow woodland) with these remaining funds (Sferra, pers. comm. 2001).[61] The estimated 603 acres that will be acquired by Reclamation (403 existing plus 200 future) will be credited toward the mitigation requirement of 1,500 acres to be acquired and managed by the RHCP. The exact amount of mitigation habitat acquired by Reclamation and credited under the RHCP will be determined after acquisition is complete. Any remaining balance would be the responsibility of SRP.

***Characteristics of Acquired Riparian Habitat***

The riparian habitat to be acquired and managed will have characteristics similar to the 750 acres that could be lost at Roosevelt Lake. Those characteristics include one or more of the following criteria as provided in the Recovery Plan:

- Habitat located in proximity to Roosevelt (FWS 2002, p. 82).
- Habitat occupied by flycatchers that is currently unprotected (FWS 2002, p. 83).
- Habitat that is suitable but currently unoccupied in proximity to existing populations of flycatchers (FWS 2002, p. 83).
- Riparian land that has, or will have, the potential for similar or greater proportions of tall, dense woodland as that lost, i.e., about 60% or greater on a site-specific basis (see Subchapter III.C) and will have moist soil or patches of surface water during the nesting season (FWS 2002, p. 11).
- Proportions of tall dense riparian habitat will need to be predicted for floodplain property that is not currently suitable or occupied flycatcher habitat, but could be suitable or occupied habitat under enhanced management over the long term. For purposes of the RHCP, the acreage of floodplain land outside of the active channel that is within 5 feet of ground water will be the amount of land that is predicted to support riparian vegetation similar to the occupied flycatcher and cuckoo habitat at Roosevelt in the future unless otherwise mutually agreed by FWS and SRP (Stromberg et al. 1996; Springer et al. 1999).[62]
- Floodplain and stream hydrological conditions favorable to habitat development, i.e., subject to scouring floods, sediment deposition, periodic inundation and ground water recharge, and having little or no gradient to the stream (FWS 2002, p. 18).

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[61] If future purchases of riparian habitat total less than 200 acres, SRP will acquire the balance as part of the RHCP. If more than 200 acres is acquired, that amount will be credited toward the total mitigation in the RHCP.

[62] Depth to ground water must generally be less than 3 feet for establishment of new cottonwoods and willows (Stromberg et al. 1991; Stromberg et al. 1996). However, salt cedar can establish with depths to ground water of about 5 feet. Once established, cottonwood-willow and salt cedar habitat can be sustained by ground water within 10 feet or more of the surface. The 5-foot criterion will be evaluated using ground water levels in the late winter and early spring.

- Locations where relatively large blocks of riparian land and large patches of potential or suitable habitat 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 2002, p. 16).
- Locations where stresses to riparian land such as water diversions, grazing and recreational uses, and stream channelization are minimized (FWS 2002, p. 16).

***Acquisition of Riparian Habitat***

SRP will acquire suitable riparian habitat through purchase of fee title or acquisition of conservation easements (see next section 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 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 RHCP, part of the riparian habitat on those lands or properties would 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 RHCP, but the agency's or organization's funds can only be used for acquisition, SRP would 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 would receive up to one-third of the total acreage (50 acres) as mitigation credits for that portion of the parcel that meets the characteristics specified above. If this type of arrangement is utilized for property acquired by Reclamation, mitigation habitat will not be double-counted as credit in the RHCP.

***Conservation Easements for Mitigation Property***

Conservation easements will be placed on all riparian habitat and other land used for mitigation in order to ensure permanent protection, management, and monitoring of these lands consistent with the provisions of the RHCP. In some cases, these easements may 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. The form of such conservation easements is provided in Appendix 6. The holder of the conservation easement 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 or development of riparian habitat characteristics in perpetuity. SRP will develop a management plan for each property within one year of acquisition in coordination with FWS and, where applicable, determine the management entity. The management plan will be approved by FWS. The template for individual management plans is provided in Appendix 6. The core elements of each management plan are as follows:

- Collect baseline data on physical and biological attributes.
- Establish management goals including:
  1. Providing ecological and conservation benefits to species covered by the RHCP;
  2. Protecting and enhance a naturally functioning system to protect and maintain a dynamic mosaic of riparian vegetation communities;
  3. Reducing threats such as cowbird parasitism and fire;
  4. Building community support, coordinate with adjacent landowners; and increase public awareness of SRP's conservation goals and strategies; and
  5. Establishing other site-specific management goals for that property.

- Develop and implement strategies to achieve the management goals.
- Monitor flycatchers, cuckoos, riparian vegetation, and overall condition of the property.
- Evaluate management success.
- Identify the need for and implement adaptive management measures.
- Review annually and amend the plan if necessary.

Specific management activities on mitigation properties, involving both initial and adaptive management measures, will include:

- Eliminating adverse cattle grazing and recreation impacts by erecting and maintaining fences to protect the riparian corridor;
- Cowbird trapping if flycatchers and cowbirds are present and trapping is needed;
- Regular or periodic patrolling for trespass cattle, all-terrain vehicle (ATV) use, and potential fire hazards;
- Fencing preserve boundaries, providing signage, and meeting with neighbors and the public to increase awareness of threats to flycatchers 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 feasible;
- Protecting trees from beavers using wire baskets, if necessary; and
- Removing non-native plants that can become invasive, if feasible.

Additional management measures and details are provided in Appendix 6.

***Additional Habitat Conservation Measures***

In addition to the Habitat Acquisition and Management described above, the RHCP provides for Additional Habitat Conservation measures specifically designed to benefit flycatcher habitat, in an amount equivalent to 750 acres of riparian habitat. These additional measures would take a variety of forms, including: 1) where feasible and appropriate, acquisition and management of upland buffers to minimize threats to protected habitats; 2) stream flow augmentation through acquisition of water rights and reduced diversion or ground water pumping, with concomitant benefits to protected riparian habitat; 3) protection and management of riparian habitat at Roosevelt; and 4) other habitat conservation measures approved by FWS.

The Additional Habitat Conservation measures of habitat protection, acquisition and management of buffers, cessation/reduction of diversions or ground water pumping, and associated management will be provided in perpetuity. Permanent funding will be provided by SRP for management and monitoring of these lands and measures.

The need to acquire and manage upland buffers, as well as Additional Habitat Conservation credit for those buffers, will be agreed upon by FWS and SRP on a case-by-case basis. The primary purpose of buffers is to help insulate riparian habitat from impacts of adjacent land uses. It is anticipated that upland buffers will be less than 10 percent of the aggregate of acquired riparian habitat, based upon a preliminary investigation of properties. Conservation easements would be placed on these lands, and the lands would be addressed in a management plan as described above.

Additional Habitat Conservation credit for stream flow augmentation through acquisition of water rights and conversion to instream flows, or retirement of ground water pumping for irrigation, will be defined by the amount of historical water use retired from irrigation or converted to instream flows. Water measures would be implemented adjacent to or upstream of conserved habitat, which will benefit from flow augmentation. SRP will aggressively assert and defend all water rights that are acquired for mitigation purposes. The amount of water retired from irrigation or converted to instream flow will be measured by the quantity (in AF) of historical annual depletion of water by the irrigation or other uses divided by 2 AF per acre for the average annual depletion of

moderate to dense riparian vegetation.[63] In addition to the acreage of riparian habitat acquired as part of the mitigation for construction of Modified Roosevelt, Reclamation retired about 164 acres of irrigated land and ponds on the San Pedro Preserve, which consumed approximately 440 AF of water per year (ADWR 1991).[64] The equivalent mitigation credit is calculated to be 220 acres, which is credited toward the total of 750 acres of additional habitat conservation measures, leaving 530 acres of Additional Habitat Conservation Measures to be implemented by SRP. The focus of SRP's water rights acquisition will be along the lower San Pedro River. In addition to water use retirement on the San Pedro Preserve, The Nature Conservancy and ASARCO have retired about 500 acres of irrigated land downstream of the town of Mammoth. Combined with SRP's efforts, current estimates are that more than 2,000 AF of additional water will be made available for riparian habitat in this area.

The acreage of upland buffer or streamflow augmentation credited as mitigation would only be counted once. In other words, a single acre acquired by SRP could count as riparian habitat, or upland buffer, or for flow augmentation, but could not count in more than one category.

SRP's funding of protection and management personnel at Roosevelt will be divided by the average cost per acre of acquisition and management of riparian land along the San Pedro River to determine the number of acres of long-term Roosevelt habitat to be credited under Additional Habitat Conservation. As shown in Table IV-2, the amount of credit for these measures is estimated to be 300 acres. This Additional Habitat Conservation measure is discussed in Subchapter IV.C.3.

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[63] Dividing by 2 represents the average annual depletion of 2 AF per acre for moderate to dense riparian vegetation (Culler et al. 1982). Larger consumptive use amounts for phreatophytes are sometimes reported in the literature (Johns 1989). However, most of the larger values are for gross evapotranspiration and do not represent net values after subtracting precipitation or losses from bare soil (Id.). In other cases, additional water is "consumed" due to unusual circumstances such as aquifer recharge to develop a water table that can support riparian vegetation (Springer et al. 1999). For the RHCP, estimates of net increases in evapotranspiration of surface and underground water from growth of phreatophytes was determined to be reasonably estimated by using salvage estimates in the vicinity (Culler et al. 1982) because these are net local values of the inverse process (removing phreatophytes rather than growing them). This method is being used because models or other analytic techniques were determined to be infeasible due to lack of existing data.

[64] These figures do not include the remaining pond on the property. A small amount of water is being used in the short term to establish sacaton grass on the retired fields, which is included in the 440 AF of water per year being retired over the long term.

**Table IV-2. Roosevelt minimization and mitigation schedule (all values in estimated acres).**

| Location | Phase 1 (Pre-Permit) | | Phase 2 (Within 1.5 Years of Permit) | | Phase 3 (Within 3 Years of Permit) | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Habitat Acquisition and Management | Additional Habitat Conservation | Habitat Acquisition and Management | Additional Habitat Conservation | Habitat Acquisition and Management | Additional Habitat Conservation | Habitat Acquisition and Management | Additional Habitat Conservation |
| **Roosevelt** | | | | | | | | |
| Rockhouse | — | — | 20 | — | — | — | 20 | |
| Enforcement/Management | — | — | — | 300† | — | — | | 300 |
| **Verde** | | | | | | | | |
| Camp Verde | — | — | 90 | 30 | — | — | 90 | 30 |
| Other Sites | — | — | 30 | 10 | — | — | 30 | 10 |
| **San Pedro and Safford Valleys** | | | | | | | | |
| Reclamation Preserve | 403 | 220 | — | — | — | — | 403 | 220 |
| Reclamation Additional | | | | | 200‡ | | 200 | |
| SRP | 75 | 140 | 492 | 30 | 190 | 20 | 757 | 190 |
| **Gila or Other*** | | | remainder | remainder | remainder | remainder | | |
| Totals | 478 | 360 | 632 | 370 | 390 | 20 | 1,500 | 750 |
| Total for Phase | 838 | | 1,002 | | 410 | | 2,250 | |

Note: Estimated acres for a particular location and phase will only be implemented if feasible. If not feasible, other locations will be selected.

†Estimated at a present value of $1.35 M for enforcement time and expenses divided by $4,500/acre (average habitat acquisition and long-term management costs for San Pedro mitigation sites). The present value of $1.35 M represents a non-wasting capital account generating $78,000/year at 6 percent interest plus an additional $50,000 in first year costs.

‡SRP would be responsible for any remaining balance.

*"Remainder" means any acreage that SRP is unable to establish or acquire in the Rockhouse, Verde, or San Pedro and Safford valleys, or if management at Roosevelt is determined to be ineffective, will be acquired at other locations along the Gila or other rivers.

***Schedule for Conservation Measures***

Prior to the effective date of the permit, at least 750 acres of mitigation will be in place in the form of Habitat Acquisition and Management of occupied or potentially occupied flycatcher habitat, or other actions needed to remove threats or to benefit riparian habitat (Additional Habitat Conservation), in accordance with the above requirements. Within 1.5 years of permit issuance, SRP will ensure that another 750 acres of mitigation will be provided under one or both categories. All mitigation will be in place within 3 years of permit issuance unless otherwise agreed by FWS. A summary of the expected timing and location of mitigation is shown in Table IV-2.

***Adaptive Management For Impacts to Occupied Habitat at Roosevelt***

Adaptive management in the form of additional mitigation will be implemented by SRP if monitoring shows that the amount of occupied flycatcher habitat lost in a single year at Roosevelt below elevation 2,151 feet exceeds 750 acres. If monitoring of occupied habitat loss demonstrates more than 750 acres have been lost, or predictive modeling indicates more than 750 acres will be lost, SRP will develop and implement additional mitigation within 3 years to address impacts for up to an additional 500 acres of lost occupied habitat, for a total of 1,250 acres.[65] The additional mitigation will be comprised of Habitat Acquisition and Management (two-thirds of the additional mitigation or up to 1,000 acres) and Additional Habitat Conservation Measures (one-third of the additional mitigation or up to 500 acres). The model used to estimate occupied habitat in the RHCP (see Subchapter III.C) will be used as the predictive model unless otherwise mutually agreed by FWS and SRP. If more than 1,250 acres are lost or predicted to be lost in a single refill or drawdown, a permit amendment would be necessary.

#### b. RHCP Mitigation Measures for Yuma Clapper Rails

Habitat mitigation for Yuma clapper rails will be incorporated into the mitigation measures for flycatchers. Specifically, 5 acres of the Rockhouse riparian vegetation establishment project on the Salt arm of Roosevelt will be dedicated to creation of cattail marshes (see Subchapter IV.C.2). In addition to providing on-site mitigation for Yuma clapper rails, these marshes will benefit the flycatcher mitigation efforts at this location by providing surface water and moist soil beneath the willow and cottonwood overstory, helping to replicate conditions preferred by flycatchers and cuckoos. Conversely, Yuma clapper rails prefer marsh habitat that is bordered by dense woody vegetation (Fitzpatrick, pers. comm. 2002), which will be established at the Rockhouse site for the benefit of flycatchers and cuckoos.

Yuma clapper rails also will benefit from the riparian habitat protection and management efforts at Roosevelt funded by SRP (Subchapter IV.C.3). In particular,

[65] Predictive modeling will be used to initiate efforts to acquire additional habitat. However, the actual quantity of additional habitat to be acquired will be based on occupied habitat determined using the method described in Subchapter III.C.2. 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 750 acre threshold) within 30 days of learning of the change and take action within 90 days.

additional protection and management of the Tonto Creek Riparian Unit (TCRU) would likely help establish and maintain cattail marshes along Tonto Creek above Roosevelt.

***Adaptive Management For Impacts to Occupied Habitat at Roosevelt***

If circumstances at Roosevelt change in the future, and more than 5 acres of occupied Yuma clapper rail habitat will potentially be lost from inundation or drawdown, SRP will establish or protect up to 5 acres of additional marsh habitat near Roosevelt on a 1:1 basis for occupied habitat to be lost. If feasible, this additional habitat will be created by expansion of the Rockhouse project. If not feasible at Rockhouse, private land along Tonto Creek or locations along the lower Salt or Gila rivers suitable for marsh protection and establishment will be acquired and placed under permanent management.

### c. RHCP Mitigation Measures for Bald Eagles

In order to minimize and mitigate the potential impact on bald eagle habitat and any resulting incidental take of bald eagles, SRP will implement the following measures:

- SRP will develop a pilot project to establish riparian vegetation, including cottonwoods, at the Rockhouse site similar to a conservation measure included in the 1990 BO (see Subchapter I.H.2).
- If constructed by Reclamation, SRP will agree to maintain the Pinto nesting platform for the duration of the permit (see Subchapter I.H.2).
- Within three years of permit issuance, SRP will acquire mitigation habitat for flycatchers, much of which is comprised of cottonwoods and willows that may be or become suitable for bald eagle nesting or roosting in some locations (see Subchapters IV.C.4 and IV.C.7).
- SRP will develop a coordinated plan with AGFD and FWS to rescue any bald eagles, bald eagle eggs, or nestlings at Roosevelt Lake. The plan will be complete within a year of permit issuance, implementation will begin within 2 years of permit issuance, and the plan will last for the duration of the permit.

In addition, SRP will continue the measures it currently engages in as part of the Southwest Bald Eagle Management Committee; these measures help manage and improve bald eagle productivity in Arizona. Those measures would include:

1. Annual funding of a pair of seasonal bald eagle nestwatchers and proportional program coordination through an existing Arizona Bald Eagle Nestwatch Program. Daily monitors throughout the breeding season to protect individual nest sites and nesting bald eagles, and to educate the public.
2. Each year, SRP will assist with three monthly Occupancy and Reproduction Assessment and nest search helicopter events and provide funding for coordination and attendance by existing bald eagle management personnel. An event may take more than one day of flying due to bad weather or other factors that would limit the length it would take to view the entire population. These flights help document productivity, can lead to the discovery of new territories and alternate nests in known territories, and guide implementation of management measures that can protect bald eagles and improve productivity.

3. SRP also will provide a maximum of three annual helicopter flights for rescue or other management efforts where helicopters are necessary for completion of the task and proportional funding for personnel. SRP will continue these measures for the life of the permit provided there is an Arizona bald eagle program in which SRP is able to participate. SRP shall not be required to create a bald eagle program if the current program is dismantled.

As a potential additional habitat conservation measure, SRP agrees to pursue, in good faith, development and implementation of a riparian management plan with Fort McDowell Yavapai Nation to improve the establishment, growth, regeneration, and management of bald eagle nest trees and associated riparian plants that protect and surround bald eagle nest trees through fencing, improved grazing management, tree planting, irrigation, recreation management, signs, educational programs, or beaver protection. This measure is discussed in more detail in Subchapter IV.C.5.

Collectively, and over time, these measures are expected to mitigate for take of bald eagles due to dam operations at Roosevelt. Additionally, the results from these efforts are sometimes not obvious. For example, it is difficult, if not impossible to directly associate public education with increased productivity. Yet, experience has demonstrated that over time, these management efforts have improved bald eagle productivity and the status of the bird in Arizona. Additionally, management efforts on the Fort McDowell Indian Reservation may not persist for the life of the project due to matters that are beyond SRP's control. However, efforts that occur for only a few short years or longer, may have a positive effect for many years to come. For example, a tree that is established due to management efforts in 2005 may take over a decade to develop, then be used by nesting bald eagles for several decades or longer.

Adaptive management is not provided for bald eagles because the mitigation measures described above address all potential changes in circumstances as a result of reservoir operations.

#### d. RHCP Mitigation Measures for Cuckoos

Separate habitat mitigation for the cuckoo is not anticipated, because on-site and off-site mitigation for flycatchers and bald eagles also will benefit cuckoos. Habitat requirements for cuckoos, bald eagles, and flycatchers overlap to a large degree. Cuckoos and flycatchers are the most similar in their habitat use. Both require blocks of dense, tall riparian vegetation, including willows and cottonwoods, for foraging and nesting; and habitat must be relatively close to open water.[66] Flycatchers tend to use nest sites that are closer to water than cuckoos. Cuckoos appear generally to require larger blocks of suitable habitat and do not nest as closely together as flycatchers. Cuckoos need at least 10-acre blocks of habitat for nesting and foraging, and generally do not use narrow strips of habitat. Cuckoo and bald eagle habitat requirements also overlap somewhat. Bald eagles use mature cottonwood trees for nesting and perching. Cuckoos

[66] Cuckoos also occasionally nest in tall dense mesquite near water but generally not in homogenous salt cedar.

also may use cottonwoods for nesting, and may require them for foraging. Cuckoos also may benefit from closure of bald eagle nesting areas to recreational use during the breeding season implemented under the Reclamation BO for construction of Modified Roosevelt Dam.

Because the mitigation measures for flycatchers and bald eagles are intended to support cuckoos as well, the following considerations are included in the selection of mitigation sites in the RHCP:

- Cuckoos benefit from the creation or protection of riparian areas composed of dense cottonwood/willow woodlands.
- For cuckoos, cottonwood/willow woodlands should be at least 10 acres in size.
- Cottonwood/willow 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 young riparian vegetation patches. Young riparian habitat has high invertebrate production and is therefore preferred by cuckoos for foraging.

As discussed in Subchapters IV.C.2 to IV.C.7, SRP is undertaking extensive minimization and mitigation measures to offset impacts on flycatcher habitat at Roosevelt. Those measures will likewise minimize and mitigate impacts from future reservoir operations on cuckoo habitat. In summary, creation of cottonwood/willow habitat on the Salt arm of Roosevelt, protection and management of riparian habitat at Roosevelt, and acquisition of riparian habitat, water rights, and buffers on the Verde, San Pedro, Gila or other rivers also will benefit cuckoos.

In addition, existing and on-going mitigation resulting from the construction of Modified Roosevelt Dam forms part of the environmental baseline for the analysis of impact on cuckoo habitat from the Full Operation alternative. The San Pedro Preserve, which was purchased by Reclamation as mitigation for the construction of Modified Roosevelt, contains about 232 acres of existing cottonwood/willow habitat and Reclamation will acquire additional mitigation properties with the remainder of the management fund established under the RPA. Retirement of ground water pumping on the San Pedro Preserve provides 220 acres of mitigation credit for habitat suitable for cuckoos. In addition, as discussed under Subchapter IV.C.1, Reclamation estimates that it is likely to acquire about 200 acres of additional cottonwood/willow habitat and other riparian vegetation with funds remaining to be spent on mitigation for Modified Roosevelt, much of which would be of benefit to cuckoos. Combined, the habitat mitigation provided by the San Pedro Preserve provides about 652 acres of mitigation credit for cuckoos.

Because comprehensive cuckoo surveys have not been completed at Roosevelt, the impact analysis in the RHCP is based on potentially suitable habitat for cuckoos at Roosevelt Lake, i.e., 313 acres. As with flycatchers, mitigation measures for the 313 acres will be 2:1 in Habitat Acquisition and Management and 1:1 in Additional Habitat Conservation. The Additional Habitat Conservation measures for cuckoos will be satisfied by the same type of measures implemented for flycatchers. The

2:1 mitigation requirement for riparian habitat (626 acres) will be determined by measuring the patches of cottonwood/willow, mixed riparian vegetation, or other suitable cuckoo habitat on the mitigation properties purchased as part of the flycatcher program.[67] If additional land is required to meet the 626-acre minimum, SRP will acquire that property and manage it in perpetuity. In the long term, an accounting of habitat actually occupied at Roosevelt and suitable and occupied habitat on mitigation properties will be conducted as part of the implementation of the RHCP (see Subchapter IV.E). If the acreage of occupied habitat at Roosevelt exceeds 313 acres, adaptive management will be employed as described below.

***Adaptive Management For Impacts to Occupied Habitat at Roosevelt***

Over time, as vegetation communities change at Roosevelt Lake, the acreage of cuckoo habitat affected is likely to change as well. Also, there is substantial uncertainty over the amount of currently occupied habitat at Roosevelt. Thus, adaptive management will be implemented if the acreage of occupied cuckoo habitat to be lost at Roosevelt from inundation or drying exceeds the 313 acres mitigated initially. SRP will implement additional mitigation within 3 years for up to an additional 800 acres of lost occupied cuckoo habitat. The additional impact of up to 800 acres will be mitigated by Habitat Acquisition and Management in perpetuity of additional acres of riparian habitat at a 2:1 ratio (up to 1,600 acres of additional habitat) and implementing Additional Habitat Conservation measures at a 1:1 ratio (up to the equivalent of 800 acres of riparian habitat). Riparian habitat acquired for cuckoos will have, or have the potential to have, vegetation characteristics like the habitat occupied by cuckoos at Roosevelt. To reiterate, flycatcher mitigation measures will be credited toward cuckoo mitigation to the extent that those measures meet the cuckoo mitigation criteria. If more than 1,113 (313 + 800) acres are lost, a permit amendment would be required.

#### e. Summary of RHCP Minimization and Mitigation Measures

Table IV-3 summarizes the minimization and mitigation sites proposed for the RHCP 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 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). Those sites would minimize and mitigate for the potential take of flycatchers, bald eagles, and yellow-billed cuckoos, and further the conservation and recovery of these species. The high priority areas of minimization and mitigation measures proposed for implementation as part of the RHCP are shown in Figure IV-1 and described below.

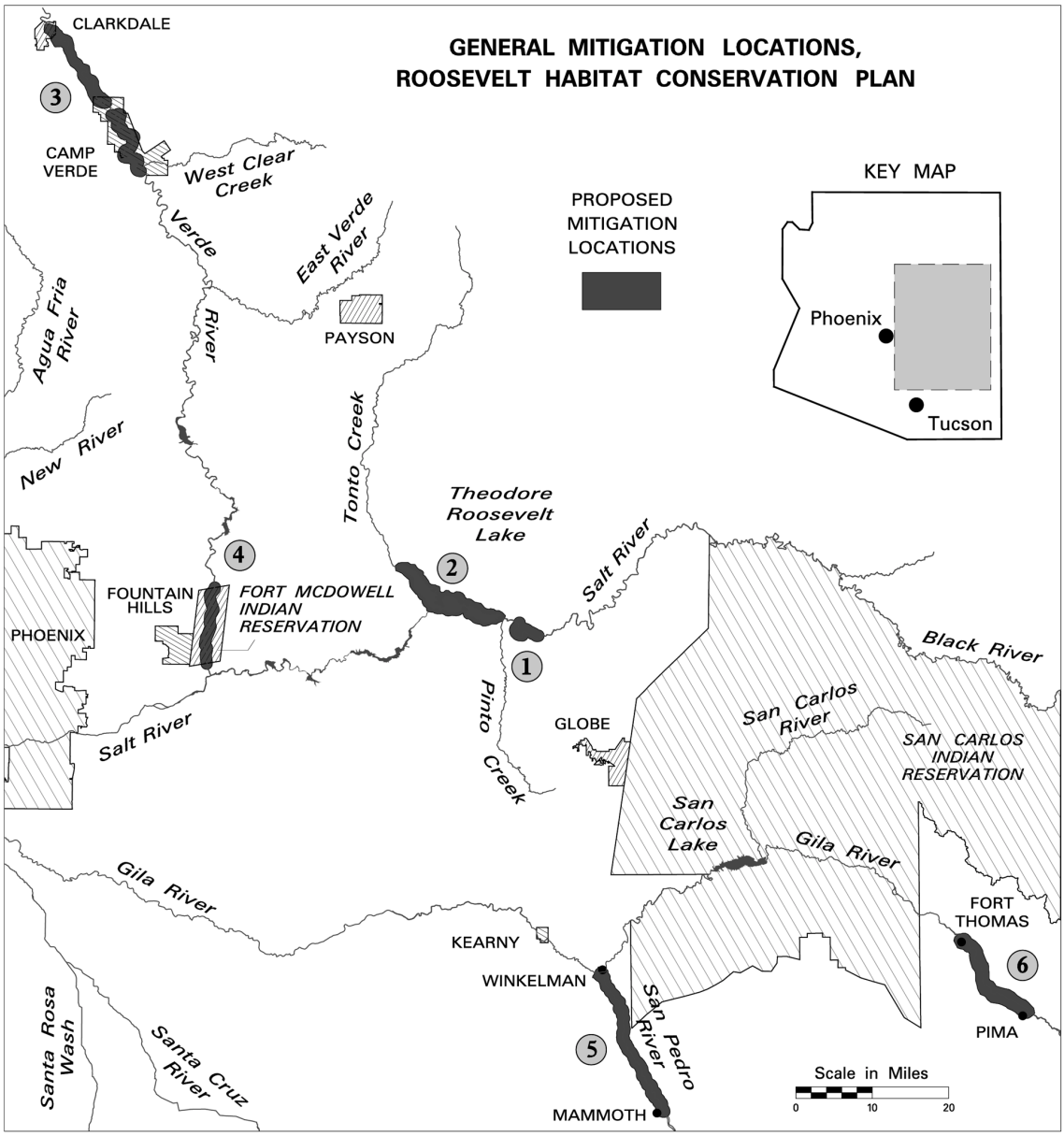
[67] Other suitable cuckoo habitat includes tall dense mesquite or mesquite/hackberry thickets near water.

**Table IV-3. Existing and proposed minimization and mitigation sites.**

| Site | Acreage | Comment |
|---|---|---|
| Salt Arm (Rockhouse) | About 20 acres | • High priority site<br>• Pilot project of 20 acres will be established and evaluated<br>• Project will be expanded up to 75 acres if feasible and needed for adaptive management |
| Roosevelt | About 300 acres† | • High priority site<br>• Management and protection of existing riparian habitat at Roosevelt |
| Verde Valley | Up to 160 acres† | • High priority site for acquisition and management of riparian habitat<br>• Acquisition of buffer land and water rights in proximity to mitigation lands<br>• There is a high probability that up to 160 acres of habitat can be acquired out of the 290 parcels and 1,900 acres of priority acquisitions identified by TNC (Fichtel and Marshall 1999) |
| San Pedro and Safford Valleys | Up to about 950 acres by SRP† | • High priority sites for acquisition and management of riparian habitat<br>• Acquisition of buffer land and water rights in proximity to off-site mitigation lands<br>• There is a high probability that up to 950 acres of habitat can be acquired out of the 125 parcels and over 2,500 acres of priority acquisitions identified by TNC (Fichtel and Marshall 1999)<br>• SRP has already acquired one parcel with 130 mitigation acres and another parcel of 95 mitigation acres is under contract to close before the end of 2002 |
| | About 623 acres by Reclamation† | • Riparian habitat already acquired (403 acres of riparian habitat and 220 acres of other habitat conservation measures) |
| | About 200 acres by Reclamation† | • Riparian habitat to be acquired. If less than 200 acres is acquired by Reclamation, the balance will be SRP's responsibility. |
| Elsewhere | Balance of habitat and other measures needed to reach 2,250 acres | • Acquisition and management or riparian habitat in other areas in central Arizona will depend on whether sufficient mitigation habitat is obtained in the sites listed above.<br>• Acquisition of water right and buffer land to benefit off-site mitigation lands<br>• 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 TNC (Fichtel and Marshall 1999) |

†Additional riparian habitat would be protected if not feasible at other sites.

**Figure IV-1. Locations of High Priority Proposed Minimization and Mitigation Measures (not in order of priority).**




**<u>Mitigation and Minimization Locations</u>**

1 — Habitat Establishment on the Salt Arm of Roosevelt (Rockhouse Pilot Project)
2 — Riparian Habitat Protection and Management at Roosevelt
3 — Habitat Acquisition and Management in the Verde Valley
4 — Restoration of Riparian Habitat on the Fort McDowell Indian Reservation
5 — Habitat Acquisition and Management in the Lower San Pedro Valley
6 — Habitat Acquisition and Management in the Safford Valley

### *2. Establishment of Riparian Habitat on the Salt Arm of Roosevelt*

As noted in Subchapter V.N.5, there is no known existing riparian habitat used by flycatchers along Tonto Creek or the Salt River above the maximum storage levels in the reservoir, and opportunities to establish or restore riparian habitat are limited. However, SRP will develop a 20-acre pilot project to establish and manage riparian vegetation suitable for the listed and candidate species encompassed by the RHCP at one or more sites on the Salt arm of Roosevelt just above the point of inflow of the Salt River. If the pilot project is successful, additional riparian vegetation will be established and managed in this area if feasible. If the pilot project is not successful, SRP will acquire and manage riparian habitat at alternative locations.[68] This component of the RHCP is addressed in more detail below.

The establishment of riparian vegetation on the Salt arm of Roosevelt will complement and add to habitat that will be available in most years at Roosevelt for flycatchers, Yuma clapper rails, cuckoos, and bald eagles. In years when Roosevelt is full, Salt arm riparian vegetation will provide some habitat for these species in the Roosevelt area. The 20-acre site is large enough to potentially provide nesting and foraging perches for one bald eagle breeding area, breeding habitat for about 6 flycatcher territories and one to two cuckoo territories, and marsh habitat for several Yuma clapper rail territories.

#### a. Description of Sites

SRP evaluated three sites for potential establishment of riparian vegetation on the Salt arm of Roosevelt (Figure IV-2). All three sites are located at or above elevation 2,151 along the Salt River near the inflow to Roosevelt. SRP conducted field investigations in December 2001 to evaluate the soils, topography and water conveyance options for each of the three sites. From the preliminary investigations, the Rockhouse Farm ("Rockhouse") site has been selected as the preferred location for the pilot project. As discussed below, if unexpected problems develop with the Rockhouse site, or if it is later determined that the pilot project can be expanded and additional habitat is needed for adaptive management, one of the other sites will be developed if feasible.

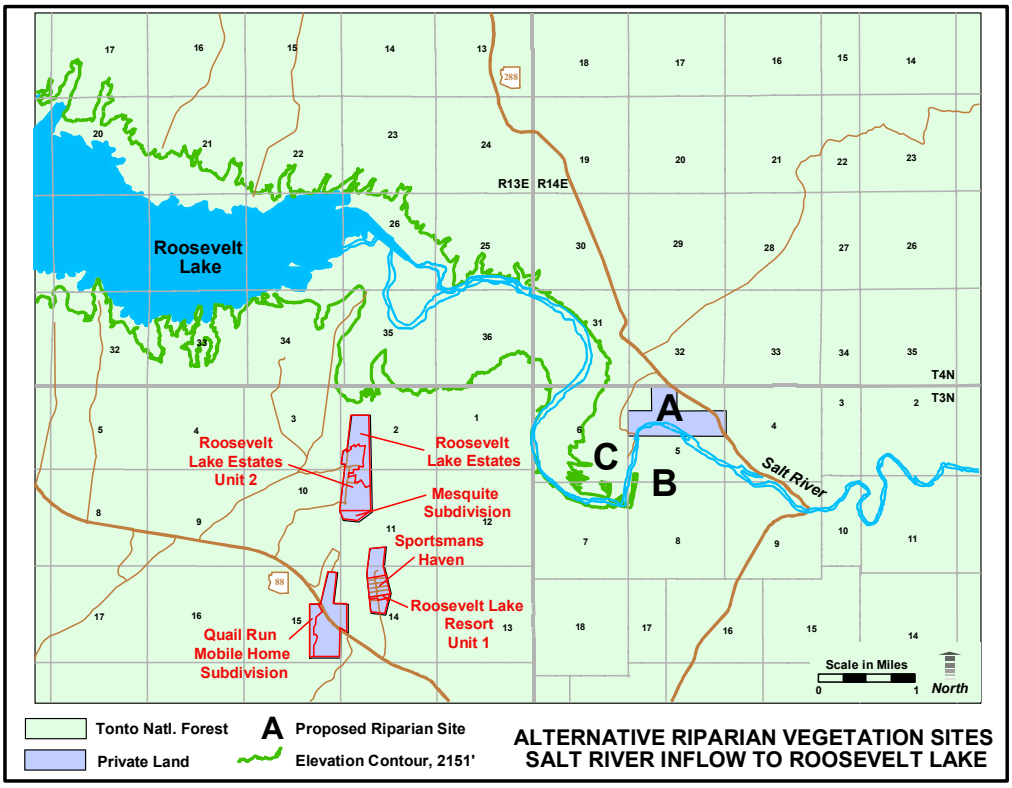
The Rockhouse site (Location A on Figure IV-2) involves fallow agricultural fields on land owned in fee by Reclamation.[69] These fallow fields are nearly level with 2 to 6 feet of sandy loam overlying cobbly sandy alluvium. Depth to the cobbly alluvium is shallowest near the Salt River and generally increases with distance from the river. The soil profile above the cobbles is slightly calcareous, nonsaline and nonsodic. Existing vegetation is comprised of scattered scrubby mesquite with a sparse understory of annual plants. Depth to ground water ranges from about 20 feet near the Salt River to about 30 feet near the northern boundary of the property. The Rockhouse site to be used in the

[68] The success criteria for the pilot project are described in Subchapter IV.C.2.c. The alternative locations are described in Subchapter IV.C.2.d.

[69] Although land ownership will remain with Reclamation, SRP will provide the funding to implement and manage the riparian establishment project on those lands including rehabilitation of the irrigation system and planting of trees.

pilot project can receive water from the Salt River via an old ditch that historically diverted water from an existing diversion dam across the Salt River.

**Figure IV-2. Minimization and Mitigation Sites on the Salt Arm of Roosevelt.**




The Power Canal site (Location B on Figure IV-2) is on floodplain land south of the Salt River near the other two sites. This area is comprised of gently sloping to level river terraces with an overall slope of 0 to 3 percent. Depth to cobbly alluvium ranges from 3 to 9+ feet being shallowest near the Salt River and generally increasing with distance from the river. The soil profile above the cobbly alluvium is slightly calcareous, nonsaline and nonsodic loamy sands to sandy loams. Existing vegetation is dominated by moderately dense mesquite with an understory of annuals. Depth to ground water is estimated to range from about 15 feet near the Salt River to about 25 feet at higher elevations within the site. The Power Canal site can receive water from the Salt River via rehabilitation of an abandoned power canal completed in the early 1900s as a part of the initial construction of Roosevelt Dam, or via a new ditch that would be constructed parallel to the old canal. Diversion of water from the Salt River would utilize the existing diversion dam across the Salt River (see Figure I-7).

The Meddler Point site (Location C on Figure IV-2) encompasses land on the floodplain at the southwest end of Meddler Point. This site is comprised of river terrace and sand bar deposits dissected by inactive river channels. Overall slope of the land is 0 to 4 percent. The alluvium in this area is generally coarse-textured with 0 to 2 feet of

medium to coarse sand overlying cobbly alluvium. Existing vegetation is dominated by moderately dense mesquite with an understory of seep willow and annual plants. Depth to ground water is estimated to range from about 15 feet near the Salt River to about 25 feet at higher elevations within the site. A new diversion and ditch from the Salt River would have to be constructed in order to deliver water from the Salt River to the Meddler Point site.

**b. Pilot Project**

The Rockhouse site was selected for the pilot project on the basis of having a combination of soils, topography, and feasibility of water delivery best suited for the establishment of willows and cottonwoods. The Rockhouse site also has limited access, which reduces potential impacts from recreational use or other disturbances. In addition, because it is elevated about 20 feet or more above the level of the Salt River, it is the least likely of the three sites to be scoured by flood flows. The planning and permitting process for implementation of the pilot project was initiated in December 2001 and is scheduled for operation by the end of January 2004 provided that permitting of the project is complete. As necessary, permits will be obtained from the Corps of Engineers, Forest Service, and Bureau of Reclamation. Construction of the irrigation facilities and maintenance road will take approximately one month.

The pilot project will be directed toward establishment of riparian habitat composed primarily of willow with some cottonwood. Patches of cattail marsh will be created at several locations. Removal of existing mesquite will be minimized. The size of the pilot project, about 20 acres, was selected because existing water rights for this land can serve at least this amount of land and 10 to 20 acres is approximately the minimum patch size needed by cuckoos.

The general engineering approach to provide water to the pilot project will be to rehabilitate the existing diversion and conveyance facilities, including lining the ditch with concrete from the diversion dam to the edge of the pilot project. The dimensions of the ditch will be: 1) depth of 3.5 feet; 2) bottom width of 2 feet; 3) sideslopes of 1:1; and 4) top width of 10 feet. A concrete box will be constructed at the head of the ditch to serve as a desilting basin and to return flow to the river as necessary. The box will be about 8 feet wide, 30 feet long, and 9 feet deep, and will be covered with a lockable grate for safety. Return of water to the river would be through a drop structure (to function as a fish barrier) and a buried 30-inch corrugated metal pipe. After leaving the box, water in the ditch would have a maximum depth of 3 feet.

A gravel road will be constructed along the ditch in order to provide construction access, to maintain the ditch (e.g., remove sediment), and to access the pilot project. The width of the maintenance road will be 10 feet. An additional 10 feet beside the maintenance road will be used for disposal of sediment removed from the ditch. Including the ditch, the total right-of-way requirement will be 35 feet. The road and ditch will be fenced with barbed wire with signs placed at frequent intervals warning of potential danger from the ditch. Two locked gates will be installed on the road, one at the entrance near the existing diversion dam and one at the boundary of the Reclamation fee land. Signs explaining the purpose of the project and the reason for closure will be

placed at each gate. Following construction, use of the road for operation and maintenance of the project is expected to average two round trips per day.

Additional public safety measures such as pipe barriers to prevent vehicle access and high-security fencing will be implemented by SRP if necessary. Safety is an especially high priority along the ditch because of heavy recreation use in the area.

On the project area, a broad, shallow, unlined main distribution ditch will be constructed as part of the water delivery facilities. This broad ditch will recharge the water table and also will serve as a moat around the project area, which may discourage intrusion from people and animals, including cats, dogs, and herbivores. The pilot project area will be fenced and signed to minimize access and disturbance. Turnouts from the main distribution ditch will be used to flood the re-established riparian vegetation.

**Vegetation Establishment.** The goal for vegetation establishment on the 20-acre Rockhouse pilot project site would be to provide a stand of dense riparian vegetation composed mainly of Goodding willows and Fremont cottonwoods along with a cattail marsh. As currently proposed, the pilot project at the Rockhouse site would be implemented over two growing seasons. In the early spring of 2004, at least one-half of the riparian vegetation would be seeded and planted using the following vegetation establishment plan. The remainder of the vegetation on the project would be established in 2005.

Prior to construction, the Rockhouse site and along the ditch from the existing diversion dam would be cleared and grubbed, but mesquite will be left where possible. The Rockhouse site would be graded to accommodate the flood irrigation system, and to allow for even flow of irrigation water throughout the site. When the Rockhouse site is graded, it will be left in a roughened condition so that vegetation can benefit from protected depressions. Also, a 5-acre area within the site will be excavated as a shallow pond to establish a cattail marsh.

The strategy for riparian vegetation establishment at the Rockhouse site would be to encourage a dense stand of vegetation over most of the site by planting cottonwood and willow cuttings. To accomplish this strategy, a windbreak would be established to protect seedlings within the 10 to 20 acres to be planted in 2004. Cottonwood and willow poles would be placed around the north, south, and western edges of the irrigated area. Poles would range from ½ to 2 inches in diameter, and range from 2 to 5 feet in length. These poles would be placed in two rows at approximately 10-foot intervals. Rooted container stock grown at a qualified nursery and hardened off before planting may be substituted for poles if SRP determines this approach to be more cost-effective than pole planting.

Inside of the windbreak, mostly willows and some cottonwoods would be planted in late winter (February or early March). Cottonwood and willow cuttings and/or tubelings would be planted on approximate 8-foot centers, at a density of about 680 plants per acre. Cottonwood and willow cuttings/tubelings would be less than 1-inch diameter, and about 2 to 3 feet long. Cottonwood and willow cuttings/tubelings for planting and poles for the windbreak would be harvested from branches of live trees at Roosevelt below elevation

2,136 in areas not used by flycatchers for nesting or from sites as close to Roosevelt as possible.

The shallow pond will be planted with cattails. Some rootstock will be used to ensure establishment and seed will be broadcast to encourage high density of cattails.

**Monitoring and Management.** The management of the Rockhouse site will involve frequent rotational flood irrigation, including maintenance of irrigation canals and feeder ditches. Irrigation frequency will be determined using soil moisture probes or sensors. Monitoring of vegetation and populations of covered species are described in the next section and in Subchapter IV.E.

It is anticipated that salt cedar may colonize the site. Colonization by this species is probably inevitable but control measures for salt cedar are not proposed because flycatchers use riparian thickets with salt cedar, and salt cedar would contribute to the vegetation density preferred for flycatcher nesting. Planting cuttings/tubelings of cottonwood and willow will provide these species with a competitive advantage over salt cedar to form the overstory vegetation at the Rockhouse site. If flycatchers and cowbirds are present, cowbirds will be trapped at the Rockhouse site unless FWS agrees that it is not appropriate.

#### c. Evaluation of the Pilot Project

The pilot project will be determined successful if woody riparian vegetation and cattail marsh within the project area become established within 5 years with the potential to meet the criteria for desirable habitat as the vegetation grows. As the trees age, they also could provide roosting and nesting habitat for bald eagles.

The success of the Rockhouse mitigation site will be evaluated annually to determine the success of habitat creation and use by flycatchers, cuckoos, and Yuma clapper rails (Subchapter IV.E.). During annual monitoring meetings, FWS, Reclamation, and SRP will determine whether to maintain, or possibly expand, the Rockhouse site. If the pilot project is successful and expansion is determined to be feasible, the project may be expanded up to a maximum of 75 acres if additional mitigation is required in the future under adaptive management.[70] The additional land to be used for riparian vegetation establishment would be selected at the Rockhouse site or at the Power Canal site (Figure IV-2). The selection of additional land to be used for riparian vegetation establishment would be based on information learned during the pilot project and the feasibility of delivering water to the site.[71] If the pilot project does not meet the objectives, SRP will acquire and manage riparian habitat at other location(s), as described in the next subchapter and irrigation of the Rockhouse site would be discontinued.

If additional land is developed as habitat along the Salt arm of Roosevelt, SRP will ensure that sufficient water rights are available to irrigate the lands and will dedicate

[70] Investigation of additional sites near Roosevelt indicated that restoration of more than 75 acres is not feasible (see Subchapter V.N.5).

[71] The Meddler Point site was eliminated from further consideration because of poor soils and difficulty in delivering water to the site.

those water rights to the project. The additional land would be planted using the techniques developed during the pilot project and would be protected with fencing from intrusion by people and animals.

#### d. Habitat Acquisition and Management at Alternative Locations

As described above, if the objective of establishing and managing riparian vegetation that could serve as potential breeding and nesting habitat for flycatchers could not be achieved on the Salt arm of Roosevelt, SRP will acquire and manage riparian habitat at other location(s). The specific alternative location(s) will be selected in consultation with FWS. The first priority for alternative sites will be to augment mitigation lands along Pinto Creek or along the Verde, San Pedro, Gila, or other rivers where SRP also will be acquiring and managing habitat as part of the RHCP (see below). Areas along the Salt River or Tonto Creek, or their tributaries upstream from Roosevelt also will be researched for potential acquisition and restoration sites. The quantity of habitat that will be acquired at the alternative location(s) will be 20 acres.

### *3. Riparian Habitat Protection and Management at Roosevelt*

Recent observations indicate that there would be a major benefit from additional management and protection efforts for riparian habitat in the vicinity of Roosevelt (e.g., Woods, pers. comm. 2001). Within 1.5 years of ITP issuance, SRP will negotiate a memorandum of understanding with the Tonto National Forest to provide funding for a Forest Protection Officer (FPO). The FPO will be responsible for habitat protection, enhancement, and management activities at Roosevelt in support of the RHCP. These activities by the FPO will be in addition to, not in substitution for, the Forest Service's efforts under the ESA given current authorities, guidance, and funding. The FPO funded by SRP will be full-time and will be equipped with a vehicle and appropriate equipment to patrol Roosevelt. The FPO will have the authority to issue citations. In terms of habitat protection, efforts will be focused on patrolling flycatcher, Yuma clapper rail, cuckoo, and bald eagle habitat at and near Roosevelt to ensure that recreation activities do not adversely impact habitat, or disturb the listed species during breeding and nesting. In addition, the habitat will be patrolled in order to protect riparian vegetation from cattle trespass, fire, or other damage. Other responsibilities will include: 1) fence maintenance including livestock exclusion fencing established by Reclamation and the Tonto National Forest as part of the Tonto Creek Riparian Unit (TCRU) during mitigation for the impacts of construction of Modified Roosevelt (see Subchapter V.N.5) as well as removal of trespass livestock from the TCRU or Roosevelt habitat; 2) maintenance of signage relative to seasonal closure areas; and 3) public education regarding endangered species management at Roosevelt. If determined by SRP, FWS and the Forest Service to be potentially beneficial, the FPO also may be available to plant or encourage riparian vegetation along the Salt River and Tonto Creek inflows to Roosevelt near elevation 2,151 in order to promote the existence of habitat when the lake fills to capacity.

If FWS determines that the habitat protection and management program is not effective, it may request SRP to devote remaining funds to habitat acquisition or other habitat conservation measures.

### *4. Habitat Acquisition and Management in the Verde Valley*

SRP intends to acquire and manage, or provide Additional Habitat Conservation measures for, up to 160 acres of riparian habitat in the Verde Valley as part of the mitigation measures in the RHCP (see Figure IV-1, Location 3).[72] The portion of the Verde Valley near the town of Camp Verde was selected as the focus of conservation in this area because the largest known flycatcher population on the Verde River is located in this area. However, if habitat conservation in this area were determined to be infeasible, riparian habitat in other portions of the Verde Valley would be evaluated for acquisition and management. If insufficient habitat is found in the Verde Valley, the balance of the acreage would be obtained along the San Pedro and Gila rivers or elsewhere in central Arizona as described in later subchapters.

#### a. 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 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 begins to meander through the Verde Valley for approximately 43 miles until it re-enters a confined canyon about 10 miles below the town of Camp Verde (Fichtel and Marshall 1999). Habitat fragmentation, water diversion, trampling due to recreational and livestock use of the river, and development pressures threaten the biological integrity of the river (Fichtel and Marshall 1999).

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 Southwestern Willow 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.

[72] Depending on the feasibility of establishment of riparian vegetation on the Salt arm of Roosevelt, up to 75 acres of additional riparian habitat may be protected along the Verde.

**Biological Significance of the Verde River.** The perennial sections of the Verde River have been recognized as biologically significant by several groups and government entities. Resulting from its assessment of the Verde River as a biologically significant area, The Nature Conservancy (TNC) has created a program to develop conservation goals and strategies that include consideration of the presence of flycatchers, bald eagles, and yellow-billed 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 the North American habitats. "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 current EPA efforts to protect ecosystems. This project extends from Sullivan Lake to Horseshoe Reservoir, covering 125 miles of the Verde River. The goals listed in the ADID project document 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 document were:
1) sedimentation from sand and gravel mining and hydrologic modifications problems;
2) polluted runoff from abandoned hard-rock mines; 3) bank stabilization; and
4) flooding (EPA 1995). The EPA recently awarded a grant to the Verde Natural Resource Conservation District to develop an outreach program for building awareness about ecological values of the river and identifying opportunities for conservation (Fichtel and Marshall 1999).

**Flycatchers on the Verde River.** In 1997, FWS designated critical habitat for the flycatcher along approximately 90 miles of the Verde River above Horseshoe Lake, including Tavasci Marsh and Ister Flat (FWS 1997a; 1997b), although the designation for critical habitat has currently been set aside (FWS 2001a).

Table IV-4 lists the results of surveys for flycatchers for the years 1993 through 2000 on the Verde River for sites that have been occupied in one or more years. From 1998 to 2000, the only site known to be occupied during the breeding season by flycatchers is at Camp Verde in the Verde Valley (Paradzick et al. 2000), although there is anecdotal evidence of nesting on private property that was not surveyed (Fichtel and Marshall 1999). In 2001, the Camp Verde site was not surveyed and no other surveyed site had resident flycatchers. In June 2002, five territories and at least two nesting pairs were found at the upper end of Horseshoe Reservoir (see Subchapter II.B.1.h).

**Table IV-4. Number of flycatcher territories on the Verde River for the years 1993-2001.**

| Site Name | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|
| Ister Flat | 1 | 0 | † | | 2 | 0 | 0 | 0 | 0 |
| Camp Verde | | 7 | | 6 | 10 | 7 | 6 | 5 | |
| Mescal Gulch | 1 | | 0 | | | | | | 0 |
| Tavasci Marsh | 0 | | 0 | 2 | 0 | | 0 | | 0 |
| Tuzigoot Bridge | 1 | | 2 | 0 | 0 | 0 | 0 | | 0 |

†Blank means that the area was not surveyed in that year.

*Source:* Arizona Game and Fish Department annual report for 2000 (Appendix L in Paradzick et al. 2001; Smith et al. 2002.)

The Camp Verde flycatcher breeding site lies on a broad floodplain, approximately 635 feet in width. The elevation at the site is approximately 3,090 feet. There are marshy areas with cattails, discrete patches of Fremont cottonwood/Goodding's willow galleries with a salt cedar understory, and dense monotypic salt cedar patches (Fichtel and Marshall 1999). An irrigation ditch runs across one side of the site. This ditch is periodically flooded by beavers damming the ditch, which results in occasional inundation along and below the ditch (Fichtel and Marshall 1999). Threats to the flycatcher breeding site include public trails that crisscross the property, deer browsing and elk grazing in the area, habitat fragmentation and loss surrounding the breeding site, and brown-headed cowbird parasitism.

Tavasci Marsh, where flycatchers have previously nested, is the remnant of an old oxbow of the Verde River at the south end of Pecks Lake. The marsh is dominated by mature Goodding's willows that are approximately 50 feet tall (FWS 2001c, p. 25). Tavasci Marsh is one of the few naturally occurring marshes in the area. The marsh is now basically a monoculture of cattails since beaver inundated the riparian trees in the area (Castillo, pers. comm. 2001). The marsh consists of palustrine emergent wetlands, wet meadows, and riparian scrub woodlands. Water sources include a ditch that supplies water at the eastern limit of the marsh from an outlet at Pecks Lake and Shea Springs, which is located at the base of cliffs on the northeast margin of the marsh (SWCA 2000b).

Flycatchers were observed nesting near the Tuzigoot Bridge until 1995. Anecdotal reports of singing flycatchers were reported at the bridge in 2000, but the flycatchers were not found nesting there. The area is marshy, with coyote willow, salt cedar, and cottonwoods dominating. A flood in 1993 destroyed the riparian vegetation, although thick regrowth has occurred and trees are now approximately 10 to 20 feet tall. The Verde River Greenway begins at the Tuzigoot Bridge and a trail originates there (Castillo, pers. comm. 2001). When possible, parcels are being acquired to add to the Greenway.

### b. Verde Valley Mitigation Measures

SRP intends to acquire and manage, or provide Additional Habitat Conservation measures for up to 160 acres of riparian habitat along the Verde River near Camp Verde in the area shown on Figure IV-1. Figure IV-3 is a photograph of riparian habitat on one parcel of land being considered by SRP for purchase, including the livestock that would be removed to benefit the habitat. The exact quantity and timing of conservation at this location will depend on the feasibility of acquiring desirable lands in this area. Preliminary investigations indicate that there are a number of constraints to habitat conservation in this area including uncertainties with land title, small parcel size, reluctant sellers, and potential encroachment by urban development. However, SRP will use its best efforts to establish a habitat preserve in this location. SRP has been researching properties, contacting and negotiating with landowners, evaluating titles, and conducting appraisals since June 2001.

**Figure IV-3. Verde Valley Riparian Habitat Being Considered by SRP.**

Photo courtesy of Susan Sferra.

To the extent that habitat can be acquired in this area, SRP also will provide management for that habitat in perpetuity. Management funding will include initial construction or improvement, and long-term maintenance of fencing to prevent access by people and livestock. Management funding also may include planting of riparian

vegetation, provision of security patrols, and other efforts needed to protect and manage the habitat as specified in the management plan for each property (see Appendix 6). If flycatchers and cowbirds are present, cowbirds will be trapped at the Verde sites unless the trapping is being performed by another entity or FWS agrees that it is not appropriate.

If SRP's efforts to conserve up to 160 acres of desirable riparian habitat in the Verde Valley are unsuccessful, SRP will pursue equivalent mitigation measures elsewhere. SRP will acquire and manage habitat at other location(s) that would be selected in consultation with FWS. The first priority for alternative sites would be to augment mitigation lands along the San Pedro or other rivers where SRP is conserving habitat as part of the RHCP (see below). The quantity of habitat acquired or additional mitigation implemented at alternative sites will be up to 160 acres, i.e., the balance of the goal in the Verde Valley.

#### *5. Restoration of Riparian Habitat on the Fort McDowell Indian Reservation*

In August 2001, SRP began discussions with the Fort McDowell Yavapai Nation (FMYN) regarding a possible joint venture to conserve habitat along the Verde River on the Fort McDowell Indian Reservation just above the confluence with the Salt River (see Figure IV-1, Location 4). This reach of the Verde River was selected for restoration efforts because it is relatively close to Roosevelt, and it has a broad floodplain with relatively low gradient that is capable of supporting patches of cottonwood and willow that could be used as habitat by bald eagles and possibly flycatchers or cuckoos.

FMYN is interested in restoring riparian habitat on the Reservation as part of maintaining its cultural and environmental heritage (Ethelbah, pers. comm. 2001). If a joint venture is established, restoration of habitat likely will be combined with protection of adjacent areas that could be used by Community members for compatible recreation and environmental education (Id.).

##### a. Description of the Fort McDowell Riparian Habitat

About 10 miles of the lower Verde River flows through the Fort McDowell Indian Reservation just above the confluence with the Salt River.[73] The floodplain along this reach of the Verde River is about 1 mile wide. The floodplain alluvium is coarse and unconsolidated, consisting of silts, sands, gravel and small cobbles. The low flow channel actively migrates across about one-third of the floodplain, sometimes becoming braided. A series of progressively higher terraces flank the active channel area.

Principal vegetation on the Verde floodplain consists of stands of mesquite, Fremont cottonwoods, Goodding willow, and salt cedar, interspersed with seepwillow (*Baccharis salicifolia*) and arrowweed (*Pluchea sericea*). As discussed in Subchapter V.N.4.b, riparian vegetation, particularly cottonwoods, has had poor regeneration over the past few decades, as a result of various factors.

[73] Information for this section is derived from SRP files (see Subchapter V.N); FWS 1980; and Duncan and Reichenbacher 1991).

Wildlife along this reach of the Verde River is typical of riparian habitat along perennial streams in central Arizona, and includes many sensitive species of birds, mammals, reptiles, amphibians, and fish. In particular, cottonwood trees in this area provide nesting for bald eagles (see Figure II-9).

#### b. Fort McDowell Mitigation Measures

If possible, in connection with any joint restoration arrangement, SRP would assist FMYN with restoration of riparian habitat on the floodplain of the Verde River that would be suitable for use by bald eagles. The exact quantity of habitat that may be restored will depend on the desires of FMYN. SRP will use its best efforts to assist FMYN's riparian habitat restoration efforts on the Reservation.

SRP's role in restoring habitat on the Fort McDowell Indian Reservation would be to provide funding for riparian restoration planning, construction and maintenance of fencing to prevent livestock and recreation access, and to promote the re-establishment of riparian vegetation. Funding also may include planting of cottonwoods and willows, signs, educational materials, beaver protection, or other efforts needed to protect and manage the riparian habitat. If these measures are not possible, no further efforts will be made by SRP at Fort McDowell.

### *6. Habitat Acquisition and Management in the Lower San Pedro Valley*

SRP intends to acquire and manage, or provide Additional Habitat Conservation measures for, riparian habitat in the lower San Pedro Valley as part of the mitigation measures in the RHCP (see Figure IV-1, Location 5 and Figure IV-2).[74] In this area, habitat conservation will focus on acquiring desirable riparian habitat through fee title or easements and managing it in perpetuity. In addition, conservation efforts will seek to provide additional water to riparian habitat through retirement of irrigated fields or other water management measures. These portions of the San Pedro Valley were selected as a major focus of acquisition and management efforts because: 1) previous mitigation efforts, including those associated with the construction of Modified Roosevelt, have already protected some habitat along the lower San Pedro; 2) flycatcher populations already occupy the lower portion of the valley; 3) the San Pedro River has relatively natural stream processes that will maintain riparian habitat in the future, in part because it is an unregulated stream; and 4) there has been some observed movement of flycatchers between Roosevelt and the San Pedro Valley.

#### a. Description of Riparian Habitat in the Lower San Pedro Valley

The San Pedro River flows from Mexico north into the Gila River at Winkelman, Arizona. The reach of the San Pedro River downstream of Mammoth, Arizona is of particular interest for riparian restoration and conservation. In this reach, the 100-year floodplain is approximately one-half to 1 mile wide and has a relatively low gradient. The river supports a variety of land uses, including agriculture (cotton, alfalfa, and

[74] For purposes of the RHCP, the lower San Pedro Valley is defined as the reach of the San Pedro from the vicinity of Mammoth to the mouth of the river.

pecans), mining (copper and silica), residential development, and riparian forest (TNC 1999). The floodplain alluvium is primarily composed of silt, sand, gravel and cobble.

Within the Winkelman to Mammoth reach of the San Pedro, riparian vegetation is composed of riparian forests in various stages of succession where sufficient water is present. At Cooks Lake, a parcel south of Dudleyville owned by Reclamation (Figure IV-2), several riparian plant associations are present. Both mature and regenerating stands of Fremont cottonwood and Goodding willow, the dominant plant association, were documented by Baker and Wright (1996). Salt cedar, velvet ash, and button-willow (*Cephalanthus occidentalis*) also were found within the San Pedro riparian zone (Baker and Wright 1996).

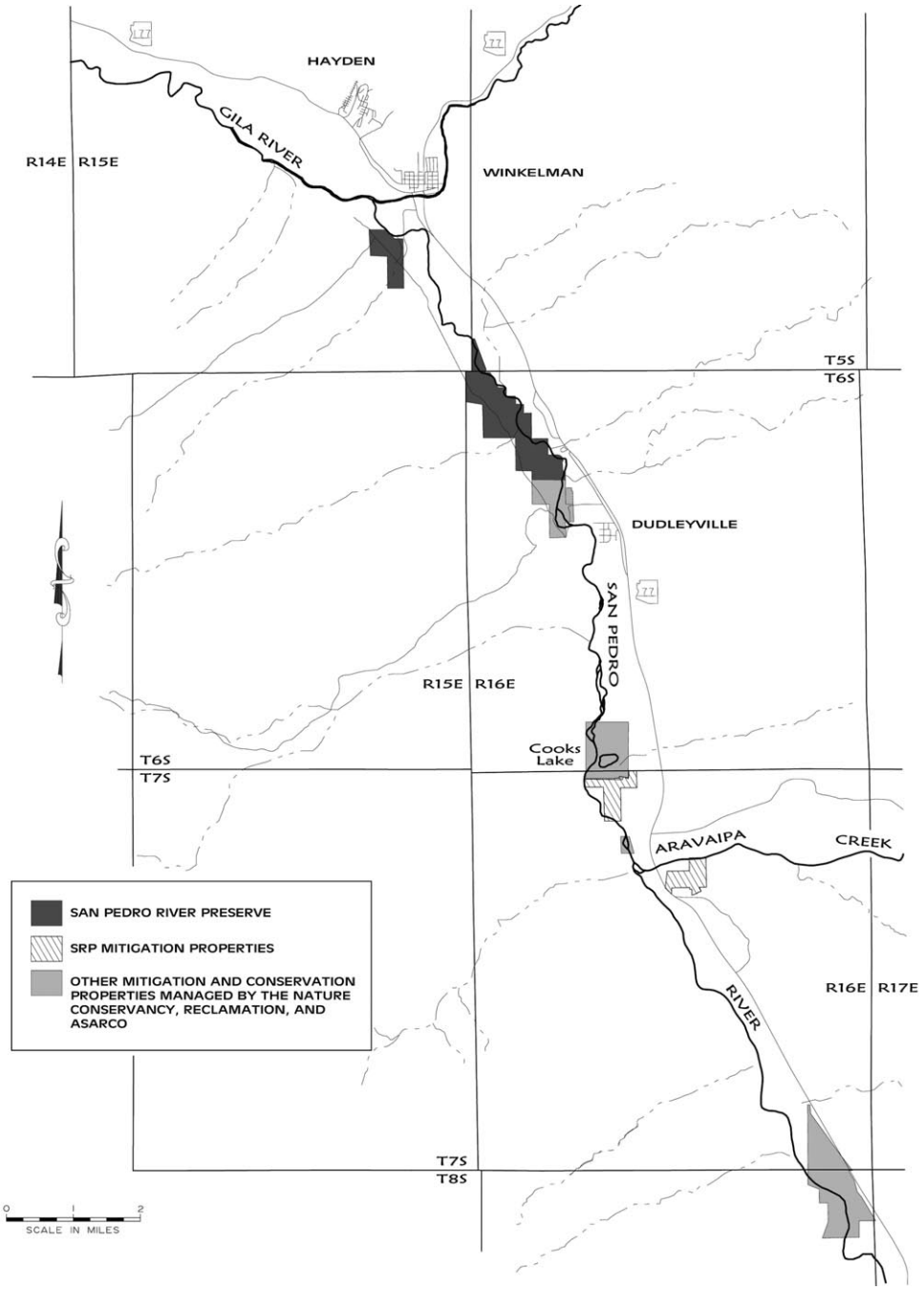
The portion of the San Pedro River between Winkelman and Mammoth was designated as critical habitat for the flycatcher (FWS 1997a). That designation was subsequently set aside by court order in 2001 (FWS 2001a).

**Existing Land Uses.** TNC owns outright or owns conservation easements on several parcels in the San Pedro River floodplain near Dudleyville. The largest of these, the San Pedro River Preserve, is 865 acres in size. State and federal ownership in the San Pedro River corridor includes the Bureau of Land Management (BLM), Reclamation, and the Arizona State Land Department. Additionally, several parcels are public domain allotments and are controlled by Native Americans. Large segments of the floodplain are owned by mining companies such as ASARCO (TNC 1999). Portions of the floodplain and adjoining areas have been converted to residential development and associated land uses such as golf courses. Other areas are actively irrigated for farming operations (TNC 1999).

**Regional Biological Significance.** The Winkelman-Mammoth reach of the San Pedro River has regional significance because of the high biological diversity it supports. Large, contiguous cottonwood/willow stands provide habitat for flycatchers and cuckoos, as well as other federally protected species and species of concern (TNC 1999). Adding to existing lands protected in the corridor offers an opportunity to protect large blocks of habitat and prevent fragmentation. The region is experiencing stress due to loss and degradation of riparian habitat from existing land uses and increasing residential development. Land use impacts to water quality and dewatering are also threats (Fichtel and Marshall 1999; Stromberg 2001b).

**General Area Proposed for Conservation.** Although the entire stretch of the San Pedro River between Winkelman and Mammoth could provide suitable flycatcher habitat, two areas have known concentrations of flycatcher populations and have been the focus of research by SRP for restoration and conservation potential. One area is near the mouth of Aravaipa Creek and along the San Pedro River above Cooks Lake, where several parcels may be available for conservation. The other area is adjacent to and below the existing San Pedro River Preserve managed by TNC. SRP has already purchased a parcel of land near Cooks Lake containing approximately 54 acres of riparian land occupied by flycatchers and cuckoos, and water right and buffer land equivalent to approximately 77 acres of mitigation credit (see Figure IV-4). An additional parcel of land near the mouth of Aravaipa Creek containing approximately

**Figure IV-4. Lower San Pedro River Area Showing Existing Mitigation and Conservation Properties.**



30 acres of riparian land that is potential habitat for flycatchers and cuckoos, and irrigated land equivalent to about 65 acres is under contract by SRP and expected to close before the end of 2002 (see Figure IV-4). Figure IV-5 is a photograph of the riparian habitat on this parcel. Parcels in these two areas are in the broad (approximately 1-mile across) 100-year floodplain of the San Pedro and support riparian communities suitable for flycatchers and cuckoos. Potential for restoration of degraded areas and retirement of agricultural lands (both from irrigated crops and livestock grazing) and water rights exist on these parcels (TNC 1999). As previously noted in this subchapter, SRP intends to focus its water rights acquisition in this area in order to benefit riparian habitat being conserved by various entities along the lower San Pedro River. In addition to water use retirement on the San Pedro Preserve, The Nature Conservancy and ASARCO have already retired about 500 acres of irrigated land downstream of the town of Mammoth (Figure IV-2). Combined with SRP's efforts, including the two parcels already being purchased, the annual increase in water supply to this portion of the river and its riparian habitat is estimated to total more than 2,000 AF.

**Figure IV-5. Riparian Habitat at the SRP Mitigation Site Along the San Pedro River Near Cooks Lake.**

Parcels along the lower San Pedro have been researched extensively by TNC for habitat restoration and conservation potential (Fichtel and Marshall 1999). Many of the parcels have been identified as priorities for habitat acquisition (Id.).

**Habitat Suitability for Flycatchers and Cuckoos.** Flycatcher nesting has been documented at several locations along the San Pedro River. In 2000 and 2001, the lower San Pedro River and the Gila River near the confluence of the San Pedro River supported approximately 35 percent of the known breeding pairs in Arizona**,** one of the largest concentrations throughout the bird's range (Paradzick et al., 2001, p. 20; Smith et al. 2002, p. 9). Table IV-5 lists the results of surveys for flycatchers along the lower San Pedro River for the years 1993 through 2001 (Id.). The number and location of surveys completed for each reach of the river varies by year. In 1993, four areas were surveyed on the lower San Pedro River. In 2000, 16 areas were surveyed on the lower San Pedro River. In 2001, 12 sites were surveyed along that reach of the San Pedro.

**Table IV-5. Numbers of flycatcher territories on the San Pedro River for the years 1993-2001. Note: The San Pedro River Preserve was acquired in 1996.**

| Site Name | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|
| Lower San Pedro River | 11 | 44 | 32 | 29 | 43 | 44 | 65 | 67 | 78 |

*Source:* Data from individual AGFD annual reports (Muiznieks et al 1994; Sferra et al 1995; Spencer et al 1996; Sferra et al 1997; McCarthey et al 1998; Paradzick et al 1999, 2000, 2001; Smith et al. 2002).

The riparian habitat along the San Pedro that is suitable for flycatchers also provides habitat for cuckoos. Yellow-billed cuckoos are known to occur along the lower San Pedro River (Harris, pers. comm. 2001).

Preliminary reports from 2002 indicate that 23 territories and 20 pairs of flycatchers were present on the San Pedro River Preserve, a large increase from a single territory in 2001 (Sferra, pers. comm. 2002).

### b. San Pedro Mitigation Measures

SRP will undertake efforts to acquire and manage, or provide Additional Habitat Conservation measures for about 950 acres of riparian habitat along the San Pedro River in the area shown on Figure IV-1. SRP will use its best efforts to protect habitat in the lower San Pedro Valley. SRP has been researching properties, contacting and negotiating with landowners, evaluating titles, and conducting appraisals since May 2001.

To the extent that habitat can be acquired in this area, SRP will provide management measures for that habitat in perpetuity. Management funding will include initial construction or improvement, and long-term maintenance of fencing to prevent unauthorized access, livestock grazing, and off-road vehicle activity. Management funding also may include planting of riparian vegetation, provision of security patrols, and other efforts needed to protect and manage the habitat as specified in the management plan for each property (see Appendix 6). Management plans for lands along the lower San Pedro will be compatible with those developed by The Nature Conservancy (TNC 1999). If flycatchers and cowbirds are present, cowbirds will be trapped at the San Pedro sites unless FWS agrees that it is not appropriate.

If SRP's efforts to acquire or provide additional mitigation for about 950 acres of habitat in the lower San Pedro Valley are unsuccessful, SRP will pursue equivalent mitigation measures elsewhere.[75] SRP will conserve 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 other rivers where SRP is conserving habitat as part of the RHCP (see below). The quantity of habitat that will be acquired and managed at these alternative locations will be the balance of the goal in the lower San Pedro Valley.

#### *7. Habitat Acquisition and Management in the Safford Valley and Elsewhere in Central Arizona*

If necessary, SRP will acquire and manage or provide Additional Habitat Conservation measures for riparian habitat along other river reaches in central and southern Arizona. Like the Verde and San Pedro areas, riparian habitat conservation will focus on acquiring property through fee title or conservation easements and managing it in perpetuity. As in the San Pedro, opportunities will be sought to provide additional water to riparian habitat through retirement of irrigated fields or other water management measures. The focus of conservation efforts along other stream systems will be in areas where flycatcher populations currently exist or in areas that are in proximity to existing populations. The primary lands for additional acquisition and management efforts are located in the Safford Valley along the Gila River between San Carlos Reservoir and Safford, Arizona (see Area #6 in Figure IV-1). Other candidate areas include lower Pinto Creek, the Gila River upstream from Safford, Arizona to Cliff, New Mexico; the middle San Pedro River Valley near Redington; the Salt River, Tonto Creek, and their tributaries above Roosevelt; 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.

##### **a. Description of Other Central Arizona Riparian Corridors**

The Safford Valley and the reaches along Pinto Creek, the Gila River, Hassayampa River, Salt River, and Santa Cruz River 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 alluvium is composed of silt, sand, gravel, and cobble, with some areas of heavier soils along the lower reaches of the Santa Cruz and Gila rivers.

The riparian vegetation in these valleys constitutes patches of cottonwood, willow, mixed broadleaf riparian vegetation, mesquite, and salt cedar. Other common species of riparian vegetation include arrowweed and seepwillow (Fichtel and Marshall 1999). Riparian habitat fragmentation, water usage, 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 yellow-billed cuckoos as well as numerous other species that are federally protected or are species of concern (Fichtel and Marshall 1999). Relatively large

[75] Additional riparian habitat would be added to this goal to the extent that the entire goal on the Verde is not met.

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 (1 to 3) territories have been documented along the Hassayampa River in past years (Paradzick et al. 2001). Although Pinto Creek, 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 been identified to have habitat that is a priority for acquisition (Fichtel and Marshall 1999). As shown on Figure II-10, cuckoos have been detected along the Gila, Hassayampa, and Santa Cruz rivers. 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.

#### b. Other Central Arizona Mitigation Measures

To the extent that sufficient acreage to fulfill the RHCP mitigation requirement cannot be obtained along the Verde and San Pedro rivers, SRP will acquire and manage, or provide additional habitat conservation measures for, the balance of those acres of riparian habitat elsewhere in central Arizona. SRP has been researching potential conservation sites in these areas since May 2001. SRP also will fund permanent management for that habitat. Management funding will include initial construction or improvement, and long-term maintenance of fencing to prevent access by people and livestock. Management funding also may include planting of riparian vegetation, provision of security patrols, and other efforts needed to protect and manage the habitat as specified in the management plan for each property (see Appendix 6). If flycatchers and cowbirds are present, cowbirds will be trapped at these other sites unless FWS agrees that it is not appropriate.

### *8. SRP Management and Coordination*

SRP will establish a full-time staff position in its Environmental Services Department to manage and coordinate implementation of the RHCP. The person filling this position will be required to have previous experience with management of biological resource issues. The primary responsibility for this staff position will be to ensure that the RHCP is fully implemented including all adaptive management, monitoring and reporting measures. The following tasks will be included in the job description:

- Manage vegetation monitoring and population surveys for flycatchers, Yuma clapper rails, and cuckoos at Roosevelt and on mitigation properties as specified in the RHCP.
- Manage the pilot project to establish and manage habitat near the Salt inlet to Roosevelt and expand if feasible, including acquisition of water rights if necessary.
- Coordinate with Tonto National Forest personnel on enforcement and management efforts for listed species at Roosevelt.
- Identify and implement management measures as necessary, including adaptive management, involving: 1) purchasing additional lands; 2) managing the start-up activities on mitigation properties (e.g., manage environmental clean-up if

needed, contract for fence construction, and develop and initiate on-going management plans); and 3) providing for ongoing management of all mitigation sites.

- Coordinate implementation of conservation measures for bald eagles.
- Prepare annual reports to be submitted to FWS.
- Prepare budget recommendations and perform other administrative tasks related to the implementation of the RHCP, including tracking schedules of land acquisition, monitoring, and management activities.

### D. Funding

SRP fully commits to ensure that adequate funding will be provided to meet all of its obligations in the RHCP. 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 7).

As part of the basic commitments in the RHCP, SRP would provide mitigation of approximately 1,427 acres of riparian habitat, water rights, and buffers.[76] SRP also would ensure adequate funding of activities in support of the mitigation efforts such as providing funds to manage mitigation lands in perpetuity, including funds to enforce conservation easements, funds to monitor species populations and habitat conditions at Roosevelt and on the mitigation lands for 50 years, and staff to implement the RHCP. If necessary, adaptive management measures implemented by SRP to address additional occupied habitat at Roosevelt would result in additional mitigation, management, and monitoring.

All costs in this section are estimated based on 2002 dollars. Inflation is incorporated into the present value calculations. Present values for staff positions and monitoring at Roosevelt are calculated at 6 percent for 50 years. Present values for management and monitoring at mitigation sites are calculated at 6 percent in perpetuity.

#### *1. Habitat Mitigation*

Of the 1,427 acres of mitigation by SRP included in the RHCP, approximately 20 acres would be established on the Rockhouse pilot project near Roosevelt, 300 acres of mitigation would be based on protection of habitat at and near Roosevelt through enforcement efforts, and approximately 1,110 acres would include Habitat Acquisition and Management along the Verde, San Pedro, or Gila rivers, or elsewhere along with Additional Habitat Conservation measures of perpetual obligation.

Preliminary estimates of the cost to establish habitat at the Rockhouse pilot project are $20,000 per acre for 20 acres or a total of $400,000. These estimates are based on rehabilitation and improvement of the irrigation system and planting of trees.

[76] Reclamation's purchase of approximately 823 acres of mitigation is subtracted from the total requirement of 2,250 acres to obtain the 1,427 acres required of SRP. If the mitigation provided for flycatchers does not completely satisfy the requirements for cuckoos, additional mitigation would be provided by SRP.

SRP would fund a Tonto National Forest enforcement position at Roosevelt. Using a first year capital cost of $50,000 and an annual cost of $78,000 per year based on Forest Service estimates, the present value of the perpetual obligation would be $1.35 M. The 300 acres of mitigation credits for this effort would be obtained by dividing the estimated average cost to acquire and manage habitat along the San Pedro River ($4,500 per acre) into the $1.35 M present value.

In order to provide mitigation, it is estimated that 1,600 to 2,000 acres would need to be purchased because some parcels will include substantial areas of upland. Water right land would be acquired along with riparian land, where possible. Depending on the location, improvements, environmental clean-up costs, and other site-specific variables, the cost of land purchase is likely to range from less than $1,000 per acre to over $10,000 per acre, based on land price research and appraisals. Given the probable distribution of land purchases listed in Subchapter IV.C.1.e, and the likely extent of improvements and environmental costs based on SRP's extensive land acquisition experience, overall property costs are expected to average approximately $2,500 to $3,000/acre. Multiplied by the estimated 1,600 to 2,000 acres to be acquired, the total acquisition costs are estimated to range from $4 M to $6 M.

#### *2. Habitat Management Costs*

A number of management costs would be incurred by SRP in support of the mitigation encompassed by the RHCP. These include land management on mitigation properties, funding assistance for riparian restoration on the Fort McDowell Indian Reservation, and SRP staff for implementation.

The habitat mitigation properties acquired for the RHCP will require land management in perpetuity. 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, public education, planting, and tree protection (see Appendix 6). Current estimates of the annualized costs for management are:

| | |
|---|---|
| Rockhouse | $20,000 |
| Verde/San Pedro/Gila/Other | $170,000 |

The present value of these annual management costs in perpetuity is about $3.1 M.

The RHCP also includes SRP's commitment to fund a defined amount of planning, fencing, or pole planting on the Fort McDowell Indian Reservation if a management plan of long-term benefit to eagles and other wildlife is developed by FMYN and is satisfactory to SRP and FWS. The estimated cost of these items is $200,000, based on preliminary discussions with FMYN.

A new SRP staff person would be hired to supervise implementation of the RHCP, 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 (see Subchapter IV.C.8). At an annual cost of approximately $95,000 per year including a vehicle and equipment, the present value is estimated to be $1.5 M. A contingency of

20 percent, or $1 M, is included in the total management cost estimate to address uncertainties.

#### *3. Monitoring Costs*

SRP would monitor flycatcher, Yuma clapper rail and cuckoo populations at Roosevelt after Reclamation's obligation ceases in 2006 and at the mitigation sites after acquisition (see Subchapter IV.E). Based on a field crew of 10 at Roosevelt in 5 out of 10 years, and a field crew of 6 at the mitigation sites in 1 out of 2 years,[77] the present value of those monitoring costs is estimated to be $1.6 M for Roosevelt (50 years) and $1.0 M for mitigation sites (in perpetuity) for a total of $2.6 M.

A contingency of 20 percent, or $0.5 M, is included in the total cost estimate to address uncertainties.

#### *4. Adaptive Management*

In the event that the habitat occupied by covered species at Roosevelt exceeds thresholds, 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 1,500 acres of mitigation might be required, necessitating the purchase of up to 2,200 to 2,600 acres of land. Using an average cost of $2,500 to $3,000 per acre, the total cost could be as much as $5.5 M to $7.8 M. The actual costs will depend on the amount of land that would need to be purchased to meet the adaptive management requirements in Subchapter IV.C.1. Additional management costs, including staff and contingencies, could total up to about $4 M. Additional monitoring costs, including contingencies, are estimated to total up to about $1 M.

#### *5. Cost Summary*

The cost estimates provided above are summarized in Table IV-6. The current estimated cost of mitigation for the Roosevelt HCP without adaptive management is about $15 M to $17 M. If adaptive management is required to address occupied habitat at Roosevelt that exceeds the thresholds, estimated costs could nearly double that amount for a total of up to $25 M to $ 30 M.

[77] The number of biologists at mitigation sites includes a core of 4 biologists for flycatcher and cuckoo surveys and 2 additional biologists for more intensive nest monitoring, cowbird trapping, or other monitoring efforts.

**Table IV-6. Cost summary.**

| **Habitat Mitigation** | **Estimated Cost** |
|---|---|
| Rockhouse habitat establishment | $0.4 M |
| Roosevelt enforcement† | 1.3 M |
| Verde/San Pedro/Gila/Other property acquisition | + 4.0 M to 6.0 M |
| Subtotal | 5.7 M to 7.7 M |
| **Management** | |
| Mitigation property management† | 3.1 M |
| Fort McDowell riparian protection | 0.2 M |
| SRP implementation and reporting† | 1.5 M |
| Contingency (20 percent) | + 1.0 M |
| Subtotal | 5.8 M |
| **Monitoring** | |
| Roosevelt and mitigation site monitoring† | 2.6 M |
| Contingency (20 percent) | + 0.5 M |
| Subtotal | 3.2 M |
| *Grand Total* | 14.6 M to 16.6 M |
| *Adaptive Management* | |
| Mitigation property acquisition | Up to 5.5 to 7.8 M |
| Mitigation property management and monitoring | + Up to 5.0 M |
| Subtotal | Up to 10.5 to 12.8 M |
| Grand Total With Adaptive Management | Up to $25.1 M to 29.4 M |

†Present value of future annual costs.

### *6. 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 from the taking of covered species and to implement the RHCP. 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 RHCP. Unless other methods of assuring permanent funding are selected by SRP,[78] principal will be placed in non-wasting accounts designated solely for that purpose. The accounts will be in the form of

[78] 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.

segregated fund(s) at SRP or separate trust account(s).[79] Principal in the accounts will be of an amount to generate annual cash-flow sufficient to satisfy SRP's continuing obligations under the RHCP, as agreed to by FWS and SRP.[80] 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 Subchapters IV.C.1.a or IV.C.1.c, 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 Section IV.D are based on the best data and information available at this time. SRP commits to fully meeting the actual costs of implementing the RHCP regardless of whether those actual costs exceed these estimates.

### E. Monitoring Measures

SRP will monitor compliance with the terms and conditions of the ITP and the effectiveness of minimization and mitigation measures as provided in this subchapter. SRP will provide monitoring for compliance and effectiveness throughout the 50-year duration of the ITP.

#### *1. HCP Handbook Provisions*

The Habitat Conservation Planning Handbook (FWS and NMFS 1996) describes monitoring measures required by Section 10 regulations of the ESA:

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[79] For segregated fund(s) at SRP or trust account(s), SRP will utilize prudent management of the financial assets of the accounts to generate the 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 five 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.

[80] 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.

> "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:

> "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).

### *2. Goals*

The goals of the monitoring are as follows:

- **Vegetation —** At Roosevelt, the goal is to monitor the density and distribution of riparian vegetation to assist in determining the timing of flycatcher and cuckoo surveys. 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 Roosevelt, the goal is to monitor habitat occupied by flycatchers to ensure compliance with the ITP, including whether adaptive management is required, and to detect long-term trends in population. At mitigation sites, the goal is to monitor species status and population trends.
- **Yuma Clapper Rails —** At Roosevelt, the goal is to monitor habitat occupied by Yuma clapper rails to ensure compliance with the ITP, including whether adaptive management is required, and to detect long-term trends in populations. At mitigation sites, the goal is to monitor species status and population trends.
- **Cuckoos —** At Roosevelt, the goal is to monitor habitat occupied by cuckoos to ensure compliance with the ITP, including whether adaptive management is required, and to detect long-term trends in populations. At mitigation sites, the goal is to monitor species status and population trends.
- **Bald Eagles —** The goal is to monitor population status by continuing the SRP contribution to the existing bald eagle monitoring program.

### *3. Annual Meeting*

A meeting will be held before November 30th of each year among SRP, FWS, Reclamation, the Tonto Basin Ranger District of the Tonto National Forest, AGFD, and the 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 RHCP implementation, specific decisions will be made

with respect to activities for the upcoming year. These decisions are described specifically below.

#### *4. ITP Compliance Monitoring at Roosevelt*

SRP will monitor compliance with the ITP by periodically collecting and evaluating information on occupied habitat and the population status of flycatchers, Yuma clapper rails, cuckoos, and bald eagles at Roosevelt as described below.

##### a. Monitoring Riparian Vegetation

At Roosevelt, SRP will use vegetation monitoring to identify when population monitoring should be conducted to ensure that adaptive management thresholds or permit limits are not exceeded. Reclamation is required to monitor riparian vegetation at Roosevelt through 2006 (see Subchapter I.H.4). If Roosevelt has not filled to elevation 2,151 before May 2005, vegetation will be monitored by SRP in the second and third years following fill using procedures compatible with the mapping of 2001 vegetation at Roosevelt (see Subchapter II.A), unless other procedures are mutually agreed upon by FWS and SRP. Beginning in 2007, monitoring of riparian vegetation will be accomplished by SRP every year using satellite images. A cloud-free satellite image during the period May to September (or April to October, if necessary) at a resolution of not more than 10,000 square feet per pixel will be used. Prior to 2007, SRP will develop a method to estimate tall dense vegetation likely to be occupied by flycatchers using the relative density of vegetation on satellite images.[81] This method will be agreed upon by FWS and SRP. Monitoring of cattail marshes will be accomplished by annual helicopter surveys when more than 3 acres of marsh exist below elevation 2,151 feet.

##### b. Monitoring Species

At Roosevelt, the goal of population monitoring is to evaluate ITP compliance relative to the thresholds for adaptive management and the cap on harm to occupied habitat. The method used to determine occupied habitat in Subchapter III.C.2 will be used to monitor ITP compliance, i.e., the 394-feet radius around the center of territories with overlapping areas being joined into one polygon. For a single reservoir fill event, the adaptive management threshold for flycatchers is 750 acres of occupied habitat and the cap on harm to occupied habitat is 1,250 acres. In addition, ITP compliance monitoring will provide data to identify long-term trends in the Roosevelt population. Reclamation is also required to monitor flycatcher populations at Roosevelt through 2006 (see Subchapter I.H.4). Beginning in 2007, SRP will monitor flycatcher populations at Roosevelt using trained personnel to perform field surveys with appropriate survey

[81] It will take at least 1 year to develop and test this model. SRP's model is likely to be similar to the AGFD model (see Subchapter III.A.4)

protocol in order to determine the location of the centers of territories (e.g., Sogge et al. 1997; Rourke et al. 1999).[82]

If Roosevelt has not filled to elevation 2,151 before 2007, population monitoring will be performed in the year of fill and the successive year to evaluate the impact of a complete reservoir fill on flycatcher populations. Following the initial fill and following each subsequent fill event, field surveys to determine locations of territories will be initiated if there is a reasonable probability that occupied habitat may approach the acreage thresholds within the next two years, i.e., 750 acres of flycatcher habitat or 313 acres of cuckoo habitat. The decision to initiate surveys will be based on the potential to exceed the thresholds using the best science available at the time of the decision based on vegetation acreage and trends, refill forecasts, and previously obtained data on relationships between vegetation, populations, and occupied habitat. SRP and FWS will agree on whether to initiate flycatcher field surveys at the annual meeting. Regardless of the decision factors, field surveys will be initiated if 500 acres of tall dense vegetation suitable for flycatcher nesting has become established below elevation 2,151 feet. Once field surveys are reinitiated, SRP and FWS will determine the annual frequency, intensity, and protocol of the surveys at the annual meeting until another fill event occurs. The decisions on field surveys also will be based on the best available science including trends, forecasts and relationships between variables. Beyond 750 acres of occupied habitat, annual surveys will be conducted if additional acreage of tall dense vegetation is becoming established within the lakebed. SRP will be monitoring less frequently than Reclamation because one of the purposes of Reclamation's monitoring was to provide basic research on flycatcher populations in central Arizona, while SRP's purpose is to monitor permit compliance, long-term population trends, and effectiveness of mitigation measures.[83]

As with flycatchers, the goal of monitoring cuckoos at Roosevelt is to evaluate ITP compliance relative to the thresholds for adaptive management and the cap on loss of occupied habitat, and to identify the long-term trend in the cuckoo population at Roosevelt.[84] The cuckoo population at Roosevelt will be surveyed in 2003 and 2004 in order to establish the number of cuckoos and areas occupied by cuckoos at Roosevelt unless a complete fill occurs in either of those years. If a complete fill occurs in 2003, surveys would not be conducted until after 2006. If a complete fill occurs in 2004, the

[82] 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. If less intensive surveys (e.g., finding the approximate location of all territories) identify that occupied habitat (as defined in Subchapter III.C.2) is less than 500 acres, more detailed surveys to identify the specific locations of each nest and territory will not be conducted at that time.

[83] The research part of the Reclamation monitoring program is intended to provide information for "recovery planning," "future consultations," and evaluation of "the impact of other Federal actions" on the flycatcher (FWS 1996, pp. 37-40).

[84] The adaptive management threshold for cuckoos is 313 acres of occupied habitat and the cap on harm to occupied habitat is 1,113 acres.

2003 survey would be completed but subsequent surveys would not be conducted until after 2006. Over the long-term, monitoring of cuckoo populations with field surveys will be accomplished by SRP using the same approach and the same schedule as the monitoring of flycatchers. Field surveys will use standard protocol (e.g., Corman and Magill 2000) unless otherwise agreed by FWS and SRP.

Surveys for Yuma clapper rails at Roosevelt have the same goal as for cuckoos, i.e., ITP compliance and long-term trends in population. The timing of surveys will also be the same as for cuckoos. Field surveys will use FWS protocol (http://arizonaes.fws.gov/yuma.htm) unless otherwise agreed by FWS and SRP.

Regular monitoring of the bald eagle population at and near Roosevelt will be accomplished by AGFD and FWS under their existing program. As described in Subchapter IV.C.1, SRP has been supporting this monitoring effort since 1990 and will continue to provide funding, donate helicopter time, and contribute other in-kind services.

#### *5. Monitoring the Effectiveness of Minimization and Mitigation Measures*

In addition to monitoring for ITP compliance at Roosevelt, SRP will monitor the effectiveness of minimization and mitigation measures that are implemented under the RHCP. These include surveying of flycatcher and cuckoo populations at all mitigation sites, surveying for Yuma clapper rails at mitigation sites with cattail marshes, assessing habitat creation at the Rockhouse site, and evaluating habitat conserved at mitigation properties. The schedule and procedures for monitoring flycatcher and cuckoo populations and habitat at these sites are discussed below. SRP's on-going support for bald eagle monitoring is described in Subchapter IV.C.1.

The Rockhouse site will be monitored to determine if woody riparian vegetation has become established with the potential to develop into desirable habitat for flycatchers and cuckoos, and to determine if cattail marshes develop for Yuma clapper rails. Monitoring will occur annually using satellite images and field observations during irrigation of the site. Monitoring and irrigation will be discontinued if it has been determined by FWS and SRP that habitat establishment is not successful (see Subchapter IV.C.2 for discussion of measures to be taken if habitat is not successfully created.)

At mitigation properties, SRP's survey of flycatcher and cuckoo populations will occur in the first spring and summer following acquisition in order to establish a baseline.[85] In addition to surveying the number of birds at each site, the number and locations of nests/territories will be noted where observed. The field biologists conducting the survey will have several additional hours each day after conducting the morning survey to look for nests and signs of parasitism, and to assess other biological conditions at the mitigation sites. Beginning in 2005, the populations at the mitigation sites will be surveyed every other year on average, but not less than every third year. The specific frequency of survey for each site will be determined during the annual meeting

[85] Surveys of the Rockhouse mitigation site would not occur until woody riparian vegetation suitable as flycatcher or cuckoo habitat, or marsh habitat suitable for Yuma clapper rails, becomes established.

— some sites may be surveyed every year for a period if necessary, sites with more stable populations may be surveyed every third year. 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 of population surveys. Field observations will be recorded on a standard form to be developed as part of the management plans.

Occasional nest monitoring at the mitigation sites will be implemented if a declining trend in number of birds is observed, and FWS and SRP find that evaluation of productivity would be of assistance in management of the mitigation site. Nest monitoring will be conducted using AGFD techniques (Rourke et al. 1999) unless otherwise agreed by SRP and FWS.

#### *6. Reporting*

SRP will provide an annual report to FWS (Arizona Ecological Services and Albuquerque Regional offices), Reclamation, and the Forest Service describing all RHCP activities occurring during the past year including management activities, monitoring results, status reports and future action items on mitigation properties, and all other activities associated with implementation of the RHCP. 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, and data collected on listed and candidate species. All field data collected by SRP at Roosevelt and at the minimization and mitigation sites 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 at the sites, 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.

#### *7. Adaptive Management*

Adaptive management is an integral part of the RHCP and an important element of a 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 above in this subchapter, monitoring in the RHCP involves a repeated assessment of the populations of covered species and their habitats at Roosevelt 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 their 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 RHCP. Annual reports and meetings will be used to evaluate and adjust management measures in accordance with changed circumstances.

SRP will implement adaptive management at Roosevelt under the RHCP as described in Subchapter IV.F.1 below. Those adaptive management measures include two components:

1) Program adaptive management — involving changes in circumstances affecting fundamental components of the RHCP, e.g., mitigation of additional acres at Roosevelt if those acres were to be occupied by the covered species (up to 500 additional acres occupied by flycatcher; up to 800 additional acres occupied by cuckoos; or up to 5 acres of additional habitat occupied by Yuma clapper rails); and

2) Biological adaptive management — involving implementation of various management measures in response to changed circumstances at the mitigation sites.

Table IV-8 is a summary of both types of adaptive management efforts provided in the RHCP, i.e., conservation, mitigation or management measures in response to changed circumstances.

### *8. Summary of Monitoring, Reporting and Adaptive Management*

The schedule for flycatcher, Yuma clapper rail, and cuckoo monitoring is provided in Table IV-7; bald eagle monitoring will be done annually by AGFD. Reporting will be on an annual basis and adaptive management measures will be implemented as needed. SRP staff responsible for management and coordination of the implementation of the RHCP will be responsible for these activities (see Subchapter IV.C.8).

**Table IV-7. Flycatcher, Yuma clapper rail, and cuckoo monitoring schedule.**

| Year | Habitat Conservation Properties | | Roosevelt | | | Rockhouse Site | |
|---|---|---|---|---|---|---|---|
| | Flycatchers and Cuckoos | Habitat | Flycatchers | Yuma Clapper Rails and Cuckoos | Riparian Vegetation | Flycatchers, Yuma Clapper Rails, and Cuckoos | Habitat Creation |
| 2003* | † | ‡ | Reclamation | X | — | — | X |
| 2004 | † | ‡ | Reclamation | X | — | — | X |
| 2005 | † | ‡ | Reclamation | — | — | — | X |
| 2006 | † | ‡ | Reclamation | — | Reclamation | — | X |
| 2007 to 2053 | ◊ | ◊ | ◊ | ◊ | X | ◊ | X |

* Or first spring and summer following issuance of the ITP.

† Flycatchers and cuckoos will be surveyed by SRP during the first two years following acquisition.

‡ Baseline survey by SRP when the property is acquired to determine the quantity of mitigation credits on the property that meets the riparian habitat criteria described in Subchapters IV.C.1.a and IV.C.1.d.

◊ Variable frequency of monitoring by SRP to be determined by FWS and SRP depending on vegetation, population trends, and other factors. Monitoring of flycatchers, Yuma clapper rails, and cuckoos will be conducted on average every two years but at least every three years.

X Annual data collected by SRP except as noted in text.

### 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."[86] Recognizing the importance of both of these goals, FWS 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 an ITP (50 CFR 17.22(b)(5) and (6) and 17.32(b)(5) and (6)). This section of the RHCP addresses the application of "No Surprises" assurances should the ITP be issued for Roosevelt.

#### *1. Changed Circumstances*

In developing the RHCP, SRP and FWS have identified all foreseeable "changed circumstances"[87] 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 ITP. These measures are listed in Table IV-8. Changes in circumstances that could not have 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 IV.F.2.

So long as the terms of this RHCP are being properly implemented, FWS will not require the implementation of any conservation and mitigation measures in addition to those specified in this Subchapter IV.F.1.

Other than the "changed circumstances" specifically identified in this Subchapter IV.F.1, all other changes in circumstances affecting a species covered by the RHCP shall be deemed "unforeseen circumstances," and shall be addressed as provided in Subchapter IV.F.2 below.

[86] HCP Handbook (FWS and NMFS 1996, p. 3-28).

[87] 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 IV-8. Changed circumstances and conservation or mitigation measures to be implemented.**

| Changed Circumstances | Conservation, Mitigation, or Management Measures |
|---|---|
| Pilot project at Rockhouse is unsuccessful | Acquire and permanently manage other riparian habitat (see Subchapter IV.C.2) |
| Habitat protection and management measures at Roosevelt are ineffective | Acquire and permanently manage other riparian habitat and implement other conservation efforts (see Subchapter IV.C.3) |
| Habitat acquisition and management in target area is infeasible | Acquire and permanently manage other riparian habitat and implement other conservation efforts (see Subchapters IV.C.4 and IV.C.6) |
| Decline of population at mitigation sites | Implement additional monitoring and management (see Subchapter IV.E and Appendix 6) |
| Invasion of exotic species at mitigation sites | Implement eradication or control efforts (see Appendix 6) |
| Increase in occupied habitat at Roosevelt above 750 acres for flycatchers, 5 acres for Yuma clapper rails, or 313 acres for cuckoos | Acquire and permanently manage other riparian habitat and implement other conservation efforts (see Subchapters IV.C.1.a, IV.C.1.b, and IV.C.1.d) |
| Reversion of title to Arizona or United States with loss of ability to achieve RHCP goal | Acquire and permanently manage replacement habitat (see Subchapter IV.F.1.a) |
| Habitat loss from scouring floods at Roosevelt or mitigation sites | No additional measures by SRP |
| Habitat loss from fire at Roosevelt or mitigation sites | No additional measures by SRP |
| Critical habitat designation for species covered by the RHCP | No additional measures by SRP |
| Downlisting or delisting the RHCP species due to recovery | No changes in measures implemented by SRP |
| Riparian restoration effort with the Fort McDowell Yavapai Nation is unsuccessful | No additional measures by SRP |

#### a. 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 RHCP reverts to a state or federal agency, at that time, FWS, the agency and SRP will confer and attempt to develop a plan for continued management of the property for species protection, consistent with the terms of the ITP, RHCP and Implementing

Agreement.[88] If the parties can reach agreement on management, SRP would continue to receive mitigation credit for the land. If no agreement is reached within a period of time agreed upon by SRP and FWS, the land would be replaced with other compensation land, and necessary measures undertaken to develop and implement a management plan for the newly acquired property within 1 year of acquisition.

#### *2. Unforeseen Circumstances*

In the event of unforeseen circumstances[89] during the life of the ITP, amendments to the RHCP may be proposed by either SRP or FWS to address these circumstances. FWS and SRP would work together to redirect resources to address unforeseen circumstances. For example, if SRP is still in the 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 RHCP; 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 RHCP, including additional restrictions on the operation of Roosevelt Dam or other dams that are part of SRP's reservoir system to mitigate the effects of continued operation of Roosevelt.

#### *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 include the following information in its annual monitoring reports (see Subchapter IV.E.6):

- Any significant adverse trends of habitat or populations of listed and candidate species that are not anticipated by the RHCP.
- Any significant new information relevant to the RHCP that was unforeseen at the time the plan was approved.

[88] 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.

[89] "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 conservation plan'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).

If any of these significant changes are reported, they will be addressed as described in Subchapters IV.F.1 and IV.F.2 above.

### G. Implementing Agreement and 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 ITP. Both documents are provided in Appendices 7 and 8, respectively.

### H. Amendments to the RHCP

SRP may propose amendments to the provisions of the RHCP using the following amendment procedures.

#### *1. Minor Amendments to the RHCP*

Minor amendments to the RHCP may include corrections of typographic, grammatical, and similar editing errors; correction of any maps or figures to eliminate errors; or other revisions to the RHCP (e.g., changes in address or principal officer) that do not diminish the level or means of mitigation or increase the impacts to the species or their habitats. Such minor amendments would not materially alter the terms of the Section 10(a)(1)(B) permit. Upon the written request of SRP, FWS is authorized to approve minor amendments to the RHCP if such amendments do not conflict with the primary purposes of the RHCP.

#### *2. All Other Amendments to the RHCP*

Other than minor amendments described in the previous subchapter, all other amendments to the RHCP 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 RHCP.
2. Changes in the geographical area included in the RHCP.
3. Changes in provisions of the RHCP addressing Habitat Acquisition and Management (Subchapter IV.C.1).
4. Changes in provisions of the RHCP addressing Additional Habitat Conservation Measures required by the RHCP (Subchapter IV.C.1).
5. Changes in the permitted activity as defined in the ITP.
6. Exceedance of take authorized by the ITP.

# V. Alternative Actions Considered

Chapter V describes the formulation of alternative species conservation and reservoir operation strategies by SRP and the selection process for the Proposed Action, the RHCP. The impacts of alternatives other than the RHCP and actions considered to minimize and mitigate the impacts under these alternatives also are discussed in this chapter.

Alternatives considered during the development of the RHCP involve two components: 1) the manner of reservoir operations; and 2) various measures to minimize and mitigate biological, environmental, or socioeconomic impacts from reservoir operations. Both components of the alternatives were considered simultaneously in the analysis because the evaluation addresses the continued operation of an existing project (in contrast to a new project where alternatives such as build/no build are strong contrasts). Also, the goal of providing for habitat conservation for federally listed and candidate species while permitting the continued operation of Roosevelt was determined to be potentially attainable through various combinations of these components.

Alternative measures to minimize or mitigate biological impacts focus on riparian habitat that may be used by flycatchers. As discussed in Chapter II, the flycatcher population is the most significant of the three federally listed and candidate species occurring at Roosevelt.

## A. Formulation and Evaluation of Alternatives

FWS and SRP solicited and developed a wide variety of options and alternatives during development of the RHCP. 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 the formulation, screening, and evaluation process were:

- Compliance with the ESA
- Impacts on listed and candidate species
- Public input
- Impacts on water delivery and power generation
- Extent and feasibility of minimization and mitigation measures
- Results of prior ESA compliance for modifications to Roosevelt
- FWS guidance

Each of these factors is discussed below.

### *1. Compliance with the ESA*

ESA requirements were considered in the formulation of alternatives. ESA regulations require applications for an ITP 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 NEPA evaluation (FWS and NMFS 1996, p.3-25). In other words, a “no action” alternative should be considered along with a reasonable array of technically and economically feasible alternatives that would reduce a project’s significant adverse impacts.

#### *2. Impacts on Listed and Candidate Species*

The purpose for preparing the RHCP is to address the potential impacts of SRP's continued operation of Roosevelt on listed and candidate species. Thus, potential impacts on these species are a primary factor in the development and consideration of alternatives. In particular, SRP evaluated alternatives in light of two ITP 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). In other words, alternatives that would minimize and mitigate the impact of Roosevelt operations and that would maintain or improve the likelihood of survival and recovery of the species were given priority over alternatives that do not satisfy these ITP criteria.

#### *3. Public Input*

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

- Changes in reservoir operation at Roosevelt or other SRP dams
- No change in reservoir operations
- Greater management of livestock grazing
- Conservation of alternative riparian habitat
- Utilization by SRP and the cities of alternative water supplies

A more complete summary of public input during scoping and the environmental alternatives is provided in Section 1.4 of the EIS.

#### *4. Impacts on Water Delivery and Power Generation*

As described in Chapter I, SRP operates Roosevelt in conjunction with other components of its water supply system to generate hydropower and to provide water to members, cities, Indian communities, and other users in the Salt River Valley. SRP water deliveries are made pursuant to numerous water rights and contracts dating back over a century (see Chapter I, Table I-1; Appendices 1 and 2). The primary purpose of Roosevelt Dam since its authorization in 1903 has been to maximize the conservation of water — to store water in times of high runoff for use during times of low runoff, and to generate power as the water is released for downstream uses. Thus, any alternative that does not permit SRP to maximize water storage would result in adverse effects to water and power users. Higher priority was given to alternatives that minimize impacts to water and power supplies.

#### *5. Extent and Feasibility of Minimization and Mitigation Measures*

The ESA requires habitat conservation plans to minimize and mitigate the impacts of taking 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 impact minimization and mitigation measures at Roosevelt and then in an ever-widening radius from Roosevelt. First, except for measures associated with the prior Section 7 consultation for construction of Modified Roosevelt, SRP eliminated measures from

further consideration that are subject to Section 7(a)(1) or (2) of the ESA because federal agencies already have a duty to manage these lands for listed species. Second, the remaining alternative minimization and mitigation measures were prioritized with highest priority being given to measures at or close to Roosevelt, with diminishing priority as distance from the reservoir increases. Finally, the feasibility of the high priority measures was evaluated and those measures that were found to be impracticable or not cost-effective were eliminated from further consideration.

#### *6. Results of Prior ESA Compliance for Modifications to Roosevelt*

In a 1996 BO on Modified Roosevelt, FWS provided an incidental take statement for the fill of newly constructed storage space at Roosevelt Lake to elevation 2,151 feet with the implementation of a reasonable and prudent alternative involving habitat acquisition and protection and other conservation measures, and satisfaction of certain terms and conditions (FWS 1996). As described in Subchapter I.H.4, reasonable and prudent alternatives, and terms and conditions of the BO included off-site protection of riparian habitat, establishment of a management fund, research and monitoring. During the consultation process, a number of alternatives were evaluated. The BO considered and rejected four of those alternatives after analyzing their merits. These four alternatives and the reasons for their rejection were reconsidered during development of the RHCP to verify whether they should continue to be eliminated from further consideration. One previously rejected alternative, creation of new riparian habitat in upland areas near Roosevelt using irrigation, is included as part of the RHCP (Subchapter IV.C.2). The other three alternatives (reservoir management to enhance riparian habitat, creation of new riparian habitat along the abandoned power canal, and creation of new riparian habitat by creating spoil islands) were rejected by SRP for the same reasons set forth in the BO; i.e., they are either infeasible or unlikely to result in suitable riparian habitat that is likely to be utilized by flycatchers (see Subchapter V.N.3.a below) (FWS 1996, pp. 28, 29).

#### *7. FWS Guidance*

Regular meetings between FWS and SRP have occurred since January 2001. Meetings directly involving FWS to discuss development of the RHCP were held on February 27, March 27, April 30, June 12, August 7, August 21, September 20, October 23, November 5, November 27, and December 18, 2001; and January 31, February 19, February 20, March 13, March 14, April 11, April 12, May 2, May 30, May 31, June 26, August 1, August 27, October 8-9, and October 22 and 23, 2002. At these meetings, FWS responded to questions from SRP by providing guidance. This guidance included input into the development and evaluation of alternatives.

### B. Overview of Alternatives

Three primary alternatives were considered for further 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 principal alternatives. Alternatives that were eliminated from further consideration during the screening process are discussed in Subchapter V.N. The alternatives considered in detail are:

- **No Permit** — No issuance of a Section 10 Permit (ITP) by FWS. Under this alternative, SRP would do everything within its control to avoid any take of federally listed species associated with its continued operation of Roosevelt.
- **Full Operation of Roosevelt (Proposed Action)** — Issuance of an ITP by FWS allowing the operation of Roosevelt by SRP consistent with pre-permit operational objectives set forth in Chapter III for full operation of the reservoir up to the maximum storage elevation of 2,151 feet. This alternative includes implementation of the RHCP measures to minimize or mitigate the potential take of federally listed species.
- **Re-operation Alternative** — Issuance of an ITP by FWS authorizing the modified operation of Roosevelt to reduce the short-term impact of reservoir operations on listed and candidate species. This alternative includes measures to minimize or mitigate the remaining potential take of federally listed species.

The No Permit and Re-Operation alternatives are discussed in more detail in the following sections. Impacts from the Full Operation of Roosevelt, and minimization and mitigation measures to address those impacts are described in Chapters III and IV.

#### *1. No Permit*

Under the No Permit alternative, FWS would not issue an ITP to SRP for continued operation of Roosevelt. Without an ITP, SRP would be expected to do everything within its control to avoid take of federally listed species associated with the continued operation of Roosevelt. To avoid the risk of potential take of listed species, Roosevelt would have to be operated to avoid extended inundation of riparian vegetation that is utilized by federally listed and candidate species. Unless a large runoff event occurred that could not be immediately passed through the reservoir, the maximum reservoir elevation would be limited to an elevation of 2,095 feet to avoid significant impacts to vegetation used by these species. Compared to bald eagles and cuckoos, which also use the lakebed as habitat, flycatchers currently use vegetation for breeding and nesting at lower levels on the lakebed. The base of the lowest tree or shrub supporting an existing flycatcher nest or territory has been determined to be near elevation 2,088 in 2001, and at a similar elevation in 2002. In order to ensure that there would be no impact on the lowest nest or territory, the No Permit alternative is the maintenance of reservoir levels below 2,095 after May 1.[90] This maximum elevation near the beginning of the nesting season ensures that inundation of the root crown of existing nesting trees and shrubs will be less than a few months, which will ensure that the vegetation will survive, and that nesting success is unlikely to be affected (see Subchapter III.A.3 for description of nest height considerations). Although the specified elevation of 2,095 would occasionally be exceeded due to uncontrollably high runoff, the reservoir level would be lowered to the specified elevation as soon as physically feasible consistent with flood control and dam safety operational requirements.

[90] Although this elevation may be lower in 2002, that information will not be known until late 2002. If the lowest nest is at a significantly lower elevation, the maximum lake level would be correspondingly lower.

As discussed in Subchapter V.C.1, it is important to note that implementation of the No Permit alternative does not mean that there would be no loss of riparian vegetation. Periodically, some loss of vegetation is likely to occur with this alternative because of limits in the structural release capability of the dam.[91] More importantly, without the long-term cycle of large fluctuations in reservoir level, much of the existing riparian vegetation on the lakebed would become decadent. Riparian vegetation would be confined to relatively narrow bands along Tonto Creek and the Salt River above elevation 2,095 and a margin above the maximum lake level on the inflow deltas. In addition, lower reservoir levels would result in a greater potential for vegetation along the Salt River and Tonto Creek inflow points to be periodically scoured during floods without higher reservoir levels to attenuate flood flows. Such occasional scouring could potentially eliminate virtually all of the vegetation used as habitat by flycatchers at Roosevelt.

#### *2. Re-operation Alternative*

The Re-operation alternative would involve issuance of an ITP by the FWS, which would include measures to minimize or mitigate the potential take of federally listed species, and which would authorize incidental take as part of the changes in operations at Roosevelt. In an effort to minimize take, the operation of Roosevelt Dam would be changed in order to modify the timing, amount, frequency, and duration of water storage at elevations where riparian habitat currently exists. Although specified elevation levels would occasionally be exceeded due to high runoff, the reservoir level would be lowered to the specified elevation as soon as practicable.

After consideration of many reservoir operation options, SRP selected release of water above elevation 2,125 as the Re-operation alternative for further evaluation in the RHCP. The selection of this alternative was based on potentially reducing the impacts of Roosevelt operations on listed and candidate species. Considerations in the selection of the Re-operation alternative are described below.

As can be seen in Figure II-4, there is an inflection in the distribution of tall dense vegetation within the Roosevelt conservation space at elevation 2,126. The inflection on the graph indicates that this is a break point in vegetation distribution—the quantity of tall dense vegetation per foot of increase in elevation increases more rapidly above elevation 2,126, probably reflecting that this elevation is near the top of the historical maximum lake level at elevation 2,136 and has not been inundated for extended periods of time in contrast to lower elevations on the lakebed.

In addition, as can be seen in Figure II-6, 60 percent of the flycatcher nests in 2001 occurred in vegetation having a root crown between elevation 2,115 and 2,125, and 70 percent of the nests occurred above elevation 2,115. A maximum reservoir elevation of 2,125 would mean that the reservoir would be drawn down over the late spring and early summer (flycatcher breeding season) to an elevation of 2,115 or less (see Appendix 3).

[91] Maximum release capacity between elevation 2,095 and 2,115 feet is about 12,000 cfs. Above elevation 2,115, release capacity increases from about 23,000 cfs at elevation 2,120 to about 110,000 cfs at elevation 2,150 feet.

This annual draw down of the lake level would mean that the vegetation between elevations 2,115 and 2,125 would be inundated only for a few winter months during high runoff years, thus enabling this vegetation to survive and be available for nesting in that year and successive years.

Finally, selection of a maximum reservoir elevation of 2,125 is close to the midpoint between elevations 2,095 and 2,151, the maximum lake levels under the No Permit and Full Operation alternatives, respectively. Thus, elevation 2,125 represents a middle point on the continuum of biological, environmental, and socioeconomic impacts between the No Permit and Full Operation alternatives.

Although potential take would be reduced under this alternative, mitigation measures would be required for potential take occurring below elevation 2,125. Mitigation measures would include protection, enhancement, or restoration of riparian habitat elsewhere in Arizona (e.g., along the Verde, San Pedro, or Gila rivers).

## C. Impacts of Alternatives on Listed Species

### *1. Effects of No Permit Alternative on Flycatchers*

The No Permit alternative restricts the storage of water at Roosevelt to an elevation no greater than 2,095 feet under normal operations.

#### a. Impact on Flycatchers

Direct take of flycatchers at Roosevelt is not likely to occur as a result of reservoir operations under the No Permit alternative because reservoir levels will be held lower than historical levels thereby avoiding inundation of current nest sites or inundation of vegetation that provides existing habitat. However, the No Permit alternative likely would have an adverse impact on flycatchers by reducing the long-term amount of habitat available. In addition, existing habitat could be lost from scouring floods, permanent drying, and fire.

Limiting the operation of Roosevelt lake levels to a maximum elevation of 2,095 will likely result in smaller average amounts of flycatcher habitat over the long-term at Roosevelt because large portions of the lakebed would not be subjected to periodic inundation and ground water recharge. As discussed in Subchapter II.A, the upper elevations of the lakebed are drying out and the overall amount of tall dense vegetation that may be suitable for flycatcher occupation may be declining. If the maximum normal level of the reservoir is restricted to elevation 2,095, much of the tall dense vegetation above that elevation would be expected to degrade as suitable habitat for flycatchers.[92] The exception would be areas along the Salt River and Tonto Creek where bands of riparian vegetation would occur on what would eventually become a riverine floodplain and areas on the edge of the reservoir where the water table remains relatively high. That riparian vegetation along the Salt River and Tonto Creek above elevation 2,095 would undergo the typical cycle of scouring and regrowth experienced along other rivers in the

[92] Infrequent flood flows exceeding the outlet capacity of Roosevelt may result in 10 to 20 days of inundation of elevations above 2,095 but this inundation is not expected to be frequent enough or of sufficient duration to establish and maintain tall dense vegetation.

Southwest. As shown in Appendix 3, Figure 2, the extent of reservoir fluctuation under the No Permit alternative would be greatly reduced in comparison to the other two alternatives and the reservoir would fill during most years to the 2,095-foot level (compare Figure 2 with Figures 1 and 3 in Appendix 3). The effect of frequent reservoir fills would be to restrict the growth of tall dense riparian vegetation to a band on the inflow deltas and on the edge of the reservoir near the high-water mark at elevation 2,095. In these areas, tall dense salt cedar is likely to persist between about elevation 2,080 and 2,110 and mixed riparian vegetation may persist between elevation 2,080 and 2,100. It is not possible to accurately estimate the amount of habitat that would be located in the "bathtub ring" near elevation 2,095 but it is likely to be significantly less than the amount of habitat created and maintained by reservoir dynamics associated with the Full Operation and Re-operation alternatives.

#### *2. Effects of Re-operation Alternative on Flycatchers*

The Re-operation alternative restricts the storage of water at Roosevelt to an elevation no greater than 2,125 feet under normal operations. Thus, the maximum reservoir level under this alternative would be about 26 feet lower than the current top of conservation storage at elevation 2,151 feet.

##### a. Impact on Flycatchers

The Re-operation alternative would have a moderate indirect adverse impact on flycatchers as a result of the effects on habitat discussed in the next subchapter. In addition, some direct take might occur due to the fall of nest trees containing eggs or fledglings as a result of tree periodic inundation or drying.[93] As discussed in Chapter III, the potential incidental take of flycatchers is primarily due to habitat modification and is difficult to quantify. Thus, the potential future incidental take that could occur is addressed by SRP in terms of the acreage of occupied flycatcher habitat that will be affected by the proposed re-operation of Roosevelt Dam.

The Re-operation alternative would have an adverse impact on flycatcher habitat. The effect would be moderated compared to the Full Operation alternative because reservoir levels would be more similar to the historical range when the maximum elevation of Roosevelt was 2,136 feet. However, the range of fluctuation would be slightly less than either historical levels or Full Operation levels, resulting in less tall dense vegetation on average over the long-term (see Subchapter V.C.1 above). In addition, fill of the reservoir to elevation 2,125 feet after an extended period of drawdown would inundate and destroy some habitat occupied by flycatchers. As shown on Figure II-6, 30 percent of the trees and shrubs with flycatcher nests in 2000 and 2001 had root crowns below elevation 2,115. Applying that proportion (30 percent) to the maximum

[93] Direct take may occur from recreation use at high lake levels (e.g., boat or jet ski disturbance to nesting flycatchers). However, recreation use at Roosevelt is subject to Forest Service management, which is outside of SRP control. As a federal action, recreation impacts on listed species are addressed as a cumulative impact under NEPA in the EIS.

predicted impact under the Full Operation alternative would result in the periodic loss of approximately 250 acres of occupied habitat.

As with the Full Operation alternative, there would be uncertainty with respect to the maximum future impact under the Re-operation alternative. Adaptive management would be employed to address such increases if they were to occur. Like the Full Operation alternative, the additional occupied habitat that would be addressed through adaptive management would be capped at 500 acres for purposes of the take statement. Thus, the upper limit of occupied flycatcher habitat that could be impacted by Roosevelt operation under the Re-operation alternative would be 750 acres (250 + 500).

#### b. Conservation Measures for Flycatchers Under Re-operation Alternative

As described above, the maximum amount of habitat predicted to be impacted by the Re-operation alternative in the future is 250 acres. The amount of acreage for mitigation would be calculated by the method used under the Full Operation alterative. Using that method, the maximum predicted impact amount of 250 acres results in a mitigation requirement of 500 acres of Habitat Acquisition and Management. In addition, 250 acres of Additional Habitat Conservation measures would be required. From that total, existing and on-going mitigation resulting from the construction of Modified Roosevelt Dam would be subtracted because it is part of the environmental baseline for this analysis of impact. As described under the Subchapter IV.C, current and future properties purchased by Reclamation as mitigation for the construction of Modified Roosevelt involve about 600 acres of riparian habitat. In addition, retirement of ground water pumping by Reclamation accounts for 220 acres of additional conservation.[94] Subtracting the 820 acres (600 + 220) acquired by Reclamation from the mitigation requirement of 750 acres would completely satisfy the mitigation requirement for habitat protection.

If adaptive management of up to 500 acres of additional impact would be necessary, SRP would protect or enhance mitigation habitat to offset that impact. Using the tripling of impact for mitigation, up to 1,000 acres of riparian Habitat Acquisition and Management would be provided and up to 500 acres of Additional Habitat Conservation measures would be implemented. SRP would be required to implement habitat conservation measures in order to minimize and mitigate that impact. The selection method and location of measures is described in more detail in Subchapter IV.C.

### *3. Effects of No Permit Alternative on Yuma Clapper Rails*

Under the No Permit alternative, direct take of Yuma clapper rails and impacts on cattail habitat at Roosevelt are not expected to occur as a result of reservoir operations because reservoir levels will be held lower than historical levels thereby avoiding inundation of existing habitat. The maximum lake elevation of 2,095 feet under this alternative is at the downstream end of the lowest cattail marsh that currently exists at

[94] The 220 acres is calculated using the procedure in Subchapter IV.C.1.a. According to the Arizona Department of Water Resources, historical consumptive use on this property that has been retired was 440 AF per year.

Roosevelt. Because the marshes are located along the inflows, they are not likely to dry out if the reservoir is drawn down.

#### *4. Effects of Re-operation Alternative on Yuma Clapper Rails*

The Re-operation alternative would have an adverse impact on Yuma clapper rail habitat similar to the Full Operation alternative because the existing cattail marshes are located below elevation 2,125 and it does not appear that cattail marshes have been present above this elevation in the past. In addition, future reservoir levels under the Re-operation alternative would be similar to the historical range. Thus, the predicted impact on Yuma clapper rail habitat under the Re-operation alternative would be the periodic loss of approximately 5 acres of cattail marsh. In addition, some direct take might occur due to inundation of nests or disturbance from recreation use on the lake.

Mitigation for Yuma clapper rails under the Re-operation alternative would require construction of the Rockhouse project to provide 5 acres of marsh and to provide adjoining dense vegetation for cover (see Subchapter IV.C.2). The total size of the Rockhouse project under this alternative would be about 10 acres, including 5 acres of marsh and 5 acres of cottonwood/willow. If adaptive management were required because additional habitat was occupied by Yuma clapper rails at Roosevelt, the Rockhouse site would be expanded up to the full 20 acres if necessary (up to 10 acres of marsh).

#### *5. Effects of No Permit Alternative on Bald Eagles*

The No Permit alternative might have an adverse indirect impact on bald eagle productivity by limiting the extent of the shallow water areas currently used by bald eagles for foraging and increasing interspecific competition between the breeding pairs (see Subchapter III.E.2.f). However, direct take of bald eagles from any breeding areas at or in the vicinity of Roosevelt would not occur as a result of the No Permit alternative because reservoir levels would be held lower than historical levels. Limiting the height of reservoir levels will eliminate the potential inundation of existing nests and nest trees except during infrequent flood inflows that exceed the capacity of the reservoir outlet works. However, restricted reservoir levels also will decrease the probability of establishment of new nesting trees at higher elevations, which is likely to increase the competition between pairs.

As noted in Availability of Nesting and Perching Habitat (Subchapter III.E.2.d above), restricting reservoir fill would likely impact existing perching and nesting trees by killing them through water deprivation. However, younger cottonwood and willows that have grown at lower elevations would eventually replace those trees. The dynamics of individual bald eagle breeding areas, wintering areas, and foraging areas would continue to change seasonally and annually, depending on a complex variety of environmental and ecological influences, including reservoir fluctuations at lower levels.

#### *6. Effects of Re-operation Alternative on Bald Eagles*

The Re-operation alternative would have adverse indirect impacts on bald eagles similar to the No Permit and Full Operation alternatives. Reservoir levels under this alternative would be similar to the historical range resulting from past operations when the maximum storage elevation was 2,136. Limiting reservoir levels at lower than historical levels will eliminate the potential inundation of existing nests and nest trees.

However, future nest trees might be inundated if they developed below elevation 2,125. In addition, future loss of bald eagle productivity might occur from lower reservoir levels.

#### *7. Effects of No Permit Alternative on Cuckoos*

Direct take of cuckoos at Roosevelt is not expected to occur as a result of reservoir operations under the No Permit alternative because reservoir levels will be held lower than historical levels thereby avoiding inundation of existing habitat. However, as discussed below, the No Permit alternative likely would have an adverse indirect impact on cuckoos by reducing the long-term amount of habitat available.

As described in Subchapter V.C.1 above, restricting the operation of reservoir levels to a maximum elevation of 2,095 likely will result in lower amounts of tall dense vegetation over the long term at Roosevelt because large portions of the lakebed would not be subjected to periodic inundation and ground water recharge. Riparian vegetation would be limited to areas along the margin of the lake and on the Salt River and Tonto Creek inflows. In addition, existing habitat could still be lost from scouring floods, drying, and fire.

#### *8. Effects of Re-operation Alternative on Cuckoos*

The Re-operation alternative would have a moderate adverse impact on cuckoo habitat because reservoir levels would be similar to the historical range. The range of reservoir fluctuation would be slightly less than either historical levels or Full Operation levels, resulting in less tall dense vegetation on average over the long term (see Subchapter V.C.1 above). In addition, fill of the reservoir after an extended period of drawdown would inundate and destroy some habitat occupied by cuckoos. Because reservoir operations lower the lake about 15 feet or more each summer, potential cuckoo habitat above elevation 2,110 feet is likely to survive inundation. Using the data in Table III-8, the predicted impact on cuckoo habitat under the Re-operation alternative would be the periodic loss of approximately 60 acres of habitat. In addition, some direct take may occur due to the fall of nest trees containing eggs or fledglings as a result of tree inundation.

##### a. Mitigation Measures for Cuckoos Under the Re-operation Alternative

No additional mitigation for cuckoos is likely to be required under this alternative because, as discussed in Subchapters IV.C.1.d and V.C.2, mitigation measures for flycatchers will benefit cuckoos and Reclamation is mitigating the impact of Modified Roosevelt construction through acquisition and management of cottonwood/willow habitat that is suitable for cuckoos.

### D. Impacts to Water Supply and Power Generation

This subchapter begins with the approach used for the impact analysis of Roosevelt operations on water supply and power generation. Additional background for these impacts is provided in Subchapter V.N.6. The effect of each alternative on water supply and hydropower generation is evaluated below.

### *1. Approach*

#### a. Water Supply

The impact of reservoir operation alternatives on water supply is based on the reservoir operation modeling developed for the RHCP (see Appendix 3). Three SRPSIM runs were made for the analysis: 1) the Full Operation alternative where water is stored up to elevation 2,151; 2) the No Permit alternative where water is released above elevation 2,095; and 3) the Re-operation alternative where water is released above elevation 2,125. The impact of the Re-operation and No Permit alternatives is the change in water supply relative to the Full Operation alternative.

The value of the water supply lost as a result of changes in operation of Roosevelt is estimated based on the cost of replacing that supply. As discussed in Subchapter V.N.6, the water supply alternatives are limited by both quantity and availability. SRP has been unable to identify a feasible long-term source of replacement water to offset all of the impact to water supply from either the Re-operation or No Permit alternatives. Effluent reuse was identified as the largest source of potential replacement water and is used to quantify the impacts from changes in reservoir operation.

As discussed in Subchapter V.N.6, effluent produced by the 91st Avenue plant that is not already contractually committed to other uses is the most viable source of a partial, long-term replacement supply for lost Salt and Verde River water.[95] In order to reuse the effluent, the Sub-Regional Operating Group (SROG)[96] would need to construct a tertiary treatment unit at the 91st Avenue plant to provide an additional level of wastewater treatment. Treated effluent would then be delivered to the Tres Rios Constructed Wetlands[97] and routed through the wetlands for additional removal of nutrients and metals. At the terminus of the Tres Rios Constructed Wetlands, water would be pumped upstream to a recharge site along the Agua Fria River (Agua Fria Linear Recharge Project). The recharged effluent would then be recovered from wells located at or near the recharge site, transported to the CAP Canal and wheeled through the Canal to the

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[95] The description of the effluent reuse project and the cost estimates were provided to SRP by the SROG cities (Kamienski, pers. comm. 2002; Greeley and Hansen 1995, 1997).

[96] SROG is the multi-city operating group that owns the 91st Avenue plant and the effluent produced by that facility.

[97] In 1995, SROG, the United States Bureau of Reclamation and Army Corps of Engineers, and others constructed the Tres Rios wetlands to further treat effluent from the 91st Avenue plant for discharge to the Salt River. The 12-acre demonstration project provides advanced water treatment, wildlife habitat and recreational opportunities. The full-scale project, to be completed in 2007, will extend downstream from the 91st Avenue plant to the confluence with the Agua Fria River. Although the Tres Rios wetlands will be a sunk cost to the extent that some of the 91st Avenue effluent could be used as a replacement water supply for Roosevelt, the cost of wetland treatment was kept in the analysis in order to represent that portion of the cost of replacement water supplies for other effluent projects.

SRP turnout located near Granite Reef Diversion Dam. From there, the recovered effluent would be diverted into the SRP canal system and wheeled through that system to city diversions located along the SRP canal system. Alternatively, recovery wells could be drilled along the CAP Canal and the recharged effluent would be recovered through these wells and discharged directly into the CAP Canal. This alternative may avoid the cost of a pipeline from the recharge site to the CAP Canal but would require higher interconnection costs due to multiple discharge locations. This option would also raise additional regulatory permitting issues due the large volume of ground water recovery outside the area of hydrologic impact of the recharge site.[98]

The costs that can be estimated for using the 91st Avenue plant effluent as a replacement water supply are listed below. All costs are in 2001 dollars, with associated capital costs amortized at 8 percent over 20 years. Again, the maximum amount of effluent available for reuse would be 66,000 AF per year.

- Effluent Tertiary Treatment at 91st Ave. Plant (capital + O&M) = $176 per AF/yr. x 66,000 AF = $11,616,000 per year
- Tres Rios Constructed Wetlands (capital + O&M) = $11,000,000 per year
- Distribution System (from 91st Ave. Plant to Tres Rios Wetlands + from terminus of Tres Rios Wetlands to Agua Fria Linear Recharge Site (capital + O&M) = $117 per AF/yr. x 66,000 AF = $7,722,000 per year
- Agua Fria Recharge Facilities (capital + O&M) = $187 per AF/yr. x 66,000 AF = $12,342,000 per year
- Recovery Well Facilities (capital + O&M) = $223 per AF/yr. x 66,0000 = $14,750,000 per year

The subtotal of the estimated costs listed above is $57,430,000 per year or about $870/AF/yr. As noted at the outset of the description of approach, the estimated cost of $870/AF/yr is used as the average cost for replacement water supplies in the analysis of impacts because it is the only available specific estimate for a large source of water. Relatively small quantities of water may be available at lower cost from other sources, at least for a short period of time. On the other hand, the total cost listed above for 91st Avenue effluent reuse is low because certain costs are not known at this time. For purposes of this analysis, it is assumed that the additional costs for effluent reuse equal or exceed potential savings from the limited quantities of lower cost sources of water that might be available. However, for a number of reasons discussed below, this estimate is still likely to be conservatively low.

[98] If effluent were to be recovered via wells located along the CAP Canal, state law would strictly regulate recovery well operation. Typically, ADWR does not include effluent in its gallons per capita per day (gpcd) calculation for determining compliance with the gpcd limits mandated by the Groundwater Management Act. However, recovery along the CAP Canal would be outside the area of hydrologic impact and the recovered effluent would be included in the gpcd calculation.

First, preliminary planning efforts by the SROG cities have identified a maximum annual volume of 66,000 AF of effluent that may be available in the future for recharge at the Agua Fria recharge site. In the short term, far less than this annual volume would be available, and in any single year operational conditions at the 91st Avenue plant, the Tres Rios Wetlands, the recharge site, the recovery wells, or the CAP Canal may limit the amount available as a replacement supply. The average annual loss of water supply from the Re-operation and Full Operation alternatives exceed 66,000 AF/yr, so more expensive water supplies would have to be obtained to replace the entire supply.

Second, a major drawback of this source as a replacement supply is that it does not provide any water to cities that are not part of the SROG. SROG includes the cities of Phoenix, Glendale, Mesa, Scottsdale, and Tempe. Effluent reused under this alternative would not represent a replacement supply option for the cities of Peoria, Chandler, Gilbert, Avondale, or Tolleson, whose water supplies also would be impacted by the No Permit and Re-operation alternatives. These cities would have to obtain more expensive replacement supplies, such as less cost-effective effluent reuse from satellite wastewater plants.

Third, the estimate provided above is not a complete total cost because certain costs cannot reasonably be estimated at this time, and no attempt has been made to include environmental, administrative, and legal costs. Specifically, the following capital and operating costs are not included in the figures presented. There is no cost estimate for constructing and operating a pipeline from the recharge site to the CAP Canal, which would be very expensive. There are too many uncertainties about the potential pipeline routing, right-of-way, the final length of the pipeline, and the actual interconnect location to the CAP Canal to develop a reasonable cost estimate at this time. In addition, the Central Arizona Water Conservation District (CAWCD) does not currently wheel water for others nor has it set a wheeling policy, including access charges and water quality requirements, for the transportation of non-Colorado River water in the CAP Canal. Also, recovery by wells may require wellhead treatment for arsenic or other constituents. At this time there is insufficient data from any potential recovery well field sites to develop a reasonable cost estimate for wellhead treatment capital and O&M costs. Finally, the costs estimated above do not include the cost of recharging and recovering additional effluent to make up for system losses, including transportation losses in the CAP Canal and the SRP canal system.

#### b. Hydropower Generation

The impact of reservoir operation alternatives on hydropower generation is based on the three SRPSIM runs made for the RHCP (see Appendix 3). Those model runs involve the Full Operation alternative where water is stored up to elevation 2,151, the No Permit alternative where water is released above elevation 2,095, and the Re-operation alternative where water is released above elevation 2,125. The impact of the reservoir operation alternatives is the net loss of hydropower value relative to the Full Operation alternative.

Several key assumptions are used in the analysis of hydropower impacts:

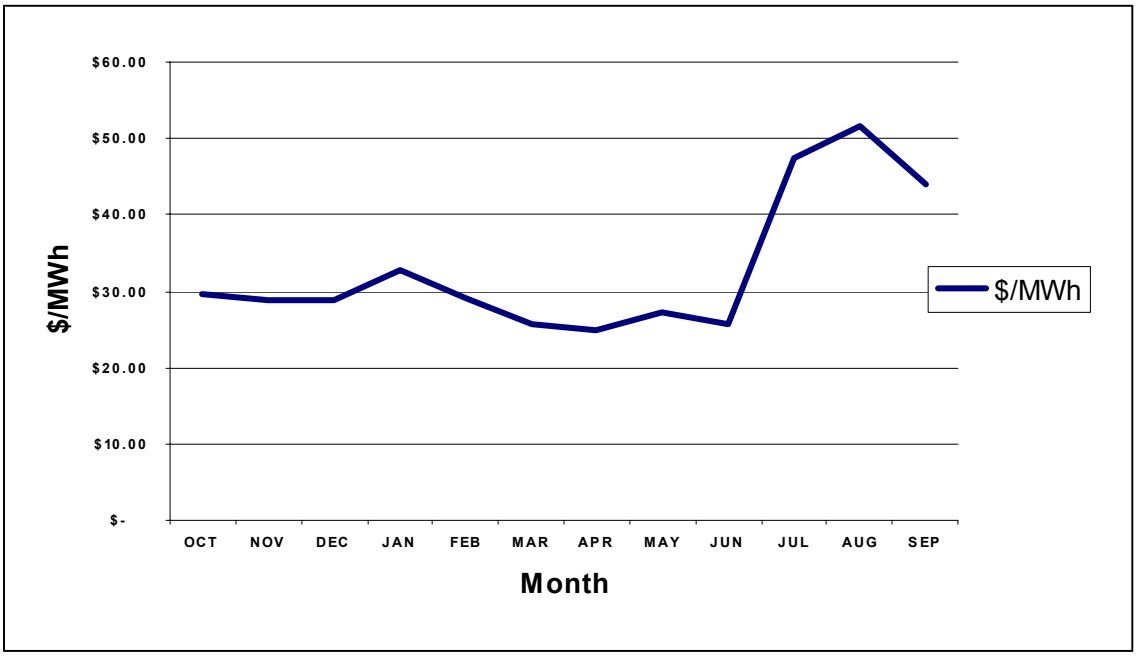
- All spills from Roosevelt are propagated throughout the rest of the Salt River storage system. This assumption is made because the lower Salt reservoirs are typically maintained at nearly full levels so there is limited storage available behind those dams.
- All water releases on the Salt River system, including "spills" above the water order, are used to generate power. The monthly spill amounts are averages over the 106-year simulation run. Because averages are used, the monthly generation capacity of the dams is not exceeded. In reality, in high runoff years, generation capacity likely would be exceeded and water would be by-passed through the spillways. However, in order to provide a conservative estimate of hydropower impacts and to simplify the analysis, long-term average spill amounts are used.
- Roosevelt generation ceases when the reservoir elevation is equal to or less than 2,062 feet. The generator at Roosevelt requires a minimum head of 150 feet to operate, which is at elevation 2,062.
- Constant reservoir heads are used when the reservoir levels are high enough to permit generator operation. In reality, the reservoir operation alternatives, especially the No Permit scenario, would result in lower Roosevelt water levels, which would reduce the head available to generate power. However, the reduction of power head under the alternatives was not considered in order to provide a conservative estimate of hydropower impacts and to simplify the analysis.
- The value of the hydropower ($/MWh) is based on projections of prices for the period October 2002 through September 2003 (see Figure V-1). Estimates of future power values are used because recent prices (2000 and 2001) have been affected by unusual conditions in the power market (Day and Meinert, pers. comm. 2001).
- The only costs considered in the economic impact analysis are the foregone value of the hydropower. As discussed in Subchapter V.N.7, the loss of Roosevelt hydropower production may result in the need to construct additional generation and/or transmission capacity. Thus, the estimates of impact presented below are conservative.

The approach used to estimate the loss of hydropower revenue from reservoir operation alternatives calculates the value of power generation for each month then compares that value to the average annual revenue generated by the Full Operation alternative.

#### c. Discount Rate

A discount rate of 6 percent is used to estimate the present value of average annual water supply and power generation impacts over 50 years. The discount rate of 6 percent is based on the long-term weighted average effective rate on SRP revenue bonds (SRP 2001, p. 31). The 50-year time period is based on the term of the ITP requested for Roosevelt.

**Figure V-1. Estimated value of hydropower ($/MWh) for the period October 2002 through September 2003.**




### *2. Effects of No Permit Alternative*

As noted at the outset of this Subchapter V.D.1.a, SRP was unable to identify water sources to replace the full amount of water supply impact under the No Permit alternative. Thus, shortfalls to SRP and city water users are likely to occur. Moreover, if effluent is reused to offset impacts from reductions in Roosevelt water supply, then that source will not be available to satisfy future growth in demand. Thus, that growth would have to be met by obtaining more expensive sources or limiting growth, which in turn would have large economic impacts to the regional economy.

Under the No Permit alternative, the average annual loss of water supplies to SRP would be 81,700 AF/yr (Appendix 3, Table 1).[99] Assuming that additional water supplies were found, and using the conservative replacement cost of $870/AF/yr, the total cost to replace this supply would be more than $71.1 million per year. The present value of those annual impacts over 50 years is approximately $1.1 billion using a discount rate of 6 percent.

In addition, the cities entitled to NCS water would lose more than 49,400 AF/yr on average (Appendix 3, Table 1). At $870/AF/yr, the total cost to replace this supply

[99] Throughout the RHCP, water losses due to alternative reservoir operations are in addition to shortfalls experienced due to low runoff.

would be more than $43 million per year. The present value of those annual impacts over 50 years is approximately $677 million.

The total impact is likely to be much larger than these estimates because the cost is based on the maximum available reuse of 66,000 AF/yr of effluent (about 50 percent of the total impact). The average cost per acre-foot will be likely much higher, presuming a replacement supply could even be identified.

These estimates of impact on SRP water supply also are very conservative because some of the potential shortfall to SRP water users from reduced reservoir storage is offset in the modeling by additional SRP ground water pumping (see Appendix 3). However, the cities served by SRP cannot fully utilize this additional ground water because their Assured Water Supply (AWS) Designations place strict annual limits on the amount of ground water that can be used by the cities in any year.[100] 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. This impact would be in addition to the estimates of impact discussed above.

Average annual hydropower losses under the No Permit alternative are conservatively estimated to be about $2.6 million per year. The present value of those annual impacts over 50 years is approximately $41.0 million using a discount rate of 6 percent. This impact includes the loss of power generation revenues to the cities of Tempe, Mesa, Chandler, Glendale, Scottsdale, and Phoenix under the terms of the NCS operating agreement.

In summary, the primary impact of the No Permit alternative is that sufficient replacement water supplies are not available to meet existing demand. To the extent that alternative water supplies are available to meet a portion of the existing and future demand, the cost of those supplies will be very high.

#### *3. Effects of Re-operation Alternative*

The average annual loss of water supplies to SRP would be 24,700 AF/yr under the Re-operation alternative (Appendix 3, Table 2). The total cost to replace this supply would be more than $21.5 million per year using the conservative replacement cost of $870/AF/yr. The present value of those annual impacts over 50 years is approximately $339 million using a discount rate of 6 percent.

In addition, the cities entitled to NCS water would lose more than 49,400 AF/yr on average (Appendix 3, Table 1). At $870/AF/yr, the total cost to replace this supply

[100] Annual ground water withdrawals by each city are limited to the 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).

would be more than $43 million per year. The present value of those annual impacts to the cities over 50 years is approximately $677 million.

As noted above under the impact analysis of the No Permit alternative, the cities also would be unable to use their portion of the 13,600 AF/yr of additional ground water pumping by SRP, which would further increase the magnitude of impact from the Re-operation alternative on municipal water users.

Again, as in the No Permit alternative, full use of effluent could not replace the water supplies lost at Roosevelt and shortfalls to SRP and city water users are likely to occur. Moreover, if effluent is reused to offset impacts from reductions in Roosevelt water supply, then that source will not be available to satisfy future growth in demand. Thus, that growth would have to be met by obtaining more expensive sources or limiting growth, which in turn has larger economic impacts than higher cost of water described above.

Average annual hydropower losses under the Re-operation alternative are conservatively estimated to be about $1.3 million per year. The present value of those annual impacts over 50 years is approximately $20.5 million using a discount rate of 6 percent. As with the No Permit alternative, these impacts include the loss of power generation revenues to the NCS cities.

### E. Effects on Recreation

The first subchapter in this section describes the approach used for the impact analysis of Roosevelt operation alternatives on recreation use on and around the lake. The effect of each alternative on recreational use is summarized in the following subchapters. Additional background for the analysis of recreation impacts is provided in Subchapter I.G.6.

#### *1. Approach*

As summarized in Subchapter I.G.6, Roosevelt provides the greatest amount of water-based recreation in central Arizona. Because much of the recreational activity is centered on the lake (e.g., boating and fishing), the analysis of impacts focuses on the effect of the alternatives on water levels in Roosevelt.

The analysis of recreation impacts is qualitative because insufficient visitor use information is available from which to derive a statistical relationship between lake levels and visitor days. As noted in Subchapter I.G.6, estimates of annual visitor use are incomplete and no estimates are available after 1996. In addition, because Modified Roosevelt has yet to fill to capacity, there are no estimates of actual use under full reservoir conditions. Given the lack of visitor use data, the impacts of the No Permit and Re-operation alternative on recreation use at Roosevelt are qualitatively described below in relation to estimates for the Full Operation alternative.

Similarly, there is insufficient data from which to estimate the economic impacts from changes in recreation visitor use at Roosevelt. However, the approximate magnitude of the total direct economic impacts from Roosevelt recreation use for the Full Operation alternative is estimated below in order to provide context for the qualitative analysis of the other two alternatives.

Although precise estimates of recreation use at alternative reservoir levels are not possible with the available data, research on recreation economics has generally identified a positive relationship between water levels and recreation use (Platt 2001). As water levels increase or decrease, so does recreation use in a roughly bell-shaped curve (Id.). The tails for the curve represent high and low reservoir levels, where visitation is lower than optimum conditions. On the high end, safety and access issues reduce visitation. On the low end, water quality, access, and poor site attractiveness are among the factors that reduce visitation. The optimum range for recreation activities at a particular site lies in between high and low water levels. In other words, as water levels increase above the low-end of the range, so does recreation use; the use peaks at an optimal fill level; and then recreation use may decrease as water levels rise further. However, the actual curve of recreation use versus lake level for a specific reservoir may not be symmetrical. At Roosevelt, because water levels above elevation 2,151 will be limited to about 20 days or less (Corps 1997), the upper-end of the water level annual visitation curve is attenuated and recreation use is likely to be lower than optimum levels for only a brief period of time.

As noted above, the economic value of recreation use at Roosevelt is difficult to assess due to the lack of visitation data and a well-researched visitor profile. However, "benefits transfer" provides a reasonable approach where site-specific data or models are not available (Platt 1996). This is most effective when using data developed within the same region as the site in question (Id.). Table V-1 lists recreation use values for the Intermountain West region that have been estimated for common recreation activities at Roosevelt. These values are consistent with the average expenditures of visitors to Roosevelt Lake calculated in the 1995-1996 Study of Travel and Tourism in the Globe-Miami Region (Leones et al. 1997).

**Table V-1. Recreation use values for camping, motor boating and fishing.**

| Activity | Mean Value per Activity Day, 1996 dollars | Mean Value per Activity Day, 2001 dollars, Indexed from 1996 using the CPI |
|---|---|---|
| Camping | $25.87 | $29.75 |
| Motor boating | $23.58 | $27.12 |
| Fishing | $31.42 | $36.13 |

*Source:* Rosenberger and Loomis 2001; CPI 2001.

Given the unknown nature of the specific mix of activities, a simple average of $31.00 per activity day is used to approximate the 2001 economic value of recreation use at Roosevelt.

As summarized in Subchapter I.G.6, Reclamation estimates that the new recreation facilities at Roosevelt will yield 867,796 recreation days annually based on the total daily capacity for 18,825 people multiplied by turnover rates for the various activities at the lake (Reclamation 1990, p. 35). Given the relatively low use by visitors in recent years when lake levels are low, this estimate is assumed to represent years when the lake is full or nearly full. Using the roughly 870,000 visitor days under full reservoir conditions

multiplied by the average value per activity day yields a total economic value of about $27 million per year. Of course, the long-term average annual value likely will be less than this total because the reservoir would not be full every year (see Appendix 3).

In order to estimate the long-term average economic value of recreation use under the Full Operation alternative, 1993 visitor data is used to develop an approximation. The reservoir level at the end of May 1993 was at about elevation 2,115, which is nearly the same as the long-term end of May reservoir level modeled under the Full Operation alternative (about elevation 2,120, which equates to about 16,360 surface acres; see Appendix 3).[101] As noted in Subchapter I.G.6, Reclamation estimated that the 1993 recreation use was 350,000 visitor days. Using the Tonto Forest's estimate of annual demand increases of 7 percent in recent years and the expanded capacity of the facilities at Roosevelt, the equivalent recreation use estimate for that lake level would be about 600,000 visitor days in 2001 for the average reservoir elevation under the Full Operation alternative. Multiplying 600,000 visitor days by an average value of $31.00 per day yields an average economic value of about $19 million per year.

#### *2. Effects of No Permit Alternative*

Reservoir operation alternatives would affect recreation opportunities at Roosevelt Lake by decreasing the maximum and average lake levels (see following sections). Although these impacts could not be fully mitigated (e.g., impacts associated with boat crowding and reduced site attractiveness), impacts associated with access to the lake might be mitigated. The primary mitigation measure that could minimize access impact would be the extension of boat ramps to lower elevations to facilitate launching at lower reservoir levels. This measure appears to be feasible in only a couple of locations, so reduced accessibility of the lake to boats may be a significant impact resulting from alternative reservoir operations. The estimated cost of extending the ramps where feasible is included as part of the impact analysis in the EIS.

Under the No Permit alternative, average May reservoir levels would be about 2,085 feet in elevation with a surface area of approximately 11,330 acres or 70 percent of the average surface area under the Full Operation alternative (see Appendix 3). As discussed above, it is not possible to estimate the precise impact of the No Permit alternative on recreation visitor days and their economic value; however, a reduction in surface area of 30 percent is likely to result in a significant decrease in recreation use. Although the precise impact is not known, the economic impact would be significant, for every 10 percent decrease in visitor use, the average annual economic impact would be on the order of $2 million. The present value of an annual loss of $2 million per year for 50 years is about $32 million. Thus, for illustration, if there is a direct relationship between lake level and recreation use, the No Permit alternative would result in an average annual loss of 30 percent or about 180,000 visitor days, with associated direct economic impacts of about $6 million per year having a present value of approximately $96 million.

[101] End of May reservoir levels are used in this analysis because this is in the early part of the high use recreation season and is assumed to provide a good index for the entire year.

#### *3. Effects of Re-operation Alternative*

Under the Re-operation alternative, average end of May reservoir levels would be about 2,107 feet in elevation with a surface area of about 14,500 acres or about 90 percent of the average surface area under the Full Operation alternative (see Appendix 3). As discussed above under Approach, it is not possible to estimate the precise impact of the Re-operation alternative on recreation use and its economic value; however, although a reduction in the average surface area of 10 percent is likely to result in a decrease in recreation use, the reduction would not be as significant as the impact under the No Permit alternative. Again, although the precise amount of impact is not known, the average annual economic impact would be on the order of $2 million for every 10 percent decrease in visitor use, with a present value of about $32 million.

### F. Water Rights Impacts

Reservoir operation alternatives would require that some storage space at Roosevelt not be used to store water. Because the water rights associated with this storage space would not be used for an extended period of time, if ever again, those rights might be lost (A.R.S. §§ 45-141.C, -188, and -189). The only option identified to minimize or mitigate the potential loss of water rights is to sever that portion of the water right from Roosevelt and transfer it to underground storage using recharge. As indicated in Subchapter V.N.6.c, the feasibility of that alternative is severely limited by legal, institutional, and practical constraints.

#### *1. Effects of No Permit Alternative*

The potential water right impact from the No Permit alternative would be the loss of the right to store water above elevation 2,095 in Roosevelt. This might result in a permanent loss of water rights to about 908,000 AF of storage space estimated to yield an average of about 131,000 AF/year. The replacement cost of the water supply and power generation for a permanent loss of the right to store water would increase from the 50-year estimate in Subchapter V.D.2 by about 6 percent based on the increase in present value of annual replacement costs between 50 years and 100+ years.

#### *2. Effects of Re-operation Alternative*

The potential water right impact from the Re-operation alternative would be the loss of the right to store water above elevation 2,125 in Roosevelt. This may result in a permanent loss of water rights to about 460,000 AF of storage space estimated to yield on average about 74,000 AF/year. The replacement cost of the water supply and power generation would increase from the 50-year estimate in Subchapter V.D.3 by about 6 percent based on the increase in present value of annual replacement costs between 50 years and 100+ years.

#### *3. Legal Challenges*

If either the No Permit or Re-operation alternative is selected, a number of potential legal challenges might be brought by water users who presently depend upon Roosevelt as a source of supply and could receive less water with implementation of either of these alternatives. For example, the implementation of either the No Permit or Re-operation alternatives would result in the long-term loss of water supplies and water storage rights granted to the Salt River Pima-Maricopa Indian Community under the 1988 Settlement

Act and its implementing Settlement Agreement (see P.L. 100-512, 102 Stat. 2551; Appendices 1 and 3; and Comment #3 in Comments and Responses, Draft Roosevelt Habitat Conservation Plan and Draft Environmental Impact Statement, which accompanies the final RHCP) The potential for such legal challenges, should the No Permit or Re-operation alternative be selected, is one of the considerations taken into account in the analysis of these alternatives in the RHCP.

### G. Effects on Listed and Rare Plants and Other Listed Wildlife and Species of Concern

As discussed in Subchapter II.C.1, listed and rare plants in the vicinity of Roosevelt are upland species that would not be impacted by any of the alternatives under consideration in the RHCP. Similarly, other listed wildlife and species of concern would not be impacted by the No Permit or Re-operation alternatives considered in the RHCP (see Subchapter II.C.2).

### H. Effects on Critical Habitat

As summarized in Subchapter II.B.1.c, critical habitat was designated for flycatchers in 1997 but was set-aside in 2001 due to a court ruling that the economic analysis incorporated in the designation needs reassessment. In the 1997 rule, the area at and in the vicinity of Roosevelt was not considered to be critical habitat (FWS 1997a). Given that critical habitat was not designated at Roosevelt in 1997 and the set-aside of the designation in 2001, there would be no effect on critical habitat from any of the alternatives considered in the RHCP.

If critical habitat at or near Roosevelt is designated in the future for flycatchers, it would not affect the Re-operation alternative. Above elevation 2,125, reservoir operations would not affect critical habitat. Below elevation 2,125, the effects of reservoir operations on flycatcher habitat would be fully addressed by the RHCP. Similarly, under the No Permit alternative, reservoir operations would not affect habitat above elevation 2,095 and no habitat is likely to be impacted below 2,095.

Critical habitat has not been proposed or designated for Yuma clapper rails, bald eagles, or cuckoos. If such habitat is designated in the future, the effects of alternative Roosevelt operations on this habitat would be the same as described above for flycatchers.

### I. Downstream Flood Impacts

Reservoir operation alternatives would increase the amount and frequency of flood flows downstream because the water could not be stored at Roosevelt. These increased flood flows could potentially impact wildlife habitat and land uses in and along the Salt River channel (e.g., Tempe Town Lake, Rio Salado Project, sand and gravel operations, and ground water recharge facilities) through the Phoenix metropolitan area and farther downstream on the Gila River. As discussed further in the EIS, changes in flood flows could benefit regeneration of riparian vegetation or scour existing riparian vegetation. However, these increased flows were determined to only occur during moderately large flow events (major floods would still be attenuated due to the limited spillway capacity of Roosevelt), and would be a relatively small increment above the flows that would otherwise exist in the absence of these reservoir operation alternatives (see Appendix 3).

Moreover, as a result of flooding in the 1980s and 1990s, the flood control capacity of the Salt River channel has been increased substantially. Thus, increased flood flows from reservoir operations considered in the RHCP were determined to have minimal impact on downstream areas, and mitigation or minimization measures were not pursued.

### J. Water Quality Impacts

As discussed above under Downstream Flood Impacts, increased releases from Roosevelt would occur under the reservoir operation alternatives because some water could not be stored at Roosevelt. These increased flood flows would impact water quality by increasing the suspended sediment load. However, for the reasons discussed under Downstream Flood Impacts, water quality impairment would be minimal and mitigation or minimization measures were not pursued.

### K. Cumulative Effects on Covered Species Under the ESA

Cumulative effects under the ESA for the No Permit and Re-operation alternatives are similar to those described for the Full Operation alternative in Subchapter III.K. For all alternatives, a statewide and regional loss or degradation of suitable habitat for flycatchers, bald eagles, and cuckoos is likely to continue. Under the No Permit alternative, a reduction in the maximum elevation of Roosevelt would prevent the loss of existing flycatcher and cuckoo habitat over the short term, and breeding habitat and productivity would be maintained. Over the long term, existing habitat is likely to decay in the absence of periodic inundation. Cumulative effects of the No Permit alternative in addition to other past, present, and future actions are difficult to predict because of the uncertainties in how riparian vegetation will respond to changes in reservoir operation and climatic conditions. The same is true for the Re-operation alternative. The periodic loss of flycatcher habitat under the Re-operation alternative in addition to regional impacts on flycatcher habitat would increase cumulative impacts. However, the acquisition and protection of suitable riparian habitat at several locations is proposed to compensate for this periodic loss of habitat. Overall, the Re-operation alternative would not add appreciably to the regional cumulative effect when mitigation measures are implemented. The No Permit alternative might increase regional cumulative effects if habitat decays from lack of inundation or increased bald eagle competition reduce productivity because no mitigation measures would be implemented.

The cumulative effects of the No Permit and Re-operation alternatives on other resources are described in the EIS.

### L. Indirect Effects on Covered Species Under the ESA

The primary indirect effects of the No Permit and Re-operation alternatives are likely losses in productivity at Roosevelt. For flycatchers and cuckoos, these productivity losses would occur when habitat is periodically inundated by reservoir fills. These productivity losses at Roosevelt are intended to be offset by increases in productivity at mitigation sites. For bald eagles, periodic losses of productivity at Roosevelt may result from extended periods of reservoir drawdown.

The indirect effects of the No Permit and Re-operation alternatives on other resources are described in the EIS.

### M. Reasons That the No Permit and Re-operation Alternatives Were Not Selected as the Proposed Alternative

After thorough consideration, SRP rejected the two major alternatives to Full Operation of Roosevelt without an incidental take permit (No Permit) and operation of the lake to maintain long-term lake levels below the full capacity of the reservoir (Re-operation) for several reasons. First, both alternatives were rejected because they would not allow Roosevelt to be used for the purposes for which it was built. Second, both would have significant socio-economic impacts through loss of water supplies, power generation and recreation use (Subchapters V.D and V.E). Third, even with the use of effluent at significant cost, SRP and the Cities would be unable to secure sufficient long-term replacement water supplies to offset those lost due to the implementation of the No Permit or Re-operation alternatives, which would result in water supply shortfalls. Fourth, both options could cause significant legal issues relative to SRP's obligations to deliver water under various water rights and contracts (Subchapter V.F, and Appendices 1 and 2). Fifth, although both alternatives would attempt to avoid (No Permit) or reduce (Re-operation) short-term impacts to listed species, it is unlikely that either alternative would support larger populations of these species over the long term than the Proposed Action (Subchapter V.C). Sixth, no storage would be allowed in NCS under either alternative and the Cities' investment of about $44.4 M[102] would be wasted.

### N. Alternatives and Measures Eliminated From Further Consideration

A number of alternatives, including certain minimization or mitigation measures for biological and socioeconomic impacts, were determined to be infeasible, would not meet the project purposes, or were simply minor variations on the three principal alternatives summarized above. The alternatives and measures that were rejected and the reasons for elimination are summarized in Table V-2 for ease of comparison. A detailed description of the reasons for their elimination is provided in this subchapter.

#### *1. Section 7 Consultation Between Reclamation and FWS*

This alternative would involve reinitiation of consultation between FWS and Reclamation and, if appropriate, issuance of an incidental take statement by FWS to Reclamation. The proposed action would be expanded from that addressed in the 1996 consultation to include operation of all conservation storage at Roosevelt rather than just construction and inundation of the NCS between 2,136 and 2,151 feet.

[102] *See* Decision of the Director of the Arizona Department of Water Resources In the Matter of the Applications to Appropriate Public Waters of the State of Arizona: Application Nos. R-2517, 33-96226, 33-96227, 33-96228, 33-96229, 33-96230, 33-96231; April 10, 1996.

**Table V-2. Alternatives eliminated from further consideration (retained alternatives and measures noted where applicable).**

| ALTERNATIVE OR MEASURE | REASONS FOR ELIMINATION |
|---|---|
| **Jurisdictional** | |
| Section 7 Consultation between Reclamation and FWS | • SRP's continued operation of Roosevelt is not a federal action |
| **Reservoir Re-Operation Alternatives** | |
| Breach Roosevelt Dam | • Defeats project purpose<br>• Permanently reduces riparian habitat<br>• Large socioeconomic and environmental impacts |
| Other Changes to Roosevelt Operations | • Options limited by high variability of runoff<br>• Not entirely eliminated — One mid-range alternative selected for further study |
| Change Verde Operations (modify reservoir fill, releases, or sediment capture) | • Options limited by high variability of runoff<br>• Impact on complex contracts with Tribes, mining company, and City of Phoenix<br>• Limited benefits to riparian vegetation<br>• High cost |
| **Measures to Minimize or Mitigate Impact on Listed Species — Salt and Verde Watersheds** | |
| Protect riparian habitat on private land | • Opportunities are limited<br>• Not entirely eliminated — protection of existing riparian habitat on private land along the Verde is one component of RHCP |
| Restore riparian habitat on private land | • Opportunities are limited due to narrow floodplains and high gradient<br>• Not entirely eliminated — one component of RHCP |
| Protect and restore riparian habitat on public land | • Subject to 7(a)(1) and (2) of ESA<br>• Limited amounts available<br>• No SRP control<br>• Not entirely eliminated, one potential component of RHCP |
| **Measures to Minimize or Mitigate Water Supply Impacts Resulting from Changes in Reservoir Operations** | |
| Additional ground water pumping | • Severely limited by Arizona Groundwater Management Act |
| Reduction of water use through conservation measures | • Already being implemented as required by the Arizona Groundwater Management Act |
| Recharge of water that cannot be stored at Roosevelt | • 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 |

| ALTERNATIVE OR MEASURE | REASONS FOR ELIMINATION |
|---|---|
| **Measures to Minimize or Mitigate Power Supply Impacts Resulting from Changes in Reservoir Operations** | |
| Construct new transmission | • Loss of Roosevelt generation may require construction of new transmission or generation facilities (see below) |
| Purchase replacement power | • Increases risks associated with price volatility and less reliable power<br>• Increases emissions levels |
| Construct new generation | • May not be permitted due to air quality issues<br>• Increases emissions levels |
| Use of renewable energy | • Currently not a cost-effective alternative |
| Increased energy conservation | • Already being implemented |

Section 7 is limited to federal agency action; its consultation requirements apply only to activities "authorized, funded or carried out" by federal agencies. The previous Section 7 consultation between FWS and Reclamation, completed in 1996, addressed Reclamation's action of modifying Roosevelt Dam, including the construction of NCS and flood control space above elevation 2,136. The consultation also addressed the effect of Reclamation's action—the eventual inundation of the new reservoir space above elevation 2,136 feet.[103] SRP's operation, storage and release of water for the original Roosevelt Dam, for which it has been responsible for the last 85 years, was not the subject of Reclamation's action. Accordingly, the 1996 consultation did not address SRP's operation of the original conservation space, where the majority of breeding sites for flycatchers are presently located.

The 1996 Section 7 consultation also did not address SRP's ongoing, long-term operation of all the conservation storage space at Roosevelt Dam, the action that is the subject of this RHCP and accompanying application by SRP for an ITP. SRP is vested with the authority over and responsibility for the operation of conservation storage at Roosevelt Dam, through its 1904 and 1917 contracts with the Secretary of the Interior, and, subsequently, the 1993 Contract authorizing SRP to operate the NCS constructed by Reclamation. The action addressed by SRP's application for an ITP (ongoing, long-term operation of conservation storage) is SRP's action, and not the Proposed Action of any federal agency. As such, it is appropriate to address the effects of SRP's operation of conservation storage at Roosevelt Dam pursuant to Section 10 of the ESA.

[103] *See* memorandum to David Harlow, U.S. Fish and Wildlife Service, from Carol Erwin, U.S. Bureau of Reclamation, dated January 5, 2000, p. 1; letter to John F. Sullivan, Associate General Manager, Salt River Project, from David Harlow, U.S. Fish and Wildlife Service, dated March 2, 2000, p. 1; both citing the 1996 BO addressing Reclamation's 1995 Biological Assessment.

For these reasons, the alternative of a Section 7 consultation between Reclamation and FWS to address SRP's operation of conservation storage was eliminated from further consideration and the impacts of this alternative are not considered in Chapter IV.

#### *2. Breach Roosevelt Dam*

This alternative would involve breaching Roosevelt Dam in an effort to avoid potential take. The elimination of Roosevelt Lake would ultimately result in the dramatic reduction of riparian habitat at Roosevelt because the combination of deltas formed and maintained by the lake and saturation of those deltas by reservoir operations has created much of the riparian habitat at Roosevelt (see Subchapter II.A.1). Also, this alternative was determined to be infeasible because it defeats the purpose of SRP's operation of Roosevelt to provide water and power to the Phoenix area. Moreover, there would be enormous socioeconomic and environmental impacts resulting from the loss of water supply, flood control, and recreation benefits provided by Roosevelt.

#### *3. Other Changes to Roosevelt Operations*

Many Roosevelt operational alternatives were identified by SRP, the FWS, and the public. Each of those alternatives was carefully considered and one, the Re-operation alternative, was selected for further analysis (see Subchapter V.B). Two other operational alternatives that were considered in developing the RHCP and eliminated from further consideration are described below.

##### **a. Reservoir Management to Enhance Riparian Habitat**

In the 1996 BO on Modified Roosevelt, FWS considered reservoir management to slowly increase maximum reservoir levels in order to promote vegetation growth at higher and higher elevations within the reservoir thereby avoiding sudden impacts to riparian habitat (FWS 1996, pp. 28, 29). The FWS determined this alternative to be infeasible "because of the difficulty of balancing water needs for developing habitat with the need to avoid destroying existing habitat or affecting reproductive attempts through prolonged inundation" (Id.). This alternative was reconsidered during development of the RHCP and it was determined that reservoir operation alternatives that attempt to manage reservoir elevation over time are infeasible because reservoir fluctuations are largely determined by the extent, duration and frequency of runoff, factors beyond the control of SRP. As discussed in Subchapter I.G, runoff into Roosevelt is highly variable, with long-term cycles of drought and flood, which prevent a sequential increase in reservoir level, or most other types of specific control of reservoir elevation.

A similar alternative to manage reservoir level in order to enhance riparian habitat would be to store water in the winter and then release it in the spring before the flycatchers return to breed and nest. However, late season storms may result in high inflow during late March and April, which would prevent the use of this alternative because there would be too great of risk of not being able to release enough water prior to the onset of the breeding season for flycatchers and, thus, there could be inadvertent take. Also, inundation of vegetation may result in modification of trees that would otherwise be used by flycatchers for nesting, roosting and foraging (FWS 1996, p. 21). This alternative provides only marginal additional water storage in the winter when less water is needed. In many years, large spring releases would: 1) negate the benefit of winter

storage; and 2) result in the loss of hydropower production during the summer demand peak period. Moreover, there is a risk of inundating flycatcher habitat during the breeding season. This alternative was eliminated because few benefits are realized for listed species but there are large impacts to water supply and power generation.

#### b. Various Other Limits for Maximum Reservoir Elevation and Timing of Fill

SRP developed a wide variety of operational rules that would limit reservoir fill to certain times of the year, certain years, or various elevations. These alternatives lie in the range between Full Operation of Roosevelt (Proposed Action) and the No Permit alternative of maintaining the reservoir below the lowest current nesting elevation.

For the reasons discussed in the previous subchapter, management of the reservoir to meet specific reservoir elevations at particular times of the year is not feasible. Thus, SRP determined that the only feasible operational alternatives involve a fixed constraint on the maximum elevation of conservation storage. To provide an intermediate reservoir operation alternative, the maximum elevation could be established anywhere between elevation 2,095 and 2,151, the No Permit and Full Operation levels. As described above in Subchapter V.B.2, a maximum elevation of 2,125 was selected for evaluation as the Re-operation alternative. The Re-operation alternative represents a point on the continuum between the Full Operation and the No Permit alternatives; thus, the impacts of the other possible maximum elevations also lie on this continuum. The impacts of all three alternatives are discussed in Chapters III and IV.

### *4. Change Verde Operations*

Riparian habitat suitable for flycatchers is limited from Horseshoe Reservoir to the mouth of the Verde River, although flycatcher activity at the inlet to Horseshoe Reservoir recently has been observed. At the suggestion of the public and FWS, several alternatives involving changes in operation of SRP's Verde reservoirs were developed by SRP in order to potentially create or enhance riparian habitat that is likely to be utilized by flycatchers at or downstream of the reservoirs. These alternatives included modifying the timing and extent of fill, releasing water to mimic the natural hydrograph, and providing sediment to the Verde downstream of Bartlett Dam.

#### a. Modifying the Timing and Extent of Fill

Alternatives that involve modifying the timing or extent of fill of the Verde reservoirs primarily would involve changing the operation of the Verde dams to create and maintain riparian vegetation at Horseshoe Reservoir, which has topographic and soil characteristics potentially more suitable for vegetation growth than Bartlett Reservoir.

Bartlett and Horseshoe dams are operated pursuant to a complex set of Congressionally approved water rights settlements and contractual relationships involving the Salt River Pima-Maricopa Indian Community, Fort McDowell Yavapai Nation, United States, City of Phoenix, and Phelps Dodge (see Subchapter I.F and Appendix 1). Modifying the operation of one or both of the Verde dams could have significant impacts on these water users. These contractual water users would have strong grounds to enjoin any modification of the operation of the Verde dams absent an overriding reason such as protecting the safety of the dams, maintenance requirements, or

avoiding Section 9 take of listed species at the Verde reservoirs. For this reason, modifying the extent and timing of fill of the Verde reservoirs was determined to be infeasible as part of the RHCP and these alternatives were eliminated from further consideration with respect to minimization and mitigation of impacts to listed species at Roosevelt.

**b. Releases of Water to Mimic the Natural Hydrograph**

The Flycatcher Recovery Team Recommendation for flycatchers suggests that reservoir operations be modified to benefit downstream riparian habitat (FWS 2001b, pp. 98, 99, Appendices I and J). Specifically, the Recommendation 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., p. J-31).[104] In light of this guidance and public input, SRP evaluated this alternative.

SRP has conducted extensive studies along the lower Verde River since 1985 to assess the hydrological and environmental impacts of dam operations (ERO 1986; SRP 2002). This work has focused on riparian vegetation communities, including evaluation of surface and ground water hydrology, ground and aerial vegetation surveys, analysis of historical aerial photos dating from 1934, coring of cottonwoods to determine age, and soil studies. Findings from these studies are summarized below:

- Alterations of the flow conditions from reservoir operations in the lower Verde River have reduced the frequency and density of cottonwood establishment and survival, although these processes continue to occur in the active floodplain. However, as noted below, broad, extensive areas of riparian woodland were not present historically and land use appears to be a limiting factor for cottonwood regeneration (ERO 1986).
- Given the relatively small size of the SRP reservoirs on the Verde, the natural hydrograph has not been substantially modified by operation of the reservoirs (SRP 2002; see Subchapter I.G.5; see also FWS 2001b, p. J-9).
- Unregulated Verde River flow prior to reservoir construction did not support extensive cottonwood galleries or broad areas of riparian vegetation within the river's floodplain; the distribution of cottonwood remains today, as it has historically, as isolated stands. Some cottonwood regeneration continues to occur; for example, a number of saplings near the Beeline Bridge resulted from high flow events in 1979 and 1980. Similarly, other riparian vegetation continues to occur mostly as strands along the river banks (ERO 1986; 1934 photos on file at SRP).
- Minimum stream flows would have a slight beneficial effect on sustaining riparian vegetation. A minimum flow of 100 cfs released from Bartlett Dam was

[104] SRP has identified flaws in the hydrological analysis on which this statement is based (SRP 2002).

incorporated into the Fort McDowell Indian water rights settlement and has been in effect since 1994 (ERO 1986; see Appendix 1).[105]

- Succession of cottonwood galleries and other riparian vegetation is a combination of natural fluctuations and man-induced changes, including such factors as natural channel migration, land use, and water regulation. Minimum flows higher than 100 cfs would have little benefit in maintaining mature cottonwoods or in facilitating regeneration of cottonwoods or other riparian vegetation because 100 cfs is adequate to maintain a stable ground water table under the floodplain in the absence of pumping large amounts of water from wells (ERO 1986).
- Sediment availability and flow alteration may not be major constraints to riparian restoration between Horseshoe Dam and Needle Rock above the Fort McDowell Indian Reservation. A relatively high-gradient channel and riparian land uses (e.g., grazing) appear to be the biggest factors limiting riparian vegetation in this reach (Graf, pers. comm. 2001). In support of that hypothesis, the reach of the Verde River above the dams (between the lower end of the Verde Valley and Horseshoe, an area subject to unregulated flows) is in similar condition to the lower Verde (Id.).
- Recreational use of riparian areas and grazing by cattle and horses are major impacts on cottonwood/willow communities along the lower Verde. Nearly all of the riparian land use along the lower Verde is subject to the jurisdiction of the Forest Service or the Fort McDowell Indian Reservation. Recruitment of new trees and shrubs from the high flow events since the late 1970s has been limited or nonexistent in these areas. Management of recreation use and livestock grazing has the greatest potential to promote perpetuation of cottonwood and willow on the Reservation (Id.).
- River morphology has not changed significantly since the construction of Bartlett Dam (Id.).
- Vegetation density on the active floodplain of the lower Verde River has increased since 1934 when river flows became regulated as the result of the construction of Bartlett Reservoir. This increase in density may be the result of salt cedar invasion (Turner 1974).
- High bank cottonwoods, which have been the focus of concern due to bald eagle nests, are overly mature. These cottonwoods appear to be decadent primarily as a result of age and disease and a declining water table due to the natural migration of the channel (ERO 1986).
- Options for perpetuating cottonwood stands and other riparian vegetation include:
    1. Attempting to maintain current population levels in an unmanaged state under current flow regulation and land use;
    2. Restocking by direct plantings; or

[105] Appendix J (p. J-9) of the Flycatcher Recovery Team Recommendation (FWS 2001b) does not reflect these minimum flows.

3. Attempting regeneration by topographic management of the floodplain and/or flow regulation.
4. Removal of cattle and management of human impacts (Id.).

- Options attempting to create regeneration by manipulating flows are unlikely to produce predictable results, in part because the sediment supply is limited (see next subchapter).

Another consideration on the Verde River is that storage facilities are not available downstream of Bartlett Dam to capture releases that exceed water demand. Thus, the range of flow variation downstream of Bartlett Dam without losing water over Granite Reef Dam is limited to a few hundred to about 2,400 cfs depending on the water demand at Granite Reef. Some flow manipulation between Horseshoe and Bartlett is possible but the range, amount, and duration of flow is limited by the relatively small storage capacity of these two reservoirs. If releases of water greater than demand were made to benefit riparian habitat, that water would be spilled over Granite Reef Dam, thus reducing water supplies for SRP shareholders and contractors.

Given the findings that additional releases of water from the Verde dams to mimic the natural hydrograph: 1) would provide limited benefit to riparian vegetation along the lower Verde River without land use changes beyond SRP's control; and 2) would potentially reduce water supplies to SRP and its contractors, this alternative was eliminated from further consideration as part of the RHCP.

#### c. 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 2001b, pp. 33, 100, J-10). Dr. Julie Stromberg, a member of the Flycatcher Recovery Team, suggested that SRP investigate the feasibility of bypassing sediment from above Horseshoe Lake to downstream of Bartlett Dam (Stromberg, pers. comm. 2001a). As a result of that suggestion, several alternatives to provide sediment to the lower Verde were evaluated by SRP. These alternatives are discussed below.

SRP concluded that it was not feasible to operate the reservoirs to pass significant amounts of sediment through the dams. 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. These 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 by SRP. The estimate is based on transporting about

4 AF of silt per year (about 8,500 cubic yards around the dams).[106] 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 million, uncertain benefits to riparian vegetation (see previous subchapter), and potential adverse impacts to bald eagles, aquatic life, and other wildlife from heavy equipment operations, this alternative was determined to be infeasible.[107]

A slurry pipeline to convey sediment also was evaluated. The capital cost to construct a pipeline and provide power to the system is estimated by SRP to exceed $8 million. Annual costs, including increased dredging at Granite Reef, are estimated to be about $700,000. This alternative was determined to be infeasible given the high capital and annual costs, uncertain biological benefits, and potential adverse impacts to wildlife from pipeline operations.

For the reasons described above, the alternatives to provide sediment to the lower Verde as a means of restoring riparian vegetation to mitigate for impacts at Roosevelt were eliminated from further consideration as part of the RHCP.

#### *5. Measures to Minimize or Mitigate Impacts on Listed Species Through Protection or Restoration of Riparian Habitat in the Salt and Verde Watersheds*

Many measures to minimize or mitigate impacts of Roosevelt operations on listed species were examined as shown in Table V-2. Feasible measures were incorporated into the RHCP (see Chapter IV). Infeasible measures and the reason(s) for elimination from further consideration are summarized in Table V-2 and briefly described below.

##### a. Protect Riparian Habitat on Private Land

An intensive search of private land suitable for riparian habitat that is likely to be utilized by flycatchers was conducted in the Salt River watershed. The search focused on private inholdings within the Tonto National Forest along Tonto Creek, the Salt River, Cherry Creek, Pinal Creek, and Pinto Creek. Although a few small areas of good quality

[106] The average annual sediment inflow to Horseshoe is estimated to range from about 400 to 650 AF (Corps 1981, p. 32). 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 cost estimation purposes.

[107] 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.

riparian vegetation were identified, there are no records of flycatchers nesting in or adjacent to these areas.

Similarly, private land along the Verde River and its tributaries was intensively searched for suitable riparian habitat that is likely to be utilized by flycatchers. The search along the Verde River was aided by the assessment of habitat acquisition priorities prepared by The Nature Conservancy (Fichtel and Marshall 1999). Based on criteria in the Southwestern Willow Flycatcher Recovery Ream Recommendation, highest priority was placed on occupied, unprotected riparian habitat and nearby suitable riparian habitat identified in existing documents (FWS 2001b, p. 81). In recent years, the only nesting flycatchers along the Verde have been near Camp Verde. This area is included as a high priority mitigation area in the RHCP (see Chapter IV).

#### b. Restore Riparian Habitat on Private Land

Because existing riparian habitat that is likely to be utilized by flycatchers is not available near Roosevelt, high priority was placed on identifying private lands where such riparian vegetation could be established or restored. The search focused on Tonto Creek between Roosevelt and Gisela, Greenback Creek (a tributary of Tonto Creek), Pinto Creek, and the Salt River immediately above Roosevelt. Except for several parcels of Reclamation fee land on the Salt River near Roosevelt that are included in the RHCP (known as part of the Rockhouse Farm ("Rockhouse"), these areas were eliminated from consideration as high priority sites due to the small size of the parcels, high gradient of the stream channels, narrowness of the floodplains, or lack of reliable water supplies. However, if riparian vegetation establishment on the Rockhouse site is infeasible, or sufficient mitigation cannot be obtained elsewhere, these locations will be reconsidered as alternatives, especially parcels along Pinto Creek.

A pilot project to evaluate the feasibility of irrigation of the Rockhouse property to establish riparian vegetation was selected from a group of options that were studied (see Subchapter IV.C.2). Several other alternatives at Rockhouse were rejected due to high cost. These alternatives involved excavation in order to lower all or a portion of the area to an elevation approximating the river level and ground water table. Excavation options were examined ranging from about 4 acres to 80 acres. The total estimated cost for these options ranges from about $700,000 (for 4 acres) to over $8 million (for 80 acres) for engineering, excavation and revegetation. Because costs exceed $100,000/acre and it is not clear that such an effort would be successful in establishing high quality riparian vegetation, these options were eliminated from further consideration.

In addition, protection and restoration of riparian vegetation on private land along the Verde River near Camp Verde is a high priority component of the RHCP (see Subchapter IV.C.4). Additional restoration efforts on private land in the Verde Valley may be included but opportunities are limited due to the narrow width of the floodplain, small parcel size, pressure from urbanization, and high land costs.

#### c. Protect Riparian Habitat on Public Land

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 Salt and Verde watersheds. The search found a few small areas of good quality riparian vegetation, but all are limited

in existing and potential size. Along the Verde River, there are records of flycatchers nesting 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.

#### d. Restore Riparian Habitat on Public Land

The Forest Service manages much of the land along the Salt River, Tonto Creek, and 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 is to minimize or mitigate the impact of Roosevelt operations by greater management of livestock grazing on Tonto National Forest lands. Public land along an 18-mile reach of Tonto Creek above Roosevelt is being managed to benefit riparian vegetation as part of the Tonto Creek Riparian Unit (TCRU) (Garcia and Associates 2001, p. 1-3). The TCRU was funded by Reclamation pursuant to the amended Fish and Wildlife Coordination Act report prepared by the FWS and Clean Water Act Section 404 permit requirements for the construction of Modified Roosevelt and New Waddell dams (Id., p. 1-1). Restoration and maintenance of riparian vegetation were to be accomplished by fencing and grazing management of the TCRU (about 6,872 acres of public lands) and other grazing allotments around Roosevelt Lake (Id., pp. 1-1 and 1-2). The monitoring report on the TCRU concludes that riparian vegetation along Tonto Creek has improved, including new cottonwood-willow acreage, but it is uncertain if all of the new vegetation will persist after future flood events (Id., p.1-5). Recommendations for future efforts include: 1) maintenance of fencing, 2) limiting grazing to the winter months with rest years, and 3) increased staff time to minimize trespass cattle and impact from recreation or other land uses (Id., pp. 5-12 to 5-14).

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 RHCP 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. One alternative suggested during scoping is to retire federal grazing rights along Pinto Creek. These grazing allotments fall within the Tonto National Forest; therefore, this alternative is already subject to Section 7(a)(1) and (2) of the ESA. However, if unique circumstances are found where measures to protect or improve riparian habitat on federal land would benefit listed species and Section 7 consultation is inadequate to achieve those benefits, SRP and FWS may agree to implement those measures as part of the Additional Habitat Conservation under the RHCP (see Subchapter IV.C.1.a).

In the 1996 BO on Modified Roosevelt, FWS considered two alternatives for creation of new riparian habitat: 1) irrigation along the abandoned power canal that runs along the south side of Roosevelt, or 2) creation of spoil islands near elevation 2,151 (FWS 1996, p. 29). The alternative of using the power canal was determined to be infeasible "because riparian habitat created would most likely consist of very narrow, linear patches parallel

to the canal, which are not considered suitable habitat" (Id.). The alternative of constructing spoil islands was determined to be infeasible "because the probability of establishing suitable habitat for southwestern willow flycatchers was considered low and the probability of a flood eroding away the spoil piles was considered high" (Id.). These options were reconsidered during development of the RHCP and again it was concluded that these alternatives are unlikely to provide long-term, suitable riparian vegetation that is likely to be used by flycatchers.

Two areas on Reclamation withdrawn lands identified to have potential for restoration are included in the RHCP as potential mitigation sites (see Subchapter IV.C.2.a). These areas would involve irrigation of riparian land along the Salt River just upstream of Roosevelt. The difference between SRP's mitigation efforts on these lands, and potential management efforts on other federal lands that were eliminated from consideration, is that SRP will be funding extensive riparian establishment efforts on these lands including irrigation systems and tree planting, a level of effort beyond the requirements of Sections 7(a)(1) and (2) of the ESA.

Another alternative examined at the Salt River inlet to Roosevelt was the construction of a grade control structure (low dam) across the floodplain slightly above elevation 2,151. The purpose of the structure would be to redistribute water and sediment upstream and downstream of the dam to promote riparian vegetation growth and to minimize the impact of floods on existing riparian vegetation downstream of the structure. Due to the width of the floodplain (about 2,500 feet), size of inflows (exceeding 200,000 cfs), and the depth of the alluvium (estimated to be greater than 20 feet), the grade control structure would require over 32,000 cubic yards of concrete for construction. The total construction cost was estimated by SRP to exceed $35 million. Given the high cost of the structure and the small amount of vegetation that would be created or protected (estimated at 200 to 300 acres), this alternative was determined to be infeasible and eliminated from further consideration.

#### *6. Measures to Minimize or Mitigate Water Supply Impacts Resulting from Changes in Reservoir Operations*

Conceptually, there are a number of measures that SRP and other water users that benefit from Roosevelt could use to minimize or mitigate water supply impacts resulting from changes in reservoir operations. One of these measures, use of effluent, is considered to be feasible at least to replace a portion of the water supply lost under Roosevelt operational alternatives (see Subchapter V.D). However, as discussed below, other 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 and institutional constraints (e.g., state and federal law including Arizona's Groundwater Management Act, court decrees, agreements, and contracts).

### a. Additional Ground Water Pumping

Because the dependable surface water supply in Arizona is insufficient to meet demand, for decades water users have relied on mining ground water to meet their needs. In 1980, the legislature recognized that in many basins withdrawal of ground water 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, 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 the 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 Arizona Department of Water Resources (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 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 Plans 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 ("GPCD") 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. The Act permits a city to pump ground water only within its service area, which is the land actually being served 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 outside the AMAs is regulated less stringently than within the AMAs, very little ground water is legally available to the cities because the legislature has forbidden its use within the 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 $10,000.00 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 preclude 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 Roosevelt 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 Measures

Cities and other water users dependent on water from Roosevelt 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 Roosevelt. However, these measures already are being implemented as a result of intensive regulation under Arizona's Groundwater Management Act in order to conserve ground water (see previous subchapter).

For example, the cities in SRP's service area have implemented several wide-ranging conservation programs since enactment of the Groundwater Management Act in 1980 that have been very successful. 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 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. Ninety-six percent of Valley residents 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 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.

In conjunction with water conservation efforts by the cities and other water users that it serves, SRP has implemented and continues to implement numerous water conservation measures. These measures include:

- Water transfers and exchanges (Subchapter I.F and Appendix 1);
- Conservation measures such as canal lining (over 90 percent are now lined), automated real-time delivery systems, more accurate water measurements, irrigation scheduling and efficiency improvements, installation of variable frequency ground water pumps, xeriscaping, and numerous public education programs (Subchapter V.N.6.b and Appendix 9);
- Increased operational flexibility through conjunctive use of alternative supplies (Subchapter I.G);
- Water rights enforcement (Appendix 2);
- Recharge and reuse (Subchapter V.N.6.c); and
- Water acquisition (Subchapter I.G and V.N.6).

Because SRP and the cities have already undertaken aggressive conservation measures as required by the Groundwater Management Act, there is little or no opportunity to replace the loss of water supply from Roosevelt under the No Permit or Re-operation alternatives 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 Roosevelt.

#### c. Recharge of Water That Cannot be Stored at Roosevelt

The recharge of water that would otherwise be stored at Roosevelt is limited by legal, institutional, and practical constraints. Arizona law limits the long-term storage of water underground, and generally the source of water must be CAP or effluent.[108] Moreover, a new appropriation or a change in water right may be required to store water in a new location (A.R.S. §§ 45-151 et seq., 45-172). 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 (Id.). Additionally, state law limits the underground storage of water if its use is based on a decreed or appropriative water right; such water must be recovered in the same calendar year in which it was recharged (A.R.S. § 45-851.01).

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

[108] See http://www.water.az.gov/recharge/Credits-Accounting.html (summarizing 45-831.01 et seq.).

also Salt River Reservoir District area on Figure I-3 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 on the location of recharge due to the fact that 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, or the lower reaches of the Agua Fria or New rivers (see Figure I-2). [109]

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 Roosevelt 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 utilized 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 and O&M cost for new wells is estimated to cost about $220/AF/yr (Subchapter V.D.1.a).

SRP's capacity in the Granite Reef Underground Storage Project (GRUSP), an existing recharge facility located near the Salt River on the Salt River Pima-Maricopa Indian Reservation, is about 25,000 AF/yr 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. Modification and expansion of GRUSP potentially could increase the capacity by as much as an additional 125,000 AF/yr (170 cfs) up to the full permitted capacity of 200,000 AF/yr; however, this would depend on additional infiltration basins being constructed as far to the south and east of the landfill as possible to allow the infiltrating water time to spread down and away from the landfill. It would also depend on the acceptability of such modifications and expansions to the Salt River Pima-Maricopa Indian Community. Seeking Community approval and obtaining all of the necessary permits would be a lengthy process taking several years (Lluria, pers. comm. 2002). SRP's share of the full capacity at GRUSP would be about 68,000 AF/yr (about

[109] 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), and relatively high ground water tables. The same issue with high ground water levels occurs along the Gila River below the confluence with the Salt.

93 cfs). SRP plans to develop another recharge facility along the Agua Fria River channel that would eventually have a capacity of 100,000 AF/yr (about 140 cfs) after a period of approximately seven years following construction (Id.). SRP is also investigating the possibility of recharging up to 10,000 to 15,000 AF/yr (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 300,000 AF/yr but the maximum rate of recharge would be about 400 cfs. As noted above under the discussion of conveying water to recharge sites, the 400 cfs rate of recharge is significantly less than peak inflow to Roosevelt, which ranges from thousands to tens of thousands of cfs.

In summary, recharge of water that could otherwise be stored at Roosevelt 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.
- Available conveyance capacity between Granite Reef Dam and potential recharge sites is one to two orders of magnitude less than Roosevelt inflows to be stored.
- The cost to recharge and recover the water would be about $400/AF or more (see Subchapter V.D).

As a result of these limitations, this alternative 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 1983, the United States Secretary of the Interior issued a decision allocating CAP water among Arizona water users (48 FR 12446, March 24, 1983). The Secretary allocated 309,828 AF for Indian Tribes' uses, 638,823 AF for Municipal and Industrial ("M&I") use, and the remainder for non-Indian agricultural use. Indian Tribes and M&I water providers share a first priority to CAP water in shortage years. In order to be eligible for actual delivery of CAP water, each non-federal entity receiving an allocation was required to sign a 50-year subcontract. Subcontracts were signed for all but 65,647 AF of the M&I water allocated. On January 20, 2000, ADWR recommended that the Secretary reallocate the remaining M&I water to certain municipal water providers. This reallocation would make small amounts of additional CAP water available to some of the cities that receive water from SRP. The Secretary did not act on ADWR's recommendation, and issued a June 2000 draft environmental impact statement (EIS) proposing several alternatives that reallocate the remaining CAP M&I water to Indian Tribes (65 FR 39177, June 23, 2000). As discussed in the draft EIS for CAP reallocation,

various CAP allocation options for Indian, M&I, and non-Indian agricultural water supplies are possible in the future. However, under each of those alternatives, the CAP supplies are fully utilized by those users (Reclamation 2000). Because all the CAP water has been or is being allocated for Indian, M&I, and agricultural uses, 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 and not a long-term 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. Excess CAP water is available on the Colorado River system 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.[110] While excess CAP water is currently available, quantities 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 addition, both the Arizona Water Banking Authority and the Central Arizona Groundwater Replenishment District plan to store much of the available excess CAP water underground to firm up deliveries to their members in years of Colorado River shortages (ADWR 1998; CAGRD 2002).

Excess CAP water will not be available in the future, and, therefore, is a viable partial replacement water supply for water lost from reduced storage capacity at Roosevelt only if it can be stored underground for future use. However, there are many obstacles to storing excess CAP water underground. First, the delivery of excess CAP water is dependent upon sufficient capacity in the CAP canal to move water from the Colorado River to the Phoenix AMA. Excess CAP water deliveries have the lowest priority for canal capacity behind deliveries for M&I, Indian and non-Indian agricultural uses pursuant to long-term contracts.[111] Second, the few potential recharge sites in the Phoenix AMA are limited by their cost, storage capacity, infiltration rates, ground water quality, proximity to the CAP canal, effects of mounding, impacts on surrounding lands and wells, and use by other entities to recharge other supplies.[112] Third, constructing the infrastructure necessary to transport water from the CAP canal to new recharge sites and

[110] Criteria for coordinated long-range operation of Colorado River reservoirs pursuant to the Colorado River Basin Project Act (1970).

[111] See Excess Water Contract for CAP M&I Water.

[112] The constraints for recharge, recovery, and distribution of excess CAP water are the same as those for effluent use discussed in the next subchapter and Subchapter III.C.3.

the acquisition of rights-of-way for those facilities would be expensive if feasible. Fourth, existing water delivery infrastructure and recharge sites have additional limitations (see previous Subchapter). For example, CAP water may be moved into SRP's delivery system through the CAP interconnection facility at Granite Reef Dam for recharge at the GRUSP site. However, the ability to move water is constrained by the size of the interconnection facility and by capacity restrictions in SRP's canals. Transportation of excess CAP water has a low priority and may be prohibited when canal capacity is needed for delivery of project water, deliveries to Indian communities, and other SRP contractual commitments. Finally, the cost to develop additional recharge and recovery facilities is an obstacle to reliance on excess CAP water to replace Roosevelt supplies (see previous Subchapter for costs).

In summary, CAP water is not a viable replacement source for water supplied from Roosevelt for the following reasons:

- Cap allocations are fully committed for existing and future Indian, M&I, and agricultural uses.
- Excess CAP water is not reliable, will diminish over time, and is being used to meet other demands in Arizona.
- Additional recharge locations and capacity are limited.
- The cost to purchase, convey, recharge, and recover excess CAP water would be greater than $465/AF/year.[113]

For these reasons, this alternative was eliminated from further consideration.

#### e. Use of Effluent

Effluent is the only water supply that is increasing in the Phoenix AMA.[114] While a substantial quantity of effluent is produced in the AMA, 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 and in Subchapter V.D, non-potable effluent is limited in quantity and increased reuse 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

[113] $55/AF is the 2002 rate for Incentive Recharge CAP water (July 16, 2001 memo from CAP to All CAP Water Customers and Interested Parties RE: Central Arizona Project Water Rates for CY 2002). Plus, the estimated annual costs to recharge water (about $187 /AF) and to recover water (about $223/AF) total about $410/AF before inclusion of conveyance costs, for which cost estimates are not available (Subchapter V.D).

[114] 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.

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 Agua Fria effluent recharge project described in Subchapter V.D. 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 would greatly exceed the estimate of $7.7 million per year to transport effluent to the Agua Fria recharge site (see Subchapter V.D). Also, the effluent provided would serve only as a partial replacement water supply for the five cities that share the plant (see Subchapter V.D). Moreover, reducing flow downstream of the 91st Avenue plant would adversely affect riparian habitat for several miles downstream including habitat used by endangered Yuma clapper rails, flycatchers, and cuckoos.

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 million per year would be incurred in acquiring recharge sites, transporting the effluent to the sites, and obtaining the necessary permits to recharge the effluent, recovering the water, and transporting it to the location of reuse (see Subchapter V.D).

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. The costs of this alternative are used in the analysis of impacts in Subchapter V.D.

#### 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 these 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 to implement.

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 in the same calendar year in which 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 Roosevelt 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 per year), the cost would be hundreds of millions of dollars. Moreover, and perhaps more importantly with respect to the listed species issue at Roosevelt, 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 Roosevelt water supplies was eliminated from further consideration.

#### *7. Measures to Minimize or Mitigate Power Supply Impacts Resulting from Changes in Reservoir Operations*

In addition to evaluating alternative water supply options to replace or augment storage in Roosevelt, several alternative measures were considered for replacing power supplied by water stored in Roosevelt. Within SRP's service territory, electric customers

have increased by more than 100,000 during the past 5 years.[115] Local generation is needed close to the location of power demands in the Southeast Valley (Mesa, Chandler and Gilbert areas) and must be integrated into the current system in order to meet power reliability needs. Hydropower produced by Roosevelt and the lower Salt River dams currently provides a portion of this local generation. Although the annual power generation from water stored at Roosevelt varies in relation to water supply, the long-term minimum projected generation is relied upon as firm capacity for planning purposes. Reduced storage at Roosevelt would decrease the firm capacity available to SRP and require replacement of that resource. The alternative measures to replace Roosevelt generation that would be lost under some reservoir operation alternatives are discussed below.

#### a. Construct New Transmission

Losing hydrogeneration capacity from reduced storage at Roosevelt would exacerbate the current transmission constraint problems of importing power into the Southeast Valley. If continued operation of Roosevelt is curtailed, transmission upgrades and/or new generating facilities may be required to bring additional power to the customer load center in the Southeast Valley. Any new generation would need to be integrated into the current system to meet the Southeast Valley's power reliability needs. When the energy source is closer to customers, electric system reliability is increased and the need for new transmission facilities to and through the Southeast Valley is decreased. Because Roosevelt feeds into the Southeast Valley, reduction of its generation capacity would further aggravate the transmission problem. It may either require that new transmission be built into the Southeast Valley or additional local generation be constructed (discussed below).

#### b. Purchase Replacement Power

To replace hydrogeneration capacity from reduced storage at Roosevelt, SRP could purchase power from the market. Contracts to purchase power can be fixed price, indexed, or priced with a maximum and minimum range. Depending on the type of purchase, this would subject SRP and its customers to greater risks associated with fuel and energy price volatility. Assuming that power could be purchased for a reasonable cost, transmission constraints could make it difficult for SRP to deliver that power to its customers. Operating its own power generating plant at Roosevelt allows SRP to control the costs of power generation, and thus avoid the price volatility associated with purchasing energy from other suppliers. Continued full operation at Roosevelt would ultimately result in a more cost-effective and reliable source of electricity for SRP retail customers. Also, replacing Roosevelt generation with market purchases from a thermal unit would contribute to increasing emissions levels. Despite the issues associated with this option, purchase of power is the likely replacement for hydropower generation lost at Roosevelt under the No Permit and Re-operation alternatives.

[115] Information for this subchapter was developed from Section 2.1 of the Kyrene Expansion Project Environmental Assessment (ENSR 2001) and the Santan Expansion Project Newsletter (SRP 2000).

#### c. Construct New Generation

If new transmission were not built to deliver power to the Southeast Valley, then new local generation may be required to replace Roosevelt's service to the Southeast Valley area. New generation would be needed close to this load center in order to meet power reliability needs. To help meet the requirement for local generation, SRP has recently begun expansion at two existing natural gas plants in the Southeast Valley. It would be very difficult to site additional new generation in the Southeast Valley largely because new power plants would probably not be permitted in the Phoenix air quality non-attainment area.[116] Full operation of Roosevelt would continue to provide a local generation source with no emissions. Again, replacing that energy with a thermal unit or market purchases from a thermal unit would contribute to increasing emissions levels.

#### d. Utilize Renewable Energy

While SRP includes a variety of renewable energy projects in its balanced approach to meeting customer demand, these technologies are primarily in the developmental stages. Expanding these programs using existing technology for the generation of electricity through renewable sources is not currently a cost-effective alternative.

#### e. Increase Energy Conservation

SRP has developed several energy conservation or demand-side management programs that have proven successful and beneficial in conserving energy. As an example, SRP has nearly 120,000 residential customers enrolled in the "Time-of-Use" program, which uses price signals to encourage customers to use the majority of their electricity during off-peak hours when demand and energy costs are lower. In addition to the residential Time-of-Use program, SRP has actively promoted commercial Time-of-Use programs, voluntary interruptible load tariffs, and the country's largest pre-paid metering program, which has a demonstrated reduction in usage of over 10 percent. SRP encourages conservation in both residential and commercial publications and continues to promote reduced consumption as a viable way to meet demand requirements. However, because full implementation of demand management programs is already built into SRP's power generation and transmission planning, additional conservation efforts would not offset the loss of power generation at Roosevelt.

### O. Reasons That Full Operation Alternative Was Selected

SRP selected the continued Full Operation of Roosevelt including implementation of the RHCP as the alternative that best meets the biological, environmental, and socioeconomic priorities described at the outset of this chapter. The Full Operation alternative:

- Fully complies with the ESA
- Minimizes and mitigates impacts on listed and candidate species to the maximum extent practicable by fully mitigating for those impacts

[116] The Phoenix metropolitan area is currently designated as a non-attainment area because carbon monoxide, particulate matter ($PM_{10}$), and ozone exceed National Ambient Air Quality Standards (ENSR 2001, p. 3-1).

- Minimizes impacts on water delivery and power generation

Continued full operation of Roosevelt in combination with implementation of the RHCP fully complies with the ESA. SRP believes that this HCP meets all Section 10 permit issuance criteria and FWS HCP policy (see Executive Summary).

Impacts on listed and candidate species are minimized under the Full Operation alternative through the acquisition and perpetual management of riparian habitat as well as the implementation of additional conservation measures. Moreover, the proposed action is likely to provide larger populations of listed and candidate species at Roosevelt on average over the long term than either the No Permit or Re-operation alternatives.

SRP believes that incidental take under the Full Operation alternative will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. The RHCP provides for substantial conservation of habitat for endangered flycatchers and Yuma clapper rails, threatened bald eagles, and cuckoos (if listed) in central Arizona. SRP believes that these conservation measures will ensure that the incidental take resulting from the permitted activity—the continued operation of Roosevelt—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 enhance the long-term survival and recovery of these species.

Finally, SRP believes that the Full Operation alternative minimizes impacts on water delivery and power generation by permitting Roosevelt to be used for the purposes for which it was built. Consequently, socioeconomic impacts (loss of water, power, and recreation) and legal issues (water rights and delivery contracts) are entirely avoided. Moreover, the cities that invested about $44 million in NCS will benefit from water storage in that space rather than completely losing the value of their investment.

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# APPENDIX 1:
# SUMMARY OF SETTLEMENTS AND CONTRACTS REQUIRING SRP DELIVERIES TO OTHER ENTITIES

Table I-1 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 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.

## 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% 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.

## 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), initially about 76,000 AF but now less than 68,000 AF due to sediment accrual. The City 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. SRP is required to deliver up to 25,000 AF/year to Phoenix. 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 next agreement).

### Cities of Chandler, Glendale, Mesa, Phoenix, Scottsdale, and Tempe

**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 new conservation capacity ("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." (Section 7.1)*

SRP is obligated to deliver the NCS water to the Cities on demand or through exchange subject to operational constraints and delivery agreements. In addition, SRP is obligated to deliver water stored in NCS space by the Salt River Pima-Maricopa Indian Community to the Community (See summary of Community entitlements and delivery obligations, below).

## 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 to the Community, including exchanges of CAP water, to store water for the Community, and to release a minimum flow of water except in extreme drought and emergency situations.

**Delivery Obligation:** SRP is required: 1) to store up to 3,000 AF of water for the Community; 2) to provide up to 6,730 AF/year of SRP stored water for use by the Community; and 3) to 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 the Community's CAP water for SRP stored water. Finally, SRP is required to release a minimum flow of 100 cfs year-round from Bartlett Dam except in situations of emergency, drought or water quality problems specified in the Settlement Agreement.

## Gila River Indian Community

**Operative Document(s):** Contract for Pumping Water for Maricopa Indians on Gila River Indian Reservation, 1936; as supplemented.

**Basis:** These 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.

**Delivery Obligation:** In order to resolve the dispute, SRP is required to provide a permanent supply of up to 5,863 AF of water per year to the Gila River Indian Community.

## 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 city 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-3).

**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 2 and the delivery obligations under other contracts are summarized in this Appendix 1. 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-Project water for Project 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/acre/year to about 2,263 acres of land in Peninsula-Horowitz.

### 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 the 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 has 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.

### 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. This agreement and its amendments were confirmed by Congress 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% 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 the Salt River Project. SRP stores credits for RWCD at Bartlett and at Roosevelt. A portion of RWCD's water entitlement is delivered to the Fort McDowell and Salt River Pima-Maricopa Indian Communities (see the summaries for those two entities in this appendix).

## 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 the Community contracted to build Bartlett Dam to carry out the provisions of the 1916 Act. As a result of the Bartlett Agreement, the Community is entitled to SRP storage credits.

Under the 1988 Water Rights Settlement Act and Agreement, the Community is entitled to: (1) store 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 exchanges 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.

**Delivery Obligation:** Under the Bartlett Agreement, SRP credits the Community with up to 60,000 AF of storage credits and is required to deliver up to 20,000 AF/yr to the Community from those credits. As a result of the settlement, SRP is obligated to annually deliver water to the Community – 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), up to 7,000 AF of normal flow stored in Roosevelt, and up to 8,000 AF of RWCD water in addition to the Community's rights to normal flow under the Kent Decree. The settlement also requires SRP to deliver up to 20,000 AF of surface water as part of the three-way exchange with the Roosevelt Irrigation District and the City of Phoenix.

## 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 with the entities listed in Table I-2 of Chapter I and under the following settlements, contracts and agreements:

(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 Feb. 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."

# APPENDIX 2:
# SRP AND CITY WATER RIGHT SUMMARY

## Introduction to SRP Water Rights

The Salt River Valley Water Users' Association (Association or SRVWUA) 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 9, 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 Salt River Valley Water Users' 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 which have been perfected under federal, territorial and state statutes, as well as state and federal court decisions (see Chapter I, Appendix 1, and the City Water Right 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, operation of Roosevelt cannot be analyzed independent of the entire water supply system because SRP operates the entire system conjunctively to provide water to meet its obligations. The Salt River Project was constructed as a comprehensive, multi-purpose 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 groundwater pumped from beneath Project lands. Likewise, the water rights that SRP uses to store water at Roosevelt are only part of the portfolio of water rights under which SRP supplies water to its shareholders and contractors.

Because the purpose of the RHCP involves compliance with the ESA at Roosevelt, the summary of SRP water rights provided below focuses on the primary water rights associated with operation of that facility in conjunction with the other major sources of SRP water. Complete descriptions of all of SRP's water rights are on file at the Arizona Department of Water Resources in the following documents, as amended:

1. Salt River Watershed
   - 39-1040
   - 39-1041
   - 39-1206
   - 39-1207
   - 39-1998
   - 39-11951
   - 39-11952
   - 39-11953
   - 39-11954
   - 39-11955

2. Verde River Watershed
   - 39-50053
   - 39-50054
   - 39-50055

3. Lower Gila Watershed
   - 39-35212
   - 39-35213
   - 39-35216
   - 39-35217
   - 39-35218

## Summary of SRP's Water Rights

The basis, priority dates, sources, uses and quantity of SRP's water rights are summarized below.

**Basis of SRP Rights**

A summary of the basis of SRP's water rights is the following:

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 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 Salt River Reservoir District 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 the Salt River Project 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 USC § 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 groundwater, whether appropriable or not under territorial or state law, beneath and appurtenant to the lands within the exterior boundaries of the Salt River Reservoir District.

5. Rights to the use of groundwater 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 Salt River Reservoir District 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 Salt River Reservoir District 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 Salt River Pima-Maricopa Indian Community 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 Salt River Pima-Maricopa Indian Community Water Rights Settlement Act of 1988, Pub. L. 100-512, 102 Stat. 2549 (1988), and its implementing Settlement Agreement, and the

Fort McDowell Indian Community 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 Salt River Pima-Maricopa Indian Community Water Rights Settlement Act of 1988, Pub. L. 100-512, 102 Stat. 2549 (1988), which Congressionally 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 Salt River Pima-Maricopa Indian Community as required by this settlement and to the Association's shareholders.

15. The Fort McDowell Indian Community Water Rights Settlement Act of 1990, Pub. L. 101-628, Title IV, 104 Stat. 4480 (1990), which Congressionally 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.

**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 (Salt River Project) 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 Salt River Reservoir District, additional lands were incorporated into the Salt River Project 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 Salt River Project 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 Salt River Project 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…"

***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 Salt River Reservoir District 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; and the Verde River and its tributaries directly used or stored in Horseshoe Lake and Bartlett Lake on the Verde River; and all water underlying the Salt River Reservoir District.

**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:

| Dam/Reservoir | Capacity in Acre-Feet |
|---|---|
| Roosevelt/Roosevelt | 1,366,966† |
| Horse Mesa/Apache | 245,138 |
| Mormon Flat/Canyon | 57,852 |
| Stewart Mountain/Saguaro | 69,765 |
| Bartlett/Bartlett | 178,186 |
| Horseshoe/Horseshoe | 58,345 |
| Total | 1,976,252 |

†This capacity does not include the NCS space in Modified Roosevelt.

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 cubic feet/second. For the South Canal, the maximum recorded flow to date is 2,401 cubic feet/second. 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 diversions from wells is about 1,490 cfs. The maximum diversion rate is claimed for the period from January 1 to December 31.

## Water Rights in NCS at Modified Roosevelt

As discussed in Chapter 1, SRP is responsible for the operation of the additional conservation capacity in Modified Roosevelt Dam (New Conservation Storage or NCS) under the Modified Roosevelt Operating Agreement[1] and the Plan 6 Funding Agreement.[2] Water is stored by SRP in the NCS for delivery by SRP to the Cities of Phoenix, Mesa, Scottsdale, Glendale, Chandler and Tempe.[3] Additionally, as part of the Salt River Pima-Maricopa Indian Community Water Rights Settlement Act, 7,000 AF of space in NCS was designated for seasonal storage of water (see Appendix 1) for the benefit of the Salt River Pima-Maricopa Indian Community. When that space is not being used to store water for the Indian Community, it is available for use by the Cities.

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[1] Operating Agreement for Additional Active Conservation Capacity at Modified Theodore Roosevelt Dam Among the Salt River Project Agricultural Improvement and Power District, Salt River Valley Water Users' Association, United States Bureau of Reclamation, Flood Control District of Maricopa County, and the Arizona Cities of Chandler, Glendale, Mesa, Phoenix, Scottsdale and Tempe, December 14, 1993.

[2] 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.

[3] In 1996, the Arizona Department of Water Resources issued permits under A.R.S. § 45-151 *et seq* for the appropriation of water in NCS, consistent with the terms of the Modified Roosevelt Operating Agreement. *See* Decision of the Director of the Arizona Department of Water Resources In the Matter of the Applications to Appropriate Public Waters of the State of Arizona: Application Nos. R-2517, 33-96226, 33-96227, 33-96228, 33-96229, 33-96230, 33-96231; April 10, 1996.

## 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:[4]

(1) Certificate of Water Right No. 1999

(2) Permit to Appropriate Surface Water Nos.:
33-96226
33-96227
33-96228
33-96229
33-96230
33-96231
33-96623
A-402

(3) Water Rights Registration Act Claim Nos.:
36-80565 (as amended)
36-102503
36-102496 through 36-102502
36-102504 through 36-102560
36-102645 through 36-102647
36-64086

(4) Application No. R2517

(5) Permit No. R2128

(6) Certificate of Water Exchange Enrollment Nos. 67-541985 and 67-541980

(7) 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.

(8) 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.

(9) Certificate of Water Exchange Enrollment No. 67-541968

(10) Certificate of Water Exchange Enrollment No. 67-541998

(11) Certificate of Water Exchange Enrollment No. 67-541993

(12) Certificate of Water Exchange Enrollment No: 67-547270

(13) Service Area Right No. 56-002043

(14) Service Area Right No. 56-002030

[4] Letter from V.C. Danos, Arizona Municipal Water Users Association to Paul Cherrington, SRP; January 14, 2002.

(15) Service Area Right No. 56-002009
(16) Service Area Right No. 56-002029
(17) Service Area Right No. 56-002037
(18) Service Area Right No. 56-002018
(19) Service Area Right No. 56-002030
(20) Service Area Right No: 56-002017
(21) 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
39-37521.a, 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

(22) Kent Decree

(23) Benson-Allison Decree

(24) Reclamation Act, 32 Stat. 388 (1902)

(25) Domestic Water Service Agreement Between the Roosevelt Water Conservation District and the City of Chandler.

(26) Domestic Water Service Agreement Between the Roosevelt Water Conservation District and the City of Mesa, April 6, 1995

(27) Domestic Water Service Agreement between the Roosevelt Water Conservation District and the Town of Gilbert, February 20, 2001

# APPENDIX 3:
# SRPSIM MODEL

## Introduction

As summarized in Subchapter III.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 RHCP 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 are also provided in this appendix.

## Model Parameters

### Study Year

The study year for the modeling is 1995. This means that the physical configuration of the reservoirs, such as area/elevation/capacity curves, reflect 1995 conditions. Likewise, water demands reflect 1995 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. These demands were extrapolated to 1995 based on the trend for 1975 through 1993. Total annual SRP demand at Granite Reef Diversion Dam (Granite Reef) for 1995 was estimated to be 951,000 AF.

Contract deliveries that are not modeled separately are estimated to total 167,000 AF: 1) 55,000 Af to the Salt River Pima-Maricopa Indian Community (SRPMIC), 2) 15,000 AF to the Fort McDowell Indian Community, 3) 35,000 to the Roosevelt Water Conservation District,[1] 4) 30,000 AF in the RID Exchange with Phoenix and SRPMIC, 5) 10,000 AF to the Buckeye Irrigation Company[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). System losses are estimated to be 80,000 AF.

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[1] Deliveries to Roosevelt Water Conservation District (RWCD) are included in SRP demand. 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 to the Salt River Pima-Maricopa and Fort McDowell Indian communities under water rights settlement agreements effective in 1991 and 1994, respectively.

[2] Deliveries to Buckeye Irrigation Company (BIC) are included in SRP demand. 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% |

**City of Phoenix Gatewater Demand.** The City of Phoenix demand for Horseshoe Reservoir Gatewater is assumed to be 25,000 AF per year based on the contract. The demand is subject to credit availability; so less than 25,000 AF is delivered when Gatewater credits are not available.

**SRPMIC Demand.** The Salt River Pima-Maricopa Indian Community (SRPMIC) demand for water from the Salt and Verde 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 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 demands for NCS water were 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.

**Reservoirs**

**Storage Allocations.** Storage allocations for each of the dams except Roosevelt are based on the most recent sediment surveys. For Roosevelt, storage elevations are taken from the May 1985 Reclamation Design Report (see table below).

| Design Storage Space | Top Elevation (ft.) |
|---|---|
| Dead Storage | 1,989 |
| SRP Conservation | 2,136 to 2,137† |
| NCS | 2,151 |
| Flood Control | 2,175 |
| Dam Safety | 2,218 |

†Varies from about 2,137 in 1995 to 2,136 in 2040 as sediment accumulates.

The 1995 storage for each elevation zone was based on the most recent sediment survey at that time (1981), the sediment expected to have accumulated since 1981, and a projected area/elevation/capacity table for the year 2040 developed by Reclamation. SRP's conservation storage capacity at the time of construction of Modified Roosevelt Dam was assigned as the space above dead storage capacity, which is the existing storage capacity that SRP had before the modifications. A small portion of this capacity is borrowed from the NCS capacity until the dead storage zone fills with sediment. This means that SRP conservation storage elevation is initially slightly higher than 2,136. For this SRPSIM simulation, the following storage capacities were used: dead storage—14,680 AF; SRP conservation—storage 1,299,220 AF; NCS—257,820 AF; Safety of Dams—1,802,000 AF.

A 1995 sediment survey of Roosevelt Reservoir was published by Reclamation in 1996 (Lyons and Lest 1996). Although there are differences in storage capacity between the estimates used in the model and the survey data, these differences are relatively small and do not significantly affect the results.

**Beginning Reservoir Storage and Credits.** Water year 1889 (beginning October 1, 1888) was selected as the initial year of modeling because relatively good flow records are available after that date. 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. The beginning credits in water accounts are average for those accounts over the entire period of record.

### Maximum Spill Releases

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. Demand releases from the Salt or Verde are in addition to the spill release.

### Minimum Flow Requirements

The minimum flow release from Bartlett Reservoir is 150 cfs (100 cfs plus the estimated Verde water order) as required by the Fort McDowell Indian Community (FMIC) Water Rights Settlement Agreement. The FMIC Agreement became effective in 1994.

### Reservoir Operations

Reservoir operating rules are based on current operations. From October through April, releases are made from the Verde to meet demand if sufficient storage is available. From May through September, releases are made from the Salt to meet demand minus the minimum flow from the Verde.

### 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 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 SRP storage credits 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 SRP storage credits are provided. Between net storage levels of 350,000 to 1.5 million AF, SRPMIC storage credits increase from 0 AF to 9,074 AF in proportion to increases in net storage. Above 1.5 million AF of net storage, additional SRP storage credits are provided to SRPMIC up to 17,400 AF.

**Phoenix.** Phoenix accrues Gatewater credits in Horseshoe Reservoir when the total Verde storage is between 236,581 AF and the top of the existing conservation storage on the Verde (currently 309,613 AF at elevation 2,126), 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. 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 73,032 AF, Phoenix loses credits equal to the amount spilled, down to a minimum remaining credit of 73,032 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 capacity of NCS space. 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.

**Hydrogeneration**

Hydrogeneration is calculated based on the monthly average Salt release during the period of simulation (106 years) of inflow records. In order to calculate hydrogeneration losses, the monthly average Salt release for the alternative reservoir operation scenario is compared to full reservoir operations up to elevation 2,151. If reservoir elevation is restricted to a lower elevation (e.g., 2,095), water that otherwise would have been stored is released from the reservoir. If stored, the water could have been used in the summer months when the value of the hydrogeneration is higher. The difference in hydrogeneration value between scenarios is based on the average annual value of generation for each alternative. The difference includes the hydropower generated by water stored in NCS, the value of which accrues to the cities with rights in NCS. Additional assumptions and the approach to valuation of hydrogeneration impacts are described in Subchapter V.D.

**Inflow**

The monthly inflows used in this model are based on gaged flows into Roosevelt Reservoir and Horseshoe Reservoir plus estimated local runoff on the lower Salt. Prior to

the availability of gage records above Horseshoe Reservoir, Verde inflows are estimated from the gage below Bartlett Dam.

### Spill Water

Spill releases in the model occur when reservoir levels rise above the top of conservation storage (SRP storage plus NCS on the Salt, SRP storage plus Horseshoe Gatewater on the Verde). Maximum conservation storage in Modified Roosevelt Reservoir is to the top of NCS space at elevation 2,151.

### Additional Deliveries During Spills

If it is determined that spill releases need to be made, then a subroutine is used to calculate additional deliveries to be made to SRP shareholders and contractors above the normally scheduled deliveries (basic demand). These additional deliveries are 70 percent of the basic demand at Granite Reef (after subtracting river losses and adding in CAP diversions) based on historical patterns of water use during spills. The deliveries in addition to the basic 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.

## Model Results

### Summary of Output

Three SRPSIM scenarios were analyzed for use in the RHCP: 1) a “Full Operation” scenario with storage up to elevation 2,151; 2) a “No Permit” alternative where all water above elevation 2,095 is released; and 3) a “Re-operation” alternative where all water above elevation 2,125 is released. Summaries of the Full Operation and No Permit alternatives are provided in Table 1. A comparison of the Full Operation and Re-operation alternatives model results is provided in Table 2. Hydrographs for the three runs are shown in Figures 1, 2, and 3. Figure 4 is the historical hydrograph for comparison.

**Table 1. Summary of SRPSIM Results, Current Reservoir System and Demand, 1889-1994 Averages (1,000s of acre feet).**

| Variable | (1) Full Operation (Store Up to Elevation 2,151) | (2) No Permit (Release Above Elevation 2,095) | (3) Difference (2) – (1) |
|---|---|---|---|
| Surface Water Deliveries | | | |
| SRP Deliveries* | 948.3 | 866.6 | -81.7 |
| NCS Deliveries | 49.4 | 0.0 | -49.4 |
| Total Surface Water | 997.7 | 866.6 | -131.1 |
| SRP Ground Water Pumping | 138.2 | 203.7 | 65.5 |
| Spills | | | |
| Salt River | 133.8 | 284.2 | 150.4 |
| Verde River | 127.7 | 135.2 | 7.5 |
| Total Spills (Granite Reef) | 261.5 | 419.3 | 157.8 |
| Hydropower Generated ($M) | 53.9 | 51.4 | 2.5 |
| Reservoir Contents (Avg. Sept. 30) | | | |
| Roosevelt | 789.4 | 416.2 | -373.2 |
| Horseshoe | 7.8 | 0.3 | -7.5 |
| Bartlett | 104.3 | 80.8 | -23.5 |

*Includes all contract deliveries except NCS.

**Table 2. Summary of SRPSIM Results, Current Reservoir System and Demand, 1889-1994 Averages (1,000s of acre feet).**

| Variable | (1) Full Operation (Store Up to Elevation 2,151) | (2) Re-operation (Release Above Elevation 2,125) | (3) Difference (2) – (1) |
|---|---|---|---|
| Surface Water Deliveries | | | |
| SRP Deliveries* | 948.3 | 923.6 | -24.7 |
| NCS Deliveries | 49.4 | 0.0 | -49.4 |
| Total Surface Water | 997.7 | 923.6 | -74.1 |
| SRP Ground Water Pumping | 138.2 | 151.8 | 13.6 |
| Spills | | | |
| Salt River | 133.8 | 227.8 | 94.0 |
| Verde River | 127.7 | 119.8 | -7.9 |
| Total Spills (Granite Reef) | 261.5 | 347.6 | 86.1 |
| Hydropower Generated ($M) | 53.9 | 52.7 | 1.2 |
| Reservoir Contents (Avg. Sept. 30) | | | |
| Roosevelt | 789.4 | 657.1 | -132.3 |
| Horseshoe | 7.8 | 0.0 | -7.8 |
| Bartlett | 104.3 | 78.8 | -25.5 |

*Includes all contract deliveries except NCS.

In order to provide more detail on the annual variation among the three alternatives, additional summary statistics are provided in Tables 3 and 4. The tables are organized parallel to Tables 1 and 2 as comparisons between the model runs for key variables in terms of minimum, maximum, and median values. Table 3 and Table 4, storage levels at the end of the water year (September 30, "EOY"), are provided for the total Salt and Verde storage, rather than by key reservoirs as listed in Table 1 and Table 2. The reason for providing combined storage is that at the extreme of maximum and minimum storage, all of the reservoirs would be affected and the impact on particular reservoirs may vary.

**Table 3. Comparison of Full Operation to No Permit Model Results (1,000s of acre feet).**

| | Full Operation | No Permit | Difference |
|---|---|---|---|
| SRP (SWD) | | | |
| Maximum | 1,316 | 1,211 | -105 |
| Minimum | 474 | 471 | -3 |
| Median | 961 | 876 | -85 |
| Average | 949 | 866 | -83 |
| NCS | | | |
| Maximum | 122 | 0 | -122 |
| Minimum | 0 | 0 | 0 |
| Median | 34 | 0 | -34 |
| Average | 49 | 0 | -49 |
| Salt River Spills | | | |
| Maximum | 1,903 | 2,284 | 381 |
| Minimum | 0 | 0 | 0 |
| Median | 0 | 0 | 0 |
| Average | 134 | 284 | 150 |
| Verde River Spills | | | |
| Maximum | 1,330 | 1,253 | -77 |
| Minimum | 0 | 0 | 0 |
| Median | 0 | 0 | 0 |
| Average | 128 | 135 | 7 |
| EOY Salt | | | |
| Maximum | 1,693 | 1,063 | -630 |
| Minimum | 347 | 284 | -63 |
| Median | 1,183 | 804 | -379 |
| Average | 1,143 | 770 | -373 |
| EOY Verde | | | |
| Maximum | 303 | 204 | -99 |
| Minimum | 27 | 12 | -15 |
| Median | 78 | 73 | -5 |
| Average | 112 | 81 | -31 |

SWD = Surface Water Deliveries

EOY = End of Water Year (September 30)

**Table 4. Comparison of Full Operation to Re-operation Model Results (1,000s of acre feet).**

| | Full Operation | Re-operation | Difference |
|---|---|---|---|
| SRP (SWD) | | | |
| Maximum | 1,316 | 1,280 | -36 |
| Minimum | 474 | 484 | 10 |
| Median | 961 | 945 | -16 |
| Average | 949 | 923 | -26 |
| NCS | | | |
| Maximum | 122 | 0 | -122 |
| Minimum | 0 | 0 | 0 |
| Median | 34 | 0 | -34 |
| Average | 49 | 0 | -49 |
| Salt River Spills | | | |
| Maximum | 1,903 | 2,280 | 377 |
| Minimum | 0 | 0 | 0 |
| Median | 0 | 0 | 0 |
| Average | 134 | 228 | 94 |
| Verde River Spills | | | |
| Maximum | 1,330 | 1,213 | -117 |
| Minimum | 0 | 0 | 0 |
| Median | 0 | 0 | 0 |
| Average | 128 | 120 | -8 |
| EOY Salt | | | |
| Maximum | 1,693 | 1,492 | -201 |
| Minimum | 347 | 342 | -5 |
| Median | 1,183 | 1,065 | -118 |
| Average | 1,143 | 1,011 | -132 |
| EOY Verde | | | |
| Maximum | 303 | 179 | -124 |
| Minimum | 27 | 16 | -11 |
| Median | 78 | 73 | -5 |
| Average | 112 | 79 | -33 |

SWD = Surface Water Deliveries

EOY = End of Water Year (September 30)

## References

Lyons, J. and L. Lest. 1996. Theodore Roosevelt Reservoir 1995 Sediment Summary. Sedimentation and River Hydraulics Group, Water Resources Services. Technical Service Center, Denver, CO. May

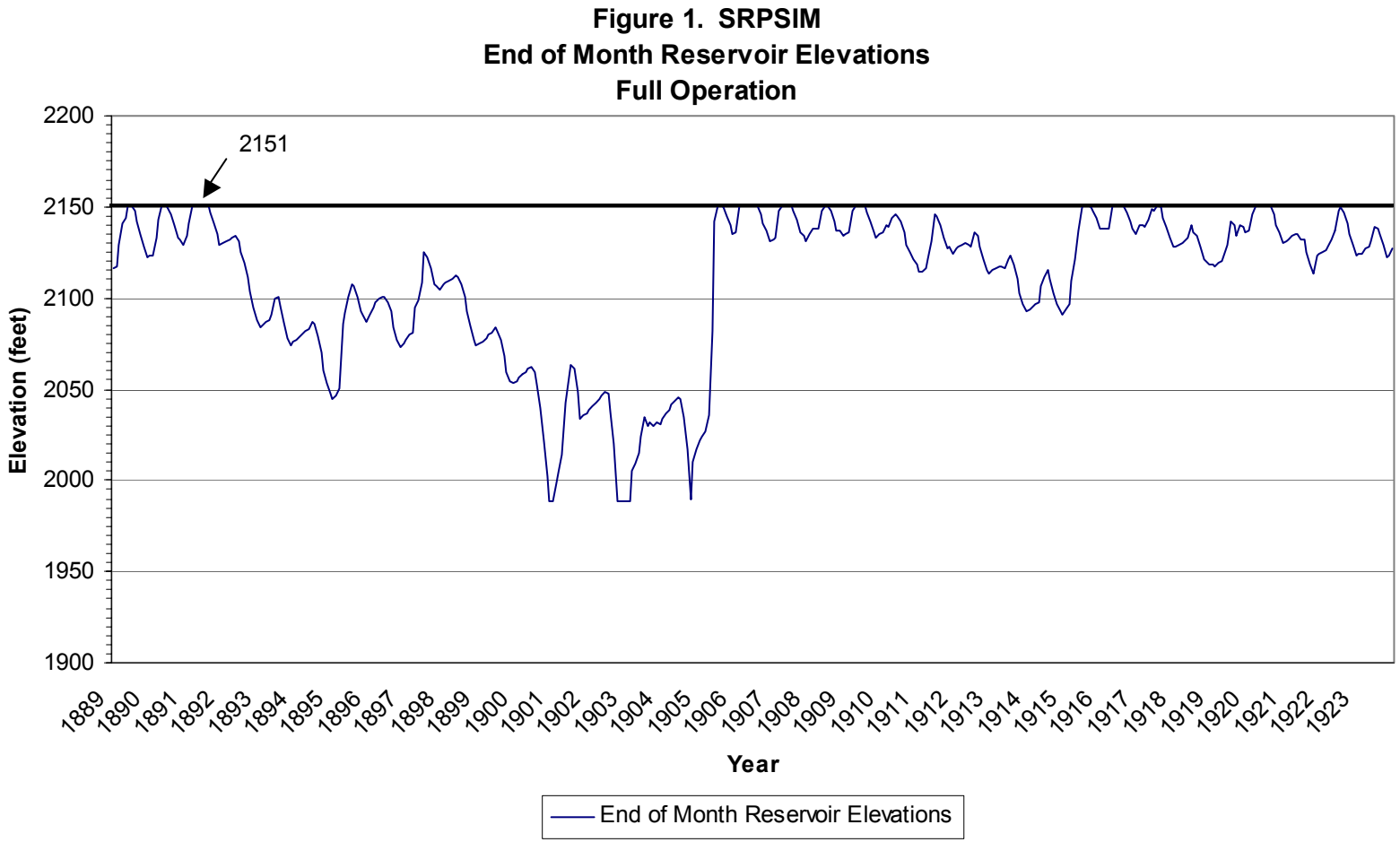


Figure 1. SRPSIM
End of Month Reservoir Elevations
Full Operation
2151
Elevation (feet)
2200
2150
2100
2050
2000
1950
1900
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
Year
End of Month Reservoir Elevations

**Figure 1 (continued). SRPSIM**
**End of Month Reservoir Elevations**
**Full Operation**

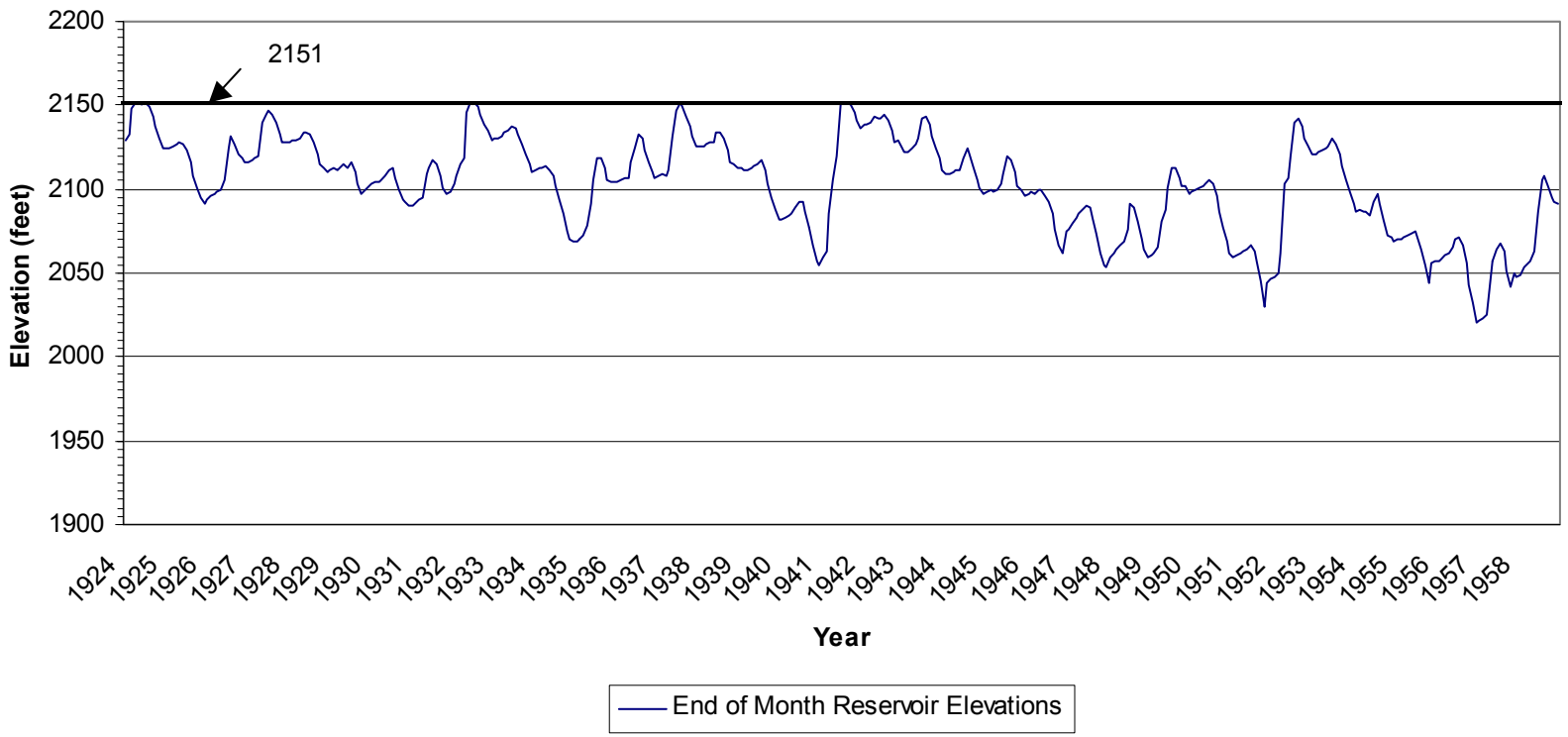
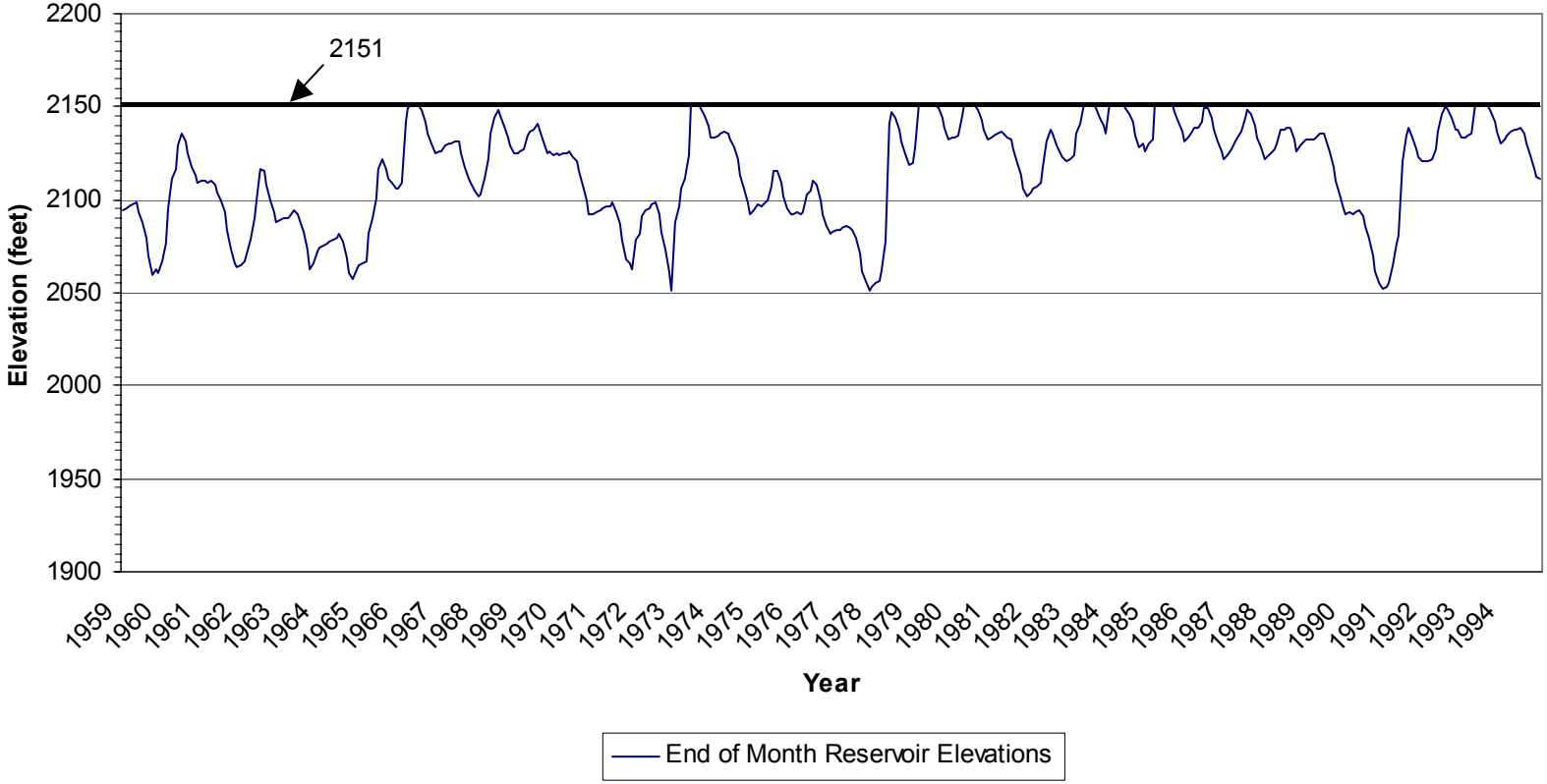


**Figure 1 (continued). SRPSIM**
**End of Month Reservoir Elevations**
**Full Operation**



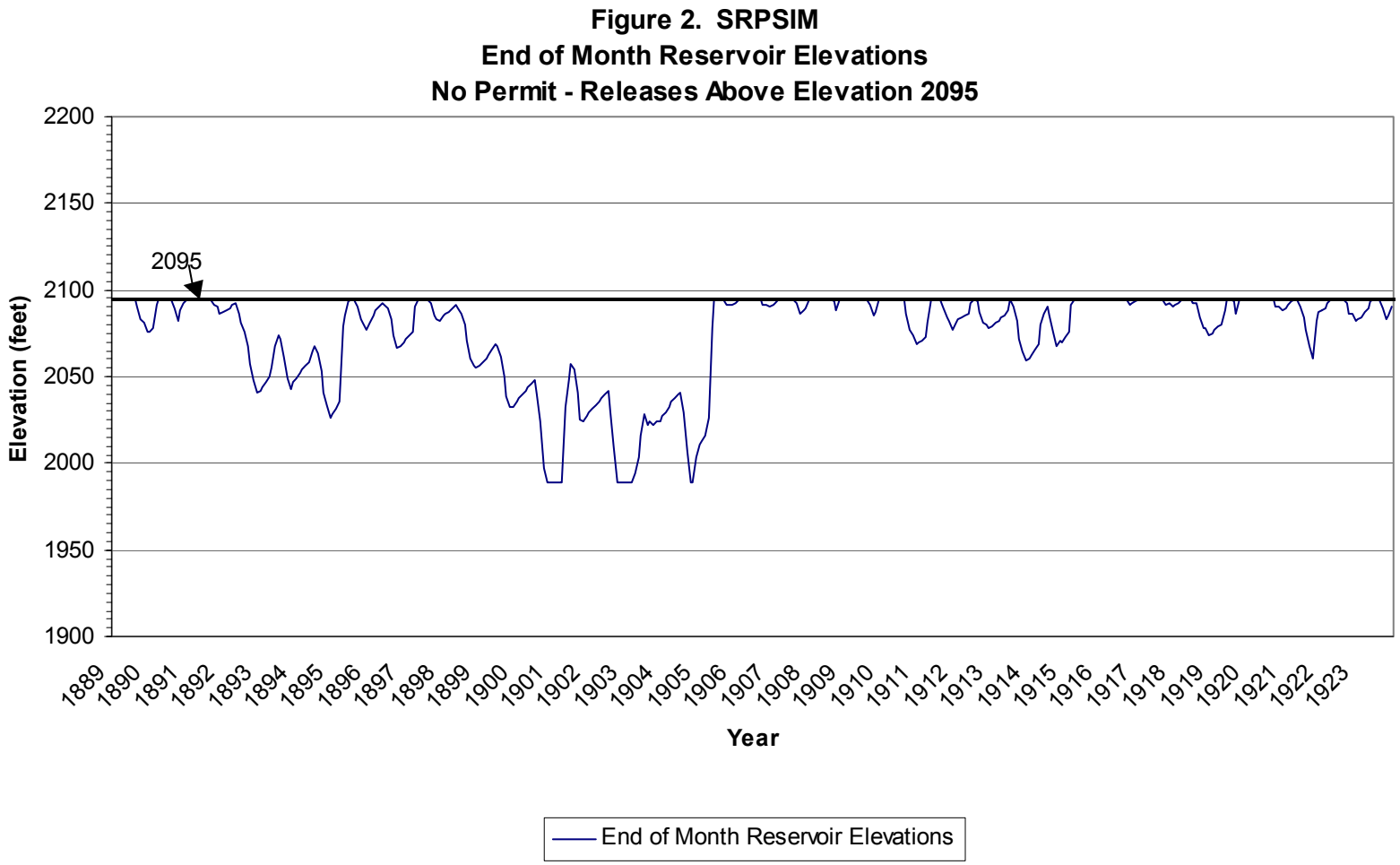


Figure 2. SRPSIM
End of Month Reservoir Elevations
No Permit - Releases Above Elevation 2095
2095
Elevation (feet)
2200
2150
2100
2050
2000
1950
1900
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
Year
End of Month Reservoir Elevations

**Figure 2 (continued). SRPSIM**
**End of Month Reservoir Elevations**
**No Permit - Releases Above Elevation 2095**

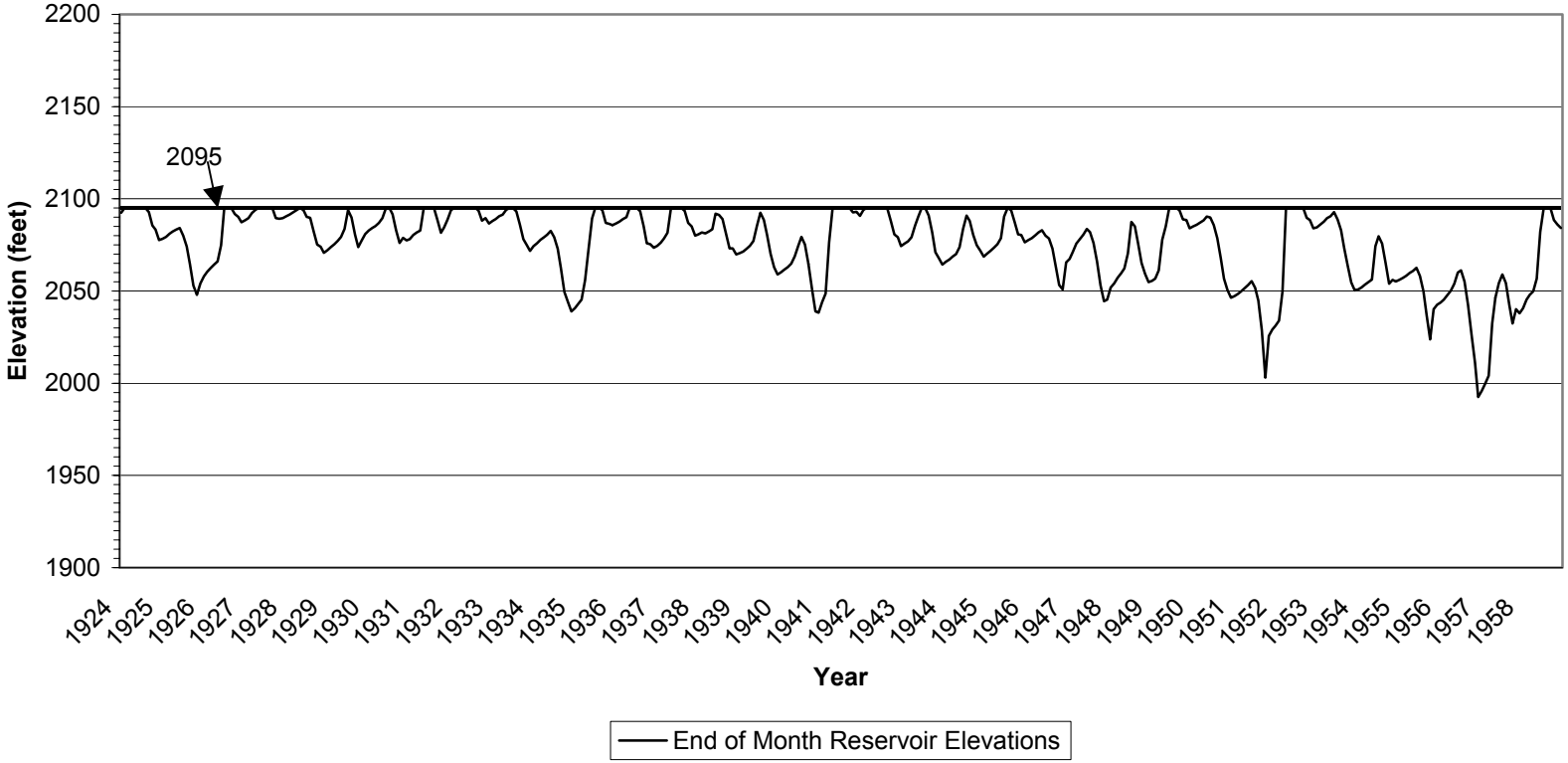


**Figure 2 (continued). SRPSIM**
**End of Month Reservoir Elevations**
**No Permit - Releases Above Elevation 2095**

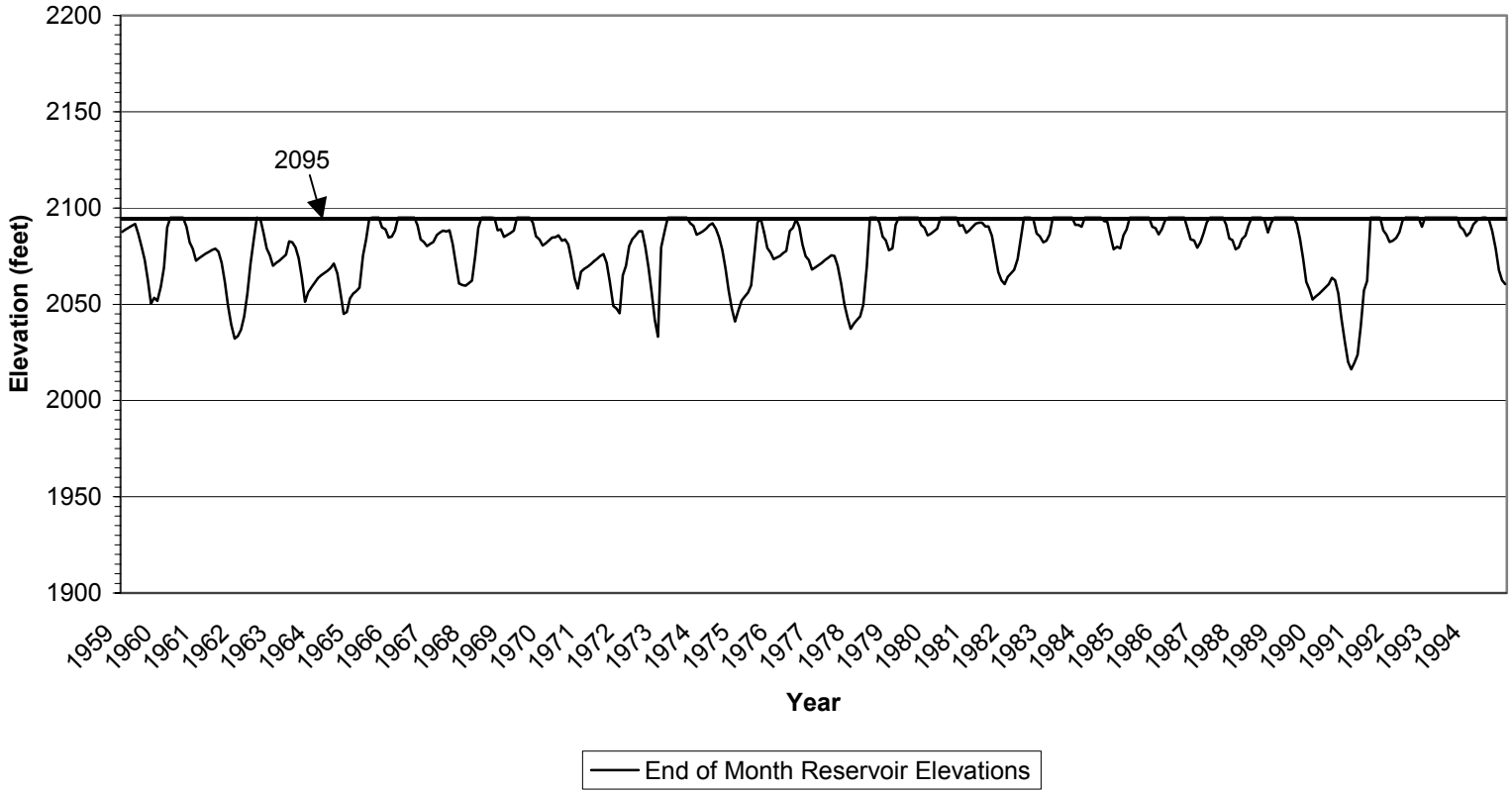


**Figure 3. SRPSIM**
**End of Month Reservoir Elevations**
**Re-Operation - Releases Above Elevation 2125**

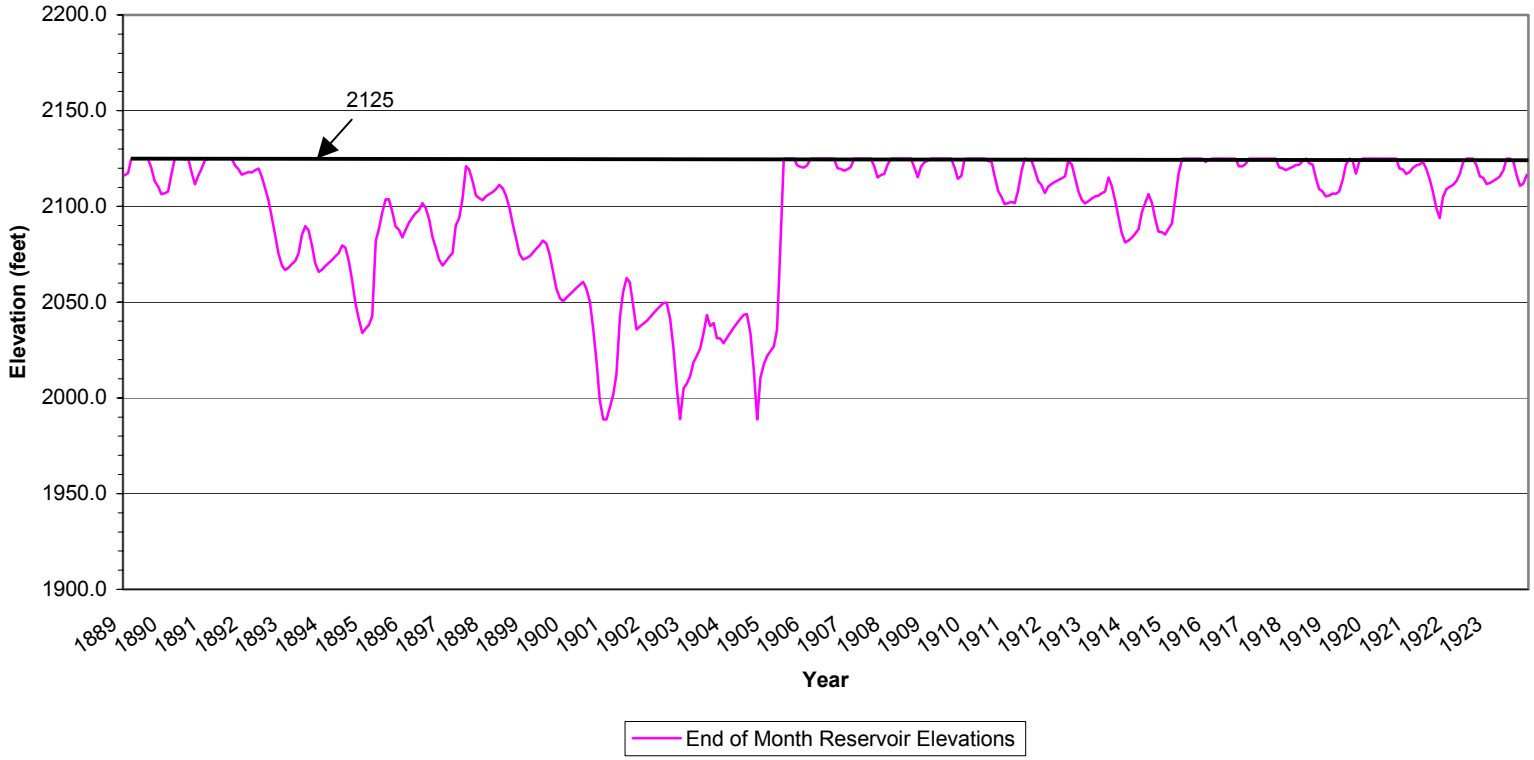
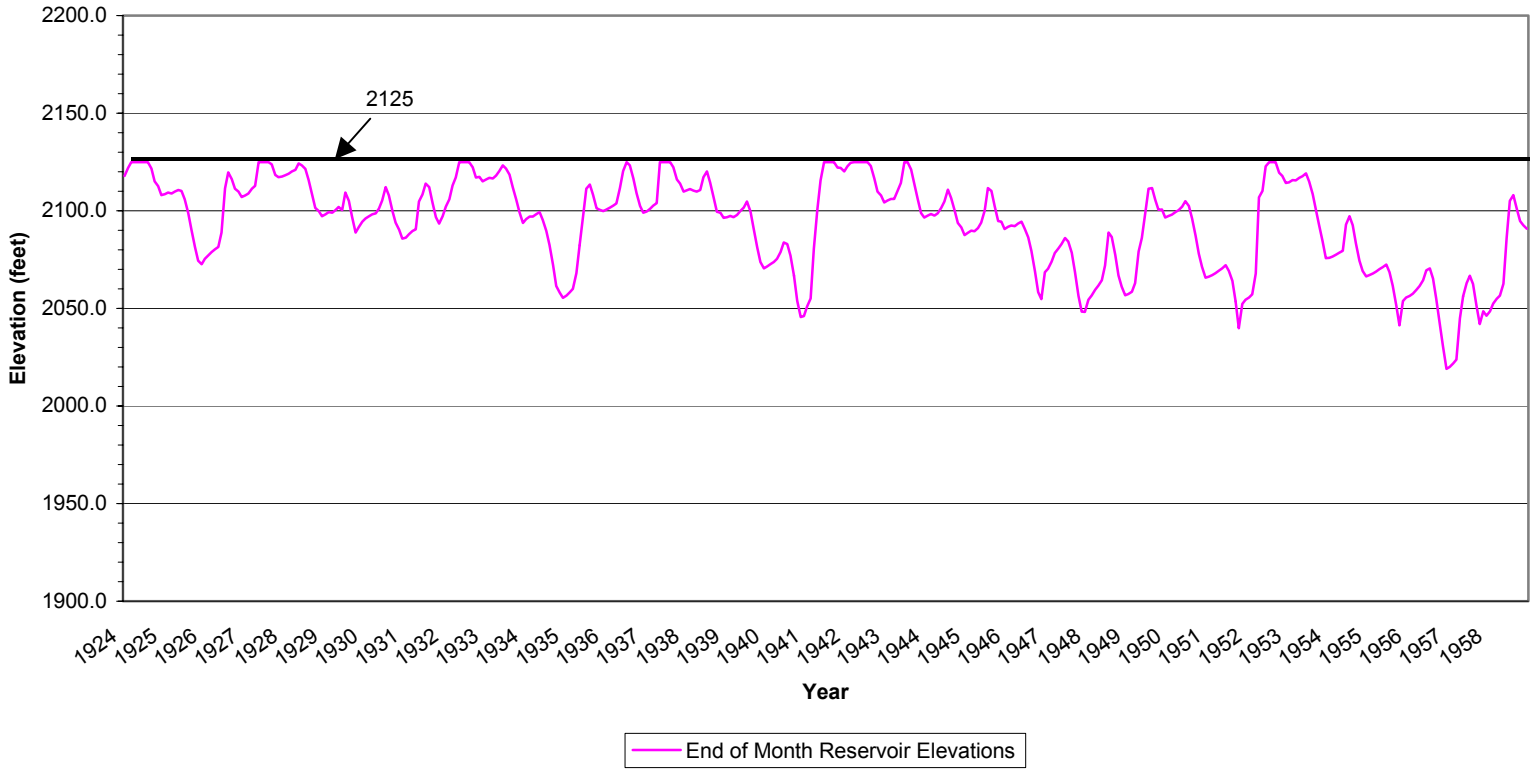


**Figure 3 (continued). SRPSIM**
**End of Month Reservoir Elevations**
**Re-operation - Releases Above Elevation 2125**



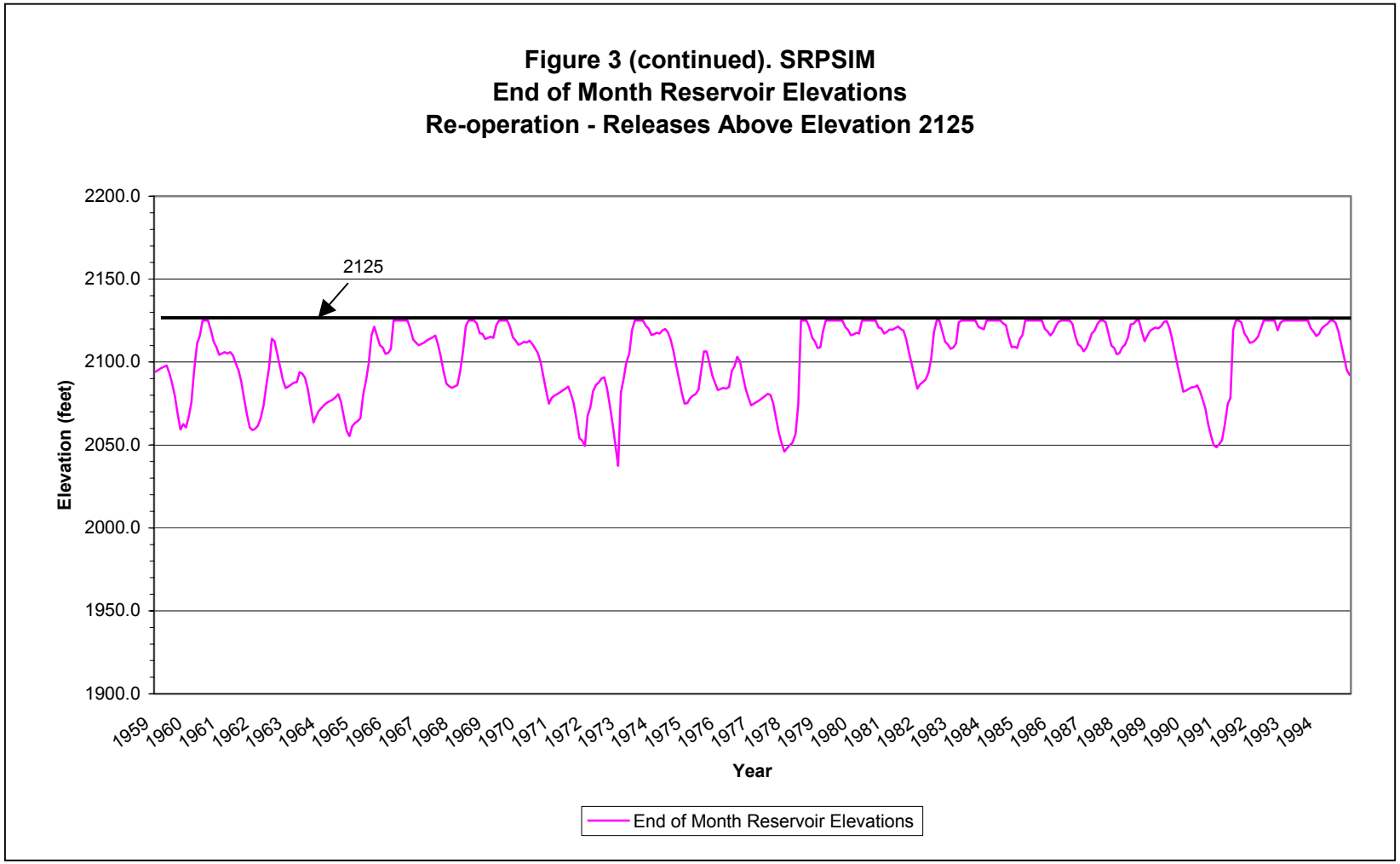


Figure 3 (continued). SRPSIM
End of Month Reservoir Elevations
Re-operation - Releases Above Elevation 2125
2125
Elevation (feet)
2200.0
2150.0
2100.0
2050.0
2000.0
1950.0
1900.0
1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994
Year
End of Month Reservoir Elevations

**Figure 4.**
**End of Month Reservoir Elevations**
**Historical Reservoir Elevations**

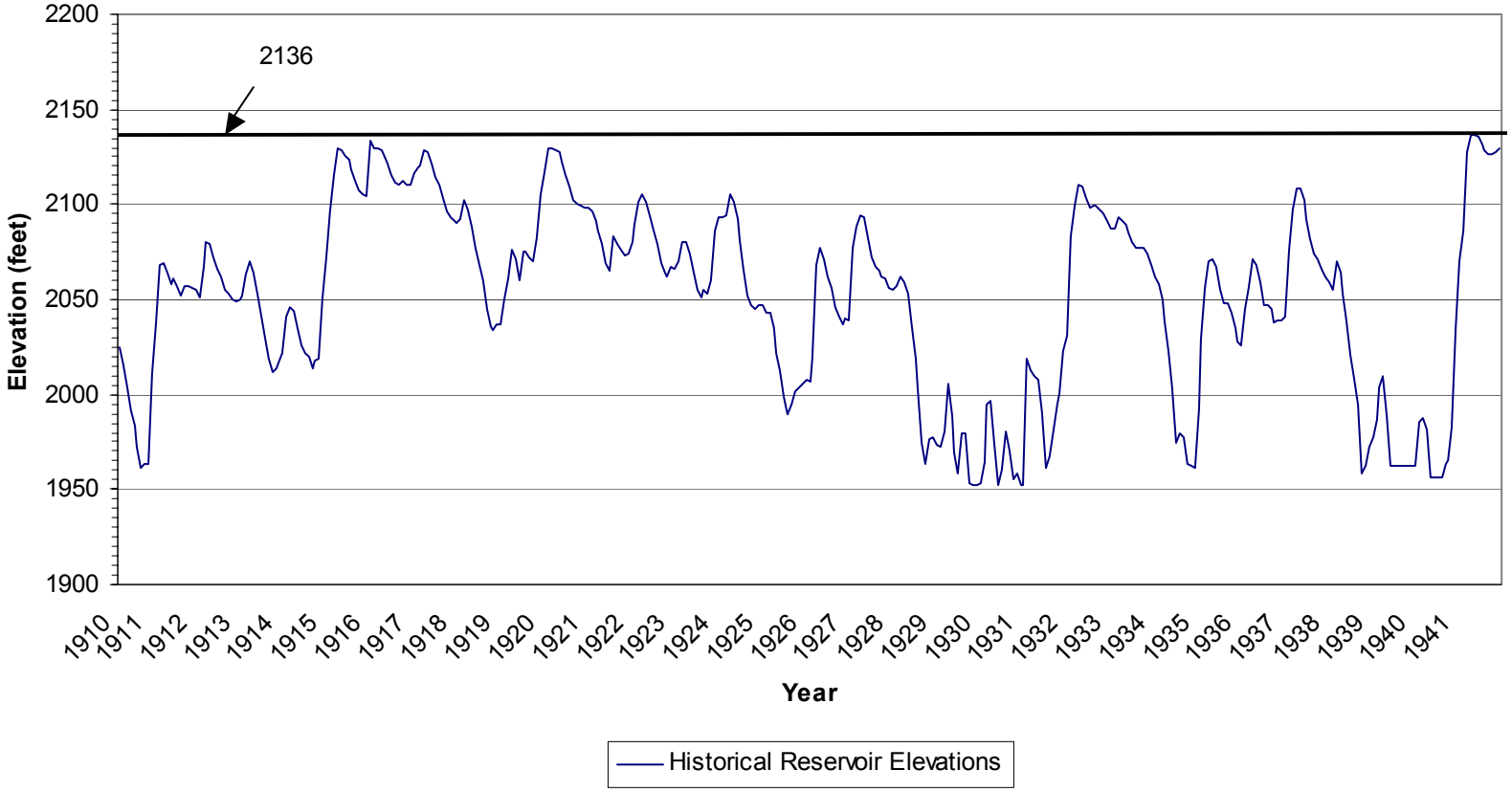


**Figure 4 (continued).**
**End of Month Reservoir Elevations**
**Historical Reservoir Elevations**

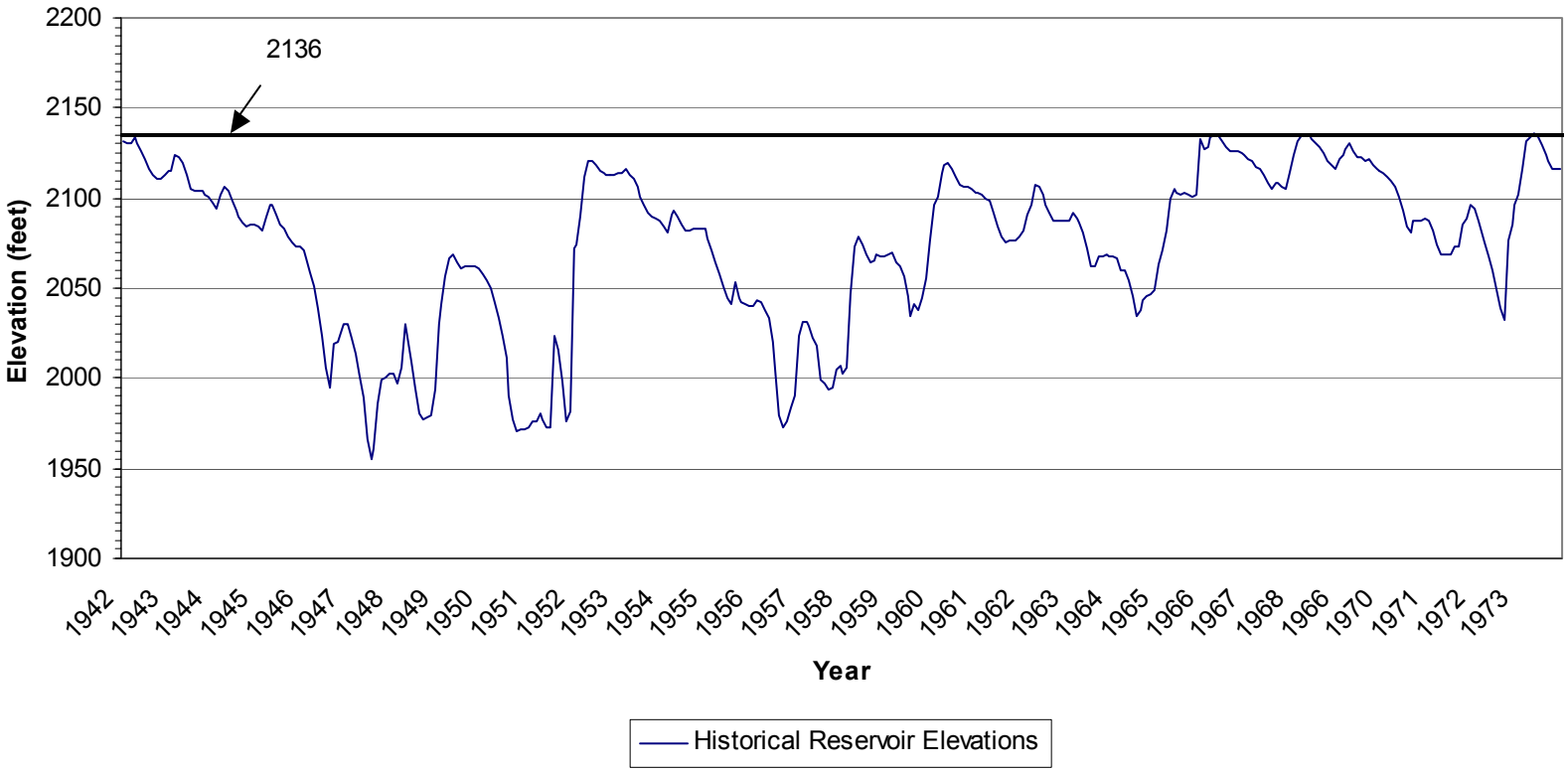
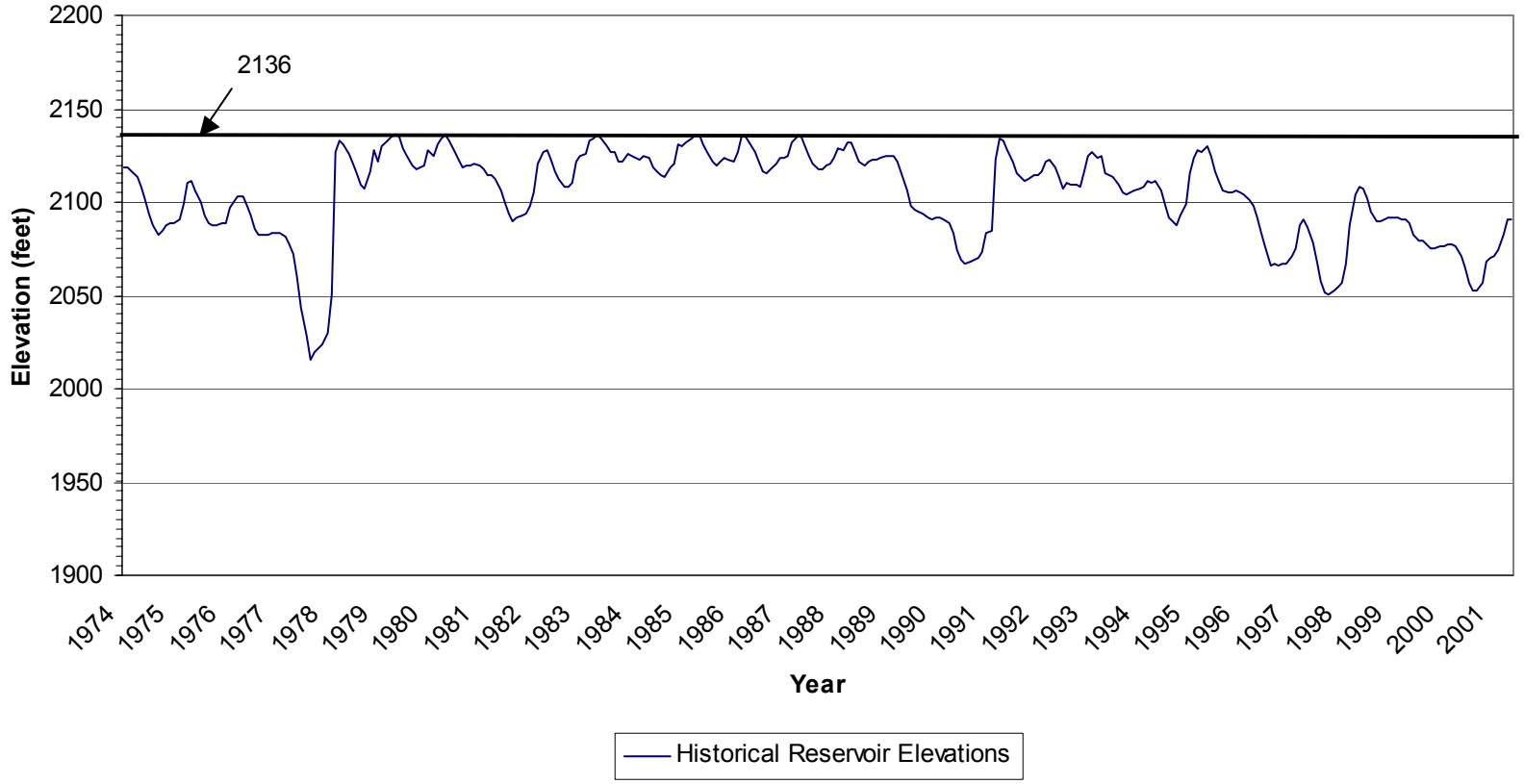


**Figure 4 (continued).**
**End of Month Historical Elevations**
**Historical Reservoir Elevations**



# APPENDIX 4:
# INUNDATION TOLERANCE OF SALT CEDAR AND OTHER RIPARIAN VEGETATION

By
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February 2002

**Summary Points**

- **Salt cedar (*Tamarix* species)[1] –** Salt cedar seedlings have significant mortality when inundated for about 25 days or longer (Gladwin and Roelle 1998; Horton et al. 1960). Two authors found that salt cedar trees experienced complete mortality when inundated for 98 days and 1 year respectively (Warren and Turner 1975; Tomanek and Zeigler 1960). Other researchers found that salt cedar trees inundated for 12 to 17 months (one growing season) experienced only 28 percent mortality (Stevens and Waring 1986; Wiedemann and Cross 1978). The height of salt cedar plants in the Warren and Turner study was 5 to 10 feet. Size or age of the trees in the other three studies was not reported. Two consecutive growing seasons of inundation kills more than 99 percent of salt cedar (Wiedemann and Cross 1978), although Stevens and Waring (1986) reported that a few individual salt cedar trees survived continuous inundation for 3 years.
- **Willow (*Salix* species) –** Willows appear to be more tolerant of inundation than salt cedar. Sandbar willow (*Salix exigua*) experienced only 12 percent mortality when inundated for 1 year (Stevens and Waring 1986). Mature Goodding willow (*Salix gooddingii*) experienced 6 percent mortality when inundated for 1 year and 64 percent mortality when inundated for 2 years (Stevens and Waring 1986; Hunter et al. 1987). A study conducted at Lake Isabella in California found that mortality of Gooding willow increased with duration of inundation and depth of inundation (Jones and Stokes 2000). Another study found that three species of willow (*Salix gracilis, S. discolor*, and *S. bebbiana*) stopped growing and

[1] The nomenclature of the genus *Tamarix* appears to be in a state of confusion. Various authors have identified the shrubby, deciduous trees of the genus Tamarix in the southwestern United States as *T. chinensis*, *T. parviflora*, *T. gallica*, *T. pentandra*, and *T. ramosissima* (Kartesz and Kartesz 1980; Welsh et al. 1993; Zimmerman 1997; Weber 2001). These species differ only in minute morphological features, making field identification nearly impossible (Zimmerman 1997). Welsh et al. recognize two species, *T. parviflora* and *T. chinensis*, and consider *T. ramosissima* a synonym for *T. chinensis* (Welsh et al. 1993). Welsh et al. consider reports of *T. gallica* and *T. pentandra* from Utah to be misidentifications of *T. chinensis* (Welsh et al. 1993). This document will follow Welsh et al. 1993. Unless otherwise stated, the terms "salt cedar" and "tamarisk" in the text refer to *T. chinensis*.

experienced 5 to 11 percent mortality after 2 growing seasons of inundation (Knighton 1981). Sub-lethal effects of inundation include decreased growth rate and loss of vigor, increased growth rate, and temporary leaf loss (Knighton 1981; Jones and Stokes 2000).

- **Cottonwood (*Populus* species) –** Mature cottonwood trees experienced no or very low mortality after partial submersion for up to 2 to 3 months, but suffered complete mortality after 2 years of partial inundation (Tesky and Hinkley 1978; Hunter et al. 1987). No data was found for intermediate periods of partial inundation. Seedlings experienced heavy mortality from partial submersion of one month or longer and complete mortality from complete submersion for periods as brief as 2 weeks (Gladwin and Roelle 1998). Most (70 percent) cottonwood snags fall within 2 years after the tree is killed by inundation (Hunter et al 1987).
- **All riparian species –** Most studies found that mature trees are more tolerant of inundation than smaller trees and seedlings. One study found that willow trees under 10 feet in height had greater tolerance of inundation than mature trees (Jones and Stokes 2000). Complete submersion leads to higher mortality than partial submersion; if part of the stem protrudes above the surface of the water, mortality decreases. For all species, mortality increases with depth and duration of inundation.

A review of literature addressing salt cedar's and other riparian vegetation's response to inundation, and conversations with wildlife refuge managers and other experts have revealed the following:

- Salt cedar is remarkably tolerant of inundation and can survive up to 3 years inundation in cold, clear, well-oxygenated water (Stevens 1989).
- Salt cedar survives prolonged flooding events that occur in regulated systems (Stevens and Waring 1985).
- In a laboratory study by Horton et al., salt cedar seedlings 4 to 12 weeks old were submerged for 1 to 6 weeks. Some dieback of stems and branches occurred on seedlings flooded for 12 to 24 days. All ages survived 1 week of submergence; inundation for 4 weeks killed 8- and 10-week old seedlings, and only the 12-week-old plants survived the 6-week period. Submergence for 4 to 6 weeks killed most salt cedar seedlings. The experiment was also carried out with seep willow seedlings. Seep willow was found to be more sensitive to flooding than salt cedar (Horton et al. 1960).
- In a Kansas reservoir, salt cedar plants "numbering in the thousands" were inundated for 1 year. Approximately 40 plants survived after 1 year (Tomanek and Zeigler 1960). The size and age of plants in this study were not reported.
- Salt cedar's ability to survive long periods of inundation and to reinvade as water recedes have probably been factors in its spread around reservoirs (Warren and Turner 1975).

- A study on the San Carlos Reservoir found that the maximum duration of root crown submergence mature salt cedars could withstand was 84 to 98 days (depending on transect). The maximum length of time a salt cedar could withstand complete shoot submergence was 70 days. Having the shoot extend above the water surface enhanced survival (Warren and Turner 1975). The salt cedar trees in this study were 5 to 10 feet tall.
- More results from Warren and Turner 1975:
  - Salt cedar submerged 0 to 1 feet above root crown for up to 43 days had 0 percent mortality.
  - Salt cedar submerged 3 feet above root crown for 71 days had 17 percent mortality.
  - Salt cedar submerged 4 feet for 81 days had 77 percent mortality.
  - Salt cedar submerged 5 feet for 90 days had 91 percent mortality.
  - Salt cedar submerged 6 feet for 98 days had >99 percent mortality.
  - Salt cedar submerged 7 feet for 107 days had 100 percent mortality.

- Wiedemann and Cross found that 13 to 17 months of flooding (includes 1 growing season) killed 28 percent of salt cedar. Flooding killed 99 percent of salt cedar after 24 months (includes 2 growing seasons). Inundated trees did not foliate the third growing season (Wiedemann and Cross 1978).
- Gladwin and Roelle found that plains cottonwood seedlings were more tolerant of fall flooding than salt cedar seedlings. Both species were more tolerant of flooding in spring than in fall, probably because seedlings were larger and had more energy reserves in spring. Survival rates for fall inundation (25 days) were 0.8 percent for salt cedar and 20.8 percent for cottonwood. Survival for spring inundation (28 days) for both species was about 91 percent (Gladwin and Roelle 1998).
- Shrader (cited in Lower Colorado BO) observed that willow experienced complete mortality when root crowns were inundated for more than 24 months.
- Knighton found that three willow species (*Salix gracilis, S. discolor, and S. bebbiana*) are tolerant of prolonged flooding of their root crowns. However, shrub growth essentially stops and significant mortality occurs after two growing seasons. These effects were not related to the amount of dissolved oxygen in the water. Knighton concluded that 3 or more years of flooding may be required to kill enough willow to substantially reduce stem density (Knighton 1981).
- Hunter et al. (1987) documented loss of cottonwood/willow habitat after 24 months of inundation of root crowns. Mortality of Fremont cottonwood was 99 percent. Mortality of Goodding willow was 64 percent. They also found that 70 percent of cottonwood snags had fallen within two years after floodwaters receded.
- "…even the most flood-tolerant species generally need to be unflooded for at least 55 to 60 percent of the growing season… Year-round root inundation can be tolerated in isolated years" (Gill 1970).

- Stevens and Waring (1986) studied effects of 3 years of flooding in the Grand Canyon on riparian vegetation. Larger plants were more tolerant of flooding than smaller plants. For example, large Goodding willow trees had much higher survivorship than smaller salt cedar. Shallow rooted species such as seep willow were more susceptible to drowning than tap rooted species such as Goodding willow, salt cedar, and mesquite. Clones of rhizomatous species had higher survival than individual plants. A few individual salt cedar trees survived continuous inundation for 3 growing seasons.
- Stromberg et al. (1993) studied the effects of flooding on riparian vegetation on the Hassayampa River. Plants on higher floodplains where water levels were not as deep had lower mortality than areas where standing water was deeper. Salt cedar had greater mortality than Fremont cottonwood and Goodding willow. Smaller trees had greater mortality than larger trees. Mature cottonwoods had no mortality.
- Tesky and Hinckley reviewed literature regarding tolerance of bottomland hardwoods to flooding. They found that mature plains cottonwood (*Populus deltoides*) could withstand partial submersion for 73 days with no mortality, but died after 2 years of partial submersion.
- A study at Lake Isabella in California documented the effects of inundation of Gooding willow over a 5-year period (Jones and Stokes 2000). This study found that mortality of Gooding willow increased with duration of inundation and depth of inundation. Jones and Stokes also found:
    - Some trees survived more than 1600 days of continuous inundation (of the root crown). However, mature Gooding willows could not survive total canopy inundation for more than 100 days.
    - Trees that were partially inundated (root crown inundated) up to 50 days had increased growth rate over non-inundated trees.
    - Gooding willow trees partially inundated more than 100 days had decreased transpiration rates until the point at which leaf loss occurred.
    - After 200 days of continuous inundation, nearly all willows had lost leaves as far as 15 feet above the ground. Those trees that survived regrew a complete canopy the following year.
    - Analysis of growth rings showed that most Gooding willow trees showed significantly wider growth rings during inundation years than during drought years.
    - Gooding willow seedlings had higher tolerance for inundation than mature trees ("seedlings" are defined as trees less than 10 feet tall). Seedlings survived complete inundation for more than 125 days (200 days maximum). Trees were 10 to 12 feet tall 36 to 37 months after germination.

- Mary Whitfield of the Kern River Research Station provided additional information on the flooding events at Lake Isabella. She noted that 3 years after

the flood receded, the formerly flooded area looked like good flycatcher habitat (Mary Whitfield, personal communication). Trees that survived the 4-year period of inundation often fell over after the water receded.

- One anecdotal report stated that a salt cedar at Alamo Reservoir survived 10 years of inundation with only a portion of the stem protruding above the water's surface (Mark Brown, personal communication).
- Flooding events at Alamo Reservoir appeared to favor willow over salt cedar (Greg Beatty, personal communication with Craig Sommers 2001). An area covered by dense stands of salt cedar was inundated for 6 months when the lake level rose to 60 feet higher than normal. When the water receded, all salt cedar and cottonwood were dead, but a few large willows had survived. About 1½ years later, the area had been colonized by large numbers of willow and salt cedar saplings. A shallower (20 feet higher than normal) and briefer flood then inundated the area. This smaller flood killed more salt cedar and favored willow. The result was a willow forest with an understory of salt cedar. Arizona Game and Fish personnel indicated that the increase in the amount of willow at the expense of salt cedar resulted from the timing of the floods, which favored germination of willow seedlings (Mark Brown, Arizona Game and Fish, personal communication, 2001).
- Anecdotal information regarding inundation tolerance of trees from the Grand Canyon and Virgin River Delta indicate that salt cedar died after 8 to 14 months of inundation, while willow could survive up to 3 years (Bob McKernan, personal communication with Janine Spencer 2001). Willows could maintain leaves for 3 years with up to 60 to 70 percent of the tree under water. Willows in the Grand Canyon that appeared dead after 2 years of inundation, with the tree completely under water for 12 months, later produced leaves and appeared to be doing fine.
- An anecdotal account from Cibola National Wildlife Refuge indicated that mature Gooding willow trees could withstand at least 4 to 6 months of continuous inundation to a depth of 6 to 10 inches from October to March (Brenda Zahn, Cibola National Wildlife Refuge, personal communication, 2001).
- Amlin and Rood (2001) found that cottonwood (*P. deltoides*) cuttings experienced reduced shoot and root growth when inundated, while willow (*S. exigua*) cuttings experienced increased shoot and root growth. They also observed that mature cottonwoods (*P. trichocarpa*) died when submerged for five years, while willows (*S. bebbiana* and *S. discolor*) appeared to be thriving.
- Examination of historical reservoir levels and aerial photographs of Roosevelt Reservoir indicates that several areas of willow and salt cedar vegetation (for example near Schoolhouse Point) were inundated to a depth of 10 to 20 feet for 4 months in 1998 with no obvious ill effects, although inundation may have favored willow at the expense of salt cedar.

**Miscellaneous Information**

Additional information on growth rate, seedling establishment, and drought tolerance of salt cedar includes:

- Growth rate of salt cedar seedlings is 2 to 5 mm per day (Stevens 1989).
- In some locations, cottonwood and willow can evidently out-compete salt cedar when the "natural" flooding regime is restored to riverine habitat (Sher et al. 2000; Brenda Zahn, Cibola National Wildlife Refuge, personal communication; Matt Connelly, Havasu National Wildlife Refuge, personal communication; Mark Brown, Arizona Game and Fish, personal communication). Sher et al. found that cottonwood could establish successfully and compete with salt cedar when historical flooding regimes and post-flood hydrology are restored (Sher et al. 2000). However, there are no dams upstream from Roosevelt Reservoir, and salt cedar dominates the vegetation at the inflows of the Salt River and Tonto Creek (personal observation).
- Hybrid poplars responded to rapid water table decline by reduced shoot growth and reduced survival (Mahoney and Rood, 1992).
- Salt cedar seedlings that were 2 years old were subjected to water stress by stopping irrigation for 29 days, resulting in 90 percent reduction in soil moisture. No ill effects were observed once water was returned (Devitt et al., 1997).

**Past Inundation of Current Nesting Sites at Roosevelt Reservoir**

Nesting sites NW of Schoolhouse Point, Salt River:

- Typically Goodding willow/salt cedar mix 20 to 30 feet high
- Unvegetated in October 1994
- Inundated (up to 40 feet) from January 1995 to April 1996 (17 months)
- Inundated (10 to 20 feet?) from April to August 1998 (4 months)

Nesting sites west (downstream) from "Old Salt" site:

- Typically Goodding willow/salt cedar mix 15 to 20 feet high
- This area appears to be sparsely vegetated in October 1994 aerial photographs
- Inferred from aerial photography and water level data that this area was inundated from February 1995 to July 1995 (5 months) and has been dry since 1995.

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| Duration of inundation | Species | Environment | Age/Size | Depth Above Root Crown | % Mortality | Reference |
|---|---|---|---|---|---|---|
| 7 days | *Baccharis salicifolia* | artificial | 4-12 weeks | 50-100% of plant submerged | 40 | 2 |
| 14 days | *Baccharis salicifolia* | artificial | 4-12 weeks | 50-100% of plant submerged | 40 | 2 |
| 28 days | *Baccharis salicifolia* | artificial | 4-12 weeks | 50-100% of plant submerged | 80 | 2 |
| 42 days | *Baccharis salicifolia* | artificial | 4-12 weeks | 50-100% of plant submerged | 100 | 2 |
| Approximately 1 month? | *Baccharis salicifolia* | river | shrub | 1.7±0.5 m (peak) | 49 | 3 |
| 1 year | *Baccharis salicifolia & B. emoryi* | river | various | variable | 64 | 6 |
| 1 year | *Baccharis sarothroides* | river | various | variable | 70 | 6 |
| 1 year | *Baccharis sergiloides* | river | various | variable | 80 | 6 |
| 2 years | *Populus balsamifera* | lake | mature | partially submerged | 100 | 14 |
| 25 days (9/15 - 10/10) | *Populus deltoides* | artificial | 8-9 weeks | 3.5 in (9 cm) | 79.2 | 1 |
| 16 days | *Populus deltoides* | ? | seedling | total submersion | 100 | 11 |
| 10 days | *Populus deltoides* | ? | seedling | partial submersion | 10 | 11 |
| 20 days | *Populus deltoides* | ? | seedling | partial submersion | 30 | 11 |
| 30 days | *Populus deltoides* | ? | seedling | partial submersion | 53 | 11 |
| 28 days (5/21 - 6/19) | *Populus deltoides* | artificial | 11 mo. | completely submerged | 7.8 | 1 |
| 152 days | *Populus deltoides* | artificial | rooted cutting | root crown submerged | 0 (reduced shoot and root growth) | 14 |
| 73 days | *Populus deltoides* | lake | mature tree | partial submersion | 0 | 11 |
| 2 years | *Populus deltoides* | lake | mature tree | partial submersion | 100 | 11 |
| Approximately 1 month? | *Populus fremontii* | river | >10 cm dbh | 0.9±0.6 m (peak) | 0 | 3 |
| Approximately 1 month? | *Populus fremontii* | river | 1-10 cm dbh | 1.8±0.6 m (peak) | 27 | 3 |
| Approximately 1 month? | *Populus fremontii* | river | <1 cm dbh | 2.1±0.3 m (peak) | 70 | 3 |
| 2 years | *Populus fremontii* | river | 3-25 m tall | ? | 99 | 10 |
| 5 years | *Populus trichocarpa* | lake | mature | partially submerged | 100 | 14 |
| 1 year | *Prosopis glandulosa* | river | various | variable | 45 | 6 |

| Duration of inundation | Species | Environment | Age/Size | Depth Above Root Crown | % Mortality | Reference |
|---|---|---|---|---|---|---|
| 152 days | *Salix exigua* | artificial | rooted cutting | root crown submerged | 0 (increased shoot and root growth) | 14 |
| 1 year | *Salix exigua* | river | individual | variable | 12 | 6 |
| 1 year | *Salix exigua* | river | clone | variable | 0 | 6 |
| Approximately 1 month? | *Salix gooddingii* | river | >10 cm dbh | 0.9±0.6 m (peak) | 0 | 3 |
| Approximately 1 month? | *Salix gooddingii* | river | 1-10 cm dbh | 1.8±0.6 m (peak) | 7 | 3 |
| Approximately 1 month? | *Salix gooddingii* | river | <1 cm dbh | 2.1±0.3 m (peak) | 64 | 3 |
| 1 year | *Salix gooddingii* | river | "large" | variable | 6 | 6 |
| 2 years | *Salix gooddingii* | river | >= 3 m tall | ? | 64 | 10 |
| 564 continuous days | *Salix gooddingii* | river/lake | mature | Up to 30 feet | 63 | 12 |
| 407 days over 2 years | *Salix gooddingii* | river/lake | mature | Up to 25 feet | 48 | 12 |
| 332 days over 2 years | *Salix gooddingii* | river/lake | mature | Up to 20 feet | 33 | 12 |
| 285 days over 2 years | *Salix gooddingii* | river/lake | mature | Up to 15 feet | 9 | 12 |
| 207 days over 2 years | *Salix gooddingii* | river/lake | mature | Up to 10 feet | 4 | 12 |
| 157 days over 2 years | *Salix gooddingii* | river/lake | mature | Up to 5 feet | 1 | 12 |
| 1,294 continuous days | *Salix gooddingii* | river/lake | mature | Up to 30 feet | 76 | 12 |
| 908 days over 4 years | *Salix gooddingii* | river/lake | mature | Up to 25 feet | 67 | 12 |
| 774 days over 4 years | *Salix gooddingii* | river/lake | mature | Up to 20 feet | 24 | 12 |
| 640 days over 4 years | *Salix gooddingii* | river/lake | mature | Up to 15 feet | 26 | 12 |
| 462 days over 4 years | *Salix gooddingii* | river/lake | mature | Up to 10 feet | 11 | 12 |
| 305 days over 4 years | *Salix gooddingii* | river/lake | mature | Up to 5 feet | 3 | 12 |
| 1,616 continuous days | *Salix gooddingii* | river/lake | mature | Up to 30 feet | 100 | 12 |
| 1,052 days over 5 years | *Salix gooddingii* | river/lake | mature | Up to 25 feet | 75 | 12 |
| 845 days over 5 years | *Salix gooddingii* | river/lake | mature | Up to 20 feet | 37 | 12 |
| 645 days over 5 years | *Salix gooddingii* | river/lake | mature | Up to 15 feet | 33 | 12 |
| 462 days over 5 years | *Salix gooddingii* | river/lake | mature | Up to 10 feet | 17 | 12 |

| Duration of inundation | Species | Environment | Age/Size | Depth Above Root Crown | % Mortality | Reference |
|---|---|---|---|---|---|---|
| 305 days over 5 years | *Salix gooddingii* | river/lake | mature | Up to 5 feet | 5 | 12 |
| 2 years | *Salix gooddingii*?? | ? | ? | 60-70 % of tree underwater | most survived | 13 |
| 12 months | *Salix gooddingii*?? | river | ? | completely covered | appeared dead but later leafed out | 13 |
| 2 growing seas. | *Salix gracilis, discolor, & bebbiana* | artificial | 1.67-2 ft (50-60 cm) tall | 0 in (0 cm) | 0 (reduced growth & vigor) | 9 |
| 2 growing seas. | *Salix gracilis, discolor, & bebbiana* | artificial | 1.67-2 ft (50-60 cm) tall | 3 in (7.5 cm) | 5.3 (reduced growth & vigor) | 9 |
| 2 growing seas. | *Salix gracilis, discolor, & bebbiana* | artificial | 1.67-2 ft (50-60 cm) tall | 6 in (15 cm) | 11 (reduced growth & vigor) | 9 |
| 5 years | *Salix discolor & S. bebbiana* | lake | mature | shoot partially submerged | 0 (thriving) | 14 |
| 43 days | *Tamarix chinensis* | lake fringes | 5-10 feet (1.5-3 m) | 0-1 ft (0-31 cm) | 0 | 4 |
| 71 days | *Tamarix chinensis* | lake fringes | 5-10 feet (1.5-3 m) | 3 ft (91 cm) | 17 | 4 |
| 81 days | *Tamarix chinensis* | lake fringes | 5-10 feet (1.5-3 m) | 4 ft (122 cm) | 77 | 4 |
| 90 days | *Tamarix chinensis* | lake fringes | 5-10 feet (1.5-3 m) | 5 ft (152 cm) | 91 | 4 |
| 98 days | *Tamarix chinensis* | lake fringes | 5-10 feet (1.5-3 m) | 6 ft (183 cm) | >99 | 4 |
| 107 days | *Tamarix chinensis* | lake fringes | 5-10 feet (1.5-3 m) | 7 ft (213 cm) | 100 | 4 |
| 12 mo. | *Tamarix chinensis* | lake fringes | ? | ? | >99 | 5 |
| 1 year | *Tamarix chinensis* | river | various | variable | 28 | 6 |
| 13 to 17 mo. (1 growing seas.) | *Tamarix gallica* | lake fringes | ? | partially or totally inundated | 28 | 7 |
| 24 mo. (2 growing seas.) | *Tamarix gallica* | lake fringes | ? | completely submerged | 99 | 7 |
| 28 mo. (3 growing seas.) | *Tamarix gallica* | lake fringes | ? | completely submerged 1st growing season | 99 | 7 |
| 36 mo. (3 growing seas.) | *Tamarix gallica* | lake fringes | ? | partially submerged | 99 | 7 |
| 7 days | *Tamarix pentandra* | artificial | 4-12 weeks | 50-100% of plant submerged | 0 | 2 |
| 14 days | *Tamarix pentandra* | artificial | 4-12 weeks | 50-100% of plant submerged | 0 (some dieback) | 2 |

| Duration of inundation | Species | Environment | Age/Size | Depth Above Root Crown | % Mortality | Reference |
|---|---|---|---|---|---|---|
| 28 days | *Tamarix pentandra* | artificial | 4-12 weeks | 50-100% of plant submerged | 40 | 2 |
| 42 days | *Tamarix pentandra* | artificial | 4-12 weeks | 50-100% of plant submerged | 80 | 2 |
| Approximately 1 month? | *Tamarix pentandra* | river | 1-10 cm dbh | 1.8±0.6 m (peak) | 62 | 3 |
| Approximately 1 month? | *Tamarix pentandra* | river | <1 cm dbh | 2.1±0.3 m (peak) | 63 | 3 |
| 25 days (9/15 - 10/10) | *Tamarix ramosissima* | artificial | 4-6 weeks | 3.5 in (9 cm) | 99.2 | 1 |
| 28 days (5/21 - 6/19) | *Tamarix ramosissima* | artificial | 10 mo. | completely submerged | 8.9 | 1 |
| 8 to 14 months | *Tamarix* sp. | ? | ? | ? | 100 | 13 |
| 1 year | *Tessaria sericea* | river | individual | variable | 44 | 6 |
| 1 year | *Tessaria sericea* | river | clone | variable | 0 | 6 |
| 24 mo. (2 growing seas.) | willow (species ?) | river | ? | ? | 100 | 8 |

**References:**
1 - Gladwin & Roelle 1998
2 - Horton et al 1960
3 - Stromberg et al 1993
4 - Warren & Turner 1975
5 - Tomanek & Zeigler 1960
6 - Stevens and Waring, 1986
7 - Wiedemann & Cross 1978
8 - Shrader - in LCRBO 1997
9 - Knighton 1981
10 - Hunter et al. 1987
11 - Teskey & Hinkley 1978
12 - Jones & Stokes, 2000
13 - McKernan, 2001
14 - Amlin and Rood, 2001

# APPENDIX 5:
# ALTERNATIVE METHODS CONSIDERED FOR QUANTIFYING EFFECTS OF ROOSEVELT DAM OPERATIONS ON FLYCATCHERS

Various methods to quantify the effect of SRP's continued operation of Roosevelt Dam on flycatchers were evaluated by SRP, FWS, and Arizona biologists from agencies active in flycatcher research and management. The agreed-upon goal for selection of a method was to provide a habitat-based index to estimate the maximum number of flycatchers reasonably expected to be taken as a result of reservoir operation over a 50-year period that is scientifically based, objective, reproducible and relatively easy to measure.

After thorough consideration of various methods, the method described in Subchapter III.C.2 was adopted because of the advantages described below. In summary, that method uses the 11.1-acre neighborhood from AGFD model to define the perimeter around territories and nests. The area within this perimeter or buffer represents occupied habitat. The future amount of occupied habitat is estimated by extrapolating the historical quantity of occupied habitat using the average between two curves: one based on the assumption that habitat is not limiting (second-order equation) and the other based on the assumption that habitat or some other factor will limit future population growth (third order equation).

This method, ultimately adopted for use in the RHCP, has the following advantages and disadvantages:

*Advantages:* Uses actual observations of nests and territories plus the variable most highly correlated with breeding site occurrence from the AGFD model (the 11.1-acre neighborhood). Includes areas outside of tall dense vegetation that are used by flycatchers. Is scientifically based, easy to apply, accurately reproducible, and highly correlated to the number and distribution of flycatchers.

*Disadvantages:* Requires identification of the location of nests or territories. The predictive ability of the model is unclear.

## Other Methods Evaluated

Various other methods were evaluated but were rejected because of disadvantages in relation to the selected approach. These alternatives, and their advantages and disadvantages, are summarized below.

### 1. Modified AGFD Model

*Summary:* Total all acres in probability habitat classes 3, 4, and 5; add acres of all territories in classes 1 and 2. Subtract non-habitat (would need to define) in class 3.

*Advantages:* The model is based on Roosevelt Lake data. Potential habitat classes 3, 4, and 5 plus territories in classes 1 and 2 would capture all occupied habitat. If methods for defining territory size and non-habitat were clear, the method should be repeatable

and fairly simple to accomplish. Could use the AGFD model to generate classes, and the 2001 territory map and the ERO vegetation map as data sources.

*Disadvantages:* Need to define territory size and non-habitat types. Model does not have predictive capability, so would need to adopt contingency planning, adaptive management, and additional modeling, e.g.: 1) assume current data reflects near maximum numbers of flycatchers and habitat over the life of the project, 2) increase occupied habitat to provide a contingency, or 3) continue vegetation mapping and modeling in the future and adjust mitigation through adaptive management.

**2. AGFD Model**

*Summary:* Total all acres in probability classes 3, 4, and 5.

*Advantages:* The model is based on Roosevelt Lake data. Highly repeatable. Uses the AGFD habitat model without modification.

*Disadvantages:* Misses known nests/territories/habitats in classes 1 and 2. Probably includes considerable unsuitable habitat in class 3, and probably smaller acres of non-habitat in classes 4 and 5. Data used are assumed to reflect near maximum numbers of flycatchers and habitat over the life of the project. Model does not have predictive capability, so would need to adopt contingency planning, adaptive management, and additional modeling, e.g.: 1) assume current data reflects near maximum numbers of flycatchers and habitat over the life of the project; 2) increase occupied habitat to provide a contingency; or 3) continue vegetation mapping and modeling in the future and adjust mitigation through adaptive management.

**3. Elevations**

*Summary:* Total all acres between an elevation modeled as the likely low lake level and below 2151.

*Advantages:* Repeatable, similar to method used in Lake Isabella consultation. Includes all areas that are habitat or likely to be habitat in the future. The only prediction needed to use the approach is the likely low lake level, which can be estimated from historical lake levels.

*Disadvantages:* Would include considerable acreage of unsuitable and unoccupied habitat and probably areas that have no potential to be occupied habitat. Ignores other sources of information about what habitats are present and where the territories have been located.

**4. Vegetation Type Maps**

*Summary:* Total all acres from the ERO vegetation maps in the following categories: cottonwood, willow, mixed riparian, salt cedar. Possible variations in regard to what should be counted, e.g., vegetation density. Would need to attempt to predict vegetation communities.

*Advantages:* Repeatable, so long as criteria are developed to identify suitable habitats. Could design the method to predict future habitats as well as extant habitats.

*Disadvantages:* Ignores other information available (i.e., AGFD model, territory locations). Method may estimate total suitable habitat but may not be a good indicator of occupied habitat and number of birds. Would need to design a predictive element to the model or adopt contingency planning, adaptive management, and additional modeling, e.g.: 1) assume current data reflects near maximum numbers of flycatchers and habitat over the life of the project; 2) increase occupied habitat to provide a contingency; or 3) continue vegetation mapping and modeling in the future and adjust mitigation through adaptive management.

**5. Experts Workshop**

*Summary:* Have the USGS Biological Research Division and AGFD draft criteria for identifying suitable habitat, and then based on those criteria, the ERO vegetation maps, AGFD habitat classes, and 2001 territory/nest locations, prepare a draft map of suitable habitats. Gather the experts on the species to critique and revise the criteria and maps.

*Advantages:* Uses all sources of information and all expert opinion available. Predictions of future habitat conditions could be calculated, as well as extant habitats.

*Disadvantages:* Repeatability likely to depend on composition of expert panel (repeatability could be enhanced by clearly defining terms and criteria for defining habitat). This method is likely to take more time than other methods because of extensive meetings with experts needed to define and carry out the process. The panel of experts may not be able to reach consensus on an acceptable approach. Predictions may require continuous monitoring of vegetation, AGFD modeling, and surveys of territory/nest locations.

**6. Territories**

*Summary:* Use an estimated territory size to define the quantity of occupied habitat. Based on 1995 AGFD data and the draft recovery plan, more than 84% of estimated territories are less than 200 feet in diameter (about 2.9 acres). Use the 200-foot radius to buffer all nests and territories and calculate the area within the buffer. Develop a method to extrapolate the future amount of occupied habitat (see #4 above).

*Advantages:* Uses nests and territories to define occupied habitat. Is scientifically based, easy to apply, accurately reproducible, and highly correlated to the number and distribution of flycatchers.

*Disadvantages:* Requires location of nests and territories. Does not include areas outside of territories used to some extent for foraging and other activities. Based on rangewide data, rather than just data collected at Roosevelt. Ignores importance of patch characteristics as a factor of flycatcher occupancy. Would require developing predictive capability, or adopt contingency planning, adaptive management, and/or additional modeling, e.g.: 1) assume current data used reflect near maximum numbers of flycatchers and habitat over the life of the project; 2) adjust occupied habitat up as a contingency; or 3) would need to continue vegetation mapping and modeling in the future and adjust mitigation through adaptive management.

# APPENDIX 6:
# TEMPLATE FOR MANAGEMENT PLANS

## RHCP 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 RHCP. A specific management plan will be developed for each property in coordination with FWS and, where applicable, the land management entity. A draft form of conservation easement that SRP and FWS have developed 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, plants, etc. 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 are summarized in the Baseline Documentation attached to the deed of conservation easement filed with the county.

**Monitoring of Species Covered by the RHCP**

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 RHCP. 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 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 non-point 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 RHCP. All mitigation lands protected through the RHCP 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 consider that species.

The primary management goal within the active channel and floodplain is to protect and enhance a naturally functioning system to protect and maintain 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 insuring that the land providing mitigation for the RHCP 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 adverse cattle grazing and recreation impacts by erecting and maintaining fences to protect the riparian corridor.
4. If flycatchers and cowbirds are present, cowbird trapping will be used on the property unless some other entity is trapping or unless FWS agrees that it is not necessary.
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 non-native 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 non-native plants that can become invasive (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.

14. Retiring irrigated agricultural lands and pumping to increase stream flow and ground water levels.
15. Obtaining Arizona Department of Water Resources maps and data for the property and adjacent lands.
16. 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 numbers of flycatchers and cuckoos using already established breeding areas, as determined through surveys.
3. Use of the site by eagles.
4. Water table depth is maintained or decreased over time and surface water is available to the largest extent practicable, taking into account climatic cycles.
5. Adverse livestock grazing is eliminated from riparian areas.
6. Adverse recreational use of the area (particularly ATVs) is substantially reduced or eliminated.

**Management Timeline**

A specific management plan will be developed for each property acquired by SRP for mitigation within one year of purchase. The management plan will be reviewed annually by SRP, FWS, and the property manager and will be amended to the extent required by changed circumstances. The properties protected by SRP for mitigation under the Roosevelt Habitat Conservation Plan will be protected and managed in perpetuity for the benefit of flycatchers, cuckoos, and bald eagles.

# DRAFT FORM
# DEED OF CONSERVATION EASEMENT FOR RHCP MITIGATION PROPERTIES

STATE OF ARIZONA §
§
COUNTY OF _____ §

THIS DEED OF CONSERVATION EASEMENT is made this _____ day of ____ 2002, 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, groundwater 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 33-27 *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 Roosevelt Habitat Conservation Plan. The Management Plan, Roosevelt 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 Roosevelt 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 non-native 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 non-native species of noxious or aggressive character, which might adversely affect the natural values of the Property.

(j) Filling, excavating, dredging, mining, drilling, exploration or extraction of minerals, hydrocarbons, soils, sand, gravel, rock or other materials on or below the surface of the Property.

(k) Pumping of groundwater 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 7:
# 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 ROOSEVELT DAM, IN GILA COUNTY, ARIZONA.**

This Implementing Agreement ("Agreement") is made and entered into as of the ___ day of _____, 2002, 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 Theodore Roosevelt Dam in Gila County, Arizona, are occupied and utilized as habitat by the southwestern willow flycatcher, an endangered species, the yuma clapper rail, an endangered species, the bald eagle, a threatened species, and the yellow-billed cuckoo, a candidate species; and

WHEREAS, SRP, with technical assistance from FWS, has developed a series of measures, described in the Roosevelt Habitat Conservation Plan ("RHCP"), to minimize and mitigate to the maximum extent practicable the effects of SRP's continued operation of the conservation storage space at Roosevelt Dam 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 1,500 or more acres of land acquired and managed by SRP or its designated agent pursuant to the terms of the RHCP.

**2.3** The term "Effective Date" shall mean the date as of which FWS issues the Permit.

**2.4** 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.

**2.5** The term "Party" or "Parties" shall mean one or more of the parties to this Agreement.

**2.6** 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.

**2.7** The term "Permit Area" shall mean the lands within the total conservation capacity at Roosevelt Dam that corresponds to a maximum surface elevation of 2151 feet, as described in Subchapter I of the RHCP.

**2.8** The term "Permitted Activity" shall mean the continued operation of the total conservation capacity at Roosevelt Dam that corresponds to a maximum surface elevation of 2151 feet, as described in Subchapter I of the RHCP, by the Permittee or any successor in interest to the Permittee.

**2.9** The term "Permittee" shall mean SRP.

**2.10** The term "Plan Species" shall mean the species identified in Section 1.0 of this Agreement and covered by the RHCP and the Permit.

**2.11** The term "RHCP" shall mean the Roosevelt Habitat Conservation Plan, to be implemented by SRP in conjunction with the Permitted Activity. Terms defined and utilized in the RHCP shall have the same meaning when utilized in this Agreement, except as specifically noted herein.

**2.12** The term "Unforeseen Circumstances" shall mean changes in circumstances affecting a species or geographic area covered by the RHCP, which could not reasonably have been anticipated by the Parties at the time of the RHCP's negotiation and development, and which result in a substantial and adverse change in the status of Plan

Species. The term "Unforeseen Circumstances" shall not include Changed Circumstances, as that term is defined in the Permit.

**2.13** The term "Unlisted Species" shall mean a species, or a distinct population segment of a vertebrate species) that is not listed as endangered or threatened under the ESA. The term "Unlisted Species" includes candidate species.

## 3.0 PURPOSES

The purposes of this Agreement are:

**3.1** To ensure implementation of each of the terms of the RHCP 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 RHCP.

## 4.0 INCORPORATION OF RHCP AND PERMIT; GOVERNING LAW

**4.1** The RHCP, 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 RHCP and the Permit, the terms of the Permit shall control. In all other cases, the terms of this Agreement, the RHCP and the Permit shall be interpreted to be supplementary to each other.

**4.2** This Agreement, the RHCP and the Permit, and the Parties' compliance therewith, shall be governed by the ESA and implementing regulations as the same exist on the Effective Date. Except as otherwise provided herein, any reference in this Agreement, the RHCP or the Permit to any provision of the ESA or to any regulation or rule of FWS shall be deemed to be a reference to such statute, regulation or rule in existence as of the Effective Date. If federal statutes are enacted or rules or regulations are issued by FWS after the Effective Date that conflict with any provision of this Agreement, the RHCP or the Permit, the provisions of this Agreement, the RHCP and the Permit shall control and continue to govern the rights and obligations of the Parties.

## 5.0 LEGAL REQUIREMENTS

In order to fulfill the requirements that will allow FWS to issue the Permit, the RHCP sets forth measures that are intended to ensure that any take occurring within the Permit Area will be incidental; that the impacts of the 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 RHCP will be provided; and that the take will not appreciably reduce the likelihood of the survival and recovery of the Plan Species in the wild. It also includes measures that have been suggested by FWS as being necessary or appropriate for purposes of the RHCP.

## 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 RHCP and this Agreement requiring the acquisition and management of Compensation Lands as habitat for the Plan 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 RHCP 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 RHCP and of this Agreement requiring the acquisition and management of Compensation Lands as habitat for the Plan 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 Plan 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

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 RHCP 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 RHCP 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 RHCP.

## 8.0 RESPONSIBILITIES OF THE PARTIES IN MITIGATION PROGRAM; IMPLEMENTATION AND MONITORING RESPONSIBILITIES

### 8.1 Responsibilities of the Permittee

a. The RHCP will be deemed properly implemented if the commitments and provisions of the RHCP, 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 RHCP in order to meet the terms of the RHCP and comply with the Permit, including the adaptive management procedures described in the RHCP, if required.

c. As required by Chapter IV.E.6. of the RHCP, 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 RHCP were met for the reporting period. The report shall be submitted to FWS on each February 1 for the previous calendar year and shall provide all reasonably available data regarding impacts to habitat of and effects on the Plan Species, and, where requested by FWS, changes to the overall population of Plan Species that occurred in the Permit area 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 RHCP that is requested by FWS for the purpose of assessing whether the terms and conditions of the Permit and the RHCP, including the RHCP'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 Permittee of threatened or endangered Plan Species resulting from the Permitted Activity.

b. After issuance of the Permit, FWS shall monitor the implementation of the terms of the Permit, this Agreement and the RHCP 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 RHCP, this Agreement and the Permit, FWS may require measures of the Permittee in addition to those required by the RHCP only in accordance with the terms 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 RHCP, 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 that 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 RHCP is being properly implemented, 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 Plan 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 Permitted Activity, 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 Permitted Activity, 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 RHCP 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
[Street Address]
[City, State, Zip Code]

Field Supervisor
United States Fish and Wildlife Service
[Street Address]
[City, State, Zip Code]

[Associate General Manager, Water]
[Salt River Project]
[Street Address or Post Office Box]
[City, State, Zip Code]

### 13.4 Entire Agreement

This Agreement, together with the RHCP and the Permit, constitutes 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 RHCP 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 the 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 _____
Regional Director
United States Fish and Wildlife Service
[City, State]

SUBSCRIBED AND SWORN TO BEFORE ME THIS ___ DAY OF _____, 200_,

_____
Notary Public

BY _____ Date _____
William Schrader, President
Salt River Project

SUBSCRIBED AND SWORN TO BEFORE ME THIS ___ DAY OF _____, 200_,

_____
Notary Public

# APPENDIX 8:
# DRAFT INCIDENTAL TAKE PERMIT TERMS AND CONDITIONS

(Terms and Conditions Proposed by SRP for Inclusion in the Incidental Take Permit)

## 1.0 DEFINITIONS

The following terms as used in this Permit shall have the meanings set forth below:

**1.1** The term "Agreement" shall mean the 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 Roosevelt Dam, in Gila County, Arizona, executed by the parties thereto concurrent with the issuance of this Permit. Terms identified and utilized in the Agreement shall have the same meaning when utilized in this Permit, except as specifically noted herein.

**1.2** The term "Changed Circumstances" shall mean the changes in circumstances affecting a species or geographic area covered by the RHCP that are identified in Subparagraph 8.1 hereof. The term "Changed Circumstances" shall not include Unforeseen Circumstances, as that term is defined in Subparagraph 1.12 hereof.

**1.3** The term "Compensation Lands" shall mean the 1,500 or more acres of land acquired and managed by SRP or its designated agent pursuant to the terms of the RHCP.

**1.4** The term "Effective Date" shall mean the date herein above, as of which FWS issues this Permit.

**1.5** 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.

**1.6** The term "Permit" shall mean this incidental take permit, issued by FWS to SRP pursuant to Section 10(a)(1)(B) of the ESA.

**1.7** The term "Permit Area" shall mean the lands within the total conservation capacity at Roosevelt Dam that corresponds to a maximum surface elevation of 2151 feet, as described in Subchapter I of the RHCP.

**1.8** The term "Permitted Activity" shall mean the continued operation of the total conservation capacity at Roosevelt Dam that corresponds to a maximum surface elevation of 2151 feet, as described in Subchapter I of the RHCP, by the Permittee or any successor in interest to the Permittee.

**1.9** The term "Permittee" shall mean SRP.

**1.10** The term "Plan Species" shall mean the species covered by the RHCP and this Permit, as fully set forth herein.

**1.11** The term "RHCP" shall mean the Roosevelt Habitat Conservation Plan, to be implemented by SRP in conjunction with the Permitted Activity. Terms defined and utilized in the RHCP shall have the same meaning when utilized in this Permit, except as specifically noted herein.

**1.12** The term "Unforeseen Circumstances" shall mean changes in circumstances affecting a species or geographic area covered by the RHCP, which could not reasonably have been anticipated by SRP and FWS at the time of the RHCP's negotiation and development, and which result in a substantial and adverse change in the status of Plan Species. The term "Unforeseen Circumstances" shall not include Changed Circumstances, as that term is defined in Subparagraph 1.2 hereof.

**1.13** The term "Unlisted Species" shall mean a species, or a distinct population segment of a vertebrate species) that is not listed as endangered or threatened under the ESA. The term "Unlisted Species" includes candidate species.

## 2.0 INCORPORATION OF RHCP AND AGREEMENT; GOVERNING LAW

**2.1** The RHCP, the Agreement 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 Agreement, the RHCP and this Permit, the terms of this Permit shall control. In all other cases, the terms of the Agreement, the RHCP and this Permit shall be interpreted to be supplementary to each other.

**2.2** This Permit, the RHCP and the Agreement, and the Parties' compliance therewith, shall be governed by the ESA and implementing regulations as the same exist on the Effective Date. Any reference in this Permit, the RHCP or the Agreement to any provision of the ESA or to any regulation or rule of FWS shall be deemed to be a reference to such statute, regulation or rule in existence as of the Effective Date. If federal statutes are enacted or rules or regulations are issued by FWS after the Effective Date that conflict with any provision of this Permit, the RHCP or the Agreement, the provisions of this Permit, the RHCP and the Agreement shall control and continue to govern the rights and obligations of SRP and FWS.

## 3.0 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 8.2 and 8.3 hereof, whichever occurs earlier.

## 4.0 PERMIT IN EFFECT FOR LISTED SPECIES ON EFFECTIVE DATE; PERMIT TO BECOME EFFECTIVE FOR UNLISTED SPECIES UPON LISTING

This Permit will take effect for Plan Species federally listed as threatened or endangered at the time the Permit is issued. Subject to Permittee's compliance with all other terms of this Permit, the RHCP and the Agreement, this Permit will take effect for Unlisted Species upon the listing of such species as threatened or endangered by FWS.

## 5.0 PROPER IMPLEMENTATION OF RHCP

The RHCP will be deemed properly implemented if the commitments and provisions of the RHCP, this Agreement and the Permit have been or are being implemented in accordance with their terms.

## 6.0 EXTENT OF INCIDENTAL TAKE PERMITTED; ADHERENCE TO IMPACT ANALYSIS MODEL TO DETERMINE COMPLIANCE

### 6.1 Take of Southwestern Willow Flycatchers

During the life of this Permit, as long as the RHCP is being properly implemented, the Permittee may adversely impact the habitat of the southwestern willow flycatcher within the Permit Area in an amount not to exceed 750 acres annually (or up to 1,250 acres annually with adaptive management), with resulting incidental take of the southwestern willow flycatcher, in conjunction with the Permitted Activity. The Parties shall adhere to the impact analysis method set forth in Subchapter III.C of the RHCP, or other method mutually agreed to by the Parties, to determine the annual amount of habitat of the southwestern willow flycatcher within the Permit Area that is adversely impacted by the Permitted Activity.

### 6.2 Take of Yuma Clapper Rails

During the life of this Permit, as long as the RHCP is being properly implemented, the Permittee may adversely impact the habitat of the Yuma clapper rail within the Permit Area in an amount not to exceed 5 acres annually (or up to 10 acres annually with adaptive management), with resulting incidental take of the Yuma clapper rail, in conjunction with the Permitted Activity. The Parties shall adhere to the impact analysis method set forth in Subchapter III.D of the RHCP, or other method mutually agreed to by the Parties, to determine the annual amount of habitat of the Yuma clapper rail within the Permit Area that is adversely impacted by the Permitted Activity.

### 6.3 Take of Bald Eagles

During the life of this Permit, as long as the RHCP is being properly implemented, the Permittee may adversely impact the nest or perch trees within the

Permit Area for all breeding areas of the bald eagle at or near Roosevelt, with resulting incidental take of bald eagles, in conjunction with the Permitted Activity.

Additionally, the Permittee may incidentally take no more than 18 bald eagles over the life of the permit in conjunction with the Permitted Activity, resulting from reduced productivity of bald eagles in the Permit Area during periods of declining water levels over the life of the Permit. The Parties shall adhere to the impact analysis method set forth in Subchapters III.E of the RHCP, or other method mutually agreed to by the Parties, to ensure that the amount of incidental take of bald eagles permitted by this Subparagraph 6.3 is not exceeded.

### 6.4 Take of Yellow-Billed Cuckoos

During the life of this Permit, so long as the RHCP is being properly implemented, the Permittee may adversely impact the habitat of the yellow-billed cuckoo within the Permit Area in an amount not to exceed 313 acres annually (or up to 1,113 acres annually with adaptive management), with resulting incidental take of the yellow-billed cuckoo, in conjunction with the Permitted Activity. The Parties shall adhere to the impact analysis method set forth in Subchapter III.F of the RHCP, or other method mutually agreed to by the Parties, to determine the annual amount of habitat of the yellow-billed cuckoo within the Permit Area that is adversely impacted by the Permitted Activity.

## 7.0 SATISFACTION OF PERMITTING REQUIRMENTS UNDER MIGRATORY BIRD TREATY ACT AND BALD EAGLE PROTECTION ACT

### 7.1 Special Purpose Permit for Listed Species Other Than Bald Eagles

The Permit shall constitute a Special Purpose Permit under 50 C.F.R. § 21.27 for the loss of habitat of the southwestern willow flycatcher, the Yuma clapper rail 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 Agreement and the RHCP. Any such take will not be in violation of the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712).

### 7.2 Nonenforcement of Migratory Bird Treaty Act and Bald Eagle Protection Act Provisions Pertaining To Eagles

FWS will not refer the incidental take of any bald eagle, *Haliaeetus leucocephalus,* for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712), or the Bald Eagle Protection Act of 1940, as amended (16 U.S.C. §§68-668d), so long as such take is in compliance with the terms and conditions of this Permit, the Agreement and the RHCP.

## 8.0 PERMIT SUSPENSION, REVOCATION AND SURRENDER

### 8.1 Permit Suspension

a. FWS may suspend this Permit if the Permittee is not in compliance with the conditions of the Permit, or with any applicable federal laws or regulations governing the conduct of the Permitted Activity, as such laws and regulations exist on the Effective Date. 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 the Permit may be subject to suspension pursuant to this Subparagraph 8.1.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 that the notice of the deficiencies is given in which to correct the deficiencies.

b. A partial suspension of this Permit may apply only to specified Plan Species, or to only a portion of the Permit Area or Permitted Activity. In the event of a partial suspension, the portion of this Permit not subject to the suspension shall remain in full force and effect.

### 8.2 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) (as amended June 17, 1999), or unless the Permitted Activity 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 in a timely fashion. Notwithstanding the foregoing, this Permit will only be revoked if FWS and its cooperators have not been successful in remedying any such inconsistency through other means.

b. A partial revocation of this Permit may apply only to specified Plan Species, or to only a portion of the Permit Area or Permitted Activity. 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 RHCP and the Agreement that are continued in effect after revocation of the Permit shall be taken into account by FWS and credited towards any future efforts by the Permittee or other responsible entities to ensure that the operation of Roosevelt Dam satisfies the requirements of the ESA. This provision shall survive the revocation of the Permit and remain in full force and effect thereafter.

## 8.3 Surrender and Cancellation of Permit

In the event that the Permittee, or any successor in interest to the Permittee, permanently discontinues the Permitted Activity, the Permittee or successor in interest shall return the Permit to FWS within 30 calendar days of the discontinuance with a written statement surrendering the 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 Plan Species that occurred pursuant to the terms of the Permit, before its surrender. Upon surrender of this Permit, no further take of the Plan Species by the Permittee shall be authorized.

# 9.0 LIMITATION ON IMPOSITION OF ADDITIONAL CONSERVATION MEASURES

## 9.1 Changed Circumstances, Notice of Same and Implementation of Response

### 9.1.1 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 the Permit:

| Changed Circumstances | Conservation, Mitigation, or Management Measures |
|---|---|
| Pilot project at Rockhouse is unsuccessful | Acquire and permanently manage other riparian habitat (see RHCP Subchapter IV C.2) |
| Habitat protection and management measures at Roosevelt are ineffective | Acquire and permanently manage other riparian habitat and implement other conservation efforts (see RHCP Subchapter IV.C.3) |
| Habitat acquisition and management in target area is infeasible | Acquire and permanently manage other riparian habitat and implement other conservation efforts (see RHCP Subchapters IV.C.4 and IV.C.6) |
| Decline of population at mitigation sites | Implement additional monitoring and management (see RHCP Subchapter IV.E and Appendix 6) |
| Invasion of exotic species at mitigation sites | Implement eradication or control efforts (see RHCP Appendix 6) |
| Increase in occupied habitat at Roosevelt above 750 acres for southwestern willow flycatchers, 5 acres for Yuma clapper rails, or 313 acres for yellow-billed cuckoos | Acquire and permanently manage other riparian habitat and implement other conservation efforts (see RHCP Subchapters IV.C.1.a, IV.C.1.b and IV.C.1.d) |
| Reversion of title to Arizona or United States with loss of ability to achieve RHCP goal | Acquire and permanently manage replacement habitat (see RHCP Subchapter IV.F.1.a) |
| Habitat loss from scouring floods at Roosevelt or mitigation sites | No additional measures by SRP |
| Habitat loss from fire at Roosevelt or mitigation sites | No additional measures by SRP |

| Changed Circumstances | Conservation, Mitigation, or Management Measures |
|---|---|
| Critical habitat designation for species covered by the RHCP | No additional measures by SRP |
| Downlisting or delisting the RHCP species due to recovery | No change in measures implemented by SRP |
| Riparian restoration effort with the Fort McDowell Indian Community is unsuccessful | No additional measures by SRP |

As long as the terms of the RHCP 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 9.1.1.

### 9.1.2 Notice of Changed Circumstances and Implementation of Response

a. 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 RHCP and Subparagraph 9.1.1 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 RHCP and Subparagraph 9.1.1 hereof and report to the FWS on its actions. The Permittee shall make any such required modifications without awaiting notice from FWS.

b. 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 RHCP and Subparagraph 9.1.1 hereof, FWS shall so notify the Permittee and direct the Permittee to make the required changes in writing. Within 90 days after receiving such notice, the Permittee shall make the required changes and report to FWS on its actions.

### 9.1.3 Effect of Changed Circumstances on Permit and RHCP

a. In General. Changed Circumstances are provided for in the RHCP and, hence, do not constitute Unforeseen Circumstances or require amendment of this Permit, the RHCP or the Agreement. 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 on its action of issuing the Permit.

b. Critical Habitat. FWS shall consider the RHCP in its preparation of any proposed designation of critical habitat concerning any Plan Species. Consistent with 50 C.F.R. § 424.12, the RHCP incorporates special management considerations necessary to conservation of the Plan Species. If critical habitat is designated for any Plan Species,

as long as the RHCP 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 RHCP.

## 9.2 Unforeseen Circumstances

### 9.2.1 No Surprises Assurances

In the event that it is demonstrated by FWS that Unforeseen Circumstances exist during the life of the 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 RHCP is being properly implemented, but only if such measures are limited to modifications within the Compensation Lands conserved pursuant to the terms of the RHCP or to the RHCP's operating conservation program for the Plan Species, and maintain the original terms of the RHCP to the maximum extent possible. Notwithstanding the foregoing, FWS shall not:

a. Require the commitment of additional land, water or financial compensation by the Permittee without the consent of the Permittee; or

b. 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 RHCP, including additional restrictions on the Permitted Activity and restrictions on the operation of other dams by the Permittee to mitigate the effects of the Permitted Activity.

### 9.2.2 Effect of Unforeseen Circumstances on Permit

Except as provided in Subparagraph 8.2 hereof, notwithstanding the occurrence of Unforeseen Circumstances, as long as the Permittee continues to properly implement the provisions of the RHCP and any additional measures required by FWS in accordance with Subparagraph 9.2.1 hereof, the Permit will remain in full force and effect.

### 9.2.3 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 RHCP or the Agreement.

## 10.0 <u>AMENDMENT OF THE PERMIT</u>

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, including its effects on operations under the RHCP and on Plan Species.

## 11.0 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.

## 12.0 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.

## 13.0 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.

# APPENDIX 9:
# SRP WATER CONSERVATION ACTIVITIES

SRP participates in many activities to conserve water, including:

- SRP, by State law, must operate 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 flowmeter calibration services ensuring 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 acre feet of water. A portion of this water will be left in the aquifer. Another recharge facility, the New River-Agua Fria Underground Storage Project, is being constructed on the west side of the Salt River valley.

- SRP is purchasing variable frequency drives for many of its groundwater wells. These devices adjust the pumping capacity at a groundwater 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 Valley Cities, Arizona Municipal Water Users Association, and the Bureau of 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.

- SRP has had a radio campaign broadcast across several radio stations throughout the summer and fall stressing the need to conserve water.

- SRP has taken the lead in communicating Arizona's drought situation and corresponding water conservation message to make water conservation a daily habit. This was accomplished through several 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 whereby 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.
  - Developing a water education video that includes water conservation tips.

- Xeriscape landscaping has been installed at SRP facilities.
  - No winter overseeding of turf areas will occur this year; water fountains are operating minimally to conserve water.