



Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Cibola NWR Unit 1 Conservation Area Restoration Development and Monitoring Plan: Overview



November 2007

Lower Colorado River Multi-Species Conservation Program Steering Committee Members

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

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Arizona Electric Power Cooperative, Inc.
Arizona Game and Fish Department
Arizona Power Authority
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Cibola Valley Irrigation and Drainage District
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City of Lake Havasu City
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Mohave Water Conservation District
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The Cocopah Indian Tribe

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Lower Colorado River RC&D Area, Inc.



Lower Colorado River Multi-Species Conservation Program

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Prepared by Gregg Garnett (Restoration Group) and Allen Calvert (Wildlife Group)

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

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Contents

Acronyms and Abbreviations	vi
Background	1
1.0 Introduction.....	3
Purpose.....	3
Location/Description.....	3
Land Ownership.....	4
Water.....	4
Agreements	4
2.0 Restoration Development Plan	8
Planting Design.....	8
Grading and Contouring	11
Planting Material/Planting Techniques.....	11
Herbicide/Fertilizer/Pesticide Application.....	12
3.0 Management Overview.....	12
Land Manager	12
Soil Management	12
Water Management.....	13
Irrigation System.....	13
Irrigation Practices	13
Structural Management.....	13
Woody Riparian Habitats.....	14
Law Enforcement.....	14
Public Use	14
Wildfire Management	14
4.0 Monitoring.....	15
Purpose.....	16
Monitoring Design	16
Resources	16
Predevelopment Monitoring	16
Implementation Monitoring	18
Habitat/Species Monitoring	20
Vegetation Classification	23
Monitoring Analysis and Evaluation	25
Reference Conditions.....	25
Thresholds.....	26
Trigger Points.....	26
Adaptive Management.....	26
5.0 Reports.....	27
Annual Report.....	27
Final Report	27
Literature Cited.....	28

Figures

Figure 1. Location of Cibola NWR Unit 1 Conservation Area5
Figure 2. Cibola NWR Unit 1 Conservation Area Detail6
Figure 3. Typical Planting Plans.....9
Figure 4. Vegetation Classification.....24

Tables

Table 1. Proposed Development Phasing Schedule.....7
Table 2. Potential Native Plant Species List.....11
Table 3. Tree Index of Condition.....19
Table 4. Vegetation Communities, Criteria, and Types.....23
Table 5. Reference Variables.....25

Acronyms and Abbreviations

AMM	Area Management Measures
BACI	Before-After-Control-Impact
Cibola NWR	Cibola National Wildlife Refuge
CW	Cottonwood-willow land cover type, as defined in the LCR MSCP HCP
HCP	Habitat Conservation Plan
HM	Honey mesquite land cover type, as defined in the LCR MSCP HCP
LCR	Lower Colorado River
MMRP	Mitigation Monitoring Reporting Program
MSCP	Multi-Species Conservation Program
NWR	National Wildlife Refuge
Reclamation	Bureau of Reclamation
SWFL	Southwestern Willow Flycatcher
USFWS	U.S. Fish & Wildlife Service
YBCU	Yellow-billed Cuckoo

Background

Cibola National Wildlife Refuge (Cibola NWR) consists of about 16,600 acres of land located along approximately 12 miles of the lower Colorado River (LCR) in Arizona and California. It was established in 1964 as a refuge and breeding ground for migratory birds and other wildlife. The Refuge is divided into six management units designated as Unit 1, Unit 2, Unit 3, Unit 4, Unit 5, and Unit 6 (Figure 1).

Unit 1 is located on the northern end of the refuge in Arizona and encompasses approximately 4,100 acres, with approximately 1,000 acres dedicated to agriculture and 3,100 acres currently undeveloped. The Bureau of Reclamation (Reclamation) has previously partnered with Cibola NWR and currently has a number of established projects at Unit 1. These include previous habitat creation projects as well as research and demonstrations projects. In 1999, the U.S. Fish & Wildlife Service (USFWS) and Reclamation planted the Cibola Corn Field/Nature Trail and established 34 acres of cottonwood-willow and mesquite land cover type within Unit 1. In 2002, USFWS and Reclamation planted approximately 18 acres of cottonwood/willow in Unit 1 north of the Corn Field/Nature Trail.

Six approximately 20-acre fields in Unit 1 have been set aside for the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) to conduct research and development projects. To date, four of the fields are occupied by three projects that have been fully or partially funded by the LCR MSCP. These include Work Task E6: Cottonwood Genetics Study, Work Task E7: Mass Transplanting Demonstration, and Work Task E8: Seed Feasibility Study. To the east of these projects are an additional two agricultural fields that are still in agricultural production. The six fields combined are currently included in a 5-year land use agreement with USFWS to continue research activities on Unit 1; the agreement expires in FY09.

The Cibola NWR Unit 1 Conservation Area incorporates the aforementioned existing projects and agricultural land as well as additional adjacent acreage into a single conservation area. Note that the Cibola NWR Unit 1 Conservation Area (about 900 acres) only includes a portion of the total area designated as Unit 1 by the Cibola NWR (about 4100 acres).

Research projects that are currently ongoing will retain their individual work task designations until the termination of research or the expiration of the current land use agreement. The land included in Cibola NWR Unit 1 Conservation Area encompasses approximately 900 acres and ranges in cover and use from agricultural fields to partially improved land, to undeveloped land. The development targets primarily for cottonwood-willow land cover type for southwestern willow flycatcher SWFL, but will also likely include a mosaic of native habitats with riparian, wetland, and riparian-upland interface areas where appropriate.

The acreage in Cibola NWR Unit 1 Conservation Area has been categorized into five areas (Figure 1). Area #1 (180 acres) includes active agricultural fields, existing (converted agriculture) cottonwood-willow land cover type, and ongoing LCR MSCP research and demonstration projects. Area #2 (Hippy Fire) includes 313 acres that have been cleared as a result of the Hippy Fire. Cibola NWR has performed substantial capital improvements to this area over the past several years, including clearing, laser-leveling, field construction, and irrigation and drainage infrastructure installation. The area is currently planted in a cover crop and is being conditioned to improve soil salinity. Areas #3 (Baseline 90) and #4 (North 160) are 100 and 146 acres of undeveloped land and fallowed agricultural land, respectively. The areas will require clearing, leveling, installation of irrigation infrastructure, and soil conditioning before development for native riparian species. Area #5 (Crane Roost, 147 acres) has been cleared and leveled and is currently irrigable. A portion of this area has been planted with cottonwood, willow, and mesquite species. This area will require modifications to the irrigation system and will need further soil conditioning prior to development.

For large habitat restoration sites that are developed over a number of years such as the Cibola NWR Unit 1 Conservation Area, restoration activities are typically divided into phases. This document, *Cibola National Wildlife Refuge Unit 1 Conservation Area Restoration Development Plan: Overview*, provides an overview of the restoration potential of the site as well as the projected phasing of development. To document the development of habitat on the property, each fiscal year a phase-specific restoration plan will be prepared that documents the planning, design, planting, and monitoring requirements of that phase.

An annual report will be prepared and made available typically in April of each calendar year summarizing restoration and monitoring activities conducted during the previous year. Specific information on the contents of the annual report can be found in Section 5 of this document.

Through the adaptive management process, a Restoration Plan for each Phase will be prepared. This plan will incorporate the monitoring results from the previous year. The Restoration Plan will include the planting design, planting techniques grading plan, and demonstration or research plan for the acreage that will be converted. The monitoring results will be used to determine the amount of structural management that will be accomplished in the next year and any modifications to previously restored habitats.

1.0 Introduction

The LCR MSCP is a multi-stakeholder Federal and non-Federal partnership responding to the need to balance the use of lower Colorado River water resources and the conservation of native species and their habitats in compliance with the Endangered Species Act. This is a long-term (50 years) plan to conserve at least 26 species along the LCR from Lake Mead to the Southerly International Boundary with Mexico through the implementation of a Habitat Conservation Plan (HCP). Most of the covered species are State and/or Federally listed special status species. Reclamation is the entity responsible for implementing the LCR MSCP over the 50-year term of the program. A Steering Committee currently consisting of 54 entities has been formed, as described in the *LCR MSCP Funding and Management Agreement*, to provide input and oversight functions in support of LCR MSCP implementation.

The overall goal for the Cibola NWR Unit 1 Conservation Area is to develop a variety of land cover types and maintain habitat that will contribute to the habitat objectives for covered species outlined in the LCR MSCP HCP.

Purpose

This document serves as the initial guide for the creation and maintenance of habitat, a process that will continue to evolve through an Adaptive Management Program described in this plan. Subsequent documents will provide detailed information for each proposed phase and identify the annual development of land cover types on the property.

The intent is to create as much riparian habitat as possible under the HCP, which will be managed for the southwestern willow flycatcher (*Empidonax traillii extimus*) (SWFL), yellow-billed cuckoo (*Coccyzus americanus occidentalis*) (YBCU), and other species covered under the LCR MSCP HCP. The creation of habitat includes both the establishment of native plants and the management of the vegetation and its structural type to meet performance standards for integrating seral stages of vegetation, moist soil, standing water, and open areas into mosaics of riparian vegetation.

This plan provides management options for habitats for covered species in Reach 4, which extends from Parker Dam (RM 192.3) to Reclamations Cibola Gage (RM 87.3), and is described in more detail in the LCR MCSP HCP habitat objectives. The plan provides habitat restoration design and management methods, including construction (planning and design), monitoring, research, and reporting incorporated within an adaptive management plan. Data from monitoring and research results will be integrated into the plan to provide for future successful habitat restoration and objectives.

Location/Description

The Cibola NWR Unit 1 Conservation Area consists of approximately 900 acres on Cibola NWR, located in Arizona between river miles 97 and 99 (Figure 1). The initial

partnership for Cibola NWR Unit 1 Conservation Area includes Reclamation and the U.S. Fish and Wildlife Service, Cibola National Wildlife Refuge. The legal description of this area is as follows:

Township 1 South, Range 23 West, Gila and Salt River Base and Meridian, La Paz County, Arizona:

Section 6, lots 4, 5, and 6;

Township 1 South, Range 24 West:

Section 1, lots 1 through 4, inclusive, S $\frac{1}{2}$ NE $\frac{1}{4}$, NW $\frac{1}{4}$, SW $\frac{1}{4}$, N $\frac{1}{2}$ SE $\frac{1}{4}$, and SW $\frac{1}{4}$ SE $\frac{1}{4}$;

Section 2, lot 1, lots 2 and 3 those portions lying east of the levee road;

Section 12, N $\frac{1}{2}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$, SW $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$, SE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ excluding that portion lying east of the irrigation drain, NE $\frac{1}{4}$ NW $\frac{1}{4}$, W $\frac{1}{2}$ NW $\frac{1}{4}$ excluding that portion lying west of the levee road, NW $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$ excluding that portion lying west of the levee road, and NE $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$.

This area comprised 906 acres, more or less.

Land Ownership

The property is owned by USFWS, who will dedicate land and water to Reclamation to develop and maintain native land cover types for the LCR MSCP. The proposed development schedule for phases 1 through 6 is shown in Table 1. The property will be owned and managed by USFWS.

Water

Cibola NWR has second priority water rights. These include a diversionary entitlement of 27,000 acre-feet per year and a consumptive use entitlement of (diversion minus return flow) of 16,793 acre-feet per year. In addition, the refuge has a circulatory (circulation water with minimum consumptive use) water right of 7,500 acre-feet per year. The 900-acre Cibola NWR Unit 1 Conservation Area will have a maximum of 5,400 acre-feet per year (6 acre-feet per acre, per year) available when the conservation area has been fully developed.

Agreements

A Land Use Agreement for restoration activities has been drafted, and when finalized, will secure the availability of land and water resources for the 50-year term of the program.

Figure 1. Location of Cibola NWR Unit 1 Conservation Area

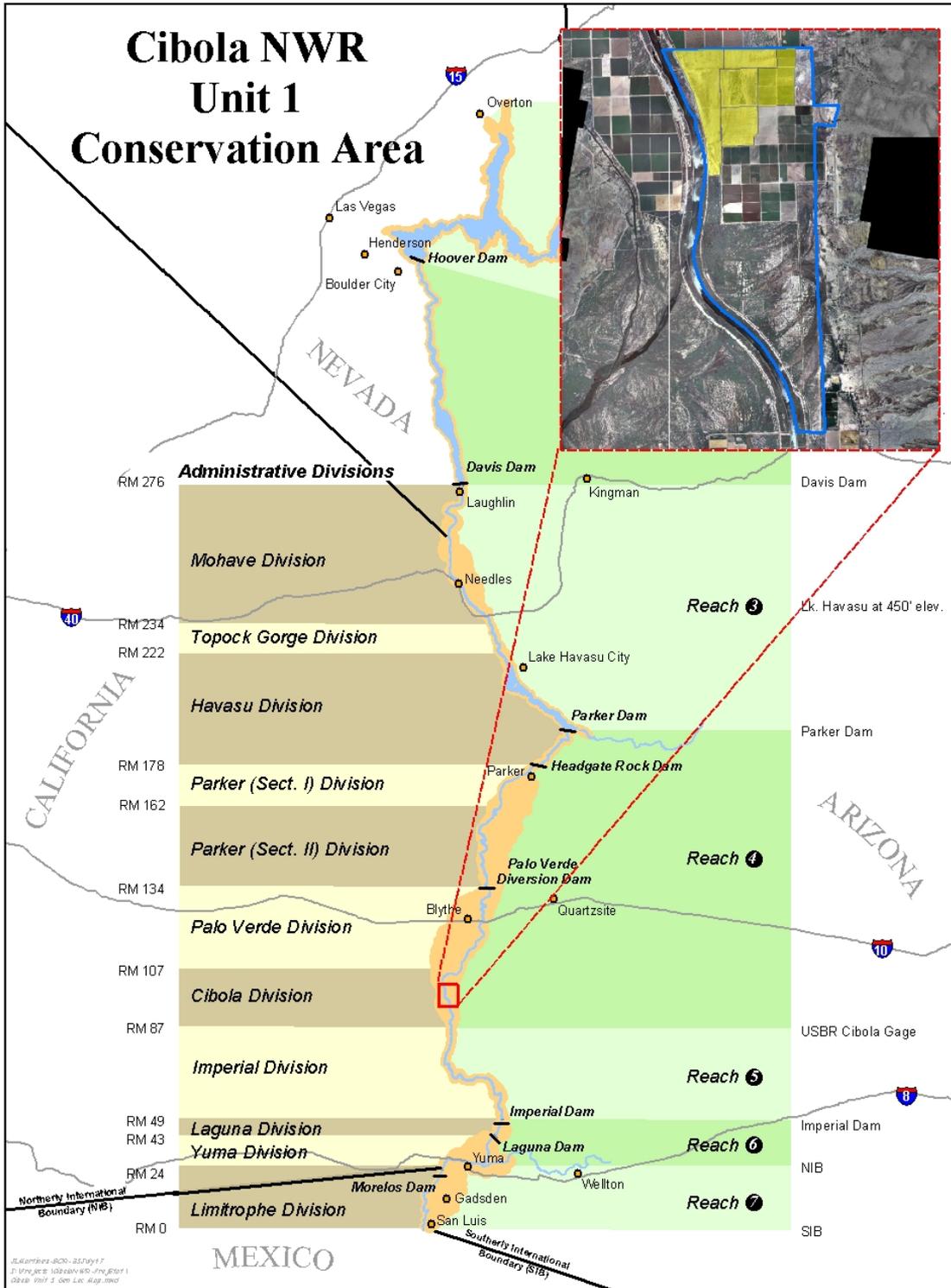


Figure 2. Cibola NWR Unit 1 Conservation Area Detail

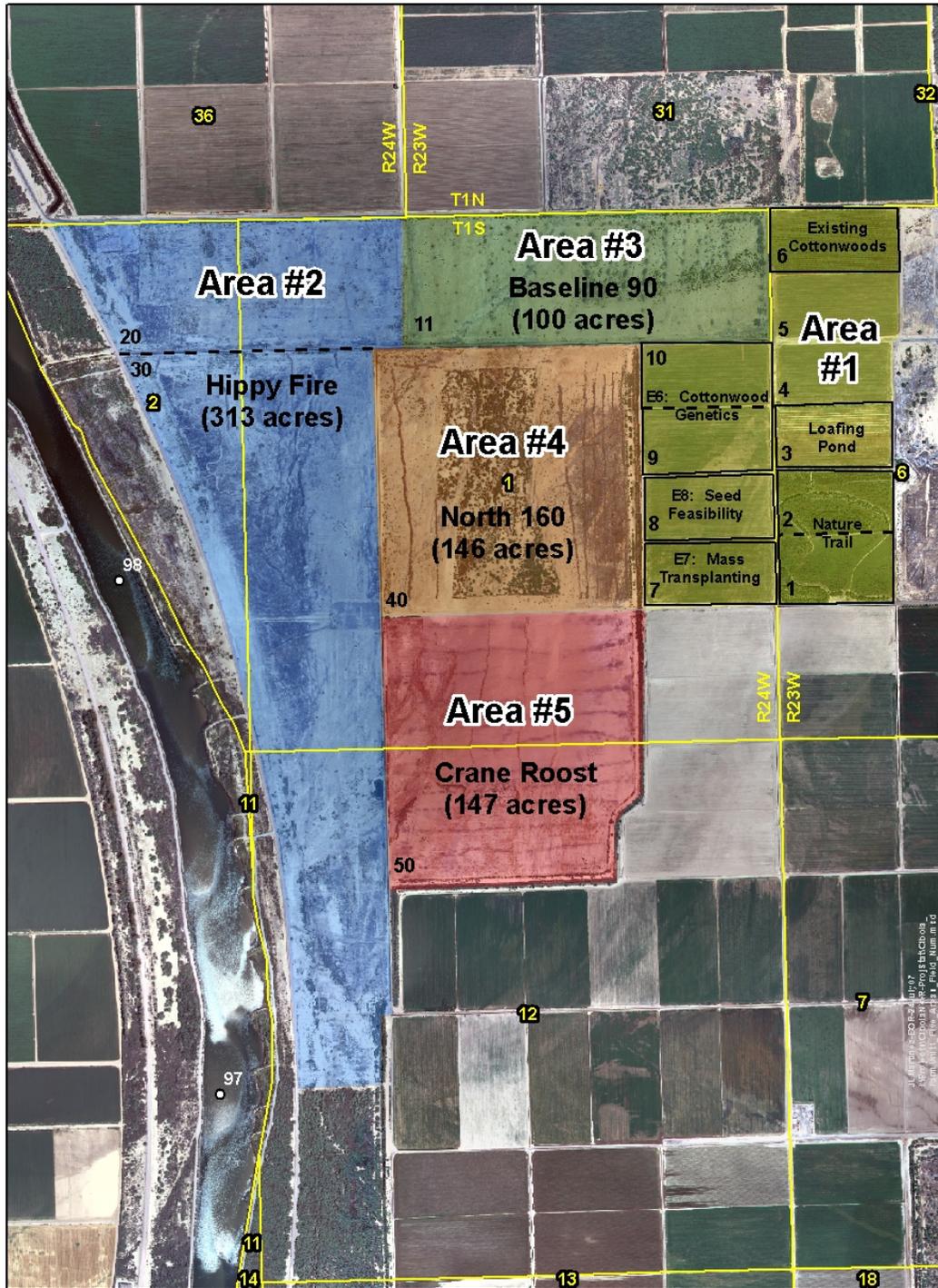


Table 1. Proposed Development Phasing Schedule

Fiscal Year/Area	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15+
Crane Roost	cover crop planting	cover crop maintenance	Phase 1 plant 150 acres	maintenance	maintenance	maintenance	maintenance	maintenance	maintenance
Hippy Fire	cover crop maintenance	cover crop maintenance	cover crop maintenance	Phase 2 plant 160 acres	Phase 3 plant 160 acres	maintenance	maintenance	maintenance	maintenance
North 160	weed control	weed control	cover crop planting	cover crop maintenance	cover crop maintenance	Phase 4 plant 150 acres	maintenance	maintenance	maintenance
Baseline 90	weed control	weed control	weed control	cover crop planting	cover crop maintenance	cover crop maintenance	Phase 5 plant 100 acres	maintenance	maintenance
Active 40	active farming	active farming	active farming	active farming	active farming	active farming	active farming	Phase 6 plant 40 acres	maintenance

2.0 Restoration Development Plan

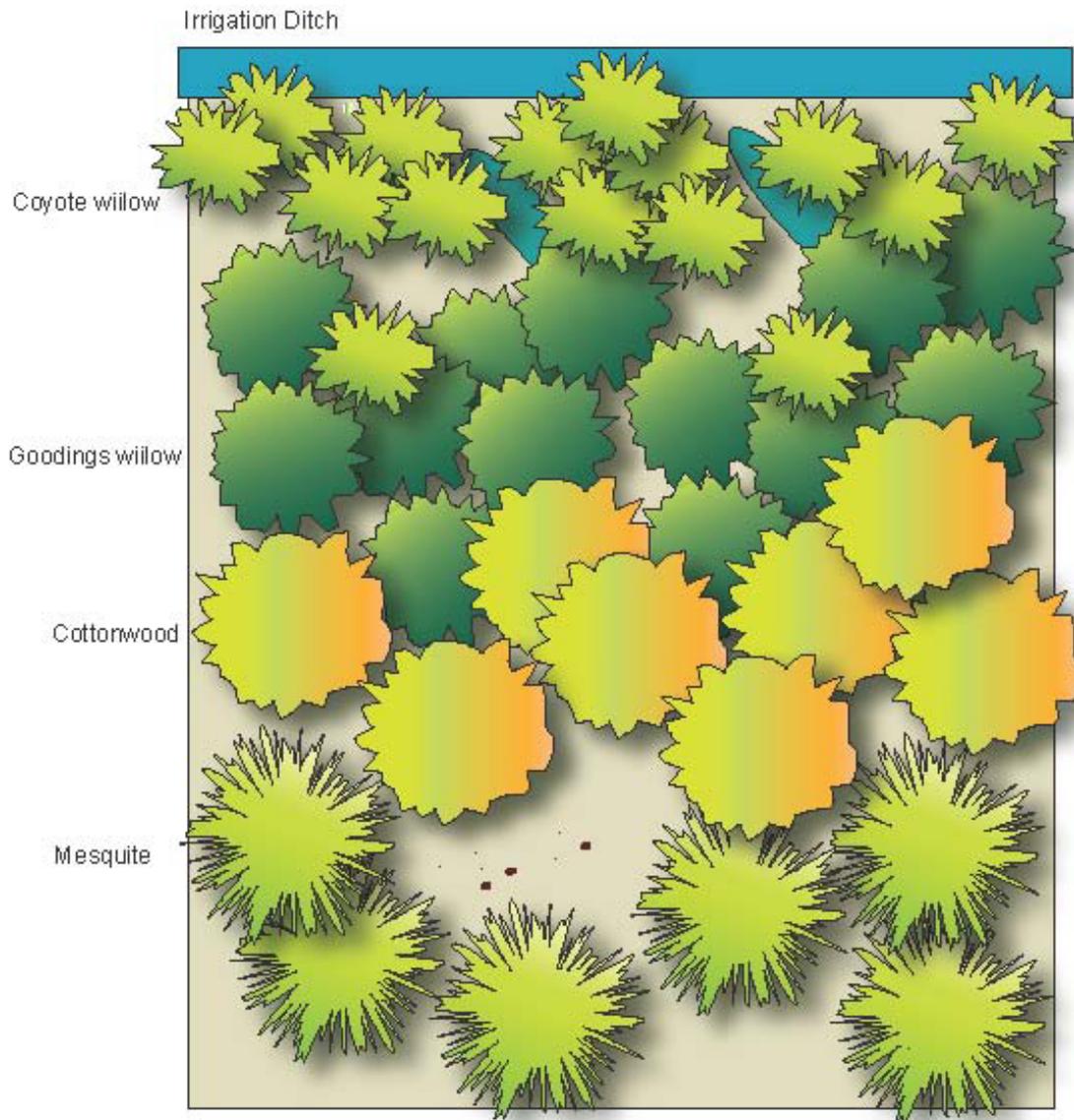
The LCR MSCP HCP goals include creation, development, and maintenance of riparian habitat conditions for 5,940 acres of cottonwood-willow (CW). This restoration development plan is intended to partially fulfill those commitments. The area will be managed for SWFL, YBCU, and other LCR MSCP covered species. The plan generally will be used as a guide to create and manage 50% of CW in seral stage I. The other 50% will be created and managed for seral stages III and IV. The area will be designed and planted to create the presently known preferred conditions necessary for the target covered species. Areas of contouring for moist soil and standing water, along with mosaics of vegetation, comprise the basis for the creation of habitat. As more specific information regarding habitat conditions for the covered species become known, that information will be incorporated into the design and management plans.

Planting Design

The planting design incorporates native riparian species along the LCR into a mosaic of created habitats. Areas of cottonwood-willow and honey mesquite cover types are based on information in the LCR MSCP HCP for each species. Patch size of created habitats are designed and managed to provide habitat for more than one species. Based on site conditions, cottonwood-willow and honey mesquite will be created in proximity to each other to re-create an integrated mosaic of habitats that approximates terrestrial communities that were historically present in the floodplain. When feasible, areas of standing water or moist soil, and open areas (areas with ground cover and low shrubs) will be incorporated into the design. Reclamation anticipates high plant diversity for habitats created at Cibola NWR Unit 1 Conservation Area based on an integrated mosaic approach for planting. By employing this approach, a higher quality habitat is anticipated.

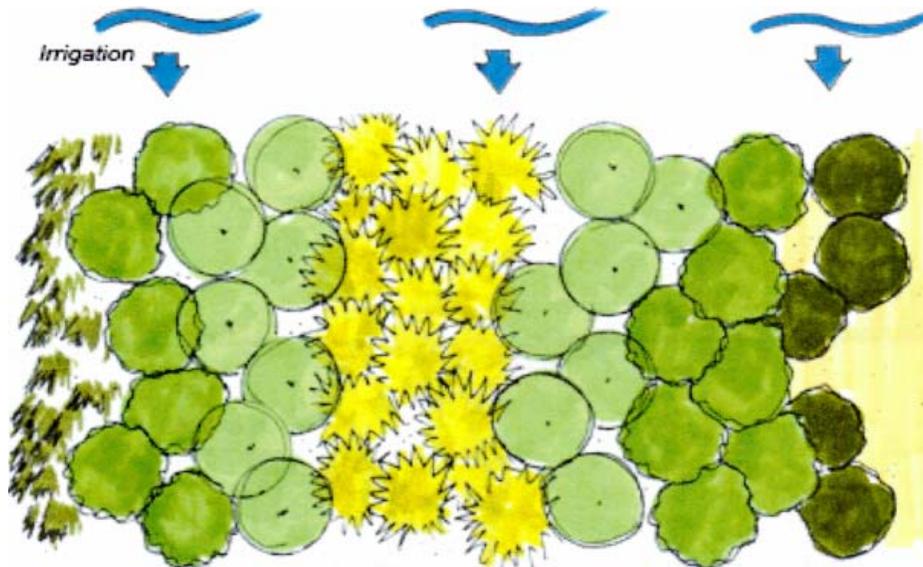
The planting design establishes vegetation species with higher water needs closer to irrigation gates, and the species that require less water further from the irrigation gates (Figure 3). Areas that target SWFL will be irrigated more frequently from April through September (breeding season of the SWFL) so that multiple areas will have moist soils or standing water.

Figure 3. Typical Planting Plans



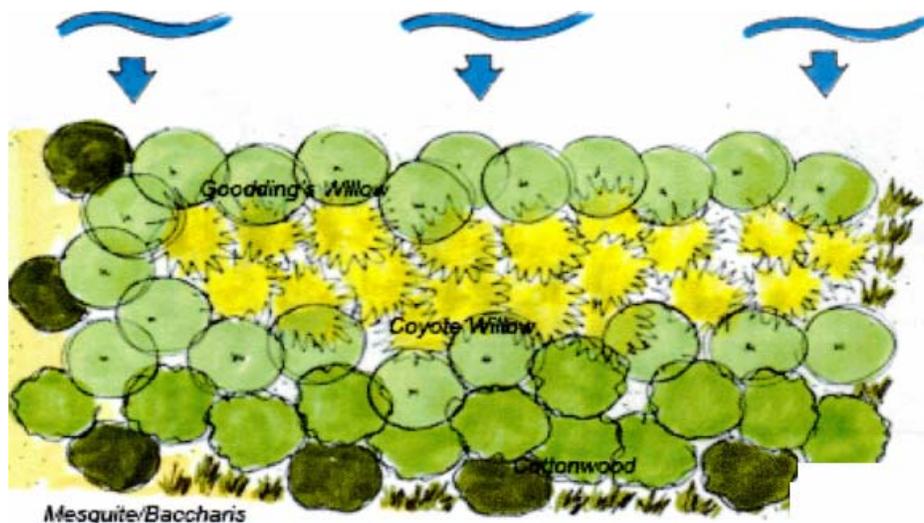
Typical riparian planting plan

This mosaic of habitats includes the following elements: drought-tolerant vegetation, riparian vegetation, and moist/saturated soils. The design takes into consideration observed natural riparian vegetation configuration by stratifying each species into zones. Those species with the greatest affinity for water are appropriately located nearest to the irrigation water supply and therefore receive the greatest amount of water and longest periods of inundation. In this way, the maximum benefit can be obtained while incorporating the greatest amount of water conservation.



Alternate planting plan #1

This mosaic of habitats includes the following elements: drought-tolerant vegetation, riparian vegetation, and moist/saturated soils. The design takes into consideration observed natural riparian vegetation configuration, with drought-tolerant vegetation on the edges progressing to riparian in the middle. The design creates a buffer zone around the Goodding's willow-coyote willow area, which is potential habitat for the southwestern willow flycatcher. Water is delivered through gates to each species according to the water requirements for the species. This planting plan may be used if the existing irrigation infrastructure includes multiple gates and irrigation checks.



Alternate planting plan #2

All the same elements are included as in Alternate Plan #1, but arranged in a different configuration. Coyote willow-Goodding's willow relationship remains the same in this planting plan. Water is controlled for moist/saturated soils and the required needs of the willows. Vegetation is planted according to water requirements of each species. Vegetation species with the highest water requirements are located closest to the irrigation gate (willows), followed by cottonwood, and an edge of mesquite. This plan may be used depending on existing soil conditions.

The following table lists the potential plant species that may be used in the development of habitat at Cibola NWR Unit 1 Conservation Area (Table 2). Each phase plan will include the specific plant species and estimated quantities that will be planted.

Table 2. Potential Native Plant Species List

Scientific Name	Common Name
<i>Populus fremontii</i>	Fremont Cottonwood
<i>Salix gooddingii</i>	Goodding's Willow
<i>Salix exigua</i>	Coyote Willow
<i>Prosopis glandulosa</i> var. <i>torreyana</i>	Honey Mesquite
<i>Atriplex lentiformis</i>	Quailbush
<i>Atriplex canescens</i>	Four-wing Saltbush
<i>Atriplex polycarpa</i>	Cattle Saltbush
<i>Baccharis sarothroides</i>	Desertbroom
<i>Baccharis salicifolia</i>	Mule's fat
<i>Distichlis spicata</i>	Inland Saltgrass
<i>Encelia farinose</i>	Brittlebush

Grading and Contouring

Initial ground preparation includes laser leveling of the existing fields to ensure complete and even coverage of irrigation water and to utilize the water in a cost-efficient manner. Generally, berms or borders are used to control irrigation to areas requiring more water and deliver water efficiently. To the extent necessary, these borders may also be used for water collection areas to create moist soils. Contouring may be used on the site to create wet swales or ponding areas; however, a specific grading design will be included with each phase plan for approval prior to implementation. Over time, such factors as wind erosion, water erosion, and build-up of debris will likely cause changes in topography that mimic a natural grading change. As necessary, the specific grading and contouring plans will be included in each individual phase plan prior to implementation.

Planting Material/Planting Techniques

Plant material for the project will be collected from the established LCR MSCP nurseries along the LCR, and areas that are ecologically similar. Planting techniques that have been proven successful to date include the following:

- Automated mass transplanting
- Dormant pole cutting/planting
- Hydro seeding
- Planting poles, potted plants, or slips with a conventional tree planter
- Seeding
- Perimeter planting of poles, potted plants, or slips

Planting techniques may include a combination of these or any other planting techniques that have been researched or demonstrated to be successful and cost effective. The specific planting technique will be included in each individual phase plan prior to implementation.

Herbicide/Fertilizer/Pesticide Application

To maintain healthy stands of native riparian species, the application of herbicides, fertilizer, and pesticides may be required. All herbicide, fertilizer, or pesticide application will be applied by persons possessing valid applicator's licenses for the chemicals being applied and in compliance with the rules, regulations, and laws set by the State of Arizona, La Paz County, and Cibola National Wildlife Refuge.

All records and associated chemical application documents will be stored by the land manager and will include:

- Training records of all employees handling pesticides and herbicides
- Material Safety Data Sheets for all pesticides, herbicides, and fertilizers
- Location map of herbicide and pesticide storage site
- Use of Arizona, La Paz County, and Refuge approved herbicide, pesticide, and fertilizers
- Record of herbicide, pesticide, or fertilizer use

3.0 Management Overview

Land Manager

Reclamation will be responsible for ensuring the long-term operation and maintenance of Cibola NWR Unit 1 Conservation Area throughout the 50-year term of the LCR MSCP. The details of operations and maintenance of Cibola NWR Unit 1 Conservation Area will be agreed upon between Reclamation and USFWS and will include species monitoring, soil, water, vegetation structure, law enforcement, public use, wildfire management, research, and monitoring. Each specific area will be addressed in the adaptive management plan.

Soil Management

Cibola NWR Unit 1 Conservation Area is located within the Colorado River Floodplain; during numerous historic flood events, sands and silts were deposited in this area. Several soil series and associations are found on the property, primarily Indio silt loam and Lagunita silt loam. Sand and sandy loam soils have a low water retention capacity and drain easily. Because some riparian habitats have areas of standing water or moist soils, soil management may include efforts to increase water holding capacity where appropriate. Adding organic material to soil will likely increase water holding capacity

and add nutrients to the soil for plant growth. Planting cover crops can decrease wind erosion and help protect topsoil. The following is a list of methods that may be used to manage soil water holding capacity and nutrients, and to prevent salinity build-up:

- Leaves, vegetative debris, and branches will be left on site to decay
- Planting a ground cover
- Appropriate irrigation schedules to flush salts from the soil
- Fertilizer

Soil management may include combination of these or any other techniques that have been researched or demonstrated to be successful and cost effective.

Water Management

Irrigation System

The primary water management at Cibola NWR Unit 1 Conservation Area will include an efficient irrigation system and irrigation schedule. Currently, the developed areas on Cibola NWR Unit 1 Conservation Area have an irrigation system that comprises lined delivery ditches and associated jack gates with concrete turnouts that supply each field. Two electric pumps deliver water to the irrigation system from the Colorado River. It is anticipated that this system may need to be upgraded in capacity as additional phases are developed in Cibola NWR Unit 1 Conservation Area.

It is anticipated that a local farmer will be under contract to provide irrigation services and to inspect ditches, canals, and gates, and report the results to Reclamation. Additional visual inspections will be performed by this person each time the fields are irrigated.

Irrigation Practices

It is anticipated that all the CW land cover will be flood-irrigated on a regular basis. Irrigation will be increased during breeding and nesting season of the SWFL to create moist soil conditions. Small areas will be created to hold irrigation water during SWFL season (April through August). Moist soils and areas of standing water encourage insect diversity and can also increase the relative humidity localized within the vegetation canopy, which has been observed as a component of habitat for SWFL. These conditions may be accomplished using liners, concrete, soil amendments, or any methods that will accomplish the goal of creating areas of standing water or moist soils.

Irrigation management may include a combination of these techniques or any other techniques that have been researched or demonstrated to be successful and cost effective. The specific irrigation schedule will be included in the individual restoration phase plans prior to implementation. This schedule may be modified as needed.

Structural Management

Selective harvesting within the CW habitat will be used to create the targeted structurally diverse habitat. Reclamation defines “harvesting” as the collection of cuttings or poles

when the trees are dormant. The intent is to mimic the seral stages preferred by the SWFL.

Woody Riparian Habitats

Created habitats will be managed to support CW types I, III, and IV for SWFL, and CW types I and III for YBCU. The following methods for structural management will be implemented to achieve the desired cover type classifications. The structural types are based on Anderson and Ohmart (1984) proportional distribution of the vegetation. The Cibola NWR Unit 1 Conservation Area will be assessed annually at the end of each growing season to identify structural types. The following methods may be modified and new methods may be added depending on research and demonstration of techniques, through the adaptive management plan:

- Planting appropriate riparian vegetation that matures to recommended heights
- Manually maintaining three distinct heights or layers of vegetation
- Designing planting plan so that canopy trees do not shade out middle and bottom foliage
- Selectively removing intermediate vegetation
- Creating open areas with shrubs and grasses that are integrated with areas of foliage

Structural management may include a combination of the above or any techniques that have been researched or demonstrated to be successful and cost effective.

Law Enforcement

Specific law enforcement arrangements will be developed once long-term land ownership is finalized.

Public Use

Public use and other activities will be coordinated with USFWS or any future land owners or managers and other stakeholders to ensure that they are consistent with and do not adversely affect restoration activities at Cibola NWR Unit 1 Conservation Area.

Wildfire Management

As guided by commitments in the HCP, wildfire management practices on Cibola NWR Unit 1 Conservation Area will:

- Reduce the risk of the loss of created habitat to wildfire by providing resources to suppress wildfires, such as contributing to and integrating with local, State, and Federal agency fire management plans

- Implement land management and habitat creation measures to support the reestablishment of native vegetation that is lost to wildfire

Wildfire management may include the rapid response of irrigating the affected field and the fields immediately adjacent to the wildfire within Cibola NWR Unit 1 Conservation Area.

4.0 Monitoring

This section contains the overall strategy for monitoring the Cibola NWR Unit 1 Conservation Area restoration project. Subsequent documents (Restoration Phase Plans) provide the specific monitoring requirements for each phase and will typically be created on an annual basis.

Monitoring 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 studies will be conducted to evaluate whether the restoration parameters established for each covered species habitat are being achieved, the restoration area develops as covered species habitat, and the habitat is being utilized by the covered species. Results on how the created habitat develops, relative to the restoration and management techniques employed, will be used to refine techniques and develop the most cost-effective and efficient approaches for future phases at Cibola NWR Unit 1 Conservation Area and other restoration sites.

Initial conservation area monitoring plans are 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 found in the LCR MSCP Draft Final Science Strategy (Bureau of Reclamation 2006). The monitoring plan elements for Cibola NWR Unit 1 Conservation Area may be revised after those strategies have been adopted.

Monitoring at Cibola NWR Unit 1 Conservation Area will be structured into four categories:

- Predevelopment Monitoring
- Implementation Monitoring
- Habitat/Species Monitoring
- Vegetation Classification

The goals for monitoring may be revised depending on the Adaptive Management Program results, covered species requirements, or other management decisions in the future. All monitoring will be designed specifically for each phase and habitat type within that phase. Covered species monitoring will be organized in the following guilds: marsh birds, neotropical birds, cavity nesting birds, small mammals, bats, and reptiles and

amphibians. The SWFL, YBCU, and MacNeill's sootywing skipper will be monitored using species-specific protocols.

Purpose

The purpose of the Cibola NWR Unit 1 Conservation Area monitoring plan is to determine whether restoration parameters established for each covered species habitat are being achieved, when each phase of Cibola NWR Unit 1 Conservation Area develops as covered species habitat, and if the habitat is being utilized by the covered species. The Avoidance and Minimization Measures, Conservation Area Management Measures (AMM), Monitoring and Research Measures (MRM), and General and Species-Specific Conservation Measures from the LCR MSCP HCP document dictate the range of data collected, analyzed, and incorporated into the adaptive management plan.

Monitoring Design

Sampling design is based on quasi-experimental design using the Before-After Control-Impact (BACI) design (Stewart-Oaten and Osenberg 1992, Bernstein and Zalenski 1983, Green 1979). The BACI approach prescribes the collection of data prior to an activity and comparison to data collected after the activity (Smith 2002). The quasi-experimental design will use pre-restoration phases as controls. The designs will utilize randomization where possible. Subsamples of each phase will be taken at the same or similar randomized points both pre- and post-restoration. To the greatest extent practicable, pre-restoration monitoring will be conducted for a minimum of 1 year prior to the implementation of each phase.

Resources

Population and habitat resources are determined based on the appropriate AMM, MRM, and General and Species-Specific Conservation Measures, and monitoring will be conducted both pre- and post-restoration. Select resources will only be monitored post-restoration if no potential exists prior to development for the existing agricultural fields to support populations of targeted covered species (e.g., SWFL has never been found to occupy cotton fields). In most cases, the resources monitoring will focus on guilds of species for efficiency. The pre- and post-restoration resources that will be monitored are summarized below in each appropriate monitoring category. Specific protocols that have been developed for each resource may be found in the document entitled *Draft 2006 Monitoring Protocols for the LCR MSCP*.

Predevelopment Monitoring

Predevelopment monitoring is designed to establish what types of restoration activities may be conducted, establish baseline data for evaluating post development, and identify whether covered species currently inhabit Cibola NWR Unit 1 Conservation Area.

To establish baseline conditions, an understanding of the current and historical conditions at Cibola NWR Unit 1 Conservation Area is necessary.

Predevelopment monitoring is divided into abiotic (soil features) and biotic (vegetation and covered species) factors:

- Abiotic Monitoring

- Soils

Samples are taken from each phase after removal of the agricultural crop and before the planting of the trees, or if the land is undeveloped, soil samples will be taken before the land is cleared and a cover crop is planted. After a cover crop is planted, samples will be taken annually to determine if the soil is ready for conversion to native riparian vegetation.

Samples in each phase are analyzed for moisture, salinity, textural classification, depth to ground water, and nutrients, including nitrate, ortho-phosphate, and ammonia.

- Microclimate

If any covered species are found during pre-restoration surveys, microclimate monitoring may be conducted to measure temperature and relative humidity, and data will be compared with post-restoration data.

- Biotic Monitoring

- Vegetation Monitoring: Currently, Cibola NWR Unit 1 Conservation Area consists of farm fields, partially developed, and undeveloped land, and no riparian or marsh habitat is present; therefore, only *Atriplex* spp. will be surveyed and mapped.

- Avian Monitoring:

A sampling approach using rapid area search surveys will be used to monitor neotropical avian species. The project will split into 9-ha plots and each area search plot on the project will be sampled one time in the last 2 weeks of May. Non-agricultural areas that will be developed may also include a double sample approach that will include both the rapid area search method as well as an intensive area search method that determines the number of individual bird territories in the plot.

Marshbirds will not be monitored, as marsh habitat is not present.

Species-specific SWFL and YBCU surveys will not be conducted, as suitable riparian habitat is not present. However, area searches will record any avian species present during the predevelopment monitoring phase.

- Small mammal presence/absence surveys will be conducted utilizing a standardized protocol. Trapping will occur prior to the implementation of each phase between late September-November and late February-May. Trapping will be conducted overnight. Trapping locations and number of trap nights will be determined depending on the size and quality of potential small mammal habitat within each phase. If quality habitat is found adjacent to a phase, trapping may take place to determine if there is a possible source population for small mammal colonization.
- Bat presence/absence surveys will be conducted utilizing active/passive AnaBat surveys at least 2 days per season (spring, summer, winter, and fall), prior to the implementation of a phase. Some phases may not be monitored in favor of concentrating on others that are more likely to have covered bat species utilizing the area. All AnaBat system locations will be chosen based on suitable habitat for the covered bat species and ability to maximize data collected.
- Amphibian and reptile monitoring will not be conducted because Cibola NWR Unit 1 Conservation Area is outside of the known range of the covered amphibian species and does not currently meet covered reptile species habitat requirements.
- MacNeill's sootywing skipper presence/absence surveys will be conducted if *Atriplex* spp. is located at Cibola NWR Unit 1 Conservation Area. Visual surveys will be conducted when the skipper flies between April and October (Pollard 1977). A minimum of three surveys will be conducted.

Implementation Monitoring

Implementation monitoring will be conducted to assess whether land cover type creation and management actions have been implemented as designed for each phase. This type of monitoring quantifies changes immediately after treatments and evaluates whether actions were implemented as prescribed (Block et al. 2001). For example, this type of monitoring would be used to determine that the planting techniques employed were effective and vegetation was planted according to the phase design specifications. This monitoring is focused on the habitat (biotic) and conditions therein (abiotic):

- Abiotic Monitoring

- Soil

Samples in each phase will be analyzed for moisture, salinity, textural classification, depth to ground water, and nutrients, including nitrate, ortho-phosphate, and ammonia.

Samples will be collected annually until the nutrient and salinity measurements are stable.

- Water
 - Deliveries will be recorded.
- Biotic Monitoring
 - Vegetation

Four to six weeks after planting (or after dormancy break), a sample of the trees will be counted and an index of condition (Table 3) will be recorded to determine initial survivorship. These data will be used to guide initial management activities, such as water use and re-planting.

After each of the first two growing seasons, growth and survivorship will be determined utilizing transects through each phase during the dormancy period (October-January). Sample transects will be randomly determined on an annual basis. The number of sample transects will be determined for each phase and will be based on several factors including patch size, restoration technique, vegetation species, and variation within each stand. Within each sample transect, every tree will be counted and recorded by species. Diameter at breast-height and tree condition (Table 2) will be recorded for every hundredth tree sampled. Percent cover will be measured at random 1-meter square plots in each transect to evaluate herbaceous and shrub plant component.

Table 3. Tree Index of Condition

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

Habitat/Species Monitoring

Habitat/Species monitoring is designed to determine whether each phase is providing the habitat requirements needed for the targeted covered species, if any covered species is utilizing the habitat; and if 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 categories:

- Habitat Monitoring
 - Abiotic Conditions
 - Soil
 - Samples will continue to be analyzed for moisture, salinity, textural classification, depth to ground water, and nutrients (including nitrate, ortho-phosphate, and ammonia) until the conditions are stable. When conditions reach the reference points, samples will be analyzed every 3 to 5 years. If conditions change, samples will be analyzed annually until conditions reach the reference point again.
 - Soil moisture probes will be utilized 10 times during the breeding season for SWFL, in SWFL habitat, beginning the year SWFL surveys are conducted.
 - Samples will be conducted minimally at the same site as the predevelopment monitoring.
 - Water
 - Deliveries to each phase will be recorded and analyzed to determine if the necessary amounts were delivered to grow the requisite habitat.
 - Microclimate
 - Random and strategically located data loggers will be placed within the habitat. Data loggers record temperature and relative humidity. The number of data loggers for each phase will be based on acreage of restored habitat. Data loggers will be downloaded approximately every 4 months. If a SWFL or YBCU nest is located, a data logger will be placed within 2 meters of the nest.
 - Biotic Conditions
 - Vegetation
 - Beginning at the end of the third growing season, habitat condition will be monitored using a standardized protocol based on a nested sample plot design. Initially, habitat monitoring will occur on an annual basis (years 3-6).

Monitoring will occur every other year between year 6 and year 10. After year 10, each site will be sampled every 5 years to monitor successional change through the LCR MSCP term. If a catastrophic disturbance (fire, flood, etc.) occurs to the stand, post-disturbance monitoring will mimic the post-restoration monitoring regime.

- Vegetation monitoring will include: overstory trees, sapling, shrub, understory, herbaceous layer, vertical foliage density, and crown closure.
- Covered Species Monitoring
 - Marshbirds

Monitoring will not be conducted because no marshbird habitat will be restored.
 - Neotropical Birds

A double sampling approach using rapid and intensive area search surveys will be used to monitor avian species. The project will split into 9-ha plots and each area search plot will be sampled one time in the last 2 weeks of May. One intensive 9-ha plot will be sampled twice a week in the month of June. Surveyors will find and map the territory of every individual bird found in the plot.

Avian monitoring will be conducted annually for 5 years after initiation. After 5 years, data will be examined and future monitoring decisions for neotropical species will be made.

Refer to Reclamation monitoring protocols (2006) for complete avian monitoring protocol.

Standardized breeding and winter season banding/mistnetting (DeSante 2005) may be conducted, if conditions warrant.

If covered species are observed, targeted species-specific surveys, nest searches, and banding/mistnetting may be conducted.
 - Cavity Nesting Birds

Elf owl surveys may be conducted after 4 to 6 years, depending on when the land cover type structure and density indicate the habitat has achieved the reference conditions. Installed nest boxes will be monitored during the breeding season (April-July) for elf owls. If an elf owl is detected during the breeding season, nest searches or targeted banding/mistnetting may be conducted for long-term use of site and refinement of habitat use.

Gilded flickers and Gila woodpeckers will be surveyed as part of the neotropical bird monitoring mentioned above. Installed snags will be monitored during the breeding season (May-July). If gilded

flickers or Gila woodpeckers are detected during the breeding season, nest searches or targeted banding/mistnetting may be conducted for long-term use of site and refinement of habitat use.

- Southwestern Willow Flycatcher
Standardized presence/absence surveys (Sogge et al. 1997, USFWS 2000) will be conducted after three growing seasons, depending on when the land cover type structure and density indicate the habitat has achieved the reference conditions. A minimum of five surveys will be conducted beginning in May and ending in July. If a SWFL is detected after June 15 or positive breeding evidence is identified, nest searches will be conducted to determine breeding status and use of habitat. Targeted banding/mistnetting may be conducted for long-term use of site and refinement of habitat use.
- Yellow-billed Cuckoo
Standardized presence/absence surveys (Halterman and Johnson 2005) will be conducted after three growing seasons, depending on when the land cover type structure and density indicate the habitat has achieved the reference conditions. A minimum of five surveys will be conducted beginning in June and ending in September. If a YBCU is detected during the breeding season, nest searches will be conducted and targeted banding/mistnetting may be conducted for long-term use of site and refinement of habitat use.
- Small Mammals
Standardized presence/absence surveys will be conducted at least once annually between September-November and late February-May. Trapping will be conducted overnight. Traps will be placed in parallel, linear transects of approximately 150 meters in length. A trap station will be located at 10-meter intervals along each transect. Transects will be located 10 to 15 meters apart, with the actual distance apart determined by the size of the area being surveyed. Trapping locations and number of trap nights will be determined depending on the size and quality of potential small mammal habitat within each phase.
- 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 equipment, data may be collected daily utilizing stationary AnaBat/Sonabat systems. The stationary system will be established for at least 5 years. Data will be examined after the 5-year period, 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.

- Reptiles and Amphibians
No monitoring will be conducted because no habitat for reptiles and amphibians will be restored or removed.
- MacNeill’s Sootywing Skipper
Pollard Walks (Pollard 1977) visual surveys will be conducted in *Atriplex* spp. habitat when the skipper flies between April and October to determine presence/absence. Surveys will be conducted when *Atriplex* crown coverage is approximately 10 feet by 10 feet. A minimum of three surveys will be conducted.

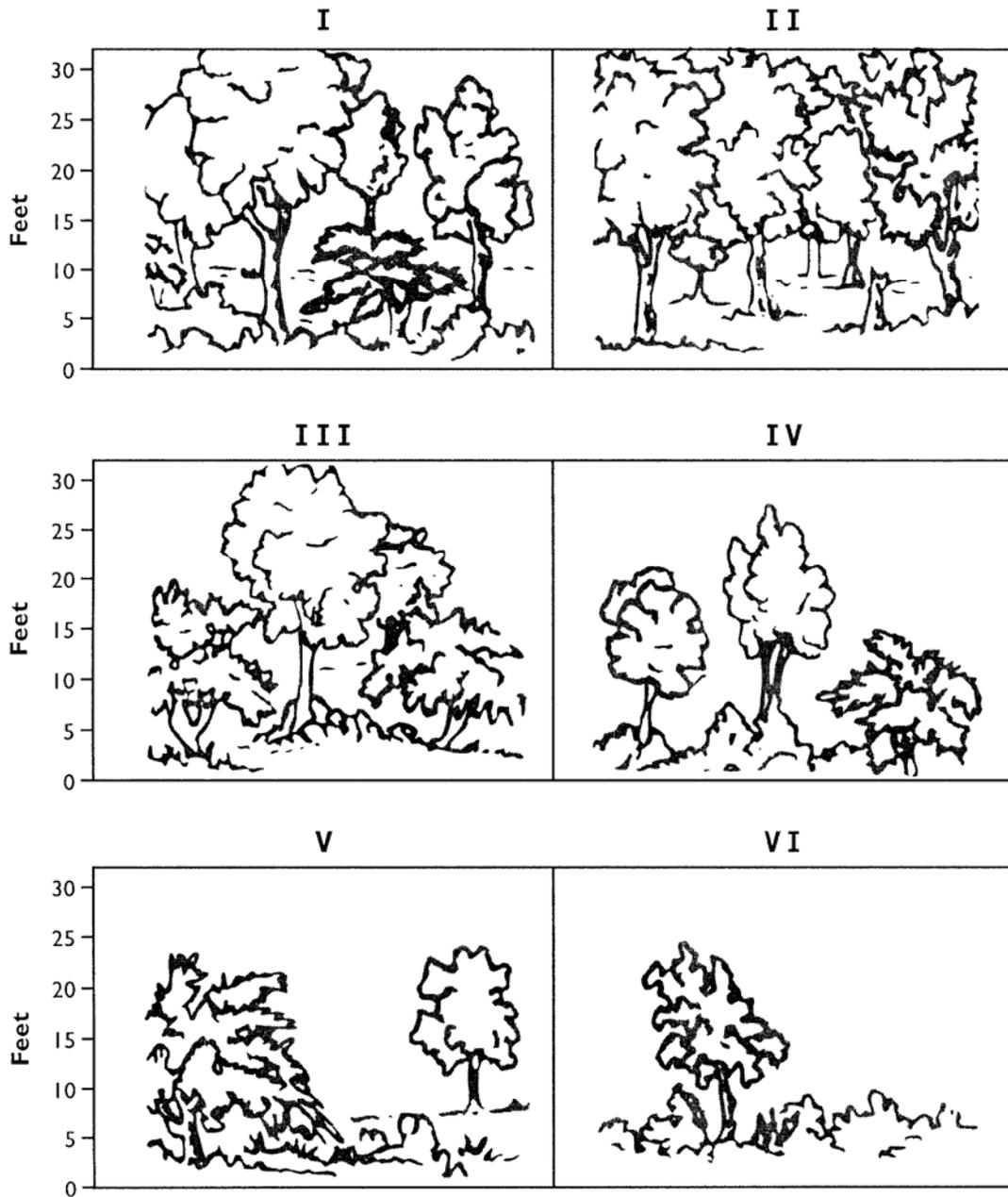
Vegetation Classification

The HCP (LCR MSCP 2004) outlines the specific habitat acreage to be created and classified utilizing the Anderson and Ohmart (1976, 1984) classification system (Table 4 and Figure 5). Using aerial imagery of the site obtained annually, each phase of the project will be mapped, classified, and ground-truthed.

Table 4. 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</i> spp. 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> , or <i>A. polycarpa</i> constituting 90-100% of total vegetation in area	I, II, III, IV, V, VI

Figure 4. Vegetation Classification



Adapted from Anderson and Ohmart (1984).

Monitoring Analysis and Evaluation

Once the data collected during implementation monitoring, habitat/species monitoring, and vegetation classification are analyzed, the results will be evaluated based on thresholds and trigger points identified by the reference conditions.

Reference Conditions

The Cibola NWR Unit 1 Conservation Area reference conditions for the SWFL will be modeled on conditions found during SWFL long-term life history site studies along the LCR (McLeod et al. 2005, Koronkiewicz et al. 2005). These variables (Table 4) may change depending on future analysis of the long-term life history studies currently being conducted. Variables that will be referenced include canopy height, canopy closure, vertical foliage density, mean soil moisture (percent volume), mean diurnal temperature, mean maximum diurnal temperature, and mean diurnal relative humidity. These variables were chosen as there were statistically significant differences in use sites versus non-use sites at the SWFL life history study sites (McLeod et al. 2005, Koronkiewicz et al. 2005).

Reference conditions may also be used for other covered species. Currently no other target species have sufficient data on reference conditions. As the LCR MSCP progresses, reference conditions for other covered species will be found and compared to conditions at the Cibola NWR Unit 1 Conservation Area.

Table 5. Reference Variables

Canopy Height (M)	Average greater than 4.0 m
Canopy Closure (percent total)	Greater than 70%
Vertical Foliage Density	Density greatest between 1 and 4 m above ground; this may change as additional analysis is completed
Mean Soil Moisture (percent 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 (percent)	Greater than 33%

Thresholds

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

- Microclimate and vegetation reference conditions are achieved
- One or more covered species are utilizing Cibola NWR Unit 1 Conservation Area during non-breeding season
- One or more covered species are utilizing Cibola NWR Unit 1 Conservation Area during breeding season
- SWFL and/or YBCU are utilizing Cibola NWR Unit 1 Conservation Area during non-breeding season
- SWFL and/or YBCU are utilizing Cibola NWR Unit 1 Conservation Area during breeding season

In addition, if any monitoring activities documented that SWFL or YBCU were occupying the site before reference conditions were achieved, management and maintenance activities would be adjusted, as appropriate.

Trigger Points

Trigger points signal the need to alter current management activities to achieve Cibola NWR Unit 1 Conservation Area goals for the restoration site or change the goals for Cibola NWR Unit 1 Conservation Area. The trigger points are:

- Microclimate and vegetation reference conditions have not been achieved
- Previously suitable land cover type structures are no longer suitable for any of the targeted covered species
- Targeted covered species habitat needs exceeded water availability

Adaptive Management

Data will be evaluated annually to determine if the thresholds and/or trigger points were reached. If results indicate that the restoration activities meet or exceed thresholds, recommendations will be made in the annual report for future management activities at Cibola NWR Unit 1 Conservation Area as well as other restoration activities. If results indicate that restoration activities were deleterious to covered species or habitats, recommendations on prescriptions and modifications will be identified, and other methods tested.

Plant community and structural type are a component necessary for obtaining performance criteria for woody riparian cover types. Criteria used to define woody riparian land cover types are determined by the Anderson and Ohmart Vegetation Classification System (1984). Annual reports will summarize the performance criteria of newly created habitat acreage and the specific habitat type acreage that will be credited as restored habitat. Through the adaptive management process, any structural management determined from vegetation classification will be defined in the annual report.

5.0 Reports

Annual Report

An annual report will be prepared by Reclamation and made available each calendar year summarizing the following:

- General 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 and monitoring actions conducted over the past year
- A summary of monitoring and research activities over the past year
- Results and analyses of monitoring and research data
- An assessment of the effectiveness of each mitigation measures in minimizing and compensating for project impacts
- The total number of acres planted
- The total number of acreage that meets or exceeds the performance standards
- Any other applicable information

Through the adaptive management process, each year a Restoration Plan for each phase will be prepared. This plan will incorporate the monitoring results from the previous year. The Restoration Plan will include the planting design, planting techniques grading plan, and demonstration or research plan for the acreage that will be converted. 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

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