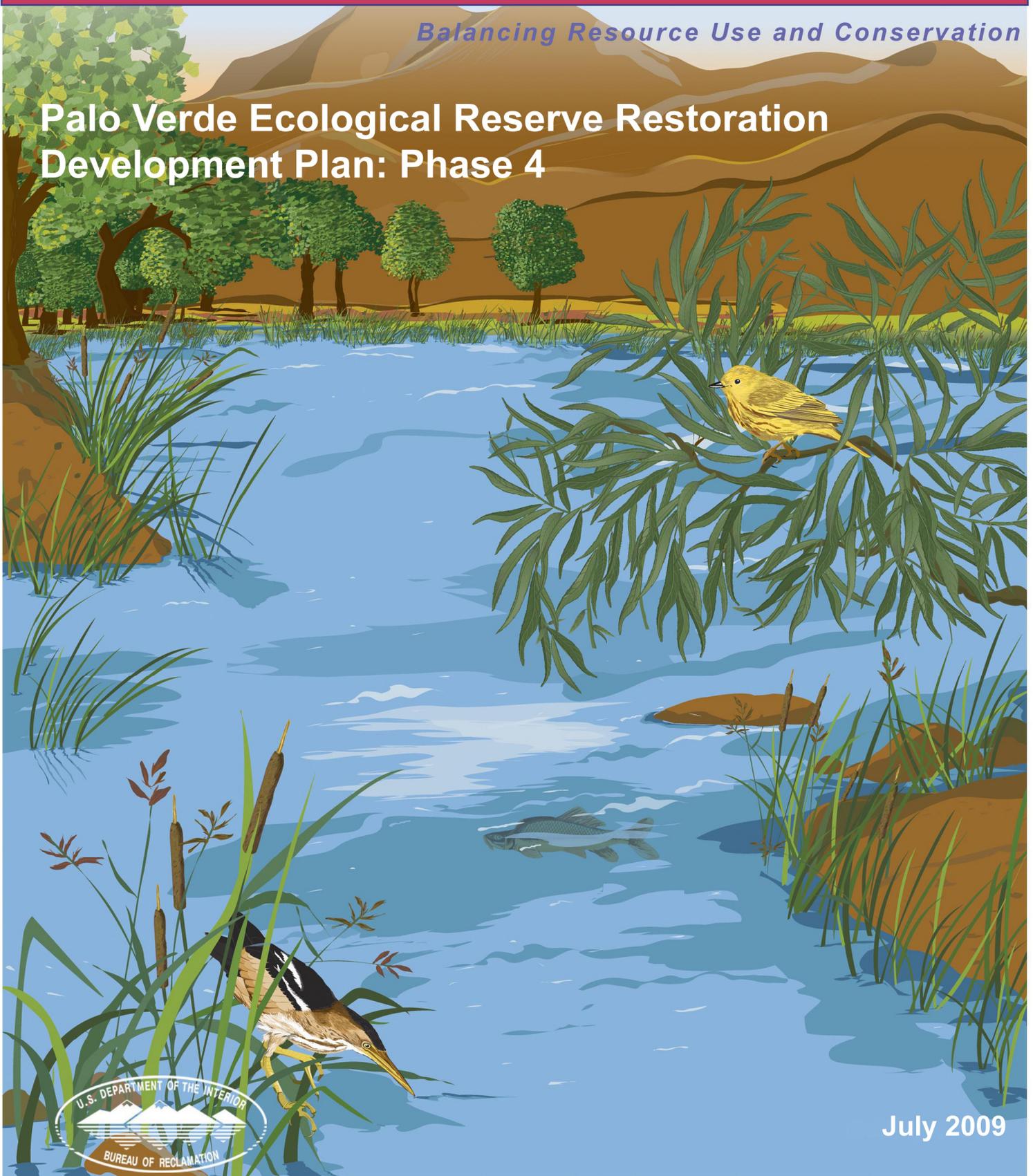




Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Palo Verde Ecological Reserve Restoration Development Plan: Phase 4



July 2009

Lower Colorado River Multi-Species Conservation Program

Steering Committee Members

Federal Participant Group

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Fish and Wildlife Service
National Park Service
Bureau of Land Management
Bureau of Indian Affairs
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Desert Wildlife Unlimited

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Lower Colorado River Multi-Species Conservation Program

Palo Verde Ecological Reserve Restoration Development Plan: Phase 4

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

July 2009

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Background

The Palo Verde Ecological Reserve (PVER) encompasses 1,352 acres of the historical floodplain of the Colorado River near Blythe, California. Formerly, the property was known as the Riverview Ranch and was owned by the Travis family. The ranch was acquired by the Trust for Public Lands in 2004 to offset degradation of wildlife habitat along the lower Colorado River. On September 3, 2004, the property was conveyed to the State of California. California has identified up to 1,300 acres of active agricultural lands on this property for habitat restoration under the Lower Colorado River Multi-Species Conservation Program (LCR MSCP), a 50-year multi-partner program administered by the Bureau of Reclamation (Reclamation).

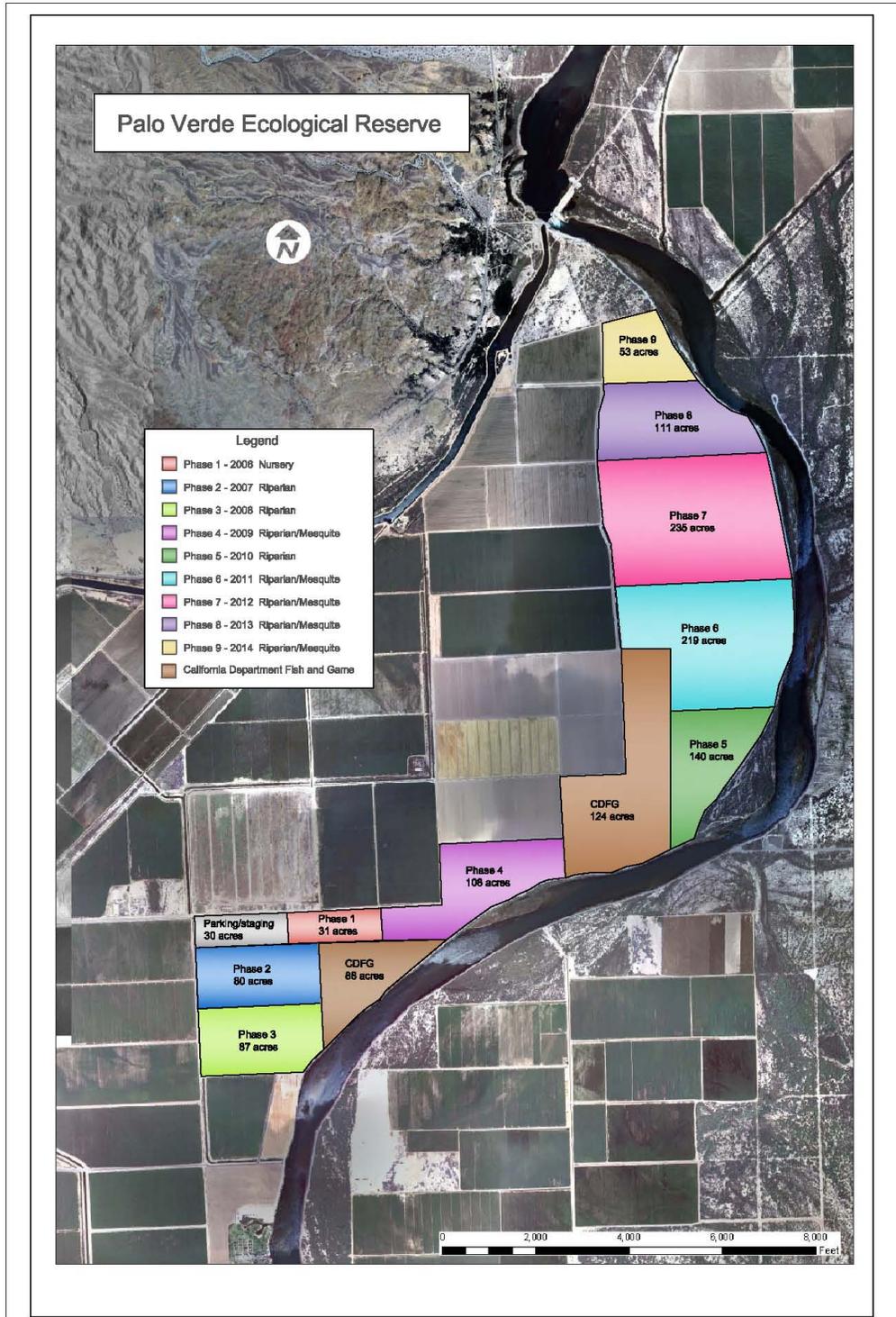
The California Department of Fish and Game (CDFG) and the LCR MSCP are jointly planning the conversion of portions of PVER from agricultural crops to a mix of native plant species. After planting is complete, the created habitats will be managed for species covered under the LCR MSCP throughout the 50-year life of the program.

The proposed development of the property is shown in Figure 1. Additional site information can be found on the LCR MSCP Web site (www.lcrmscp.gov) in the report, *Palo Verde Ecological Reserve Restoration Development Plan: Overview*. In Phase 1, during Fiscal Year 2006 (FY06), 30 acres of riparian nursery were planted. In Phase 2 (FY07), 80 acres of cottonwood-willow land cover type were planted. In Phase 3 (FY08), 80 more acres of cottonwood-willow land cover type were planted. Phase 4 will be planted in 2009. Additional information on the design, planting, and monitoring of Phases 1-3 can be found in the reports, *Palo Verde Ecological Reserve Restoration Development Plan: Phase 1*, *Palo Verde Ecological Reserve Restoration Development Plan: Phase 2*, and *Palo Verde Ecological Reserve Restoration Development Plan: Phase 3*; these reports are available on the LCR MSCP Web site.

1.0 Purpose

The objective of Phase 4 is to create, develop, and maintain approximately 108 acres of cottonwood-willow seral stages I, III, and IV. Each phase builds upon previously created habitat mosaics within the site, with the eventual goal of creating approximately 1,100 acres of riparian habitat. Phase 4 will be managed for the southwestern flycatcher (SWFL), and will benefit other species covered under the LCR MSCP (LCR MSCP 2004) that utilize cottonwood-willow land cover types.

Figure 1. Proposed Phasing Map



2.0 Design/Planting Plan

One hundred and eight acres of cottonwood-willow land cover type will be planted with the intent of creating habitat using both mass transplanting and hand planting techniques. Riparian species composition and density will mimic a natural riparian landscape. The design incorporates cottonwood, willow, and *Baccharis* species, and open areas of grasses, *Atriplex*, and mesquite (Table 1). The acreage will be divided into 16 checks (areas between borders) for water management. After the initial growing season, it is anticipated that irrigation schedules for vegetation species with higher water requirements, such as cottonwood and willow, will be kept on the same schedule, whereas vegetation with lower water requirements, such as mesquite and *Atriplex*, will be placed on a reduced schedule.

The entire acreage will be disked and prepared for planting using standard farming techniques. Borders will be disked and placed, separating the fields into 16 checks (Figure 3). Prior to tree planting, a cover crop of alfalfa/rye grass will be densely seeded in checks 1-12 and 14-15, and then planted with coyote willow, Goodding's willow, Fremont cottonwood, and *Baccharis*. Approximately 2,200 trees or shrubs per acre will be planted. Checks 15 and 16 will be planted with a cover crop of wheat and then planted with *Atriplex* and honey mesquite. Cover crops have proven helpful in previous restoration sites for reducing the amount of invasive vegetation and adding nitrogen.

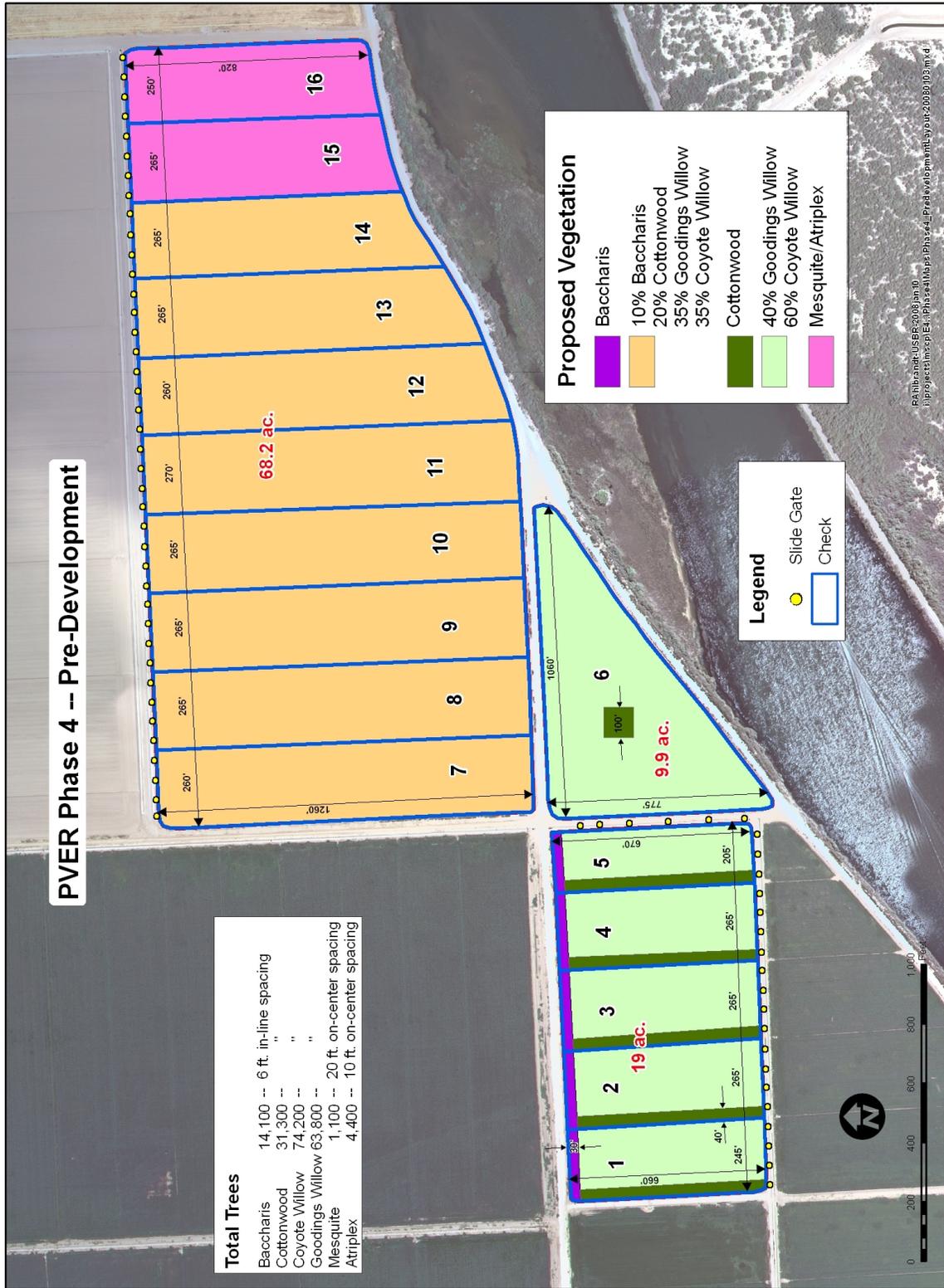
Checks 1-5 are 250 feet wide by 670 feet long. Check 6 is triangular and measures 755 feet by 1060 feet by 680 feet. The northern checks (7-16) in Phase 4 graduate from 1270 feet long by 265 feet wide to 860 feet long by 250 feet wide on the east end. Each check has four slide gates to control irrigation water to each field. When planted, Phase 4 will include approximately 100 acres of cottonwood-willow land cover type (Figure 2).

Figure 2. Typical Riparian Planting



Trees and shrubs with similar water requirements are planted between borders for control of irrigation. Typical riparian planting includes cottonwood, Goodding's willow, coyote willow, and *Baccharis*.

Figure 3. Phase 4 Riparian Habitat Design



Planting Plan

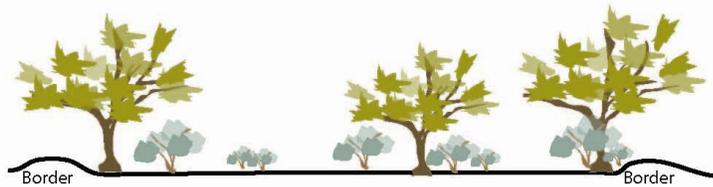
Check 1-5 will be planted with a random mix of 60% coyote willow and 40% Goodding's willow. Each check will have a 40 foot by 620 foot area planted with cottonwood on the western edge. A 30-foot strip of *Baccharis* will be planted on the north end of each check. All plantings of cottonwood, Goodding's willow, *Baccharis*, and coyote willow in Phase 4 will be mass-planted on 6-foot in-line spacing with 40-inch rows. This spacing allows for tree growth and required density of vegetation for habitat.

Check 6 will be planted with a random mix of 60% coyote willow and 40% Goodding's willow with a one-half acre area of cottonwood in the middle of the check.

Checks 7-14 will be planted with a random mix of 35% coyote willow, 35% Goodding's willow, 20% cottonwood, and 10% *Baccharis*.

Checks 15 and 16 will be planted in the spring with *Atriplex* and honey mesquite along with the other riparian trees and shrubs. The mesquite will be hand-planted employing an auger to dig the holes. Honey mesquite will be planted on 20-foot centers (Figure 4). Wild heliotrope (*Heliotropium curassavicum*) and sea purslane (*Sesuvium verrucosum*) seed will be broadcast throughout the two checks; both of these plants will provide nectar sources for MacNeill's sootywing.

Figure 4. Typical Mesquite/Atriplex Planting



Plants with similar water requirements, such as honey mesquite and *Atriplex*, are planted together in the same check for irrigation control. Typically, these areas will include honey mesquite, *Atriplex*, and grasses.

Weed Management

Invasive weeds such as morning glory, pigweed, and dodder will be managed by a Certified Pesticide Applicator or controlled by manual hand picking.

Table 1. Phase 4 Native Plant Species List

Scientific Name	Common Name
<i>Populus fremontii</i>	Cottonwood
<i>Salix exigua</i>	Coyote Willow
<i>Salix gooddingii</i>	Goodding's Willow
<i>Prosopis glandulosa v. torreyana</i>	Honey Mesquite
<i>Baccharis sarothroides</i>	Desertbroom
<i>Atriplex lentiformis</i>	Quailbush
<i>Baccharis salicifolia</i>	Mule-Fat

Grading/Contouring

The fields will be laser leveled to ensure efficient flood irrigation and drainage. No grading or contouring is expected on Phase 4. Borders will be reworked for efficient water control and delivery.

Irrigation

The anticipated irrigation schedule for the first calendar year is shown in Table 2 for cottonwood-willow and Table 3 for mesquite/*Atriplex*. Irrigation regimes may be modified due to climatic conditions such as rain, wind, and high temperatures, or to ensure vegetation moisture requirements are met.

Irrigation water will be delivered by two canals. Checks 1-5 will be irrigated with flows of water from south to north, check 6 from west to east, and checks 7-16 will be irrigated with flows from north to south.

Table 2. Phase 4 Irrigation Schedule—Cottonwood-Willow

Day/Week/Month	Frequency	Comments
Planting day	Immediately post planting	
Week 1-4: April, May	Once per week	Or as necessary to keep root ball moist
Week 5-9	Every 10 days	Or as necessary to keep root ball moist
Week 10-12	Every 10-14 days	
Week 12 through August	Every 14 days	
September	Twice	
October	Twice	
November	Once	
December	No water	

Table 3. Phase 4 Irrigation Schedule—Mesquite/*Atriplex*

Day/Week/Month	Frequency	Comments
Planting day	Immediately post planting	
Week 1-4: April, May	Once every 3 weeks	Or less if plants shows signs of over watering
June, July, August	Once per month	Or less if plants shows signs of over watering
September	No water	
October	Once	Immediately after planting mesquite
November	Once	
December	No water	

3.0 Monitoring

Conservation area monitoring plans are based on elements described in the HCP (LCR MSCP 2004) and in the Final Science Strategy (LCR MSCP 2007). Monitoring at PVER is structured into four main categories:

- Pre-development Monitoring
- Implementation Monitoring
- Habitat/Species Monitoring
- Vegetation Monitoring

Pre-development Monitoring

Pre-development monitoring of Phase 4 is designed to establish baseline data for evaluating post-development and to identify whether covered species inhabit PVER prior to implementation of Phase 4. Pre-development monitoring is divided into abiotic (soil features) and biotic (vegetation and covered species) factors.

- Abiotic Monitoring
 - Soil
- Biotic Monitoring
 - Vegetation

Past planting results at PVER do not indicate problems with soils so pre-development soil samples will not be taken in Phase 4.

Prior to planting, all fields at PVER are planted in agricultural crops; no riparian or marsh habitat is present except for possible small patches of *Atriplex* spp. When present, these areas are isolated and too small to support the MacNeill's sootywing skipper.

- Avian
 - Marshbirds will not be monitored, as marsh habitat is not present.
 - Pre-development monitoring for neo-tropical avian species will be undertaken at randomly selected agricultural fields.
 - Cavity nesting birds will not be monitored until the vegetation has matured and is able to support these species.
 - Species-specific southwestern willow flycatcher pre-development surveys will not be conducted, as the required structure of riparian habitat is not present.
 - Species-specific yellow-billed cuckoo pre-development surveys will not be conducted, as the required structure of riparian habitat is not present.
- Small Mammal
 - The agricultural fields do not provide habitat for the LCR MSCP covered species so pre-development monitoring for small mammals will not be conducted.
- Bat
 - Presence-absence surveys will be conducted utilizing passive AnaBat surveys at least 2 days per season (spring, summer, winter, and fall) prior to the implementation of Phase 4. All AnaBat 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 PVER 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 extensive *Atriplex* spp. is located at PVER. 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 Phase 4. Implementation monitoring quantifies changes immediately after treatments and evaluates whether actions were completed as prescribed.

After Phase 4 planting has been completed, the site will be continually assessed through the first growing to detect potential issues that may impact early development of the site. Qualitative

assessments will be made to evaluate planting results, weed infestations, irrigation problems, or plant/soil disease and pathogens. If potential implementation or management issues are observed by the Project Manager or other parties, these issues will be reported to the Monitoring Coordinator for further action.

Implementation monitoring will focus on the habitat (biotic) and conditions therein (abiotic):

- Abiotic Monitoring
 - Water

Water deliveries will be documented.
- Biotic Monitoring
 - At the onset of dormancy following the first growing season, tree growth and stand density will be determined. Sample plots will be randomly determined for Phase 4. The number of sample plots will be dependent on several factors including patch size, restoration technique, species, and variation within each stand. Within each sample plot, each tree will be recorded by species. Tree height, Diameter at Breast Height, and tree condition will be recorded. Random 1-meter square plots will be measured in each plot to estimate percent cover of herbaceous and shrub plant components.

Habitat/Species Monitoring

Habitat/Species monitoring is designed to determine whether each phase is providing the habitat requirements needed for the targeted covered species as defined by reference conditions, whether any covered species are utilizing the created habitat, and whether there are differences in wildlife use of the habitat depending on planting design, composition, and watering regimes. Monitoring protocols have been developed for documenting habitat characteristics and species response to created land cover types.

- Habitat Monitoring
 - Abiotic Monitoring
 - Soil
 - Soil samples will be analyzed, if conditions warrant, for moisture, salinity, textural classification, and nutrients, including nitrate, ortho-phosphate, and ammonia.
 - Once Phase 4 cottonwood-willow has developed into structural class IV, soil moisture measurements will be conducted to determine average moisture content, percent area of Phase 4 with saturated soils or standing water, and average duration for moist soil areas.

Water

- Deliveries to each phase will be recorded and analyzed to determine whether the scheduled timings were sufficient to grow the requisite habitat.

Microclimate

- HOBO H8 Pro data loggers will be placed randomly and strategically within Phase 4 to record temperature and relative humidity. The number of loggers placed in Phase 4 will be based on acreage of planted land cover type. Data loggers will be downloaded approximately every 4 months. If a SWFL or YBCU nest is located, a data logger will be placed within 6 feet of the nest. Data loggers will be placed within the habitat in 2010.

○ Biotic Monitoring

Vegetation

- After the second growing season, vegetation parameters for overstory trees, saplings, shrubs, understory, and herbaceous layers will be monitored using a standardized monitoring protocol based on a nested sample plot design.
- Plots will be selected using a stratified random sample based on the Ohmart and Anderson vegetation classification system, and the initial planting design. Plot locations will be chosen randomly within each strata. As the site matures and variability in structure changes, plots will be added as needed.
- Vegetation monitoring will occur on an annual basis from year 2 through year 6 and continue every other year between years 6-10. After year 10, Phase 4 will be sampled 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 be determined based on acreage involved, type of disturbance and restoration methods implemented. At a minimum, post-disturbance monitoring will occur for the first two growing seasons.

• Covered Species Monitoring

○ Marshbirds

Monitoring will not be conducted because no marshbird habitat is being created in Phase 4.

○ Neotropical Birds

A standardized intensive area search survey methodology will be utilized. Surveys will be conducted annually during the breeding season (May-July) beginning the first May after planting Phase 4.

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

- Cavity Nesting Birds

Elf owl presence/absence surveys will be conducted after 4 to 6 years, depending on when the land cover type, structure, and density indicates that the habitat contains the characteristics known to be preferred by the species. Any installed nest boxes will be monitored during the breeding season. If elf owls are detected during the breeding season, nest searches and mistnetting/banding may be conducted.

Gilded flickers and Gila woodpeckers will be surveyed as part of the system-wide neotropical bird monitoring effort. Once suitable nesting habitat (snags and cavities) develops on the site, more directed presence/absence surveys may be conducted for gilded flicker or Gila woodpeckers. If gilded flickers or Gila woodpeckers are detected during breeding season, nest searches and mistnetting/banding may be conducted.

- Southwestern Willow Flycatcher

Standardized presence-absence surveys (Sogge et al. 1997, USFWS 2000) will be conducted in the riparian habitat after three growing seasons (2011). A minimum of five surveys each year 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 and mistnetting may be conducted to document long-term use of site and to define habitat requirements.

- Yellow-billed Cuckoo

Standardized presence-absence surveys (Halterman and Johnson 2005) will be conducted after three growing seasons (2011). 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 and mistnetting may be conducted to document long-term use of the site and to define habitat requirements.

- Small Mammals

Presence-absence surveys will be conducted utilizing a standardized protocol. Trapping will be conducted overnight. Traps will be placed in parallel, linear transects approximately 500 feet long. A trap station will be located every 33 feet along each transect. Transects will be located 33 to 50 feet apart, with the actual distance apart determined by the size of the area being surveyed. Trapping will be conducted for a minimum of 500 trap nights.

- Bats

Presence-absence surveys will be conducted in Phase 4 utilizing passive AnaBat surveys at least 2 days per season (spring, summer, winter, and

fall) annually, beginning in 2009. When the vegetation is at sufficient height to hide the AnaBat system, data may be collected daily utilizing one stationary AnaBat or Sonabat system. The stationary system will be established for at least 10 years and may be relocated within Phase 3 or Phase 4 to maximize detections. After 10 years, data will be examined and future monitoring decisions for bat species will be made. All 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 created or altered.

- MacNeill's Sootywing Skipper

Pollard Walks (Pollard 1977) visual surveys will be conducted in the quailbush habitat between April and October to determine presence and absence. Surveys will be conducted when vegetation covers an area approximately 10 feet by 10 feet. A minimum of three surveys will be conducted.

Vegetation Classification

The Habitat Conservation Plan (LCR MSCP 2004) outlines the specific habitat acreage to be created and utilizes the Anderson and Ohmart (1976, 1984) classification system as the performance standard. Reclamation will evaluate compliance with performance standards by determining vegetation classification annually until the target goals have been met.

To map the vegetation at PVER, Reclamation will annually obtain aerial imagery of the site. Each phase will be mapped out utilizing the Anderson and Ohmart system (1976, 1984; Tables 4 and 5).

Table 4: Vegetation Communities, Criteria, and Types

Community Type	Criteria	Vegetation Structural Type
Cottonwood-willow (CW)	<i>P. fremontii</i> and/or <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> , and/or <i>A. polycarpa</i> constituting 90-100% of total vegetation in area	I, II, III, IV, V, VI

(From Anderson and Ohmart 1984)

Table 5. Vegetation Classification

Structure Type	Characteristics
I	Mature stand with distinctive overstory greater than 15 feet high, intermediate class from 2-15 feet tall, and understory from 2-0 feet tall
II	Stand with overstory (>15 feet) constituting greater than 50% of the trees with little or no intermediate class present
III	Stand with largest proportion of trees between 10 and 20 feet high with few trees above 20 feet or below 5 feet
IV	Few trees above 15 feet present; 50% of the vegetation is 5-15 feet tall with the other 50% between 0-2 feet high.
V	60-70% of the vegetation present is between 0-2 feet tall with the remainder in the 5-15 foot class
VI	75-100% of the vegetation is from 0-2 feet high.

(From Anderson and Ohmart 1984)

Monitoring Analysis and Evaluation

Once the data is collected each sampling period, and vegetation classification is analyzed, the results will be evaluated based on thresholds and trigger points identified by the reference conditions for each species.

Reference Conditions

PVER reference conditions will be based on data collected on the lower Colorado River for the southwestern willow flycatcher (McLeod et al. 2005; Koronkiewicz et al. 2004, 2006). These variables may change depending on future analysis of the long-term life history studies currently being conducted. Variables that may 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 (Table 6). These variables were chosen because there were statistically significant differences in occupied versus unoccupied habitat for the southwestern willow flycatcher life history study sites (McLeod et al. 2005, Koronkiewicz et al. 2004, 2006).

Reference conditions for yellow-billed cuckoos are in the process of being compiled by Reclamation from past and current studies. The species composition to be planted at PVER is suitable for cuckoos as well as other LCR MSCP-covered species. Variables that may be referenced include, but are not limited to, those listed above for southwestern willow flycatchers. Other LCR MSCP covered species, such as vermilion flycatcher, Arizona Bell's vireo, summer tanager, Gila woodpecker, gilded flicker, and yellow warbler are frequently observed during surveys for flycatchers and cuckoos. Reclamation will continue to expand the compilation of known reference conditions for these species for use in future development and management plans.

Table 6. Southwestern Willow Flycatcher Reference Variables

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%

Thresholds

Thresholds signal that conditions are appropriate and current management practices should be continued. Thresholds for Phase 4 include:

- Microclimate and vegetation reference conditions have been achieved.
- Phase 4 is being utilized by one or more covered species during the non-breeding season.
- Phase 4 is being utilized by one or more covered species during the breeding season.

If monitoring activities document occupancy of Phase 4 by SWFL, YBCU, or other targeted covered species before reference conditions are achieved, then management and maintenance activities would be adjusted, as appropriate.

Trigger Points

Trigger points signal the need to alter current management activities to achieve goals for the site or to re-evaluate stated goals for Phase 4. 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 yearly to determine whether the thresholds 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. If results indicate that restoration activities are deleterious to covered species or habitats, recommendations for modifications will be identified.

Performance criteria for woody riparian cover types are based on plant community and structural type classification (Anderson and Ohmart 1984). Annual reports will summarize each created habitat land cover type and its acreage. Monitoring results and data analysis will be followed by adaptive management recommendations, which will be implemented as appropriate.

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