Lower Colorado River Multi-Species Conservation Program
Steering Committee Members

Federal Participant Group
Bureau of Reclamation
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

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.

Other Interested Parties Participant Group
QuadState County Government Coalition
Desert Wildlife Unlimited
Lower Colorado River
Multi-Species Conservation Program

Imperial Ponds Conservation Area
Restoration Development Plan

Prepared by Nathan Lenon (Restoration Group), Chris Dodge (Wildlife Group), and Tom Burke (Fisheries 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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1.0 Introduction

The Lower Colorado River Multi Species Conservation Program (LCR MSCP) is a partnership of Federal and non-Federal stakeholders responding to the need to balance the use of lower Colorado River (LCR) water resources and the conservation of native species and their habitats in compliance with the Endangered Species Act. This is a long-term (50-year) 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 covered species are State and/or Federally listed special status species. The Bureau of Reclamation (Reclamation) is the entity responsible for implementing the LCR MSCP over the 50-year term of the program. A Steering Committee currently consisting of 56 entities has been formed, as described in the LCR MSCP Funding and Management Agreement, to provide input and oversight functions to support LCR MSCP implementation.

One facet of this program is to develop land cover for multiple species in integrated mosaic patterns over a large area. The Imperial Ponds Conservation Area is such a project. The project is located on Imperial National Wildlife Refuge (NWR) north of Yuma, Arizona. Originally known as the DU2 Ponds, the site was first constructed under a joint action by the U.S. Fish and Wildlife Service (USFWS), Ducks Unlimited, and Reclamation. The plan was to provide land cover for native fish, marsh, and riparian species. The site consisted of four interconnected ponds, surrounded by newly planted riparian vegetation.

Problems developed with both the fish and the wildlife habitat. The ponds were shallow and could not be effectively isolated from one another without compromising water quality management. Only one pond could be effectively managed for native fish, while the rest experienced diminished water quality. The soil around the ponds could not be adequately flushed of salts, which resulted in poor survival of planted cottonwoods and willows.

In December of 2004, an interdisciplinary group of subject matter experts developed recommendations for improvements that could be made to the site. In July of 2005, a conceptual design was completed. The total land cover to be created under this plan will be approximately 80 acres of backwaters for native fish, 34 acres of cottonwood-willow forest targeting western yellow-billed cuckoo, and 12 acres of managed marsh for California black rail. In addition, materials excavated from the ponds will be used to raise and reconstruct up to 70 acres of fields that will be managed for migratory waterfowl.

The objectives for this project are to: 1) develop the site into a mosaic of multiple land cover types required for the LCR MSCP targeted species, 2) provide opportunities for species and restoration research, and 3) to acquire information through adaptive management to improve effectiveness and efficiency in creating and managing habitat for
LCR MSCP target species. This document describes plans for the design, construction, planting, monitoring, and management of the proposed land cover at the Imperial Ponds Conservation Area.

1.1 Location/Description

The Imperial Ponds are located on Imperial NWR to the east of the Colorado River, near River Mile 59, just north of Martinez Lake. The project area is within a portion of the refuge known as the Intensive Management Area, which consists of fields and marshes that are managed for waterfowl, marsh birds, native fish, riparian obligate bird species, and other wildlife. The entire Intensive Management Area is restricted from public access (Figure 1).
1.2 Land Ownership

The Imperial NWR is owned and managed by the USFWS, and was established February 14, 1941 by Executive Order 8685 as a refuge and breeding ground for migratory birds and other wildlife. The refuge encompasses 25,765 acres along the LCR.

1.3 Water

The Imperial NWR has an entitlement, granted in the 1964 Supreme Court Decree in *Arizona v. California* (Decree) and by Secretarial reservation, in annual quantities reasonably necessary to fulfill the purposes of the refuge, not to exceed 28,000 acre-feet of water diverted from the main stream or 23,000 acre-feet of consumptive use of mainstream water, whichever is less, with a priority date of February 14, 1941. Imperial NWR has agreed to make Colorado River water available for maintaining adequate supply/quality in ponds, irrigation of cottonwood-willow land cover types, and marsh created under this plan.

1.4 Agreements

The *Land Use Agreement for the Imperial Ponds* recognizes Reclamation’s and USFWS’s commitment to work together and assure the land and water resources will be available for the 50-year term of the LCR MSCP. This agreement defines the roles and responsibilities of both agencies related to operations and maintenance of the land cover developed under this plan.

1.5 Land Manager

Reclamation and USFWS will be jointly responsible for ensuring the long-term operation and maintenance of the Imperial Ponds throughout the duration of the LCR MSCP. The details of operations and maintenance of the Imperial Ponds will be agreed upon between Reclamation and Imperial NWR to include water and fisheries management, 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.

1.6 Law Enforcement

Imperial NWR is responsible for law enforcement at Imperial Ponds. Reclamation will work with Imperial NWR to ensure these activities do not conflict with the LCR MSCP HCP.
1.7 Public Use

Currently, the intensive management area, within which the Imperial Ponds are located, is closed to the general public. Imperial NWR has the authority to regulate hunting and recreation uses pursuant to USFWS and other applicable statutes, regulations, and policies. In cooperation with Reclamation, Imperial NWR will coordinate its public use and related activities so they are consistent with and do not adversely affect restoration activities at Imperial Ponds Conservation Area.

1.8 Wildfire Management

As guided by commitments in the HCP (LCR MSCP 2004), wildfire management practices at Imperial Ponds are intended to:

- Reduce the risk of the loss of created land cover to wildfire by providing resources to suppress wildfires (e.g., contributing to and integrating with local, State, and Federal agency fire management plans)
- Implement land management and land cover creation measures to support the reestablishment of native vegetation that is lost to wildfire

Imperial Ponds wildfire management may include the rapid response of irrigating the affected field and the fields immediately adjacent to the wildfire. In addition, the roads around the created land cover will be maintained to provide access and some degree of additional protection from fires in the general vicinity.

1.9 Environmental Compliance

Compliance with the National Environmental Policy Act was completed by the Lower Colorado River National Wildlife Refuges Comprehensive Management Plan and Environmental Assessment, dated September 19, 1994. Additionally, programmatic coverage for the creation of backwater and marsh land cover under the LCR MSCP was provided by the Lower Colorado River Multi-Species Conservation Program Final Programmatic Environmental Impact Statement/Environmental Impact Report.

Coverage for the creation of backwater and marsh land cover types under the Endangered Species Act was completed by the Lower Colorado River Multi-Species Conservation Program Final Biological Assessment, and the Lower Colorado River Multi-Species Conservation Program Final Habitat Conservation Plan.

To comply with Section 106 of the National Historic Preservation Act, Reclamation archaeologists have undertaken two separate cultural resource inventories, which include all lands affected by this project. Concurrence with no properties/no effect from the Arizona State Historic Preservation Office has been received for all of the lands affected by this project. Compliance with sections 401 and 404 of the Clean Water Act was
completed under Nationwide Permit Number 27: Stream and Wetland Restoration Activities.

1.10 Herbicide/Fertilizer/Pesticide Application

To maintain healthy stands of native riparian and marsh species, as well as maintain open backwater areas for native fish, the application of herbicides, fertilizer, or pesticides may be required. All herbicide, fertilizer, or pesticide application would be applied by person(s) possessing a valid and current applicator’s license for the chemical being applied and in compliance with the rules, regulations, and laws set by the State of Arizona and Yuma County. Only herbicides, fertilizers, and/or pesticides that are approved for use on Imperial NWR will be applied.

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, a location map of herbicide and pesticide storage sites; use of Arizona and Yuma County approved herbicides, pesticides, and fertilizers; and records of herbicide, pesticide, or fertilizer use.

2.0 Restoration Development Plan

The following plan is separated by land cover type into three sections: backwater, cottonwood-willow, and marsh. The majority of the land cover development and associated costs have focused on the backwaters portion of the site. However, the creation of the ponds required excavation, transport, and placement of approximately 500,000 cubic yards of earthen materials. During the planning phases of the project, the need to place these materials nearby, combined with the Imperial NWR’s need to improve drainage in their adjacent farm fields, resulted in an opportunity to accomplish both goals, while creating an additional 34 acres of cottonwood-willow land cover for LCR MSCP covered species. Finally, a 12-acre marsh unit will be developed, targeting the conditions required to support California black rail, adjacent to marsh units which currently function, and are occupied by California black rail (Figure 2).

At the time of this publication, most of the backwater construction has been completed. The descriptions related to development of the land cover types are written in the tense appropriate to the current project stage; tasks already completed are referred to in the past tense, while tasks not yet completed are referred to in the future tense.
Figure 2. Proposed Land Cover Types
3.0 Backwater Development Plan

Six isolated backwater ponds, comprising 80 acres, have been designed and constructed to provide habitat for razorback sucker (*Xyrauchen texanus*), bonytail (*Gila elegans*), and other LCR MSCP covered species (Figure 3). While the primary design centered on fish species, specific features within the ponds will enhance habitat for marsh obligate species such as Yuma clapper rail (*Rallus longirostris yumanensis*), and western least bittern (*Ixobrychus exilis*). Additional details can be found in the conceptual design report (Reclamation 2005).

3.1 Pond Design and Construction

The design and construction maximized the backwater acreage within the boundaries created by the existing roads. The six ponds range in size from approximately 9 acres to 21 acres (Figure 3). Each pond has a variety of water depths with a diversity of contours. The target depth ratios were: 20% less than 5 ft, 60% between 5 and 10 ft, and 20% 10 to 12 ft (or greater) in depth. The deeper areas were intended to provide thermal refuge during the summer, and to reduce emergent plant growth. Steeper slopes were created along some of the pond edges to limit encroachment of emergent vegetation. Rip-rap, which has been shown to provide valuable escape cover for native fish, was used to stabilize the steep side-slopes.

**Water Delivery and Drainage**

There are no hydrological surface connections between the ponds. Each pond has a separate water inlet and water outlet. This will allow for individual water management, so that if a pond requires renovation for any reason, other ponds will not be affected.

Fresh water will be supplied from Martinez Lake by a new pump system. To minimize risks of introducing non-native fish, this system will utilize an integrated wedge-wire screen constructed of 0.02-inch mesh Z-alloy, equipped with a compressed-air back-flush. This configuration provides optimal balance of protection from non-native fish and biofouling, while still providing adequate inflow. Water will be conveyed through a 24-inch pipe to a manifold system from which each pond has its own inlet pipe. The total capacity for this system is 6,000 gallons per minute (gpm), or 1,000 gpm per pond.

**Inflow Placement**

Each pond is equipped with an independent, adjustable inflow pipe, which is metered to record instantaneous and total flows. Inflow pipes were set in relatively shallow water. The capacity exists, at a future date, to create pipe extensions to bring fresh water inflow to deep water portions of the ponds (this design feature was initially suggested to provide a lens of cooler, more oxygenated water to the bottom of the ponds during the hot summer period when fish normally become stressed). If placement of inflow pipe extensions becomes necessary, this modification will be addressed in the appropriate annual report.
Drainage Systems
An integrated drainage ditch was constructed along the east side of the ponds. Each pond contains a water control structure to regulate outflow to the ditch. This will allow for management of water levels during normal operations. Complete dewatering events, however, will require a portable pump system to drain each pond into the ditch.

The ditch has been designed and constructed to be oversized so as to accommodate both dewatering of the ponds and receive runoff from the farm field area. This configuration should prevent water from backing into one of the other ponds and possibly causing cross-contamination with non-native fishes, and reducing the chances for fertilizers and chemicals from the farm fields to access the ponds. The ditch terminates to the south of the site, into a wetland/marsh area.

Hummocks
The design incorporated hummocks, which are planting beds for emergent vegetation (Figure 4). These submerged mounds provide shallow zones for planting/colonization of California bulrush (Schoenoplectus californicus). The emergent vegetation will provide shade and cover for native fish. The hummock design provides the spatial pattern of emergent vegetation and open water to encourage a diverse invertebrate community, which in turn provides a food source for native fish. This pattern also creates favorable conditions for insect predators that prey on mosquito larvae.

The hummocks will also provide habitat for a variety of marsh species. The tops of the hummocks were set within 12 inches of the water surface for the benefit of marsh birds, including western least bittern (Ixobrychus exilis), Yuma clapper rail (Rallus longirostris yumanensis), and other species. The final number of hummocks varied slightly from the proposed design, due to site conditions. Following construction of the ponds, the hummocks may be planted with native bulrush stock found at Imperial NWR.

Spawning Gravel
Each pond includes areas with gentle topographical relief designed to provide suitable habitat for native fish to spawn. Selected shallow areas surrounding the hummocks and boat ramps was covered with gravel (½ inch to 3 inches diameter). These areas range from 2 to 6 feet deep, and are adjacent to deeper water areas. If placement of additional spawning gravel becomes necessary, this modification will be addressed in the appropriate annual report.

Fish Collection Kettles
The deepest pond areas are around the outflow/drain pipes. Kettles will serve to concentrate all of the fish (when the pond is drained) into a small, manageable area, which would facilitate fish salvaging efforts. The kettle itself is essentially just a small deep hole (approximately 10 ft by 10 ft); however, the size varies individually by pond. Drawing the water down to this level will also facilitate chemical treatments for non-native fish eradication by minimizing the volume of water to be treated. This would result in large cost savings during each treatment over the life of the site. It is possible that groundwater recharge may be too great to allow for dewatering to the level of the fish kettle areas.
**Boat Ramps/Staging Areas**
A boat ramp and staging area was constructed at each pond. These areas will allow for access for fisheries management and site maintenance. These ramps have been appropriately sloped and covered with gravel to inhibit growth of emergent vegetation and provide for safe access for site management. Road areas adjacent to these ramps have been widened to adequately provide staging areas for the setup and temporary storage of equipment including trucks, boats, pumps, etc. These ramps and staging areas are located near the outflow structures, fish collection kettles, and the drainage system.

**3.2 Backwater Management Overview**

**Fishery Management**
The primary purpose of the pond complex is to provide refugia for endangered bonytail and razorback sucker, and this will be the ultimate focus of the fishery management program over the life of the project (50 years). However, as provided for in the HCP, the ponds can also be used for 1) fish production to aid the Fish Augmentation Program, 2) species research actions to increase overall understanding of species life cycles and/or habitat needs, and 3) created habitat research to evaluate the various fish-friendly features incorporated into the project design.

During the initial 8 to 10 years, it is expected that one or more ponds will be actively involved in one or more of these activities. For example, the ponds will undergo extensive research to investigate and evaluate the ecological relationships between native fishes and the physical attributes added to the pond designs. This research will require fish of both species. Appropriately, one pond will be initially established for razorback sucker production and another pond initially set up to provide for bonytail production; each pond will develop a source of fish for experiments to take place in the other ponds.

Once adult fish are in any of the ponds, observations can be made as to use of gravel spawning-beds, hummocks, bankline riprap, and so forth. Each design feature, and almost any aspect of species research could be tested for at this facility. To guide this research, Reclamation will utilize the LCRMSCP Fishery Research Advisory Team (the team is being assembled in 2007 to develop and prioritize species research needs for razorback sucker and bonytail in conjunction with the Fish Augmentation Program). Upon completion of this propagation and research phase, a fishery management plan will be developed to guide the long-term operation of the ponds as native fish refugia.
Figure 3. Imperial Ponds Proposed Site Design
Figure 4. Excavated Materials Fill Areas and Quantity Calculations

TOTAL POND EXCAVATED MATERIAL FILL VOLUME: 309,842 YD³

THE ADDITIONAL EXCESS MATERIAL TO BE PLACED ON POND
ROAD SURFACES TO MAINTAIN AN APPROXIMATE 100 FT ROAD,
TOP ELEVATION AROUND AND BETWEEN PONDS,
INCLUDING APPROACHES.

PROPOSED RIPARIAN AND MOIST SOIL

UNITED FOR WATERFOWL (184.0 ACRES) AT 3 TO 4 FT AVERAGE
DEPHT:610,000 YD³.

EXCAVATED MATERIAL PLACEMENT AREAS
TO BE LEVELED, DIVIDED INTO CELLS AND
INTEGRATE AN AGRICULTURAL DRAINAGE
SYSTEM PER AGRICULTURAL ENGINEERING DESIGN.

TOTAL EXISTING POND WATER SURFACE ACREAGE: 28 ACRES
TOTAL PROPOSED POND WATER SURFACE ACREAGE: 80 ACRES
NET GAIN BACKWATER SURFACE AREA: 52 ACRES

PROPOSED POND SURFACE AREA: 22.56 ACRES
PROPOSED POND SURFACE AREA: 13.14 ACRES
PROPOSED POND SURFACE AREA: 15.73 ACRES
PROPOSED POND SURFACE AREA: 9.06 ACRES

PROPOSED MARSH HABITAT
(12.0 ACRES)

PROPOSED POND DESIGN VOLUME REPORT

SOUTH PROPOSED POND DESIGN VOLUME REPORT

ORIGINAL GROUND SURFACE

EXCAVATION

FILL

NET

ORIGINAL GROUND SURFACE

ESTIMATE DESIGN SURFACE MFL WATER ELEVATION

CUT

716,683 Cu Yd

70,882 Cu Yd

927,750 Cu Yd

+ Cut

- Fill

2,682 Cu Yd
Figure 6. Cross Sections for Ponds 1-3
Figure 7. Cross Sections for Ponds 4-6
Figure 8. Cross Sections-Conceptual View
**Water Management**

The water supply and drainage systems will be operated and managed to provide adequate habitat conditions for native fish. Operation of the ponds will be adjusted through the adaptive management process as information is developed through research and monitoring. The water supply system was designed to provide variable flows of up to 6,000 gpm. The system may only need to run periodically to alleviate low levels of dissolved oxygen, to reduce water temperatures, to flush salts, and/or to refill the ponds after renovation events. There also may be times when it is better not to operate the system. For example, the wedge-wire screens are expected to pass eggs and larvae of threadfin shad. Shad eggs and larvae are only available from mid-April to late May. Pond renovations and refills conducted during winter months would therefore avoid entraining shad eggs and larvae.

Drainage of the ponds will require installing a portable pump system, which discharges into the adjacent drainage ditch. It is possible that terrestrial and/or marsh habitat conditions for ESA-listed species may develop within the drainage area. Pond management and operation plans will take this into consideration, and will look to enhance habitats for, and minimize impacts to, both fish and wildlife populations.

### 3.3 Backwater Monitoring

The ultimate purpose for these ponds is to provide habitat for razorback sucker and bonytail. Pond designs include features thought to provide the necessary attributes for completing life history within these habitats. However, nowhere in the lower Colorado River floodplain have these designs been tested. Monitoring and research is therefore necessary to assess the relative value of these features to the fish.

Monitoring will be conducted in order to understand how well these habitats are functioning. Sampling will be conducted in a manner that will best answer the following questions:

- What is the basic water quality of the ponds?
- What food is available for the fish?
- Are the native fish surviving?
- What is their condition?
- Are the native fish growing?
- Are the native fish spawning?
- Is there evidence of recruitment?
- Are fish using the available cover and substrates?
- Are there non-native fish present?

These questions will be addressed annually for all ponds, regardless of fish research, fish production, or created habitat research actions underway.
Renovation
Pond renovations are an extreme fishery management action, and will be conducted on an as needed basis. To the extent possible, water level management will be the first tool applied when major fishery adjustments are needed (ponds have been designed so that they are isolated from each other and can be drained to some minimum elevation). Physical removal of fish following maximum, practical reduction of volume will be the next level of action. Should application of some type of chemical toxin still be necessary, it will be applied according to application procedures and by certified personnel.

Stocking
As described previously in section 3.2, it is planned to have two ponds initially stocked with one species each; one pond with razorback sucker and one pond with bonytail. Both species are available at Willow Beach NFH and have been reared for this purpose (under the HCP, fish stocked into the ponds are credited to the Fish Augmentation Program). These initial stockings will be accomplished as research actions and will provide information on pond production capability. A research study plan will be drafted to guide stockings of two additional ponds during the first year. Finally, two ponds will not receive fish initially, so that the water management system can be manipulated to extremes without jeopardizing any endangered fishes. These ponds will be evaluated for both water quality parameters and for vegetation growth and development. Future stockings during the first 8 to 10 years will be in conjunction with species and/or fish production research activities.

Fish Monitoring
The fish community will be monitored using standardized sampling techniques, unless otherwise specified in approved study plans for research. Sampling events will be conducted to target specific life stages and quantify habitat usage. The number of replicates for net-sets, trap-sets, transects, etc. will be established using appropriate scientific design to allow for statistical accuracy and long term database development.

In general, it is expected that spring sampling events will look for larval fish, utilizing larval light traps. Summer sampling would utilize passive monitoring techniques like snorkel surveys to observe and count fish. (This avoids handling the fish during periods when they are already stressed by extremes of temperature, oxygen, etc…) Fall sampling events will use more active techniques, such as trammel-netting and electro-fishing in order to collect population data. Other scientifically recognized sampling may be used at anytime of the year in conjunction with approved research study designs.

Fish will be measured for total length, weighed, sexed, scanned for PIT tag, and overall condition will be noted. Fish may be tagged or marked in someway to provide for growth analyses, to determine distribution among habitats, for population estimates, and/or to accomplish other research specific tasks.

Much of the above monitoring is specific to fish production, species research and created habitat research needs. As described in the Fishery Management overview in section 3.2, once the “research phase” is completed, a long-term fishery management plan will be
developed to guide operation of the ponds as native fish refugia. A specific monitoring program will be included in that plan to assure program goals are both attained and then maintained.

**Water Quality**

Water quality parameters will be monitored across the seasons to gather trends and establish minimum-maximum levels for such things as temperature, dissolved oxygen, hydrogen ion (pH), and salinity (or conductivity). These standard physical parameters will be measured in-situ along a vertical profile with electronic multiprobe equipment such as a hydrolab (these parameters may also be monitored as part of ongoing research actions, specific to study design descriptions).

During the summer, samples will be collected for major ion analysis, chlorophyll a, total dissolved solids (tss), and elemental and contaminant analysis (Hg, Se, As, ClO4). Vertical zooplankton tows will be collected in February and/or March, and in mid-summer, and phytoplankton and chlorophyll samples will be collected in April. Macro-invertebrates will be sampled using a variety of techniques (light traps, seines, dredge, etc.) in March, June, and October. Samples will be analyzed for abundance and diversity

**Submergent and Emergent Vegetation**

Both submergent and emergent vegetation are important to fishes. Both vegetation types provide cover, and are direct and indirect sources of food. A minimum of once per year plant abundance and composition will be estimated by percent aerial coverage. When visibility permits, north-south, east-west, and pond perimeter transects will be snorkeled to create a map showing extent of coverage by each plant species. The general health of the plants will be noted and the refuge will be notified of any invasive species. Plant material may also be used to monitor trace element or contaminant bioaccumulation.

### 4.0 Cottonwood-Willow Development Plan

#### 4.1 Field Design and Construction

Approximately 100 acres of fields adjacent to the ponds were filled approximately 3-4 feet with approximately 500,000 cubic yards of fill. Incorporating the excavated fill materials from the ponds into the fields provided both a nearby and economical fill location, while improving drainage in the fields. The depth-to-water in these fields, prior to filling was less than 1 foot, which prevented effective flushing of salts, resulting in low success rates for previous cottonwood-willow plantings. Raising field surfaces above the water table is expected to promote the flushing of salts, as well as provide adequate drainage for the cottonwood and willow root systems.
Approximately 34 acres of these fields will be developed into cottonwood-willow land cover targeting yellow-billed cuckoo and other covered species, with the remaining acreage to be managed by Imperial NWR for migratory waterfowl (Figure 4).

### Irrigation System

The existing irrigation pump is being upgraded to a larger system, capable of delivering up to 20 cfs, which is necessary to supply the expanded acreage. This pump will be constructed on the current platform, and will replace the current irrigation pump. To accommodate higher flow rates, the existing 18-inch water delivery pipe will be replaced with 24-inch pipe.

Prior to receiving fill materials, the existing concrete irrigation canals within the fill area was demolished and disposed of in a local landfill. A new concrete irrigation ditch system will be constructed to supply the cottonwood-willow and waterfowl fields, and will be reconnected to the additional fields supplied by the current system. This system will consist of approximately 4,000 linear feet of concrete-lined canal, capable of delivering up to 20 cfs to the fields.

Because raising the fields is expected to increase drainage, the new design breaks up the existing 13 fields into 17 smaller fields (five of which are for cottonwood-willow) to improve irrigation efficiency, and improve the managing of soil moisture. This will require the installation of 10 field turnout structures to manage irrigation to the fields. The layout of the fields is indicated in Figure 9.

### Grading and Contouring

The field areas were rough-graded during construction. Following construction of the irrigation system, a contractor will laser level the fields for more effective and efficient irrigation.

### Soil Management

One to two years of soil preparation is anticipated before planting cottonwood-willow land cover, based on preliminary soil analyses. During the first year, considerable flushing of salts is anticipated to reduce the salinity of the soils in the fields. This flushing will commence once construction of the irrigation system is completed, and will continue, as needed, until the following spring.

A salt-tolerant cover crop may be planted, in concert with this flushing, to assist in minimizing the establishment of saltcedar, increase soil nutrients, and minimize wind erosion. Potential cover crops may include watergrass, alfalfa, or other grasses, which may be disked in prior to planting cottonwood and willow.

### Planting Plan

#### Fields

The purpose of the planting plan for the fields is to create a heterogeneous canopy that will maximize structural diversity, to provide conditions that are believed to be suitable for yellow-billed cuckoo and other covered species.
To accomplish this objective, coyote willow (Salix exigua), which requires the most water of the target riparian species, will be planted in all of the fields, closest to the irrigation turnout structures. The bulk of the fields will be planted with a mixture of Goodding’s willow (Salix gooddingii) and Freemont cottonwood (Populus fremontii). Willows and cottonwoods will be interspersed randomly to maximize structural diversity.

**Drainage Ditch**

The primary purpose of the planting plan for the ditch is to take advantage of moist soil conditions, which will provide beneficial micro-climate conditions along the edge of the cottonwood-willow fields, to enhance the habitat conditions within the cottonwood-willow habitat. The secondary purpose is to prevent encroachment of common reeds, which would impose an additional maintenance burden. The addition of the planted drainage ditch will promote the integrated mosaic concept by providing a transition between backwater and riparian land cover types.

The bottom of the drainage ditch will be allowed to colonize naturally with a mixture of bullrush and cattails. The side slopes of the ditch may be planted with coyote willows.

**Planting Techniques**

It is anticipated that the fields will be planted through the use of conventional tree planters. It is anticipated that the ditch will be hand-planted through the use of coyote willow poles and other native vegetation types.

**4.2 Cottonwood-Willow Management Overview**

**Irrigation Schedule**

**Fields**

The anticipated irrigation schedule for the cottonwood-willow fields will be as follows: immediately after planting and then once a week for 4 weeks, followed by every 10-14 days through September, and then once a month only in October and November for the first growing season. Typically, no irrigation is conducted in the months of December, January, and February.

**Drainage Ditch**

The ditch will not be irrigated specifically. The depth to water in the ditch is likely to support the vegetation planted without irrigation. Supplemental water, which drains from the ponds, is likely to enhance this area by maintaining moist soils, mainly during the summer months.

**Vegetation Management**

Non-native species management in the fields may be addressed through a combination of disking, hand pulling, and/or herbicide treatments. Non-native species management in the drainage ditch may be addressed by the above methods with the possible addition of prescribed burning.
Figure 9. Planting Plan
Figure 10. Drainage Ditch Cross Section

Drainage Ditch Planting Section

November 2006

Coyote Willow with random Goodings Willow

-14'-

-approx. 20'-

-Three square bulrush-

Coyote Willow with random Goodings Willow

-4'-

2:1
elev. 192

2:1
elev. 187

Detail Area

Road

Road

Riparian area

Drainage ditch
Structural Management
Selective harvesting within the cottonwood-willow habitat may be used to mimic successional stages to create the targeted structurally diverse habitat. The intent is to mimic the seral stages preferred by the yellow-billed cuckoo and other covered species.

Woody Riparian Habitats
Created habitats would be managed to support cottonwood-willow types I and III for yellow-billed cuckoo and other covered species. 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 (see Figure 11). The following methods may be modified and new methods may be added depending on research and demonstration of techniques, through the adaptive management process:

- Planting appropriate riparian vegetation that matures to recommended heights
- Manually maintaining the two distinct heights or layers of vegetation
- Planting designed so canopy trees do not shade out mid- and bottom foliage, and open areas (areas planted with only ground covers) are integrated
- Selective removal of intermediate vegetation (pruning and thinning)
- Creating open areas with shrubs and grasses

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

4.3 Monitoring
Pre-monitoring began during the summer of 2006 as the project was implemented, and post-monitoring of the project will continue as the restored habitats grow and develop. The cottonwood-willow habitat will be monitored for growth and density of the vegetation, for the presence and relative abundance of avian species, for the presence and activity of bat species, and after vegetation growth and development has occurred, for the presence/absence of small mammals.

Purpose
The purpose of this monitoring effort is to collect data to monitor habitat development and suitability for LCR MSCP listed species.

Monitoring Design
The area planted with native cottonwoods and willows will be monitored for avian use, vegetation growth and development, small mammal presence or absence, and the use of the site by bat species. Point counts were conducted in June of 2006, as part of the effort to pre-monitor the site before the restoration was implemented.
Implementation Monitoring
The cottonwood-willow habitat will be monitored for survivorship and successional change. Vegetation will be monitored from approximately October to March of each year, following the growing season. Previous restoration projects have shown that most mortality of planted trees occurs in the first two years (Reclamation 2005). Randomly selected sample transects will be established throughout the entire cottonwood-willow habitat. The number of transects will be based on an initial analysis of the variation in size and species composition of vegetation at the site. Within each transect, every tree will be counted and recorded by species. For every 10th tree, DBH (Diameter at Breast Height, 1.37 meters), height, and tree condition will be recorded. Percent cover will also be measured at random 1-meter plots in each transect to measure herbaceous and shrub vegetation.

Photo points will be established at four points around the restored cottonwood-willow habitat. The points will be located just outside the restored habitat facing directly into the restored habitat. A point will be located in the center of each edge (north, south, east, and west). These photos will be taken at least for the first 10 years of the project.

Habitat/Species Monitoring
Every June, a rapid-assessment area search will be conducted at the created cottonwood-willow habitat. This area search will follow the same protocol as used for the system-wide avian monitoring program that Reclamation is using along the LCR to monitor bird species (Bart 2007). The entire created habitat, along with the existing nursery area, and the small strip of fringing cottonwood-willow habitat immediately adjacent to the west will be included in the search. All bird species detected either aurally or visually will be recorded on a standardized data sheet. The area search will be conducted for approximately 2 hours between sunrise and 9:00 a.m. Individuals will only be recorded once. Data from the site will be compared with data from system-wide avian surveys conducted along the Lower Colorado River (LCR), and with data from other habitat creation sites.

Surveys for southwestern willow flycatchers and yellow-billed cuckoos will begin three years after the cottonwood-willow habitat has been planted, or when one of the species is detected at the site. Surveys for both species will follow the established protocols used by Reclamation and its contractors on the LCR (Sogge et al. 1997, U.S. Fish and Wildlife Service 2000, Halterman et al. 2002). Surveys will not be conducted until Year 3 because the cottonwood-willow stand needs to develop to a height and density that provides habitat for willow flycatchers and yellow-billed cuckoos.

Two years after planting, the long-term habitat monitoring will begin. Vegetation monitoring will be conducted on fixed-radius plots (0.04 hectares), which will be located randomly within the cottonwood-willow habitat. At each plot, all trees measuring at least 1.37 m in height and 12.7 cm at DBH will be measured and recorded by species, total height, and DBH. Any tree at least 1.37 m in height and 8-12.7 cm DBH will be tallied by species, if the tree is between 5 and 11.3 meters of plot center. Within a 5-meter radius circle around plot center, all tree and shrub species will be measured and recorded. This
information will be recorded on an annual basis for years 3 through 6, and then every 2 years from years 7 through 10. After year 10, the site will be monitored every 5 years.

Three years after planting, a monitoring effort for small mammals will begin in the cottonwood-willow and marsh habitats. This effort will concentrate on finding the Yuma hispid cotton rat (*Sigmodon hispidus eremicus*), a listed species under the LCR MSCP. Surveys will begin in Year Three to allow an herbaceous understory to develop. An herbaceous understory is a habitat requirement for many species of small mammals, especially the Yuma hispid cotton rat. All trapping will occur at night. Surveys will be conducted for a minimum of 500 trap nights per year. A trap night is counted for each trap set out during a night of trapping. Any small mammals captured will be identified to species, and the location of capture will be recorded. Trap locations will be set on a grid, with a randomized starting location. These surveys will be for presence/absence initially, and if Yuma hispid cotton rats are captured, a more intensive trapping regime may be conducted to determine population density.

Quarterly acoustic surveys will be conducted to monitor bat use of created land cover using Anabat detectors coupled to Zero Crossing Analysis Interface Modules (ZCAIM). Data will be recorded directly on compact flash cards built into the ZCAIM. Acoustic sampling will be conducted for two complete sample nights (dusk to dawn) per site, at two locations in each created land cover type (cottonwood-willow, marsh, backwater). Anabat locations are already established on Imperial NWR at the cottonwood nursery. Monitoring will continue at this site, quarterly.

Anabat bat detectors will be placed in waterproof containers and camouflaged. All of the sampling locations within the site will be sampled simultaneously to avoid and minimize variations in bat activity associated with weather, moon phase, insect abundance, relative humidity, or other factors.

**Monitoring Analysis and Evaluation**

Vegetation growth and development will be tracked within the cottonwood-willow land cover. The initial establishment of a cottonwood-willow stand at the site will be monitored for percent of survivorship and growth for the first 2 years. This will be used to determine if the initial planting effort was successful or if high mortality occurs among planted trees. The vegetation plot data collected after Year 2 will be used to monitor stand parameters such as vegetation volume, stand density, average tree height, and DBH. This information is important in determining the habitat suitability for species such as the southwestern willow flycatcher, yellow-billed cuckoo, and Yuma hispid cotton rat.

Area searches will be used to monitor changes in avian species diversity and richness over time and as the stand grows and matures. Indices will be created for community similarity (Renkonen) and species diversity (Shannon-Weaver Index) (Nur et al., 1999), and these values will be compared between years and over the first 5-year period. Lower Colorado River MSCP covered species will be analyzed for any significant changes in overall detections.
Mammal trapping will begin in Year 3 in both the cottonwood-willow habitat and in the marsh vegetation fringing the ponds. Initially, presence/absence surveys will be conducted and if Yuma hispid cotton rats are captured then further trapping may be conducted to determine population densities.

For data collected from Anabat surveys, data summaries will be calculated for each sample location for species richness (number of species at each sample location), relative abundance as measured by the number of bat passes of each species per site, and bat activity as measured by the number of bat passes per hour.

**Adaptive Management**

After sufficient post-monitoring data have been collected, an analysis of trends and changes in habitat composition, avian use of the area, and small mammal presence will be made. These data will be used to determine if management techniques (i.e. irrigation schedules, planting schemes) are creating viable habitat according to the HCP guidelines, and current scientific understanding. During the first 5 years of the project, some research may be conducted into the habitat requirements of several LCR MSCP listed species such as the Yuma hispid cotton rat and yellow-billed cuckoo. Any new information collected from these efforts will be incorporated into the management of the site.

A yearly analysis will be made at the site of the habitat growth and LCR MSCP covered species use. This will be used to determine if any serious problems arise in the development of the site for use as habitat for covered species. A yearly analysis will not provide accurate information on trends or subtle shifts in site suitability, but can determine if some parts of the site are failing to grow or develop. This will allow a yearly change in management, if immediate problems in the development of the site occur.

### 5.0 Marsh Development Plan

A bulrush-dominated marsh unit of approximately 12 acres is planned for Field 18, targeting the conditions which are believed to promote suitable habitat conditions for California black rail. Field 18 is located adjacent to bulrush-dominated marsh units, Fields 16 and 17, which are both occupied by California black rail (Figure 15). The conversion and subsequent management of Field 18 as a bulrush-dominated marsh unit is intended to duplicate the habitat conditions found in the adjacent marsh units.

The conceptual design for the Field 18 marsh unit was modeled after the habitat conditions and irrigation management of the Field 16 marsh unit through collaboration with subject matter experts from Reclamation, Imperial NWR, U.S. Geological Survey, and Arizona Game and Fish Department. Field 16 was selected as the basis for the conceptual design because past surveys have reported the highest occurance of California black rail there, amongst the marsh units at Imperial NWR.
Field 18 is currently unmanaged, and is primarily composed of salt cedar, common reed, and a small number of previously planted native trees (primarily mesquite). Additionally, small patches of three-squared bulrush are present in areas where the water table is nearest the surface.

The water table is typically 12 to 18 inches below ground. Water is supplied by a concrete irrigation ditch to the west, which also serves the adjacent marsh units. The elevation of the field is highest near the water supply, and slopes down approximately 1 foot, from west to east, across the length of the field (figures 11-13).
Figure 11. Existing Conditions, Fields 16-19; October 17, 2006
Figure 12. Field 18 Existing Conditions; View from West; June 7, 2006

Figure 13. Field 18 Existing Conditions; View from East; June 7, 2006
5.1 Marsh Design and Construction

The objectives behind the design and future management of the Field 18 marsh unit are intended to closely replicate conditions which are believed to promote suitable California Black Rail habitat conditions in Fields 16 and 17, and to further our understanding of how to best develop suitable habitat conditions for California black rail through ongoing adaptive management.

The HCP specifies water depths for California black rail to target no more than 1 inch. Recent monitoring at Field 16 indicates an approximate variation in surface water levels at Field 16 (and adjacent managed California black rail field) which range from dry/moist ground to approximately 9 inches over the course of each irrigation cycle (Reclamation unpublished data).

The new design for Field 18 maintains a graded relief of 1 foot over the length of the field, while maximizing the transitional area between standing water and dry ground. The primary purpose of the slope is to establish a depth gradient, such that under the current irrigation cycles, some portion of the field should always maintain shallow (up to 1-inch) water depths. The secondary purpose of the slope is to facilitate water movement across the field. The specific layout of the elevation contours was selected to balance the needs to maintain areas of shallow standing water, with a design which would promote efficient water movement across and throughout the field. See Figure 14.

Development
Field 18 will first be cleared and contoured according to the conceptual design (Figure 16). Vegetation clearing may be conducted using a combination of any of the following methods; mechanical clearing, herbicide, and/or prescribed burning. Selected native trees may be left in-place to serve as snags for wildlife. No additional improvements are planned for the irrigation system at this time.

Planting Plan
Following clearing and leveling, flood irrigation will commence at Field 18. Vegetation will initially be allowed to colonize naturally, from wetland plants occurring both onsite and adjacent to Field 18. Supplemental plantings may be conducted with native three-squared bulrush stock (and potentially other native wetland plants) collected on Imperial NWR, and nearby locations. The field will be irrigated, according to the schedule described below. The vegetation will be allowed to fill in, which is anticipated to take between 1 and 1½ years.
Figure 14. Marsh (Field 18) Contouring Plan
5.2 Management Overview

Water Management
To develop water management practices for Field 18 (and other bulrush-dominated marsh units), Reclamation and Imperial NWR are recording 1 year of intensive water management data at Field 16, which will be used to guide the initial management of Field 18. This information includes irrigation frequencies and duration, as well as the subsequent water levels before, during, and after irrigation, throughout the field at six locations, over a 1-year period immediately preceding the proposed marsh establishment.

Currently, all managed California black rail fields on Imperial NWR are irrigated three times per week. Initially, Field 18 will be irrigated three times per week, at the same rate as Fields 16 and 17. These irrigation practices may be adjusted, based on the results of the water management data. Changes in water management will be reflected in the adaptive management plan.

Vegetation Management
The USGS and Imperial NWR are currently developing vegetation practices to maintain managed marsh units, primarily for Yuma clapper rail and California black rail, which emphasizes periodic prescribed burning. This method has been demonstrated to be highly effective and economical in maintaining early seral stages of marsh vegetation, which in turn provide suitable habitat conditions for target species, such as California black rail. When finalized, these recommendations will be incorporated into the adaptive management plan for managing the vegetation in Field 18.

Methods to control invasive vegetation species may include changes in water management, application of herbicides, mechanical clearing, prescribed burning, hand pulling, and/or additional plantings. Invasive species control will be discussed in the adaptive management plan.

5.3 Monitoring

Introduction
A plan has been developed for the monitoring of the Imperial Ponds Restoration project. Pre-monitoring began during the summer of 2006 when the project was implemented, and post-monitoring of the project will continue as the restored habitats develop. The marsh habitat created by the restoration of the Imperial Ponds and Field 18 will be monitored for marsh bird presence/absence, and for changes in vegetation type and composition.

Purpose
The purpose of this monitoring effort is to collect data to monitor habitat development and suitability for LCR MSCP listed species, including Yuma clapper rail (Rallus...
longirostris), California black rail (*Laterallus jamaicensis*), and western least bittern (*Ixobruchus exilis hesperis*).

**Monitoring Design**

The marsh habitat components of this project encompass areas within the ponds as well as Field 18. These marsh habitats will be monitored for vegetation growth and development, marsh bird use, bat activity, and small mammal presence or absence. In addition, water levels in Field 18 will be monitored.

**Implementation Monitoring**

Photo points will be established at each pond or marsh site. The UTM coordinates of these points will be recorded. The compass direction the photo is taken at and the height from which it is taken will be recorded. The compass direction of the photo will be determined by the direction that allows the best complete view of the pond. Every year, at the end of the growing season, the photo will be taken from the same location as it was originally taken. These photos will be taken for at least the first 10 years of the project.

All created fields will be monitored for elevation, depth of water, and depth to water table. Created ponds will be monitored for water level. Before construction, elevation for all fields and ponds was measured, and after construction, fields and ponds will be measured for elevation. Piezometers equipped with pressure transducers are being used to measure water elevations in Field 16. Piezometers will also be used to measure water elevations in Field 18. This information along with elevation measurements will be used to create conditions in Field 18 that mimic existing conditions in Field 16. These measures will be taken to create and maintain proper habitat for California black rails in Field 18. Irrigation schedules will be maintained, detailing amounts of water released, and dates and times of release.

**Habitat/Species Monitoring**

At each pond and at Field 18, at least one survey point will be established for marsh bird surveys. The UTM coordinates will be recorded for each survey point. From each point, a marsh bird call/playback survey will be conducted twice per year, once in April and once in May. The survey protocol used will be the Standardized North American Marsh Bird Monitoring Protocols (Conway 2006), which is the same protocol the LCR MSCP uses for all marsh bird surveys. At each survey point, a 10-minute recording will be played. The recording consists of 5 minutes of silence, followed by 30 seconds of recorded calls and 30 seconds of silence, for four different marsh bird species, including black rail, Yuma clapper rail, western least bittern, and Virginia rail (*Rallus limicola*). During the entire 10-minute period, any marsh birds aurally or visually detected will be recorded on a standardized data sheet. The periods of silence are designed to facilitate the aural detection of birds before and after the playing of calls. Surveys will begin approximately ½ hour before sunrise and will end no later than 10 a.m. This data will be used over a period of several years to create indices of density and abundance, and to estimate population trends.

Quarterly acoustic surveys will be conducted to monitor bat use of created land cover using Anabat detectors coupled to Zero Crossing Analysis Interface Modules (ZCAIM).
Data will be recorded directly on compact flash cards built into the ZCAIM. Acoustic sampling will be conducted for two complete sample nights (dusk to dawn) per site, at two locations in each created land cover type (cottonwood-willow, marsh, backwater). Anabat locations are already established on Imperial NWR at Pond 1, Pond 5, Field 14 (a managed marsh unit), and McAllister Lake. Monitoring will continue at these sites quarterly.

Anabat bat detectors will be placed in waterproof containers and camouflaged. All of the sampling locations within the site will be sampled simultaneously to avoid and minimize variations in bat activity associated with weather, moon phase, insect abundance, relative humidity, or other factors.

Vegetation Classification
At each survey point, a vegetation survey will be conducted once per year, during the same time as the marsh bird surveys are conducted (April-May). The general methodology will follow what is outlined under habitat measurements in the North American Marsh Bird Survey Protocol (Conway 2006). The protocol was slightly modified to consider each pond and the surrounding vegetation as one point, rather than using a fixed radius around the location of each actual survey point. This was done because each pond is a separate, disjunct area of marsh habitat and a fixed radius plot around the point count would include areas of bare ground that do not need to be surveyed. Vegetation will be quantified by the percentage of major plant species present at each pond or marsh, through a careful visual inspection conducted by walking the perimeter of each pond or area. The data will be used to track any changes in the proportion of vegetation types present at each survey site from year to year. Aerial photographs of the site will also be taken on a yearly basis and these will similarly be used to quantify the proportion of vegetation types.

Three years after planting, a monitoring effort for small mammals will begin in the cottonwood-willow and marsh habitats. This effort will concentrate on finding the Yuma hispid cotton rat (Sigmodon hispidus eremicus), a covered species under the LCR MSCP. Surveys will begin in Year Three to allow an herbaceous understory to develop. An herbaceous understory is a habitat requirement for many species of small mammals, especially the Yuma hispid cotton rat. All trapping will occur at night. Surveys will be conducted for a minimum of 500 trap nights per year. A trap night is counted for each trap set out during a night of trapping. Any small mammals captured will be identified to species and the location of capture recorded. Trap locations will be set on a grid, with a randomized starting location. These surveys will be for presence/absence initially, and if Yuma hispid cotton rats are captured, a more intensive trapping regime may be conducted to determine population density.

Monitoring Analysis and Evaluation
Analysis of the marsh bird surveys will consist of an annual summation of birds detected, by species, at each pond, and for all areas combined. Percent vegetation cover, per cover type, for each pond, will be summarized in the annual report. Aerial photos will be used to classify the vegetation at each pond and field according to the Anderson-Ohmart
vegetation classification system for the LCR. Water levels will be tracked and recorded throughout the year in Field 18.

After sufficient post-monitoring data have been collected, the data will be summarized and an analysis of population trend will be made. Number of birds detected will be tracked and any statistically significant increases will be noted for each pond and for Field 18. This data will be compared to any changes recorded in water levels at the restored ponds or Field 18. This data will also be compared with data collected from Field 16, which currently has a California black rail population. If Yuma clapper rail or California black rail are detected at any of the ponds or fields, their population numbers over the monitoring period will be tracked and correlated to any change in vegetation that may occur at the site.

Mammal trapping will begin in Year 3 in both the cottonwood-willow habitat and in the marsh vegetation fringing the ponds. Initially, presence/absence surveys will be conducted and if Yuma hispid cotton rats are captured, then further trapping may be conducted to determine population densities.

For data collected from Anabat surveys, data summaries will be calculated for each sample location for species richness (number of species at each sample location), relative abundance as measured by the number of bat passes of each species per site, and bat activity as measured by the number of bat passes per hour.

**Adaptive Management**

After sufficient post-monitoring data have been collected, an analysis of trends and changes in habitat composition, avian use of the area, and small mammal presence will be made. These data will be used to determine whether management techniques (i.e. irrigation schedules, planting schemes) are creating habitat according to the HCP guidelines and current scientific knowledge. During the first 5 years of the project, some research will be conducted into the needs of several LCR MSCP covered species such as the Yuma hispid cotton rat, yellow-billed cuckoo, and the California black rail. Any new information collected from these efforts will be incorporated into the management of the site.

A yearly analysis will be made at the site of the habitat growth and small mammal and avian use. This will be used to determine whether any serious problems arise in the development of the site for use as habitat for LCR MSCP covered species. A yearly analysis will not provide accurate information on trends or subtle shifts in site suitability, but can determine whether some parts of the site are failing to grow or develop. This will allow a yearly change in management, if immediate problems in the development of the site occur. Problems that may trigger a change in management include lack of development or growth of marsh vegetation, and unsuitable water levels that would not promote the establishment of proper marsh habitat.
6.0 Reports

6.1 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 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 conducted over the past year
- A summary of monitoring and research activities conducted over the past year
- An assessment of the effectiveness of each mitigation measure in minimizing and compensating for project impacts
- The total number of acres converted to habitat for LCR MSCP covered species
- The total number of acreage that meets or exceeds the performance standards
- Any other applicable information

Through the adaptive management process, annual reports will be prepared. This plan will incorporate the monitoring results from the previous year. The 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.

6.2 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
- All available information regarding project-related incidental take of covered species
- Information regarding other project impacts on the covered species in the permit
- An assessment of effectiveness of the permit’s conditions of approval for minimizing and compensating for project impacts
- Recommendations on how mitigation measures might be changed to more effectively minimize and mitigate the impacts of future projects on the species
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