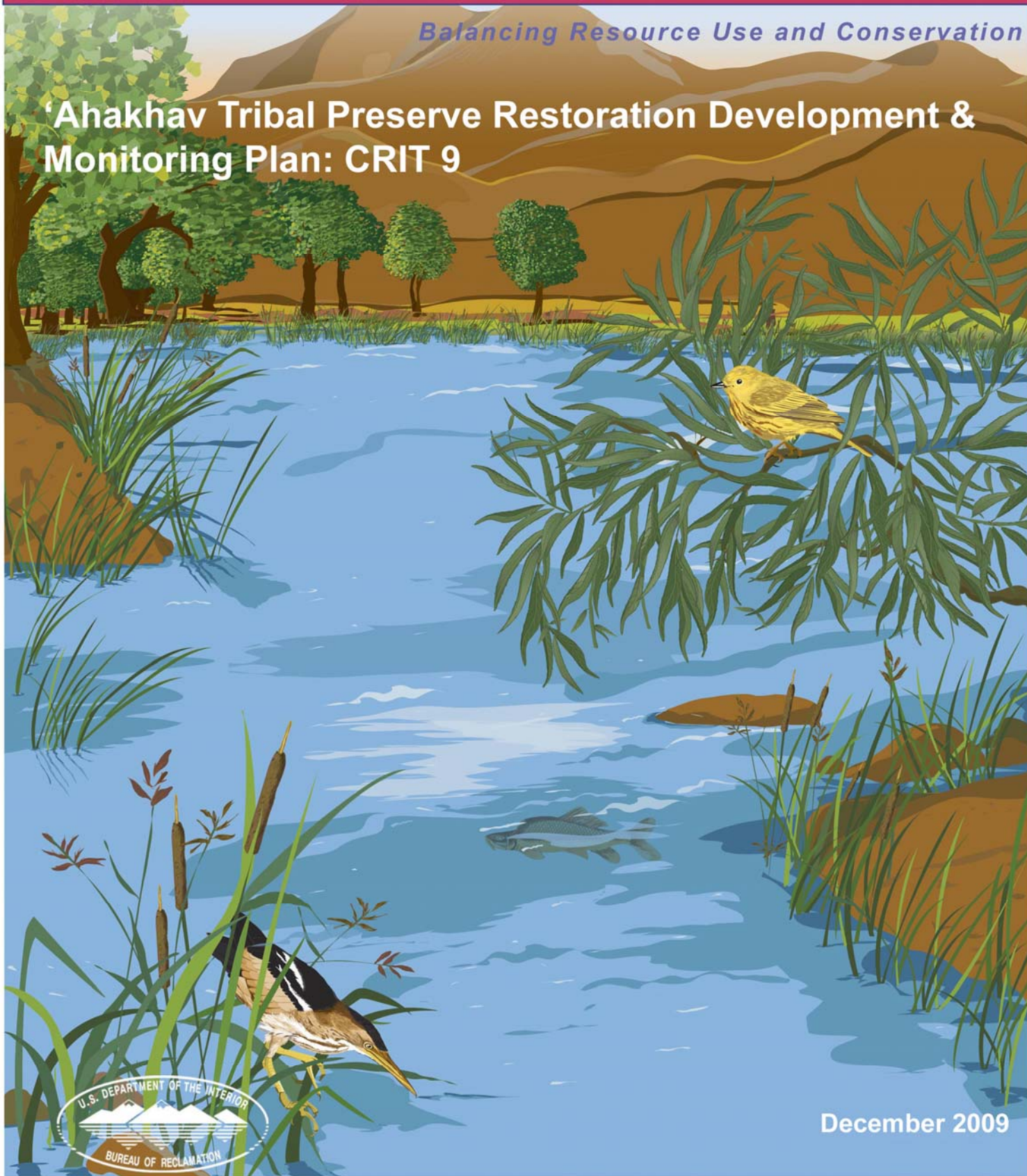




# Lower Colorado River Multi-Species Conservation Program

*Balancing Resource Use and Conservation*

## 'Ahakhav Tribal Preserve Restoration Development & Monitoring Plan: CRIT 9



December 2009

# Lower Colorado River Multi-Species Conservation Program Steering Committee Members

## **Federal Participant Group**

Bureau of Reclamation  
U.S. Fish and Wildlife Service  
National Park Service  
Bureau of Land Management  
Bureau of Indian Affairs  
Western Area Power Administration

## **Arizona Participant Group**

Arizona Department of Water Resources  
Arizona Electric Power Cooperative, Inc.  
Arizona Game and Fish Department  
Arizona Power Authority  
Central Arizona Water Conservation District  
Cibola Valley Irrigation and Drainage District  
City of Bullhead City  
City of Lake Havasu City  
City of Mesa  
City of Somerton  
City of Yuma  
Electrical District No. 3, Pinal County, Arizona  
Golden Shores Water Conservation District  
Mohave County Water Authority  
Mohave Valley Irrigation and Drainage District  
Mohave Water Conservation District  
North Gila Valley Irrigation and Drainage District  
Town of Fredonia  
Town of Thatcher  
Town of Wickenburg  
Salt River Project Agricultural Improvement and Power District  
Unit "B" Irrigation and Drainage District  
Wellton-Mohawk Irrigation and Drainage District  
Yuma County Water Users' Association  
Yuma Irrigation District  
Yuma Mesa Irrigation and Drainage District

## **Other Interested Parties Participant Group**

QuadState County Government Coalition  
Desert Wildlife Unlimited

## **California Participant Group**

California Department of Fish and Game  
City of Needles  
Coachella Valley Water District  
Colorado River Board of California  
Bard Water District  
Imperial Irrigation District  
Los Angeles Department of Water and Power  
Palo Verde Irrigation District  
San Diego County Water Authority  
Southern California Edison Company  
Southern California Public Power Authority  
The Metropolitan Water District of Southern California

## **Nevada Participant Group**

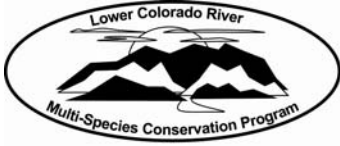
Colorado River Commission of Nevada  
Nevada Department of Wildlife  
Southern Nevada Water Authority  
Colorado River Commission Power Users  
Basic Water Company

## **Native American Participant Group**

Hualapai Tribe  
Colorado River Indian Tribes  
The Cocopah Indian Tribe

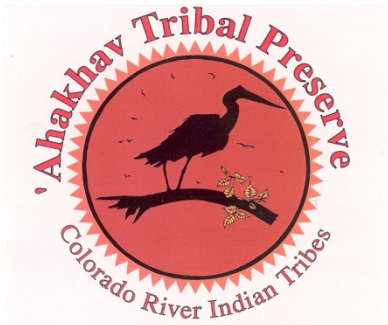
## **Conservation Participant Group**

Ducks Unlimited  
Lower Colorado River RC&D Area, Inc.



# Lower Colorado River Multi-Species Conservation Program

## 'Ahakhav Tribal Preserve Restoration Development & Monitoring Plan: CRIT 9



Lower Colorado River  
Multi-Species Conservation Program  
Bureau of Reclamation  
Lower Colorado Region  
Boulder City, Nevada  
<http://www.lcrmscp.gov>

December 2009

# Executive Summary

Since 2004, the 'Ahakhav Tribal Preserve (Preserve) and the Lower Colorado River Multi-Species Program (LCR MSCP) have been operating on the site through the use of a Federal Cooperative Agreement. Currently the Preserve and LCR MSCP administrators are finalizing a long-term land use agreement. This land use agreement will allow for continued habitat maintenance on CRIT 9 and future land cover type creation throughout the Preserve.

CRIT 9 is a 154-acre block of native land cover types consisting of cottonwood-willow and honey mesquite. The site was established in phases during years 2001-2005. Currently, maintenance of existing habitat and site infrastructure improvements are ongoing.

Several plant propagation methods, planting techniques, and design layouts were tested on this site. The use of seed, pole plantings, and potted plants were all tested. Potted plants and pole plantings were ultimately more successful than the use of seed for native plant establishment.

The majority of the site lacks understory growth, giving a visual "park-like" appearance. The Preserve and LCR MSCP staffs are analyzing several alternatives to develop a productive understory for the site.

Originally planned as southwestern willow flycatcher (SWFL) habitat, the extremely sandy soils have precluded the establishment of the dense vegetation and moist soils preferred by SWFL. Depending on future monitoring data, the site may ultimately be managed for yellow-billed cuckoo.

LCR MSCP covered species that have recently been confirmed as nesting on CRIT 9 include vermilion flycatcher and summer tanager. Yellow-billed cuckoo, western yellow bat, and western red bat have been observed utilizing the habitat as well.

Included in this document is a summary of:

- Land and water ownership
- Propagation and irrigation techniques
- Design layout
- Law enforcement and wildland fire
- Species monitoring techniques and data collection

# Background

Since 2001, Bureau of Reclamation's Lower Colorado Region (Reclamation) has been assisting the Colorado River Indian Tribe's (CRIT) Preserve in their efforts to restore native habitat on their lands near Parker, Arizona. CRIT 9 is an existing re-vegetation project on the Preserve and is the focus of this Restoration Development and Monitoring Plan. Work on CRIT 9 began in 2001 and the area is now approximately 150 acres of cottonwood, willow, and mesquite land cover type habitats.

Vegetation and LCR MSCP covered species monitoring of CRIT 9 described in this document is being conducted by Reclamation or its appointees. Monitoring results for established habitat will be documented in the E3 'Ahakhav Tribal Preserve Annual Report. Monitoring on the Preserve will be consistent with established protocols adopted by the LCR MSCP.

## 1.0 Introduction

In late 2004, in anticipation of the LCR MSCP, Reclamation and CRIT entered into a 5-year federal cooperative agreement. The purpose of the agreement was to continue to restore habitat, provide funds for maintenance of projects previously funded by Reclamation, and provide a location to demonstrate innovative techniques for restoration and maintenance and management of riparian habitat.

Since the inception of the LCR MSCP, the program has budgeted and described activities conducted on the Preserve within the program's annual work plan process. For current information regarding this conservation area, please see Work Task E3: 'Ahakhav Tribal Preserve in the *Final Implementation Report, Fiscal Year 2009 Work Plan and Budget, Fiscal Year 2007 Accomplishment Report*.

### Purpose

This habitat demonstration area was designed to test planting, maintenance, and irrigation methods on fallow agricultural fields while creating a 150-acre mosaic of native land cover types. Land cover types were created for the use of southwestern willow flycatcher, western yellow-billed cuckoo, gilded flicker, and other potential LCR MSCP covered species.

The intended outcome of this project was the establishment of over 150 acres of riparian habitat in extremely sandy soils. At the present time, the area is being considered for management of yellow-billed cuckoo and, potentially, southwestern willow flycatcher. LCR MSCP covered species already present on the Preserve include vermilion flycatcher, summer tanager, western yellow bat, and California leaf-nosed bat.



## Location/Description

The project site is located on the Colorado River Indian Tribes Reservation south of Parker, Arizona. The Colorado River Tribal Council approved the 'Ahakhav Tribal Preserve in special session through Tribal Resolution #168-95 in August 1995. The Resolution was created to protect fish and wildlife resources and provide educational and outreach opportunities for the local community. The 'Ahakhav Tribal Preserve is located within Reach 4 of the LCR MSCP Planning Area between river miles (RM) 173 and 174.

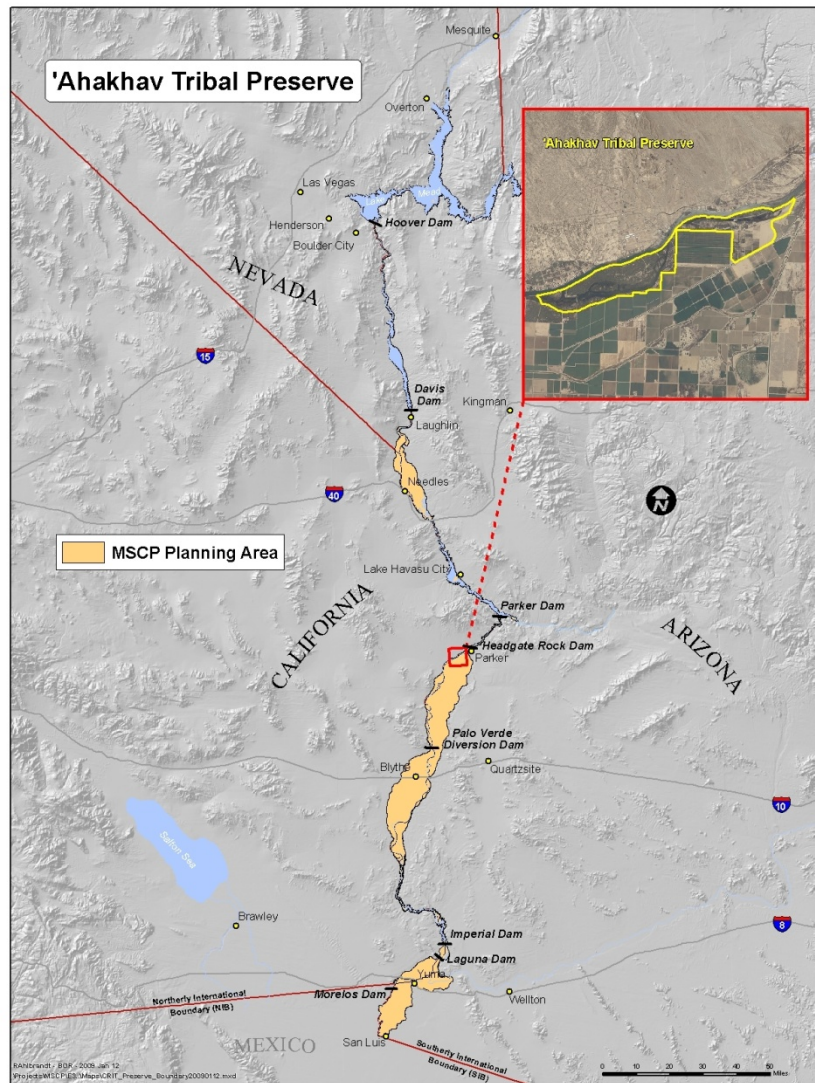


Figure 1. 'Ahakhav Tribal Preserve Boundary.

## **Land Ownership**

The 'Ahakhav Tribal Preserve is an in-holding encompassed by the Colorado River Indian Tribes Reservation. "The CRIT Reservation was created in 1865 by the Federal Government for "Indians of the Colorado and its tributaries," originally for the Mohave and Chemehuevi, who had inhabited the area for centuries. People of the Hopi and Navajo Tribes were relocated to the reservation in later years." ([http://www.crit-nsn.gov/crit\\_contents/about/2008](http://www.crit-nsn.gov/crit_contents/about/2008)).

## **Water**

The CRIT maintain a Present Perfected Water Right #2 in the state of Arizona of 662,402 acre feet. Irrigation water to be used for habitat development or maintenance will be reported annually. The Preserve and LCR MSCP staff will jointly determine the duration and irrigation frequency to be applied on existing habitat.

## **Agreements**

Reclamation and CRIT are working together under a 5-year Cooperative Agreement signed in September 2004. This agreement, which expires in December 2009, specifies areas to be restored and outlines the roles and responsibilities of each partner. Quarterly coordination meetings between the Preserve and LCR MSCP staff ensure that all activities and reimbursable costs to be incurred are identified in advance. In 2008, Reclamation and the Preserve administrators drafted a long-term land use agreement. At the time of this writing both organizations have performed technical reviews of the agreement and are awaiting reviews from both organization's solicitors.

## **2.0 Design/Planting Plan**

CRIT 9 was constructed in two phases: Phase 1, which includes sections 1 and 2, and Phase 2, which includes sections 3 and 4. Since 2001, photos have been taken at recorded locations that chronicle the maturation of the land cover types planted in each phase of the project. A short description of each of the planted sections is presented here, along with photos of the area.

### **CRIT 9, Section 1**

In November 2001, 25 acres of CRIT 9, Section 1 were planted with 555 cottonwoods, 916 Goodding's willows, and 1,285 honey mesquites. Trees were planted approximately 15 feet apart and in a "crop circle" design to demonstrate an alternative to traditional row planting. Each circle was 1 acre and consisted of 10 concentric circles of increasing diameter. In January 2005, the area was planted with a seed mix to help increase understory diversity. Unfortunately, the understory establishment was unsuccessful and is dominated by common sunflower, with only small amounts of the other species present.



**Figure 2. CRIT 9, Sections 1, 2, 3 and 4 (November 2005).**



**Figure 3. Section 1, Cottonwood and Willow, Year 2 (April 2003).**



**Figure 4. Section 1, Cottonwood and Willow, Year 3 (April 2004).**



**Figure 5. Section 1, Cottonwood and Willow, Year 4 (April 2005).**



## CRIT 9, Section 2

In April 2002, 42 acres were planted with 2,217 cottonwoods, 1,744 Goodding's willows, and 646 honey mesquites. All trees were grown in 1-gallon sized containers in the Preserve's nursery. The cottonwoods and willows were started from cuttings and mesquites were grown from seed. The understory was seeded with wildflowers in January 2005 in an attempt to promote understory growth; unfortunately, the seeding attempts were unsuccessful.

Areas planted in rows are shown in figures 6-7 and areas planted in a circular design are shown in figures 8-9. A circular planting design was chosen to test creation of a more natural appearance.



**Figure 6. Section 2, Cottonwood and Willow, Year 1 (July 2002).**



**Figure 7. Section 2, Cottonwood and Willow, Year 2 (April 2003).**



**Figure 8. Section 2, Mesquite and Cottonwood, Year 3 (April 2004).**



**Figure 9. Section 2, Mesquite and Cottonwood, Year 4 (May 2005).**

## CRIT 9, Section 3

Section 3 totals approximately 42 acres of cottonwood, willow, and mesquite. The first planting began in April 2003. A total of 1,233 plants were planted in Section 3. Seed and pole planting were used in planting willow, cottonwood, and mesquite species. The Preserve's greenhouse was utilized to raise the seeded plants prior to transplanting in the fields.

In February 2004, 1,387 cottonwood and 1,118 Goodding's willow poles collected from the Bill Williams National Wildlife Refuge were planted. Figures 10 and 11 show the growth of these trees through 2005. At the same time, 4.9 acres were planted with honey mesquite grown in 1-gallon sized pots from seed in the nursery. The trees were planted in rows and spaced 10 feet apart. Figures 12-13 show their growth during the first two growing seasons.



**Figure 10. Section 3, Year 1, Willow from seed (June 2003).**



**Figure 11. Section 3, Year 4, Willow from seed (May 2005).**



**Figure 12. Section 3, Year 1, Honey Mesquite (October 2004).**



**Figure 13. Section 3, Year 2, Honey Mesquite (September 2005).**

## CRIT 9, Section 4

Section 4, totaling 35 acres, demonstrated the use of smaller poles planted or buried at an angle or horizontally. A total of 25,765 poles were planted in February and March 2005 using this technique. Preliminary observations of these horizontally planted cottonwoods and willows after the first growing season indicated that as branches sprout along the length of the pole, they continue to grow very close together, creating a dense hedge and resulting in a higher stem count than individual trees planted upright. Figures 14-15 show the site after planting.



**Figure 14. Section 4, Year 1 (February 2005).**



**Figure 15. Section 4, Year 1 (March 2005).**

## Native Plant Nursery

In order to achieve the habitat density requirements outlined in the LCR MSCP's Habitat Conservation Plan, a native plant nursery was incorporated into the southwestern portion of CRIT 9. The development of a native plant nursery aides in reducing transportation and acquisition costs of new plant material. Also, by utilizing local plant materials, genetic integrity of the existing stands is sustained. The establishment of the nursery will provide a consistent and readily accessible source of plant materials (i.e., cuttings, poles, seeds). "Reclamation defines the term "poles" as plant material 1 to 4 inches in diameter that are taken from large branches, an entire tree, or from a tree with multiple trunks, and are planted directly into the ground." (*Cibola Valley Conservation Area Restoration Development Plan: Phase 1*). Goodding's willow and Fremont cottonwood were planted in the nursery. In order to accommodate motorized vehicle access, trees were planted 10-15 feet on center.

## **Planting Techniques**

This project examined the use of seed, planting poles, and potted plants to achieve the desired land cover type density of cottonwood-willow and honey mesquite. A wild flower seed mix combined with native seeds was examined; raising seeds was also demonstrated. Both seeding practices utilized the onsite greenhouse. The use of seeds alone raised in the greenhouse prior to planting proved the most successful.

Pole plantings and potted plants raised from seed proved to be the most effective in creating the desired native land cover type. Seed, although a proven re-vegetation technique, will be used sparingly to develop habitat and may be used to help in establishing a complimentary understory.

The Preserve maintains a native plant greenhouse used to aide restoration efforts, both for LCR MSCP projects and non-LCR MSCP projects. Potted mesquite and willow trees were grown in the greenhouse and planted throughout CRIT 9.

## **Grading**

The site was cleared of all non-native plants and root-ripped to slow the re-growth of non-native plants. Once cleared, the site was developed in phases as labor, plants, and equipment resources allowed. Farm equipment was used to laser level fields and to create 1-acre crop circles. The crop circle design was used to examine an alternative method of planting versus the traditional method of planting in rows.

A variety of site preparation methods were used on CRIT 9. Annually as new CRIT 9 sections were developed, Preserve and Reclamation staff collaborated on specific site layout design.

## **Irrigation**

The site is serviced by concrete-lined irrigation canals that are connected to the main canal servicing the Reservation. The CRIT 9 canals are gravity diverted and are operated by Preserve staff. Costs associated with the operations and maintenance of the CRIT 9 canal systems are budgeted for under the annual budget of Work Task E3: 'Ahakhav Tribal Preserve, contained within the *Final Implementation Report, Fiscal Year 2009 Work Plan and Budget, Fiscal Year 2007 Accomplishment Report*. During quarterly coordination meetings between Preserve and Reclamation staff, irrigation duration and frequency are agreed upon.

## **Law Enforcement**

Law enforcement regulations are handled through the Colorado River Indian Tribes Fish and Game Department. Examples of regulations the Fish and Game wardens enforce are: use periods during authorized times, no hunting (except in designated areas), valid fishing and hunting licenses, no alcohol allowed with the Preserve, and vehicle access restrictions within the habitat areas.



## **Wildfire Management**

Wildland fire management activities are coordinated through the Colorado River Indian Tribes' Wildland Fire Office. The Preserve is incorporated into the entire Reservation's Fire Management Plan. CRIT Wildland maintains mutual aid agreements with multiple wildland fire agencies along the river. These agreements allow the use of other agencies' personnel and resources in the event of a large-scale wildland fire. In fiscal year 2009, the LCR MSCP will be soliciting for a law and fire consulting firm to develop a comprehensive law and fire strategy, as well as a conservation area specific strategy.

## **Public Use**

Public use on the Preserve is limited to low impact recreational activities. Although hunting is not allowed within habitat areas, hunting is allowed on portions of the Preserve not scheduled for habitat development. Examples of low impact recreation include: wildlife watching, sport fishing, walking trail use, collection of native plant material for cultural uses and education, and outreach opportunities for the local community.

## **4.0 Monitoring**

Monitoring was conducted by Preserve staff since planting began in 2001 until 2006. Specific monitoring and reporting requirements have now been established under the LCR MSCP that were not included in the current Cooperative Agreement.

Beginning in FY 2006, Reclamation began monitoring the Project using the newly established LCR MSCP monitoring protocols and reporting formats to gather and report on vegetation, birds and wildlife use of restored areas. The monitoring plan for the Preserve is in Appendix A.

## **5.0 Reports**

### **Annual Report**

An annual report for the 'Ahakhav Tribal Preserve will be prepared by Reclamation and Preserve staff and posted to the program's website ([www.lcr.mscp.gov](http://www.lcr.mscp.gov)). The annual report will be made available each calendar year and will summarize the following:

- Specific description of the project status and the effects on the covered species
- A table from the Mitigation Monitoring and Reporting Program (MMRP) indicating current implementation status of each mitigation measure
- A description of all restoration activities, monitoring actions, and research conducted over the past year
- Results and analyses of monitoring and research data
- The total area planted or maintained

- The total habitat area that meets or exceeds the performance standards
- Any other applicable information

The monitoring results will indicate the amount of structural management that will be accomplished in the next year and any modifications to previously restored habitats.

## **Final Report**

A final report will be prepared by Reclamation and submitted no later than 180 days after the completion of all mitigation measures. The final report is anticipated in 2055 and will include the following information:

- A copy of the table in the MMRP with notes showing when each mitigation measure was implemented
- Recommendations on how mitigation measures might be changed to more effectively minimize and mitigate the impacts of future projects on the species
- Any other pertinent information
- An as-built engineering drawing describing infrastructure and habitat acreage

**Table 1. Reference variables for the creation of southwestern willow flycatcher habitat.**

Canopy Height (M)	Average greater than 13.0 ft (4.0 m)
Canopy Closure (% total)	Greater than 70%
Vertical Foliage Density	Density greatest between 3.3 and 13.1 ft (1.0-4.0 m) above ground. This may change as additional analysis is completed.
Mean Soil Moisture (% volume)	Minimum of 17% Average of 23%
Mean Diurnal Temperature (Celsius)	Between 79°F ( 26°C) and 91°F (33°C)
Mean Maximum Diurnal Temperature (Celsius)	Maximum of 113°F (45°C) Average between 90°F (32°C) and 113°F (45°C)
Mean Diurnal Relative Humidity (%)	Greater than 33% Average between 33% and 63%

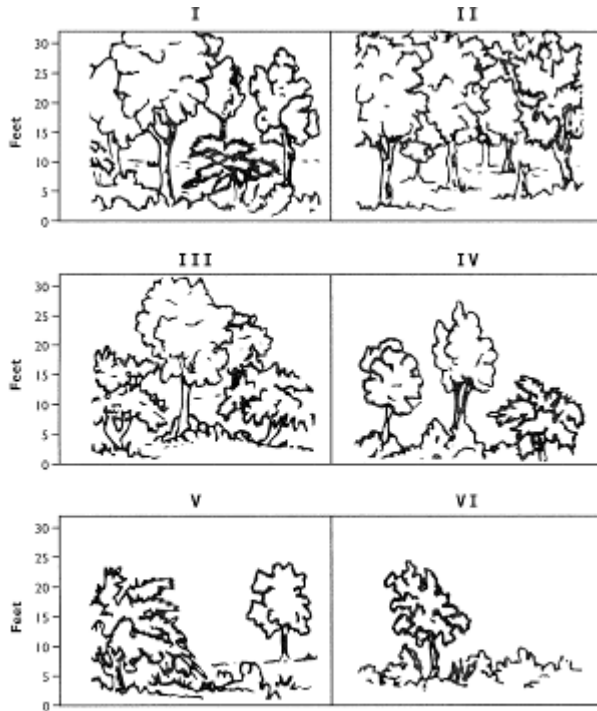
**Table 2. Tree Index of Condition.**

<b>Condition</b>	<b>Definition</b>
<b>Live</b>	Trees appear in apparently good condition – leaves green, no symptoms of wilting, die-back, or chlorotic appearance of leaves.
<b>Stressed</b>	Trees appear to be in generally poor condition – chlorotic leaves and leaf drop.
<b>Tip die-back</b>	The main stem is in good condition; the most apical portions are in very poor condition exhibiting wilting and die-back symptoms.
<b>Basal sprouts</b>	Main stem dead; new growth is initiated from stem base or root stock.
<b>Not found</b>	Seedling not found during particular sampling period. If seedling not found in two consecutive periods, it is considered dead.
<b>Apparently dead</b>	General appearance of stem is dry and brittle; no live wood observed and no observable green foliage growth; re-sprouting still possible.
<b>Dead</b>	Previously listed as apparently dead; tree in such poor condition that survival by re-sprouting is unlikely.

**Table 3. Vegetation Communities, Criteria, and Types.**

Community Type	Criteria	Vegetation Type
Cottonwood/willow (CW)	<i>P. fremontii</i> and <i>S. gooddingii</i> constituting at least 10% of total trees	I, II, III, IV, V, VI
Saltcedar (SC)	<i>Tamarix chinensis</i> constituting 80-100% of total trees	I, II, III, IV, V, VI
Saltcedar/Honey mesquite (SH)	<i>P. glandulosa</i> constituting at least 10% of total trees	I, II, III, IV, V, VI
Saltcedar/Screwbean mesquite (SM)	<i>P. pubescens</i> constituting at least 20% of total trees	I, II, III, IV, V, VI
Honey mesquite (HM)	<i>P. glandulosa</i> constituting at least 90% of total trees	I, II, III, IV, V, VI
Arrowweed (AW)	<i>Tessaria sericea</i> constituting at least 90-100% of total vegetation area	I, II, III, IV, V, VI
<i>Atriplex</i> spp. (ATX)	<i>A. lentiformis</i> , <i>A. canescens</i> , and/or <i>A. polycarpa</i> constituting 90-100% of total vegetation in area	I, II, III, IV, V, VI

**Table 4. Vegetation Type**



Adapted from Anderson and Chmura (1988).



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# Appendix A. Monitoring Plan for 'Ahakhav Tribal Preserve CRIT 9

## Introduction

Monitoring of habitat creation areas is critical to the adaptive management program. This process allows the LCR MSCP to analyze implementation activities, address the uncertainty inherent in a 50-year program, and respond appropriately. Scientifically designed monitoring will be conducted to evaluate whether the restoration parameters established for each covered species habitat are being achieved, the habitat creation area develops as covered species habitat, and the habitat is being utilized by the covered species. Results reported on how the created habitat develops, relative to the restoration and management techniques employed, will be used to refine or develop future techniques. This should ensure that the most cost-effective and efficient approaches will be used at other restoration sites.

For the purposes of the LCR MSCP, initial conservation area monitoring plans will be based on elements described in the HCP (LCR MSCP 2004). A document describing the science and adaptive management plan strategies for the LCR MSCP is being developed.

Monitoring of Habitat Creation Projects will be structured into four schemes: 1) predevelopment, 2) implementation monitoring, 3) habitat/species monitoring, and 4) vegetation classification. Predevelopment monitoring is designed to establish what types of restoration activities may be conducted, establish baseline data for evaluating post-development, and identify covered species currently inhabiting the habitat creation project. Implementation monitoring will be analyzed to determine whether the site was created as designed. Habitat/species monitoring will be analyzed to determine that the site meets the established life history requirements necessary to provide habitat for the targeted covered species. The site will also be classified according to the Anderson and Ohmart vegetation classification system (1976, 1984). The goals for these monitoring techniques may be revised, depending on the adaptive management program results, science strategy, covered species requirements, or other management decisions in the future.

## Purpose

CRIT 9 is a demonstration site designed to find the most successful, efficient, and cost-effective restoration methods for various types of habitat creation projects. Another goal was the development of habitat for the southwestern willow flycatcher, yellow-billed cuckoo, gilded flicker, and other riparian covered species under the LCR MSCP.

Scientifically designed monitoring studies will be conducted to determine whether different planting regimes and techniques succeeded in creating appropriate structural vegetative communities and provided habitat to LCR MSCP covered species. Scientifically designed monitoring and research studies will be conducted to quantify habitat characteristics (biotic and abiotic) that exist where covered species are detected.

Results of habitat monitoring, relative to the restoration and management techniques employed, will be used to refine and/or develop techniques for future larger-scale habitat creation projects.

The Preserve staff conducted monitoring at CRIT 9 from 2001 to 2006 according to the Preserve's monitoring protocols. Soil analysis was the only form of predevelopment monitoring that was conducted. The analysis consisted of 58 sample points, which were systematically distributed over the 135-acre (54-ha) area that was to be restored. At each point two samples were taken, one near the surface and another 4.0 to 6.0 feet (1.2 to 1.8 m) below the surface. Soil type, salinity, moisture, and moisture holding capacity were analyzed.

Vegetation monitoring of restored areas was conducted in September and October by Preserve staff annually. Ten percent of the trees were measured for height and condition. Data were also collected on percent herbaceous cover, seedlings and non-planted trees. Photo monitoring points were set up in each block on all four planted sections alternating between the canal bank and service roads and photos were taken in the beginning of January, April, July and October. The amount, time and quantity of water used to irrigate the restored areas were recorded.

Avian point counts were conducted in 2005 and 2006. Small mammal surveys were conducted in 2004. For complete soil, vegetation, avian point count and small mammal survey protocols utilized between 2001 and 2006, refer to the 'Ahakhav Tribal Preserve Revegetation Research and Development Project 2006 report (CRIT 2006).

Beginning in 2007, Reclamation is responsible for data collection, analysis, and documentation using established monitoring LCR MSCP protocols for vegetation, bird, and wildlife surveys. The development and monitoring plan documents monitoring that Reclamation will implement beginning in 2007 at CRIT 9. For monitoring purposes, the four sections of different age classes that comprise CRIT 9 will be treated as one stand. Restoration at CRIT 9 was completed in March 2005; therefore, this document does not cover pre-development or implementation monitoring, as this monitoring was previously conducted by the Preserve staff.

### **Habitat/Species Monitoring**

Habitat/species monitoring is designed to determine whether the site is providing the habitat requirements needed for the targeted LCR MSCP covered species, whether any covered species is utilizing the habitat, and whether there are differences in wildlife use of the habitat depending on planting design, composition, and watering regimes. All monitoring will be designed specifically for each phase and habitat type within that phase. The monitoring is divided into habitat and covered species and will be analyzed incorporating both parameters. The results of this monitoring may:

- Determine whether portions of cottonwood-willow structural types III-IV have become southwestern willow flycatcher habitat, determined by reference conditions.



- Determine whether each field contains the appropriate vegetation community structural type (Anderson and Ohmart 1976, 1984) per year according to original design of the project.
- Determine quantitative values for habitat characteristics such as canopy height, canopy closure, species density, species composition, basal area, herbaceous cover, mean soil moisture, mean diurnal temperature, mean diurnal relative humidity, and vertical foliage density.
- Determine whether habitat is being utilized by the southwestern willow flycatcher, yellow-billed cuckoo, or other LCR MSCP covered species.

- Habitat Monitoring

- Abiotic Conditions

- Soil

- Soil moisture will be monitored 10 times during the breeding season (May-August) and once a month during August and September, beginning in 2007, with a ThetaProbe ML2x soil moisture probe coupled to an HH2 Moisture Meter at microclimate locations.
- Soil moisture measurements will be recorded directly beneath a HOBO data logger and in each cardinal direction for a minimum of five measurements per location.

- Water

- Deliveries to the site will be recorded and analyzed to determine whether the necessary amounts of water were delivered to grow the requisite habitat.

- Microclimate

- Temperature and relative humidity will be recorded utilizing HOBO H8 Pro data loggers made by Onset Computer Corporation in Pocasset, MA.
- HOBO data loggers will be placed at fixed radius plot (see below) centers throughout the stand, and will record throughout the year. Data will be recorded every 15 minutes and downloaded every 3-6 months.

- Biotic Condition

- Vegetation

- CRIT 9 will be sampled annually from 2007 to 2009 in October-November, based on a nested sample design using fixed radius plots. From years 2010-2014, sampling will take place every other year. After year 10, sampling will

take place every 5 years to monitor successional change through the MSCP period. If a catastrophic disturbance (fire, flood, etc.) occurs to the stand, post-disturbance monitoring will mimic the post-restoration monitoring regime.

- Fixed radius plots will be chosen using a stratified random sampling design. The strata will be divided using the Anderson and Ohmart vegetation classification system (1976, 1984). Sample size will be based on size of project area, species, and variation within the project.
- Vegetation parameters monitored will include overstory trees, sapling, shrub, understory, herbaceous layer, vertical foliage density, and crown closure.
- Photo points will be conducted annually at points previously established by the Preserve staff.
- Covered Species Monitoring
  - Marsh Birds
    - No marsh bird monitoring will be conducted at CRIT 9 because habitat does not exist for marsh birds.
  - Neotropical Birds
    - Area search surveys will be conducted to monitor avian species. The project will be split into 23-ac (9-ha) plots and each area search plot on the project will be sampled at least one time in the last two weeks of May using the rapid area search protocol. Each plot will be surveyed for a maximum of 2 hours. A representative random sample of the plots will be sampled in the months of May and June following the intensive area search protocol. Surveyors will find and map every individual bird's territory in the intensive plot to gather a complete census of birds. Intensive area search plots will be compared to rapid area search plots to determine a detectability ratio per species (Bart 2007).
    - Avian monitoring will be conducted annually for 5 years after their initiation. After 5 years, data will be examined and future monitoring decisions for neotropical species will be made.
    - Standardized breeding and winter season banding/mist netting (DeSante 2005) may be conducted, if conditions warrant.

- If covered species are observed, targeted species-specific surveys, nest searches, and banding/mist netting may be conducted.
- Cavity Nesting Birds
  - Gilded flicker and Gila woodpecker (*Melanerpes uropygialis*) will be surveyed as part of the neotropical bird monitoring. If gilded flicker and/or Gila woodpecker are detected during the breeding season, nest searches and/or targeted banding/mist netting may be conducted for long-term use of site and refinement of habitat use.
- Elf Owl
  - Monitoring will be conducted for elf owls (*Micrathene whitneyi*) in mature cottonwood/willow habitat during the breeding season of 2008 according to LCR MSCP monitoring protocols (2006).
- Southwestern Willow Flycatcher
  - Standardized presence/absence surveys (Sogge et al. 1997, USFWS 2000) will be conducted beginning in the breeding season of 2007 in areas of the site managed for southwestern willow flycatchers. A minimum of five surveys will be conducted beginning in May and ending in July. If a flycatcher is detected after June 15 or positive breeding evidence is identified, nest searches will be conducted to determine breeding status and use of habitat. If nests are found, they will be monitored according to Arizona Game and Fish Department protocol (Rourke et al. 1999). If nests are found, vegetation data will be collected around nests. If breeding populations of more than 10 birds are established, banding may be conducted for long-term use of site and refinement of habitat use.
  - Surveys will be conducted annually during the breeding season for 5 years after their initiation. After 5 years, data will be examined and future monitoring decisions for southwestern willow flycatchers will be made.
- Yellow-billed Cuckoo
  - Presence/absence tape play-back surveys for the yellow-billed cuckoo will be conducted, beginning the breeding season of 2007, using established protocol (Halterman and Johnson 2005). The site will be assessed to determine whether it is suitable yellow-billed cuckoo habitat by aerial and ground surveys. If determined suitable, three to five breeding surveys will be conducted from mid-June to late

August. If yellow-billed cuckoos are present during the breeding season, nest searches will be conducted and targeted banding/mist netting may be conducted for long-term use of site and refinement of habitat use.

- Surveys will be conducted annually during the breeding season for 5 years after their initiation. After 5 years, data will be examined and future monitoring decisions for the yellow-billed cuckoo will be made.
- Small Mammals
  - Small mammal monitoring may be conducted opportunistically, but this site is not being managed for any LCR MSCP covered small mammal species.
- Bats
  - Presence/absence surveys will be conducted utilizing active/passive AnaBat surveys at least 2 days per season (spring, summer, winter, and fall) annually. When the vegetation is at sufficient height to hide the AnaBat system, data will be collected daily utilizing one stationary AnaBat/Sonabat system. The system will be installed in the riparian section. The stationary system will be established for at least 5 years and may be relocated within other phases to maximize detections. After 5 years, data will be examined and future monitoring decisions for bat species will be made. All system locations will be chosen based on suitable habitat for the covered bat species and ability to maximize data collected. Bat capture techniques may be used to compliment acoustic data, to identify bats that cannot be picked up acoustically, and to obtain voucher calls.
- Reptiles and Amphibians
  - No monitoring will be conducted because this site is not being utilized for habitat creation for reptiles and amphibians.
- MacNeill's Sootywing Skipper
  - No monitoring will be conducted because this site is not being utilized for habitat creation for MacNeill's sootywing skipper.

## Vegetation Classification

The HCP (LCR MSCP 2004) outlines the specific habitat acreage to be restored and utilizes the Anderson and Ohmart (1976, 1984) classification system as the performance standard. Reclamation will determine vegetation classification annually until target goals have been met. To map the vegetation, Reclamation will obtain aerial imagery of the site. With the digital imagery, CRIT 9 will be mapped out utilizing the Anderson and Ohmart (1976, 1984) vegetation classification system.

## Reference Conditions

Reference conditions for the creation of southwestern willow flycatcher habitat will be based on the long-term life history studies along the LCR (McLeod et al. 2005, Koronkiewicz et al. 2004). These variables may change depending on future analysis of the long-term life history studies currently being conducted. Variables that would be referenced include canopy height, canopy closure, vertical foliage density, mean soil moisture (% volume), mean diurnal temperature, mean maximum diurnal temperature, and mean diurnal relative humidity. These variables were chosen because there were statistically significant differences in use sites versus non-use sites at the southwestern willow flycatcher life history study sites (McLeod et al. 2005, Koronkiewicz et al. 2004). Reference variables for southwestern willow flycatcher habitat are presented in Table A-1 and may change as future data refines these ranges.

**Table A-1. Reference Variables for Phase I**

Canopy Height (M)	Average greater than 4.0 m
Canopy Closure (% total)	Greater than 70%
Vertical Foliage Density	Density greatest between 1 m and 4 m above ground. This may change as additional analysis is completed.
Mean Soil Moisture (% volume)	Minimum of 17% Average of 23%
Mean Diurnal Temperature (Celsius)	Between 26°C and 33°C
Mean Maximum Diurnal Temperature (Celsius)	Maximum of 45°C Average between 32°C and 45°C
Mean Diurnal Relative Humidity (%)	Greater than 33% Average between 33% and 63%
Contaminant Load for Irrigation Return Flow	Will be defined by water quality samples taken in adjacent drains prior to restoration
Average Soil Salinity Range of Soil Electroconductivity – a function of salinity concentration (mMHO/cm) (Rorabaugh, YAO, various articles from Internet)	Will be defined by targeted plant species thresholds Cottonwood = <2.0 Willow = <2.0 Honey and Screwbean Mesquite = <9.4 Atriplex = <16.4 Baccharis = <16.4

## **Monitoring Analysis and Evaluation**

Once the implementation and habitat/species monitoring data are analyzed, the results will be evaluated with two sets of management guidance criteria: thresholds and trigger points. These criteria will be used to evaluate all phases of implementation.

### **Thresholds**

Thresholds signal that conditions are appropriate and to continue current management practices. The thresholds currently established are:

- Microclimate and vegetation conditions achieved for the reference conditions of southwestern willow flycatcher habitat in portions of cottonwood-willow III-IV.
- The site is the vegetation community structure (Anderson and Ohmart 1976, 1984) as designed.
- Site is utilized by one or more covered avian species during the breeding season.
- Site is utilized by the southwestern willow flycatcher.
- Site is utilized by the yellow-billed cuckoo.

### **Trigger Points**

Trigger points signal the need to alter current management activities to achieve the conservation area goals of the restoration site or change goals for site. The trigger points currently established are:

- Low survivorship of trees planted with potted plants or cuttings.
- Non-native vegetation dominates particular areas of the site.
- Portions of cottonwood-willow III-IV are not providing habitat characteristics required by the southwestern willow flycatcher.

## **Data Collection and Analysis**

All data collected will be entered into the long-term relational database that is in the process of development for the LCR MSCP. Analysis will be both qualitative and quantitative, depending on the data collected.

## **Evaluation of Results and the Adaptive Management Program**

Data will be evaluated yearly to determine whether thresholds or trigger points are reached. An annual monitoring report will be written with summary results of all monitoring studies conducted that year. A 5-year summary report will be written after the first 5 years post-development to give trend analysis and to determine whether results indicate that restoration activities meet or exceed thresholds. Recommendations will be made in the annual report and in the 5-year summary report for future management actions and for changes in protocols or monitoring regimes. If results indicate that effects are deleterious to species or habitats, recommendations on prescriptions and modifications will be identified and other methods evaluated. All data and recommendations flow into the AMP.