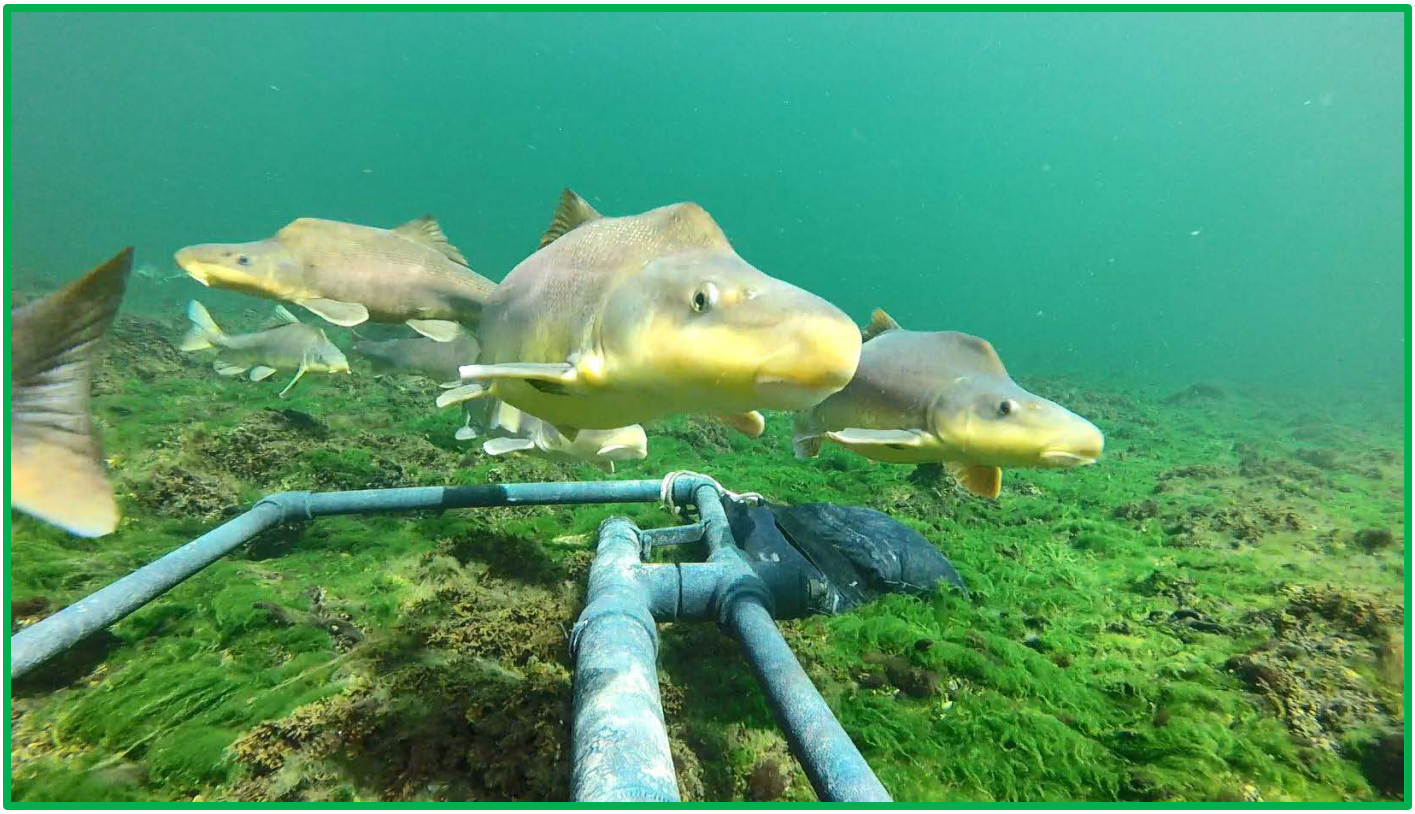
# Lower Colorado River Multi-Species Conservation Program

*Balancing Resource Use and Conservation*

## Final Implementation Report, Fiscal Year 2020 Work Plan and Budget, Fiscal Year 2018 Accomplishment Report



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2019

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

### Federal Participant Group

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

### Arizona Participant Group

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

### Other Interested Parties Participant Group

QuadState Local Governments Authority
Desert Wildlife Unlimited

### California Participant Group

California Department of Fish and Wildlife
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
Chemehuevi Indian Tribe

### Conservation Participant Group

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

# Lower Colorado River Multi-Species Conservation Program

## Final Implementation Report, Fiscal Year 2020 Work Plan and Budget, Fiscal Year 2018 Accomplishment Report

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

**June 2019**

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AJ | Arizona Juvenile backwater |
| AKN | Avian Knowledge Network |
| ALS | aerial laser scanning |
| AMM | Avoidance and Minimization Measure |
| AMP | Adaptive Management Program |
| ARCC | Aquatic Research Conservation Center (Arizona Game and Fish Department) |
| AZGFD | Arizona Game and Fish Department |
| BBCA | Big Bend Conservation Area |
| Bill Williams River NWR | Bill Williams River National Wildlife Refuge |
| BLCA | Beal Lake Conservation Area |
| BLM | Bureau of Land Management |
| BO | Biological and Conference Opinion |
| CDFW | California Department of Fish and Wildlife |
| CEM | conceptual ecological model |
| Center | Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico |
| CESA | California Endangered Species Act |
| cfs | cubic foot/feet per second |
| CI | confidence interval |
| Cibola NWR Unit #1 | Cibola National Wildlife Refuge Unit #1 Conservation Area |
| CMM | Conservation Area Management Measure |
| Commission | California State Lands Commission |
| CRAB | Colorado River Aquatic Biologists |
| CRTR | Colorado River Terrestrial and Riparian |
| CRWUA | Colorado River Water Users Association |
| CVCA | Cibola Valley Conservation Area |
| CVIDD | Cibola Valley Irrigation and Drainage District |
| DNA | deoxyribonucleic acid |
| eDNA | environmental DNA |
| EPA | Environmental Protection Agency |
| ESA | Endangered Species Act |
| FMA | Funding and Management Agreement |
| FMC | Freeport Minerals Corporation |
| FY | fiscal year |
| Glen Canyon Dam AMP | Glen Canyon Dam Adaptive Management Program |
| GNSS | global navigation satellite system |

| | |
|---|---|
| HCP | Habitat Conservation Plan |
| HMF | Habitat Maintenance Fund |
| HMM | Hart Mine Marsh |
| | |
| Imperial NWR | Imperial National Wildlife Refuge |
| IPCA | Imperial Ponds Conservation Area |
| ISC | interim surplus criteria |
| | |
| kHz | kilohertz |
| | |
| LCR | lower Colorado River |
| LCR MSCP | Lower Colorado River Multi-Species Conservation Program |
| LCDO | Lower Colorado Dams Office |
| LDCA | Laguna Division Conservation Area |
| lidar | light detection and ranging |
| | |
| m | meter(s) |
| MAPS | Monitoring Avian Productivity and Survivorship |
| MEFF | mobile electronic field form |
| Metropolitan | The Metropolitan Water District of Southern California |
| mg/L | milligram(s) per liter |
| Middle Bill Williams River NWR | Middle Bill Williams River National Wildlife Refuge |
| mm | millimeter(s) |
| Mora NFH | Mora National Fish Hatchery |
| MOU | Memorandum of Understanding |
| MRM | Monitoring and Research Measure |
| mtDNA | mitochondrial deoxyribonucleic acid |
| MVCA | Mohave Valley Conservation Area |
| | |
| N/A | not applicable |
| NDOW | Nevada Department of Wildlife |
| NPS | National Park Service |
| | |
| pH | acidity or alkalinity of a solution |
| PIT | passive integrated transponder |
| ppm | parts per million |
| PVER | Palo Verde Ecological Reserve |
| PVER-South | Palo Verde Ecological Reserve-South |
| PVID | Palo Verde Irrigation District |
| PWCA | Pretty Water Conservation Area |
| | |
| Reclamation | Bureau of Reclamation |
| RISE | Reclamation Information Sharing Environment |
| RMF | Remedial Measures Fund |

| | |
|---|---|
| SDCWA | San Diego County Water Authority |
| Section 26 | Section 26 Conservation Area |
| SNP | single nucleotide polymorphism (aka “snip”) |
| SNWA | Southern Nevada Water Authority |
| sootywing | MacNeill’s sootywing skipper (*Pholisora gracielae* = *Hesperopsis gracielae* [MacNeill]) |
| TL | total length |
| TLS | terrestrial laser scanning |
| UAS | unmanned aerial system |
| USFWS | U.S. Fish and Wildlife Service |
| WET | Water Education for Teachers |
| Willow Beach NFH | Willow Beach National Fish Hatchery |
| YCNHAC | Yuma Crossing National Heritage Area Corporation |
| YEW | Yuma East Wetlands |
| YMCA | Yuma Meadows Conservation Area |
| 1997 BO | 1997 Biological and Conference Opinion |

## Symbols

| | |
|---|---|
| > | greater than |
| ≥ | greater than or equal to |
| < | less than |
| ≤ | less than or equal to |
| μS/cm | microsiemens per centimeter |
| % | percent |
| + | plus (at least) |

# LCR MSCP: 27 COVERED AND 5 EVALUATION SPECIES

| Conservation Measure | Common Name | Scientific Name |
|---|---|---|
| BEVI | Arizona Bell's vireo | *Vireo bellii arizonae* |
| BLRA | California black rail | *Laterallus jamaicensis coturniculus* |
| BONY | Bonytail | *Gila elegans* |
| CLNB* | California leaf-nosed bat | *Macrotus californicus* |
| CLRA | Yuma clapper rail | *Rallus longirostris yumanensis* (also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*) |
| CRCR | Colorado River cotton rat | *Sigmodon arizonae plenus* |
| CRTO* | Colorado River toad | Bufo *alvarius* = Incilius alvarius |
| DETO | Desert tortoise (Mojave population) | *Gopherus agassizii* |
| DPMO* | Desert pocket mouse | *Chaetodipus penicillatus sobrinus* |
| ELOW | Elf owl | *Micrathene whitneyi* |
| FLSU | Flannelmouth sucker | *Catostomus latipinnis* |
| FTHL | Flat-tailed horned lizard | *Phrynosoma mcalli* |
| GIFL | Gilded flicker | *Colaptes chrysoides* |
| GIWO | Gila woodpecker | *Melanerpes uropygialis* |
| HUCH | Humpback chub | *Gila cypha* |
| LEBI | Western least bittern | *Ixobrychus exilis hesperis* |
| LLFR* | Lowland leopard frog | *Rana yavapaiensis* = *Lithobates yavapaiensis* |
| MNSW | MacNeill's sootywing skipper | *Pholisora gracielae* = *Hesperopsis gracielae* (MacNeill) |
| NMGS | Northern Mexican gartersnake | *Thamnophis eques megalops* |
| PTBB* | Pale Townsend's big-eared bat | *Corynorhinus townsendii pallescens* = *Plecotus townsendii pallescens* = *C. townsendii townsendii*[1] |
| RASU | Razorback sucker | *Xyrauchen texanus* |
| RLFR | Relict leopard frog | *Rana onca* |
| STBU | Sticky buckwheat | *Eriogonum viscidulum* |
| SUTA | Summer tanager | *Piranga rubra* |
| THMI | Threecorner milkvetch | *Astragalus geyeri* var. *triquetrus* |
| VEFL | Vermilion flycatcher | *Pyrocephalus rubinus* |
| WIFL | Southwestern willow flycatcher | *Empidonax traillii extimus* |
| WRBA | Western red bat | *Lasiurus blossevillii* |
| WYBA | Western yellow bat | *Lasiurus xanthinus* |
| YBCU | Yellow-billed cuckoo | *Coccyzus americanus occidentalis* |
| YHCR | Yuma hispid cotton rat | *Sigmodon hispidus eremicus* |
| YWAR | Sonoran yellow warbler | *Dendroica petechia sonorana* = *Setophaga petechia sonorana* |

* Evaluation species.

[1] Genetic analyses on the pale Townsend's big-eared bat indicate that the lower Colorado River is likely in the range of the Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*) rather than the pale Townsend's big-eared bat (Piaggio and Perkins 2005). The bats recorded along the lower Colorado River will be referred to as pale Townsend's big-eared bats in this report, as the nomenclature change has not yet been verified by the U.S. Fish and Wildlife Service.

Piaggio, A.J. and S.L. Perkins. 2005. Molecular phylogeny of North American long-eared bats (Vespertilionidae: *Corynorhinus*); inter- and intraspecific relationships inferred from mitochondrial and nuclear DNA sequences. Molecular Phylogenetics and Evolution 37:762–775.

# LIST OF COMMON AND SCIENTIFIC NAMES

| Common Name | Scientific Name |
|---|---|
| **Amphibians** | |
| Colorado River toad | *Bufo alvarius = Incilius alvarius* |
| Lowland leopard frog | *Rana yavapaiensis = Lithobates yavapaiensis* |
| Relict leopard frog | *Rana onca* |
| **Bats** | |
| California leaf-nosed bat | *Macrotus californicus* |
| Pale Townsend's big-eared bat | *Corynorhinus townsendii pallescens = Plecotus townsendii pallescens = C. townsendii townsendii* |
| Western red bat | *Lasiurus blossevillii* |
| Western yellow bat | *Lasiurus xanthinus* |
| **Birds** | |
| Arizona Bell's vireo | *Vireo bellii arizonae* |
| Bell's vireo | *Vireo bellii* |
| Brown-headed cowbird | *Molothrus ater* |
| California black rail | *Laterallus jamaicensis coturniculus* |
| Cormorant | *Phalacrocorax auritus* |
| Elf owl | *Micrathene whitneyi* |
| European starling | *Sturnus vulgaris* |
| Flycatcher | *Empidonax traillii* |
| Gila woodpecker | *Melanerpes uropygialis* |
| Gilded flicker | *Colaptes chrysoides* |
| Great blue heron | *Ardea herodias* |
| Kentucky warbler | *Geothlypis formos* |
| Ladder-backed woodpecker | *Dryobates scalaris* |
| Sonoran yellow warbler | *Dendroica petechia sonorana = Setophaga petechia sonorana* |
| Southwestern willow flycatcher | *Empidonax traillii extimus* |
| Summer tanager | *Piranga rubra* |
| Vermilion flycatcher | *Pyrocephalus rubinus* |
| Western least bittern | *Ixobrychus exilis hesperis* |
| Yellow-billed cuckoo | *Coccyzus americanus occidentalis* |
| Yellow warbler | *Setophaga petechia* |
| Yuma clapper rail | *Rallus longirostris yumanensis* (also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*) |

| Common Name | Scientific Name |
|---|---|
| **Fish** | |
| Bluegill | *Lepomis macrochirus* |
| Bonytail | *Gila elegans* |
| Flannelmouth sucker | *Catostomus latipinnis* |
| Flathead catfish | *Pylodictis olivaris* |
| Humpback chub | *Gila cypha* |
| Largemouth bass | *Micropterus salmoides* |
| Mosquitofish | *Gambusia affinis* |
| Rainbow trout | *Oncorhynchus mykiss* |
| Razorback sucker | *Xyrauchen texanus* |
| Striped bass | *Morone saxatilis* |
| **Invertebrates** | |
| MacNeill's sootywing skipper | *Pholisora gracielae* = *Hesperopsis gracielae* (MacNeill) |
| Quagga mussel | *Dreissena bugensis* |
| **Plants** | |
| Alfalfa | *Medicago sativa* |
| Arrowweed | *Pluchea sericea* |
| California bulrush | *Schoenoplectus californicus* |
| Cattail | *Typha* spp. |
| Common three-square bulrush | *Schoenoplectus pungens* |
| Five-hook bassia | *Bassia hyssopifolia* |
| Fremont cottonwood | *Populus fremontii* |
| Golden algae | *Prymnesium parvum* |
| Goodding's willow | *Salix gooddingii* |
| Honey mesquite | *Prosopis glandulosa* |
| Mediterranean grass | *Schismus barbatus* |
| Mesquite | *Prosopis* spp. |
| Phragmites | *Phragmites australis* |
| Quailbush | *Atriplex lentiformis* |
| Saguaro | *Carnegiea gigantea* |
| Sahara mustard | *Brassica tournefortii* |
| Saltcedar | *Tamarix* spp. |
| Softstem bulrush | *Scripus tabermontani* |
| Sticky buckwheat | *Eriogonum viscidulum* |
| Olney's three-square bulrush | *Scirpus olneyii* |
| Threecorner milkvetch | *Astragalus geyeri* var. *triquetrus* |
| Willow | *Salix* spp. |

| Common Name | Scientific Name |
|---|---|
| **Reptiles** | |
| Desert tortoise (Mojave population) | *Gopherus agassizii* |
| Flat-tailed horned lizard | *Phrynosoma mcalli* |
| Northern Mexican gartersnake | *Thamnophis eques megalops* |
| **Small Mammals** | |
| Colorado River cotton rat | *Sigmodon arizonae plenus* |
| Desert pocket mouse | *Chaetodipus penicillatus sobrinus* |
| Yuma hispid cotton rat | *Sigmodon hispidus eremicus* |

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## Attachments

Attachment


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**B** Description of Take

B-1: Federal Flow-Related Covered Actions and Accomplishments, Calendar Year 2018

B-2: Federal Non-Flow-Related Covered Actions and Incidental Take Summary, Fiscal Year 2018

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# PROGRAM OVERVIEW

The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) is a partnership of Federal and non-Federal stakeholders created to respond 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 (ESA). This is a long-term (50-year) program to conserve at least 27 species along the LCR from Lake Mead to the Southerly International Boundary with Mexico through implementation of a Habitat Conservation Plan (HCP).

Under this long-term program, current water diversions and power production will be accommodated, and opportunities for future water and power development will be optimized to the extent consistent with the law. This comprehensive program addresses future Federal agency consultation needs under Section 7 of the ESA and non-Federal agency needs for endangered species incidental take authorization under Section 10 of the ESA. The LCR MSCP also allows California agencies to meet their obligations under California State law for the California Endangered Species Act (CESA).

Twenty-seven Federal or State listed, candidate, and sensitive species and their associated habitats, ranging from aquatic and wetland habitats to riparian and upland areas, are covered under the LCR MSCP. Of the 27 covered species, 8 are currently listed under the Federal ESA. This program addresses the biological needs of mammals, birds, fishes, amphibians, reptiles, invertebrates, and plants.

Implementing the LCR MSCP will help create at least 8,132 acres of new habitat (5,940 acres of cottonwood-willow, 1,320 acres of honey mesquite, 512 acres of marsh, and 360 acres of backwater) and produce 660,000 subadult razorback suckers and 620,000 bonytail to augment the existing populations of these fishes in the LCR. Under the LCR MSCP, participation in the recovery programs for these fishes may include funding other appropriate activities in lieu of stocking. In addition, there is a substantial research and monitoring component to this program: A $25 million fund was established to support projects implemented by land use managers to protect and maintain existing habitat for covered species.

The estimated cost of this program in 2003 dollars, as outlined in the Funding and Management Agreement (FMA), is approximately $626 million, and it will be adjusted annually for inflation. The Bureau of Reclamation (Reclamation) will pay 50% of the LCR MSCP cost. The States of California, Nevada, and Arizona will pay the remaining 50%, with California paying one-half of the State total and Nevada and Arizona each paying one-quarter of the State total.

## Program Implementation

On April 2 and 4, 2005, the United States Secretary of the Interior; representatives from Arizona, California, and Nevada; and water and power organizations in these States signed the program documents required to implement the LCR MSCP. The documents for the LCR MSCP include an environmental impact statement/environmental impact report, a biological assessment, a 2005 Biological and Conference Opinion (BO), a HCP, a Record of Decision, a FMA, an Implementation Agreement, and a Section 10 Permit. These documents can be found on the LCR MSCP website (www.lcrmscp.gov).

Implementation of the LCR MSCP also provides compliance for two other actions:

1. In December 2001, the U.S. Fish and Wildlife Service (USFWS) issued to Reclamation the *Biological Opinion for Interim Surplus Criteria, Secretarial Implementation Agreements, and Conservation Measures on the Lower Colorado River, Lake Mead to the Southerly International Boundary, Arizona, California and Nevada* (2001 BO). Although this is a separate compliance action, the requirements listed in the 2001 BO were integrated into the LCR MSCP and were implemented by Reclamation in conjunction with the LCR MSCP. Section 8.6 of the FMA states that implementation of the 2001 BO conservation and mitigation measures shall be credited against the requirements of the LCR MSCP in accordance with the HCP. Requirements under the 2001 BO for the Secretarial Implementation Agreements were completed in fiscal year (FY) 2008, and requirements for the interim surplus criteria (ISC) were completed on December 31, 2015.

2. On April 4, 2005, Reclamation entered into a Memorandum of Agreement with the California partners to implement the LCR MSCP in a coordinated manner to help meet the requirements of the CESA permit issued by the California Department of Fish and Wildlife (CDFW). The requirements of the CESA permit are generally consistent with the LCR MSCP Habitat Conservation Plan. A copy of the memorandum and the CESA permit are available from the California partners upon request.

As agreed to in the FMA, Reclamation is the entity responsible for implementing the LCR MSCP over its 50-year term. The FMA also calls for the establishment of a Steering Committee, currently consisting of 57 entities, to provide input and oversight functions in support of LCR MSCP implementation. The Steering Committee includes Federal and non-Federal entities, which are receiving ESA coverage through the LCR MSCP, or stakeholders interested in the environment of the LCR. A complete list of Steering Committee members can be viewed on the LCR MSCP website (www.lcrmscp.gov). During FY18, Perri Benemelis, Central Arizona Groundwater Replenishment District, served as Chair of the Steering Committee, and Jayne Harkins, Colorado River Commission, served as Vice Chair.

Section 7.4.1 of the FMA requires Reclamation to submit an implementation report, work plan, and budget (annual report) to the Steering Committee each year, consistent with the program documents. This current annual report contains a description of conservation activities accomplished during FY18, a summary of work underway during FY19, and proposed work to be performed during FY20. It also documents research and monitoring activities undertaken in support of the LCR MSCP and incidental take for covered actions implemented during FY18. This annual report fully meets the reporting requirements outlined in Section 7.4.1 of the FMA.

## LCR MSCP Funding

As outlined in the FMA, the total program cost in 2003 dollars is $626,180,000, which is split in a 50-50 cost share among Federal and non-Federal entities. Table 7-1 of the HCP outlines the annual minimum funding level before inflation. Each year, the annual program cost is adjusted for inflation based on a formula outlined in Section 8.1.1 of the FMA. Table 1-1 provides the annual contribution before inflation, a composite inflation index, and indexed annual program (Federal and non-Federal) contributions. Indexed annual program costs are calculated using the composite inflation index from 2 years prior as outlined in the FMA. A summary of required contributions received to date is provided in attachment D-1.

**Table 1-1.—Federal/Non-Federal Funding Requirements for the LCR MSCP**

| Fiscal Year | Annual Contribution Before Inflation | Composite Inflation Index | Composite Calculation Year | Indexed Annual Program | Indexed Annual Federal | Indexed Annual Non-Federal |
|---|---|---|---|---|---|---|
| 2006 | $11,214,000 | 1.083 | 2004 | $12,144,762 | $6,072,381 | $6,072,381 |
| 2007 | $11,214,000 | 1.122 | 2005 | $12,582,108 | $6,291,054 | $6,291,054 |
| 2008 | $11,214,000 | 1.187 | 2006 | $13,311,018 | $6,655,509 | $6,655,509 |
| 2009 | $11,214,000 | 1.210 | 2007 | $13,568,940 | $6,784,470 | $6,784,470 |
| 2010 | $11,214,000 | 1.294 | 2008 | $14,510,916 | $7,255,458 | $7,255,458 |
| 2011 | $27,540,000 | 1.191[1] | 2009 | $32,800,140 | $16,400,070 | $16,400,070 |
| 2012 | $27,540,000 | 1.210[1] | 2010 | $33,323,400 | $16,661,700 | $16,661,700 |
| 2013 | $27,540,000 | 1.251[1] | 2011 | $34,452,540 | $17,226,270 | $17,226,270 |
| 2014 | $27,540,000 | 1.276[1] | 2012 | $35,141,040 | $17,570,520 | $17,570,520 |
| 2011–14 | Underfunding makeup | | | $7,601,040 | $3,800,520 | $3,800,520 |
| 2015 | $27,540,000 | 1.358 | 2013 | $37,399,320 | $18,699,660 | $18,699,660 |
| 2016 | $22,164,000 | 1.387 | 2014 | $30,741,468 | $15,370,734 | $15,370,734 |
| 2017 | $22,164,000 | 1.393 | 2015 | $30,874,452 | $15,437,226 | $15,437,226 |
| 2018 | $22,164,000 | 1.410 | 2016 | $31,251,240 | $15,625,620 | $15,625,620 |
| 2019 | $22,164,000 | 1.442 | 2017 | $31,960,488 | $15,980,244 | $15,980,244 |
| 2020 | $22,164,000 | 1.501 | 2018 | $33,268,164 | $16,634,082 | $16,634,082 |

[1] Original inflation index. The difference between the original inflation index and the revised inflation index is shown as "Underfunding makeup."

Section 8.1.2 of the FMA states that funds provided by either a Federal party or a State permittee that are in excess of the funding obligation for a specific year shall be treated as a credit against future funding obligations. Any shortage of funds provided by either a Federal party or a State permittee will be treated as a deficit to future funding obligations. Attachment D-2 provides a summary of funding credits earned and funding credits used.

## FY20 Contributions and Adjustments

As outlined in table 1-1, the annual funding commitment for FY20 is $22,164,000, based on the 2003 estimate, and $33,268,164 after the composite inflation index of 1.501 is applied. In accordance with Section 8.3 of the FMA, the Federal share of the cost for FY20 and the non-Federal share of the cost by State are shown in table 1-2. Section 8.3 of the FMA allows for adjusted non-Federal funding during the first 30 years of the program. The FY20 adjusted funding amounts for the three States are also shown in table 1-2 (amounts based on direction from the Central Arizona Water Conservation District [attachment A]).

**Table 1-2.—FY20 Contribution Schedule**

| Funding Entity | FY20 Contributions | FY20 Adjusted Contributions |
|---|---|---|
| Federal | $16,634,082.00 | $16,634,082.00 |
| Non-Federal | $16,634,082.00 | $16,634,082.00 |
| *California* | *$8,317,041.00* | *$7,921,919.63* |
| *Arizona* | *$4,158,520.50* | *$4,948,763.23* |
| *Nevada* | *$4,158,520.50* | *$3,763,399.14* |
| **Total** | **$33,268,164.00** | **$33,268,164.00** |

## 2001 Biological Opinion Account

A total of $6 million, plus interest, was available to Reclamation through the 2001 BO funding agreement. This funding is part of LCR MSCP contributions from the San Diego County Water Authority (SDCWA) and The Metropolitan Water District of Southern California and was used to meet the financial commitments for these entities. The mitigation requirements outlined in the 2001 BO needed to be implemented at the outset of the LCR MSCP; therefore, funding in excess of the entities' LCR MSCP annual required contribution was requested by Reclamation and resulted in funding credits in the early years of this program. In FY08, requirements under the 2001 BO specifically related to the Secretarial Implementation Agreement were completed, and all remaining funds were withdrawn. In FY09, the SDCWA started using their funding credits to meet their LCR MSCP annual contribution, and they will continue to use these

credits to meet their annual obligations until they are exhausted. The Metropolitan Water District of Southern California used their remaining credits in FY13.

## Habitat Maintenance Fund

As outlined in Section 8.4.2 of the FMA, a $25-million (2003 dollars) Habitat Maintenance Fund (HMF) was developed during the first 10 years of LCR MSCP implementation to restore covered species habitats that have been degraded; a share of each State's contribution was set aside in interest-bearing accounts referred to as Habitat Maintenance Fund accounts. Each State is maintaining its own account, and interest earned on these accounts will be added to the accounts for the benefit of implementing the LCR MSCP. The HMF was fully funded in FY15. A detailed accounting of the HMF is included in attachment D-3a. The total amount in the HMF through FY18 is $34,285,574.82. No funds have been withdrawn from any of the accounts to date.

## Remedial Measures Fund

The HCP requires that contingency funds be set aside to pay for implementing remedial measures in the event that changed circumstances affect program conservation measures (HCP, Section 5.12.3). The amount of funding is set forth in table 7-1 of the HCP, totaling $13,270,000 (2003 dollars) to be paid from year 6 through year 25 of the LCR MSCP. On April 25, 2012, the Steering Committee passed Program Decision Document 12-001, which approved establishment of State Remedial Measures Fund (RMF) accounts. Interest earned on these accounts will be added to the accounts for implementation of remedial measures. Table 1-3 provides FY18 contributions, total funds contributed through FY18 with interest, FY19 contributions, and FY20 projected contributions. A detailed accounting of the RMF is included in attachment D-3b. No funds have been withdrawn from any of the accounts to date.

**Table 1-3.—RMF**

| Funding Partner | FY18 Contribution | Cumulative through FY18[1] | FY19 Contribution | FY20 Projected Contribution |
|---|---|---|---|---|
| California | $561,180.00 | $3,901,429.95 | $573,916.00 | $597,398.00 |
| Arizona | $280,590.00 | $1,526,352.71 | $286,958.00 | $298,699.00 |
| Nevada | $280,590.00 | $2,114,338.50 | $286,958.00 | $298,699.00 |
| **Total** | $1,122,360.00 | $7,542,121.16 | $1,147,832.00 | $1,194,796.00 |

[1] Includes interest earned.

## Land and Water Fund

A Land and Water Fund has been established by Reclamation to set aside funds for acquisition of land and water resources to implement conservation measures described in the HCP. Through guidelines developed under Work Task E16, Reclamation works with interested parties to secure land and water resources. Once potential sites have been evaluated, including determining financial value through the Federal appraisal process using the U.S. Department of the Interior's designated Office of Valuation Services, land and water resources nominated by Reclamation for acquisition must be approved by the Steering Committee. The entire site selection process may extend over multiple years; therefore, this fund has been established to ensure funding will be available to complete these acquisitions. The Land and Water Fund will be limited to the total amount of funding identified in table 7-1 of the HCP for land and water acquisition, indexed for inflation. Once land and water resources have been approved for acquisition, funds will be withdrawn from the Land and Water Fund and a work task developed. If funds set aside in the Land and Water Fund are no longer required for land or water acquisition, they may be used to implement other actions necessary for conservation measure accomplishment. Table 1-4 lists the funds set aside in the Land and Water Fund through FY18. No additional funds were contributed in FY18. It had been anticipated that $3,300,000 would be placed into the Land and Water Fund in FY19. This additional funding was not added, but $9,730,000 was withdrawn to secure land and water for the Dennis Underwood Conservation Area. No additional funding will be contributed in FY20. A detailed accounting of the Land and Water Fund can be found in attachment D-3c.

**Table 1-4.—Land and Water Fund Contributions**

| Funding Partner | FY18 Contribution | Cumulative through FY18 | FY19 Contribution | F20 Projected Contribution |
|---|---|---|---|---|
| Reclamation | $0 | $15,400,000 | $0 | $0 |

## In-Kind Contributions

Section 8.7.4 of the FMA provides that in-kind goods or services shall be credited based on approval by the Program Manager and the Steering Committee. In October 2007, the Steering Committee passed Program Decision Document 08-001, which provides specific guidelines for the calculation of in-kind credit for goods and services. No in-kind contributions were provided in FY18.

## California Endangered Species Act Permit

The California partners are responsible for meeting the terms of the CESA permit. While Reclamation, other Federal agencies, and non-Federal entities located in Nevada and Arizona have no legal requirement to comply with the CESA permit with respect to the LCR MSCP, Reclamation is working with the California partners in meeting their requirements.

A Memorandum of Agreement between Reclamation and the California partners was signed in April 2005 that acknowledges Reclamation's commitment to implement the HCP in a manner that facilitates CESA compliance requirements. In exchange, the California partners have made land and water available at no cost in the Palo Verde Irrigation District for program purposes. Given this exchange and the overall commonality between the CESA permit and the HCP, these California-specific actions are not expected to result in additional program costs.

## Proposed FY20 Program Activities and FY18 Accomplishments

The minimum funding required in the LCR MSCP documents for FY20 is $33,268,164: $16,634,082 Federal and $16,634,082 non-Federal. Reclamation is proposing an annual program budget of $27,104,814 (table 1-5). The proposed annual program budget is less than the minimum required funding due to current construction capability. The balance will be held in reserve by Reclamation and used in future years to complete conservation measure requirements, especially habitat creation and management activities.

**Table 1-5.—FY20 Proposed Program Funding**

| Program Area | FY20 Funding |
|---|---|
| Program Administration | $1,528,018 |
| Fish Augmentation | $2,325,000 |
| Species Research | $866,000 |
| System Monitoring | $3,025,000 |
| Conservation Area Development and Management | $13,631,000 |
| Post-Development Monitoring | $2,870,000 |
| Adaptive Management Program | $1,540,000 |
| Funding Accounts – Remedial Measures | $1,194,796 |
| Public Outreach | $125,000 |
| **Subtotal** | $27,144,814 |
| Land and Water Fund Contribution | $0 |
| **Total** | **$27,104,814** |

Table 1-6 shows the following by work task: FY18 approved estimates and actual accomplishment, cumulative program expenditures (FY04–18), FY19 approved program funding, FY20 proposed program funding, and out-year funding for FY21 and FY22. Out-year funding estimates are not adjusted for inflation because the inflation index is not calculated until 5 months prior to the start of each fiscal year. In table 1-6, current year accomplishment is shown as obligations (money that is set aside during the year for program expenses). Cumulative accomplishment is shown as expenditures (actual funding expended).

**Table 1-6.—Annual Funding Matrix**

| Work Task | Name | FY18 Approved Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Projected Estimate[1] | FY22 Projected Estimate[1] |
|---|---|---|---|---|---|---|---|---|
| **A** | **Program Administration** | | | | | | | |
| A1 | Program Administration | $1,435,380.00 | $1,288,045.42 | $14,567,331.25 | $1,467,956.00 | $1,528,018.00 | $1,528,018.00 | $1,528,018.00 |
| Closed[2] | Work Tasks Pre-FY18 | | | $130,535.22 | | | | |
| | | **$1,435,380.00** | **$1,288,045.42** | **$14,697,866.47** | **$1,467,956.00** | **$1,528,018.00** | **$1,528,018.00** | **$1,528,018.00** |
| | | | | | | | | |
| **B** | **Fish Augmentation** | | | | | | | |
| B1 | Lake Mohave Razorback Sucker Larvae Collections | $215,000.00 | $211,549.45 | $2,758,292.26 | $215,000.00 | $215,000.00 | $215,000.00 | $215,000.00 |
| B2 | Willow Beach National Fish Hatchery | $325,000.00 | $324,870.50 | $4,285,114.94 | $325,000.00 | $325,000.00 | $325,000.00 | $325,000.00 |
| B3 | Achii Hanyo Native Fish Rearing Facility | $170,000.00 | $166,345.03 | $1,718,575.78 | $170,000.00 | $170,000.00 | $170,000.00 | $170,000.00 |
| B4 | Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico | $260,000.00 | $259,697.43 | $2,995,990.79 | $260,000.00 | $260,000.00 | $260,000.00 | $260,000.00 |
| B5 | Bubbling Ponds Fish Hatchery | $330,000.00 | $541,538.62 | $4,035,820.22 | $475,000.00 | $475,000.00 | $475,000.00 | $475,000.00 |
| B6 | Lake Mead Fish Hatchery | $400,000.00 | $324,717.13 | $1,581,681.06 | $350,000.00 | $525,000.00 | $585,000.00 | $585,000.00 |
| B7 | Lakeside Rearing Ponds | $200,000.00 | $183,822.20 | $2,562,442.70 | $200,000.00 | $150,000.00 | $150,000.00 | $150,000.00 |
| B8 | Fish Tagging Equipment | $135,000.00 | $137,535.12 | $1,233,857.39 | $135,000.00 | $135,000.00 | $135,000.00 | $135,000.00 |
| B12 | Maintenance of Alternate Bonytail Broodstock | $65,000.00 | $65,881.81 | $195,152.93 | $70,000.00 | $70,000.00 | $70,000.00 | $70,000.00 |
| Closed[2] | Work Tasks Pre-FY18 | $0.00 | $0.00 | $987,445.58 | $0.00 | | | |
| | | **$2,100,000.00** | **$2,215,957.29** | **$22,354,373.65** | **$2,200,000.00** | **$2,325,000.00** | **$2,385,000.00** | **$2,385,000.00** |
| | | | | | | | | |
| **C** | **Species Research** | | | | | | | |
| C2 | Sticky Buckwheat and Threecorner Milkvetch Conservation | $11,000.00 | $11,101.09 | $149,108.25 | $11,000.00 | $11,000.00 | $11,000.00 | $11,000.00 |
| C14 | Humpback Chub Program Support | $57,000.00 | $0.00 | $288,216.61 | $1,000.00 | $60,000.00 | $60,000.00 | $60,000.00 |
| C24 | Avian Species Habitat Requirements | $150,000.00 | $124,254.93 | $2,557,998.38 | $0.00 | $0.00 | $0.00 | $0.00 |

**Table 1-6.—Annual Funding Matrix**

| Work Task | Name | FY18 Approved Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Projected Estimate[1] | FY22 Projected Estimate[1] |
|---|---|---|---|---|---|---|---|---|
| C31 | Razorback Sucker Genetic Diversity Assessment | $160,000.00 | $149,136.13 | $1,001,788.53 | $0.00 | $0.00 | $0.00 | $0.00 |
| C40 | Genetic and Demographic Studies to Inform Conversation Management of Razorback Suckers and Bonytail in Off-Channel Habitats | $415,000.00 | $413,755.84 | $1,374,916.70 | $0.00 | $0.00 | $0.00 | $0.00 |
| C53 | Sonic Telemetry of Juvenile Flannelmouth Suckers in Reach 3 | $40,000.00 | $42,475.54 | $674,709.08 | $0.00 | $0.00 | $0.00 | $0.00 |
| C59 | Selenium Monitoring in Created Backwater and Marsh Habitats | $160,000.00 | $153,470.62 | $337,926.20 | $160,000.00 | $160,000.00 | $160,000.00 | $160,000.00 |
| C60 | Habitat Manipulation | $175,000.00 | $156,839.19 | $341,788.77 | $175,000.00 | $175,000.00 | $175,000.00 | $175,000.00 |
| C61 | Evaluation of Alternative Stocking Methods for Fish Augmentation | $300,000.00 | $288,857.26 | $608,840.13 | $10,000.00 | $10,000.00 | $10,000.00 | $0.00 |
| C63 | Evaluation of Habitat Features that May Influence Success of Razorback Suckers and Bonytail in Backwater Environments | $150,000.00 | $98,270.13 | $329,291.30 | $0.00 | $0.00 | $0.00 | $0.00 |
| C64 | Post-Stocking Movement, Distribution, and Habitat Use of Razorback Suckers and Bonytail | $750,000.00 | $451,416.35 | $1,824,358.15 | $450,000.00 | $450,000.00 | $450,000.00 | $450,000.00 |
| C65 | Evaluation of Immediate Post-Stocking Survival of Razorback Suckers and Bonytail | $120,000.00 | $44,359.14 | $254,014.94 | $0.00 | $0.00 | $0.00 | $0.00 |
| C66 | Marsh Bird Water Depth Analysis | $20,000.00 | $25,505.31 | $152,601.94 | $0.00 | $0.00 | $0.00 | $0.00 |
| Closed[2] | Work Tasks Pre-FY18 | | ($6,782.53) | $21,153,615.43 | | | | |
| | | **$2,508,000.00** | **$1,952,659.00** | **$31,049,174.41** | **$807,000.00** | **$866,000.00** | **$866,000.00** | **$856,000.00** |

**Table 1-6.—Annual Funding Matrix**

| Work Task | Name | FY18 Approved Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Projected Estimate[1] | FY22 Projected Estimate[1] |
|---|---|---|---|---|---|---|---|---|
| **D** | **System Monitoring** | | | | | | | |
| D1 | Marsh Bird Surveys | $40,000.00 | $40,504.44 | $404,881.27 | $40,000.00 | $40,000.00 | $40,000.00 | $40,000.00 |
| D2 | Southwestern Willow Flycatcher Presence/ Absence Surveys | $650,000.00 | $706,478.94 | $9,985,453.06 | $200,000.00 | $340,000.00 | $340,000.00 | $340,000.00 |
| D5 | Monitoring Avian Productivity and Survivorship | $250,000.00 | $269,757.00 | $3,589,680.22 | $250,000.00 | $250,000.00 | $250,000.00 | $250,000.00 |
| D6 | System Monitoring of Riparian Obligate Avian Species | $480,000.00 | $94,088.91 | $2,729,976.71 | $500,000.00 | $500,000.00 | $500,000.00 | $500,000.00 |
| D7 | Yellow-billed Cuckoo Presence/Absence Surveys | $50,000.00 | $62,281.40 | $6,984,786.34 | $50,000.00 | $50,000.00 | $50,000.00 | $50,000.00 |
| D8 | Razorback Sucker and Bonytail Stock Assessment | $925,000.00 | $1,043,344.18 | $8,469,354.63 | $1,125,000.00 | $1,125,000.00 | $1,125,000.00 | $1,125,000.00 |
| D9 | System Monitoring of Covered Bat Species | $140,000.00 | $129,056.63 | $2,466,618.17 | $100,000.00 | $100,000.00 | $100,000.00 | $100,000.00 |
| D10 | System Monitoring of Rodent Populations | $40,000.00 | $31,374.56 | $320,302.97 | $40,000.00 | $0.00 | $0.00 | $0.00 |
| D14 | System-Wide Monitoring of MacNeill's Sootywing Skippers | $0.00 | $0.00 | $0.00 | $20,000.00 | $20,000.00 | $20,000.00 | $0.00 |
| D15 | Genetic Monitoring and Management of Native Fish Populations | $0.00 | $0.00 | $0.00 | $0.00 | $600,000.00 | $600,000.00 | $400,000.00 |
| Closed[2] | Work Tasks Pre-FY18 | | $7,468.38 | $1,791,815.19 | | | | |
| | | **$2,575,000.00** | **$2,384,354.44** | **$36,742,868.56** | **$2,325,000.00** | **$3,025,000.00** | **$3,025,000.00** | **$2,805,000.00** |
| | | | | | | | | |
| **E** | **Conservation Area Development and Management** | | | | | | | |
| E1 | Beal Lake Conservation Area | $250,000.00 | $220,524.14 | $4,627,611.10 | $900,000.00 | $900,000.00 | $750,000.00 | $400,000.00 |
| E4 | Palo Verde Ecological Reserve | $600,000.00 | $644,951.71 | $10,712,137.86 | $500,000.00 | $650,000.00 | $650,000.00 | $650,000.00 |

**Table 1-6.—Annual Funding Matrix**

| Work Task | Name | FY18 Approved Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Projected Estimate[1] | FY22 Projected Estimate[1] |
|---|---|---|---|---|---|---|---|---|
| E5 | Cibola Valley Conservation Area | $850,000.00 | $839,589.33 | $13,240,974.03 | $850,000.00 | $600,000.00 | $350,000.00 | $350,000.00 |
| E9 | Hart Mine Marsh | $250,000.00 | $116,905.59 | $7,424,821.59 | $250,000.00 | $250,000.00 | $150,000.00 | $150,000.00 |
| E13 | McAllister Lake | $400,000.00 | $28,776.19 | $180,822.70 | $400,000.00 | $400,000.00 | $50,000.00 | $40,000.00 |
| E14 | Imperial Ponds Conservation Area | $1,450,000.00 | $515,675.14 | $10,808,015.81 | $350,000.00 | $350,000.00 | $350,000.00 | $350,000.00 |
| E16 | Conservation Area Site Selection | $700,000.00 | $1,077,161.04 | $7,264,268.50 | $200,000.00 | $150,000.00 | $100,000.00 | $100,000.00 |
| E17 | Topock Marsh Pumping | $1,000.00 | $0.00 | $477,133.33 | $1,000.00 | $1,000.00 | $1,000.00 | $1,000.00 |
| E18 | Law Enforcement and Fire Suppression | $200,000.00 | $402,885.33 | $2,115,485.48 | $250,000.00 | $250,000.00 | $250,000.00 | $250,000.00 |
| E21 | Planet Ranch | $3,000,000.00 | $1,151,199.48 | $12,355,172.49 | $4,000,000.00 | $4,000,000.00 | $1,000,000.00 | $1,000,000.00 |
| E24 | Cibola National Wildlife Refuge Unit #1 Conservation Area | $750,000.00 | $1,131,907.15 | $7,106,550.91 | $900,000.00 | $1,000,000.00 | $2,500,000.00 | $3,000,000.00 |
| E25 | Big Bend Conservation Area | $20,000.00 | ($6,534.23) | $1,224,828.92 | $20,000.00 | $60,000.00 | $320,000.00 | $520,000.00 |
| E27 | Laguna Division Conservation Area | $150,000.00 | $156,319.43 | $27,670,351.23 | $120,000.00 | $120,000.00 | $100,000.00 | $100,000.00 |
| E28 | Yuma East Wetlands | $300,000.00 | $373,739.17 | $2,661,157.55 | $275,000.00 | $275,000.00 | $275,000.00 | $275,000.00 |
| E31 | Hunters Hole | $30,000.00 | $40,847.96 | $538,747.72 | $30,000.00 | $30,000.00 | $30,000.00 | $30,000.00 |
| E33 | Pretty Water Conservation Area | $40,000.00 | $24,647.30 | $1,793,801.56 | $30,000.00 | $20,000.00 | $20,000.00 | $20,000.00 |
| E35 | Mohave Valley Conservation Area | $3,500,000.00 | $4,240,523.35 | $8,957,749.40 | $1,750,000.00 | $160,000.00 | $100,000.00 | $100,000.00 |
| E36 | Parker Dam Camp | $50,000.00 | $1,167.13 | $17,591.82 | $40,000.00 | $5,000.00 | $5,000.00 | $5,000.00 |
| E37 | Palo Verde Ecological Reserve-South | $500,000.00 | $0.00 | $10,027.29 | $100,000.00 | $500,000.00 | $500,000.00 | $300,000.00 |
| E38 | Three Fingers Lake | $200,000.00 | $173,347.70 | $289,090.33 | $100,000.00 | $10,000.00 | $10,000.00 | $10,000.00 |
| E39[4] | Dennis Underwood Conservation Area | $6,000,000.00 | $213,860.00 | $122,675.06 | $10,230,000.00 | $1,500,000.00 | $1,500,000.00 | $350,000.00 |
| E40 | Yuma Meadows Conservation Area | $0.00 | $26,478.64 | $11,625.60 | $4,000,000.00 | $2,000,000.00 | $3,000,000.00 | $300,000.00 |
| E41 | Section 26 Conservation Area | $0.00 | $0.00 | $0.00 | $0.00 | $400,000.00 | $100,000.00 | $100,000.00 |
| Closed[2] | Work Tasks Pre-FY18 | | $0.00 | $5,531,635.42 | | | | |
| | | **$19,241,000.00** | **$11,373,971.55** | **$125,142,275.70** | **$25,296,000.00** | **$13,631,000.00** | **$12,111,000.00** | **$8,401,000.00** |

**Table 1-6.—Annual Funding Matrix**

| Work Task | Name | FY18 Approved Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Projected Estimate[1] | FY22 Projected Estimate[1] |
|---|---|---|---|---|---|---|---|---|
| **F** | **Post-Development Monitoring** | | | | | | | |
| F1 | Habitat Monitoring at Conservation Areas | $850,000.00 | $966,385.23 | $6,139,012.89 | $700,000.00 | $700,000.00 | $700,000.00 | $700,000.00 |
| F2 | Avian Monitoring at Conservation Areas | $350,000.00 | $360,204.59 | $2,747,081.22 | $450,000.00 | $450,000.00 | $450,000.00 | $450,000.00 |
| F3 | Rodent Monitoring at Conservation Areas | $65,000.00 | $64,748.87 | $596,139.98 | $65,000.00 | $65,000.00 | $65,000.00 | $65,000.00 |
| F4 | Bat Species Monitoring at Conservation Areas | $80,000.00 | $88,410.11 | $1,227,132.74 | $140,000.00 | $140,000.00 | $140,000.00 | $140,000.00 |
| F5 | Post-Development Monitoring of Fishes at Conservation Areas | $500,000.00 | $381,622.26 | $2,472,419.44 | $450,000.00 | $450,000.00 | $400,000.00 | $400,000.00 |
| F6 | Post-Development Monitoring of MacNeill's Sootywing Skippers at Conservation Areas | $40,000.00 | $41,121.18 | $565,676.33 | $20,000.00 | $20,000.00 | $20,000.00 | $20,000.00 |
| F7 | Marsh Bird Monitoring at Conservation Areas | $40,000.00 | $38,104.37 | $170,329.54 | $40,000.00 | $10,000.00 | $10,000.00 | $10,000.00 |
| F8 | Reptile and Amphibian Monitoring at Conservation Areas | $25,000.00 | $9,699.58 | $9,699.58 | $25,000.00 | $25,000.00 | $25,000.00 | $25,000.00 |
| F9 | Southwestern Willow Flycatcher Monitoring at Conservation Areas | $100,000.00 | $53,502.65 | $53,502.65 | $500,000.00 | $360,000.00 | $360,000.00 | $360,000.00 |
| F10 | Yellow-billed Cuckoo Monitoring at Conservation Areas | $600,000.00 | $618,393.95 | $424,700.22 | $650,000.00 | $650,000.00 | $650,000.00 | $650,000.00 |
| | | **$2,650,000.00** | **$2,622,192.79** | **$14,405,694.59** | **$3,040,000.00** | **$2,870,000.00** | **$2,820,000.00** | **$2,820,000.00** |
| | | | | | | | | |
| **G** | **Adaptive Management Program** | | | | | | | |
| G1 | Data Management | $1,000,000.00 | $1,081,315.25 | $7,647,277.31 | $1,250,000.00 | $1,000,000.00 | $750,000.00 | $750,000.00 |
| G3 | Adaptive Management Research Projects | $300,000.00 | $5,386.62 | $2,818,200.69 | $300,000.00 | $100,000.00 | $100,000.00 | $100,000.00 |

**Table 1-6.—Annual Funding Matrix**

| Work Task | Name | FY18 Approved Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Projected Estimate[1] | FY22 Projected Estimate[1] |
|---|---|---|---|---|---|---|---|---|
| G4 | Science/Adaptive Management Strategy | $400,000.00 | $654,991.70 | $2,358,791.87 | $400,000.00 | $400,000.00 | $400,000.00 | $400,000.00 |
| G6 | Conceptual Ecological Models | $40,000.00 | $15,162.76 | $92,681.58 | $40,000.00 | $40,000.00 | $40,000.00 | $40,000.00 |
| | | **$1,740,000.00** | **$1,756,856.33** | **$12,916,951.45** | **$1,990,000.00** | **$1,540,000.00** | **$1,290,000.00** | **$1,290,000.00** |
| | | | | | | | | |
| **H** | **Funding Accounts** | | | | | | | |
| H1[3] | Habitat Maintenance Fund | $0.00 | $0.00 | $32,466,770.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| H2 | Remedial Measures Fund | $1,122,360.00 | $1,122,360.00 | $7,329,835.38 | $1,147,832.00 | $1,194,796.00 | $1,194,796.00 | $1,197,184.00 |
| | | **$1,122,360.00** | **$1,122,360.00** | **$39,796,605.38** | **$1,147,832.00** | **$1,194,796.00** | **$1,194,796.00** | **$1,194,796.00** |
| | | | | | | | | |
| **I** | **Public Outreach** | | | | | | | |
| I1 | Public Outreach | $125,000.00 | $141,757.83 | $890,818.82 | $125,000.00 | $125,000.00 | $125,000.00 | $125,000.00 |
| Closed | Work Tasks Pre-FY18 | | | $61,059.68 | | | | |
| | | **$125,000.00** | **$141,757.83** | **$951,878.50** | **$125,000.00** | **$125,000.00** | **$125,000.00** | **$125,000.00** |
| | | | | | | | | |
| | **Program Total:** | **$33,496,740.00** | **$24,858,154.65** | **$298,057,688.71** | **$38,398,788.00** | **$27,104,814.00** | **$25,344,814.00** | **$21,404,814.00** |

[1] FY21 and FY22 numbers are not adjusted for inflation.
[2] Closed work tasks are shown in appendix D-4.
[3] H1 cumulative habitat maintenance amount does not include interest.
[4] Resolution 19-002 was approved by the Steering Committee on April 24, 2019.

In accordance with the FMA, a description of the work is being presented to the Steering Committee to ensure that no disputes exist; the description will subsequently be presented to the USFWS to ensure that the work is consistent with the HCP.

Reclamation's goal is to fully implement the LCR MSCP in a biologically effective, cost-efficient, and transparent manner. During FY20, should Reclamation determine that a specific work task cannot be undertaken, funds identified for that specific work task will be redirected and used for the following purposes: (1) funding another work task approved through this document, (2) increasing the funding for a work task that is expected to require funding in FY21 or FY22, (3) providing more than the minimum funding required to the RMF, or (4) beginning activities associated with any changed circumstances as defined in Section 5.12.3 of the HCP, should any occur.

In FY18, Reclamation estimated work tasks totaling $33,496,740.00. Actual LCR MSCP accomplishment (obligations) for FY18 was $24,858,154.65. Actual accomplishment was less than the minimum accomplishment due to delays in securing land and water for the Dennis Underwood Conservation Area, delays in initiating the construction of erosion control structures at Planet Ranch, and costs for canal improvements at the Imperial Ponds Conservation Area (IPCA), which were less than anticipated. In accordance with the FMA, Reclamation incurred a funding credit of $1,295,823.63 for FY18 (attachment D-2e). Cumulative program accomplishment (expenditures) through FY18 was $298,057,688.71 (attachment D-4).

# Compliance Reporting

## LCR MSCP

As required in the FMA, the following information is included in this annual report:

1. *A running tabulation of habitat created or restored under the LCR MSCP*

   To meet species habitat creation requirements, goals are provided in the HCP for habitat creation based on land cover types. These land cover types are described using the Anderson and Ohmart vegetation classification system. In total, 8,132 acres of the cottonwood-willow, honey mesquite, marsh, and backwater land cover types are directed to be designed and created under the LCR MSCP. This is the minimum amount of land cover type to be created to meet species habitat requirements. Table 1-7 shows how much land cover by type has been created at each conservation area. Total land cover established through FY18 was 6,049 acres.

**Table 1-7.—Conservation Area Land Cover Type**

| Land Cover Type | Management Unit | Established Acres FY18 | Established Acres Total[1] |
|---|---|---|---|
| Cottonwood-willow | E1 Beal Lake Conservation Area (Arizona) | 0 | 119 |
| | E4 Palo Verde Ecological Reserve (California) | 0 | 945 |
| | E5 Cibola Valley Conservation Area (Arizona) | 0 | 452 |
| | E21 Planet Ranch (Arizona) | 0 | 396 |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area (Arizona) | 158 | 786 |
| | E27 Laguna Division Conservation Area (California and Arizona) | 0 | 1,129 |
| | E28 Yuma East Wetlands (Arizona) | 0 | 183 |
| | E31 Hunters Hole (Arizona) | 0 | 44 |
| **Total** | | **158** | **4,054** |
| Honey Mesquite | E4 Palo Verde Ecological Reserve (California) | 0 | 78 |
| | E5 Cibola Valley Conservation Area (Arizona) | 193 | 670 |
| | E27 Laguna Division Conservation Area (California and Arizona) | 0 | 42 |
| | E28 Yuma East Wetlands (Arizona) | 0 | 103 |
| | E33 Pretty Water Conservation Area (California) | 0 | 566 |
| | E36 Parker Dam Camp | 0 | 80 |
| **Total** | | **193** | **1,539** |
| Marsh | E9 Hart Mine Marsh (Arizona) | 0 | 255 |
| | E14 Imperial Ponds Conservation Area (Arizona) | 0 | 12 |
| | E28 Yuma East Wetlands (Arizona) | 0 | 94 |
| **Total** | | **0** | **361** |
| Backwater | E14 Imperial Ponds Conservation Area (Arizona) | 0 | 80 |
| | E25 Big Bend Conservation Area (Nevada) | 0 | 15 |
| **Total** | | **0** | **95** |
| | **TOTAL** | **351** | **6,049** |

[1] May be adjusted due to projected versus actual acreage established, changes in conservation area or phase acreage, or changes in habitat composition.

The HCP specifies that created land cover types will be designed in an integrated mosaic and managed for more than one covered species, including habitat elements for each species. The HCP contains habitat creation conservation measures for 21 of the 27 species. Table 1-8 shows the total creditable acres for each species habitat creation conservation measure by conservation area through FY17. Lidar data are not yet available to perform the habitat creation accomplishment analysis for FY18. Work Task F1 provides additional information.

The creditable acres established exceed species habitat creation conservation measure requirements in FY17 for WRBA2, WYBA3, CRCR2, YHCR2, ELOW1, GIWO1, SUTA1, and MNSW2.

**Table 1-8.—Conservation Area by Species Habitat Creation Conservation Measures**

| Species Habitat Creation Conservation Measures (Required Acres) | Management Unit | Creditable Acres FY17[1] | Creditable Acres Total | Percent of Acres Creditable by Species Conservation Measure |
|---|---|---|---|---|
| CLRA1 (512 acres) | E9 Hart Mine Marsh | 0 | 255 | |
| | E14 Imperial Ponds Conservation Area | 0 | 12 | |
| | E28 Yuma East Wetlands | 0 | 94 | |
| **Total** | | **0** | **361** | **71%** |
| WIFL1 (4,050 acres) | E1 Beal Lake Conservation Area | 0[2] | 0 | |
| | E4 Palo Verde Ecological Reserve | 0 | 945 | |
| | E5 Cibola Valley Conservation Area | 0[2] | 0 | |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area | 0[2] | 0 | |
| **Total** | | **0** | **945** | **23%** |
| BONY2 (360 acres) | E14 Imperial Ponds Conservation Area | 0 | 80 | |
| | E25 Big Bend Conservation Area | 0 | 15 | |
| **Total** | | **0** | **95** | **26%** |
| RASU2 (360 acres) | E14 Imperial Ponds Conservation Area | 0 | 80 | |
| | E25 Big Bend Conservation Area | 0 | 15 | |
| **Total** | | **0** | **95** | **26%** |
| WRBA2 (765 acres) | E1 Beal Lake Conservation Area | 0 | 119 | |
| | E4 Palo Verde Ecological Reserve | 0 | 1,023 | |
| | E5 Cibola Valley Conservation Area | 0 | 670 | |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area | 0 | 271 | |
| | E36 Parker Dam Camp | 0 | 80 | |
| **Total** | | **0** | **2,163[3]** | **> 100%** |
| WYBA3 (765 acres) | E1 Beal Lake Conservation Area | 0 | 119 | |
| | E4 Palo Verde Ecological Reserve | 0 | 1,023 | |
| | E5 Cibola Valley Conservation Area | 0 | 670 | |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area | 0 | 271 | |
| | E36 Parker Dam Camp | 0 | 80 | |
| **Total** | | **0** | **2,163[3]** | **> 100%** |
| CRCR2 (125 acres) | E1 Beal Lake Conservation Area | 0 | 119 | |
| | E4 Palo Verde Ecological Reserve | 0 | 1,023 | |
| | E5 Cibola Valley Conservation Area | 0 | 670 | |
| | E9 Hart Mine Marsh | 0 | 255 | |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area | 0 | 365 | |
| | E36 Parker Dam Camp | 0 | 80 | |
| **Total** | | **0** | **2,512[3]** | **> 100%** |
| YHCR2 (76 acres) | E28 Yuma East Wetlands | 0 | 183 | |
| **Total** | | **0** | **183[3]** | **> 100%** |

**Table 1-8.—Conservation Area by Species Habitat Creation Conservation Measures**

| Species Habitat Creation Conservation Measures (Required Acres) | Management Unit | Creditable Acres FY17[1] | Creditable Acres Total | Percent of Acres Creditable by Species Conservation Measure |
|---|---|---|---|---|
| LEBI1 (512 acres) | E9 Hart Mine Marsh | 0 | 255 | |
| | E14 Imperial Ponds Conservation Area | 0 | 12 | |
| | E28 Yuma East Wetlands | 0 | 94 | |
| **Total** | | **0** | **361** | **71%** |
| BLRA1 (130 acres) | E9 Hart Mine Marsh | 0[4] | 0 | |
| | E14 Imperial Ponds Conservation Area | 0 | 12 | |
| | E28 Yuma East Wetlands | 0 | 94 | |
| **Total** | | **0** | **106** | **82%** |
| YBCU1 (4,050 acres) | E1 Beal Lake Conservation Area | 0 | 119 | |
| | E4 Palo Verde Ecological Reserve | 0 | 945 | |
| | E5 Cibola Valley Conservation Area | 0 | 265 | |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area | 0 | 365 | |
| | E28 Yuma East Wetlands | 0 | 183 | |
| **Total** | | **0** | **1,877** | **46%** |
| ELOW1 (1,784 acres) | E1 Beal Lake Conservation Area | 0 | 119 | |
| | E4 Palo Verde Ecological Reserve | 0 | 985 | |
| | E5 Cibola Valley Conservation Area | 0 | 670 | |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area | 0 | 271 | |
| | E28 Yuma East Wetlands | 0 | 286 | |
| | E36 Parker Dam Camp | 0 | 80 | |
| **Total** | | **0** | **2,410[3]** | **> 100%** |
| GIFL1 (4,050 acres) | E1 Beal Lake Conservation Area | 0 | 119 | |
| | E4 Palo Verde Ecological Reserve | 0 | 945 | |
| | E5 Cibola Valley Conservation Area | 0 | 265 | |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area | 0 | 365 | |
| | E28 Yuma East Wetlands | 0 | 183 | |
| **Total** | | **0** | **1,877** | **46%** |
| GIWO1 (1,702 acres) | E1 Beal Lake Conservation Area | 0 | 119 | |
| | E4 Palo Verde Ecological Reserve | 0 | 945 | |
| | E5 Cibola Valley Conservation Area | 0 | 265 | |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area | 0 | 365 | |
| | E28 Yuma East Wetlands | 0 | 183 | |
| **Total** | | **0** | **1,877[3]** | **> 100%** |

**Table 1-8.—Conservation Area by Species Habitat Creation Conservation Measures**

| Species Habitat Creation Conservation Measures (Required Acres) | Management Unit | Creditable Acres FY17[1] | Creditable Acres Total | Percent of Acres Creditable by Species Conservation Measure |
|---|---|---|---|---|
| VEFL1 (5,208 acres) | E1 Beal Lake Conservation Area | 0 | 119 | |
| | E4 Palo Verde Ecological Reserve | 0 | 985 | |
| | E5 Cibola Valley Conservation Area | 0 | 670 | |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area | 0 | 365 | |
| | E28 Yuma East Wetlands | 0 | 286 | |
| | E36 Parker Dam Camp | 0 | 80 | |
| **Total** | | **0** | **2,505** | **48%** |
| BEVI1 (2,983 acres) | E1 Beal Lake Conservation Area | 0 | 119 | |
| | E4 Palo Verde Ecological Reserve | 0 | 1,023 | |
| | E5 Cibola Valley Conservation Area | 0 | 670 | |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area | 0 | 365 | |
| | E28 Yuma East Wetlands | 0 | 286 | |
| | E36 Parker Dam Camp | 0 | 80 | |
| **Total** | | **0** | **2,543** | **85%** |
| YWAR1 (4,050 acres) | E1 Beal Lake Conservation Area | 0 | 119 | |
| | E4 Palo Verde Ecological Reserve | 0 | 945 | |
| | E5 Cibola Valley Conservation Area | 0 | 265 | |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area | 0 | 365 | |
| | E28 Yuma East Wetlands | 0 | 183 | |
| **Total** | | **0** | **1,877** | **46%** |
| SUTA1 (602 acres) | E1 Beal Lake Conservation Area | 0 | 119 | |
| | E4 Palo Verde Ecological Reserve | 0 | 945 | |
| | E5 Cibola Valley Conservation Area | 0 | 265 | |
| | E24 Cibola National Wildlife Refuge Unit #1 Conservation Area | 0 | 271 | |
| | E28 Yuma East Wetlands | 0 | 183 | |
| **Total** | | **0** | **1,783[3]** | **> 100%** |
| FLSU1 (85 acres) | E25 Big Bend Conservation Area | 0 | 15 | |
| **Total** | | **0** | **15** | **18%** |
| MNSW2 (222 acres) | E4 Palo Verde Ecological Reserve | 0 | 40 | |
| | E5 Cibola Valley Conservation Area | 0 | 405 | |
| **Total** | | **0** | **445[3]** | **> 100%** |

[1] Starting in FY14, the LCR MSCP began the transition from using terrestrial vegetation measurements to remotely sensed measurements (lidar). The habitat creation accomplishment analysis was not performed for FY18 since this lidar data was not available. Work Task F1 provides additional information.

[2] WIFL1 – Although these conservation areas provide the appropriate structure type (cottonwood-willow I–IV) as defined in WIFL1, the LCR MSCP is in the process of gathering the appropriate hydrologic data to determine saturated soils, moist soils, or slow-moving water at each of these areas. During FY15, hydrologic data were collected at the Palo Verde Ecological Reserve (PVER), and it was determined that the PVER does meet both structure type and moist soils requirements. Once this has been determined at the other conservation areas, they will be evaluated.

[3] The total for creditable acres established exceeds the species habitat creation conservation measure requirements. For many species, creditable acres established beyond conservation measure requirements is due to habitat creation efforts for other species. A portion of the creditable acres will be actively managed to meet species' habitat needs.

[4] BLRA1 – The LCR MSCP is in the process of determining the land and water interface and the method for delineating California blackrail marsh habitat ≤ 1 inch deep. Once this has been determined, Hart Mine Marsh will be evaluated.

2. *A running tabulation and description of all conservation measures that have been completed from the commencement of the LCR MSCP to the date of the report*

   Tables 1-9a–c (following page) provide a summary of fish repatriation. Table 1-10 provides a matrix showing the work tasks and their related conservation measures. Attachment E lists the technical reports that were published in FY18.

3. *A description of any take known to have occurred during the previous budget period*

   In accordance with FMA Section 7.4.1(F), any incidental take known to have occurred during LCR MSCP implementation in FY18 is reported in attachment B. The USFWS Section 10 Permit and the 2005 BO authorize incidental take resulting from Federal covered actions, non-Federal covered activities, and Reclamation's implementation of the HCP, as long as conservation measures and avoidance and minimization measures are in place. Due to the wide range and scope of this program, surrogate measures were used in the program compliance documents to quantify impacts. These same surrogates were used to determine the types and levels of any incidental take known to have occurred in FY18. As described in the 2005 BO, the surrogate measures for incidental take are listed below.

   **Flow-Related**

   Total loss of suitable habitat for covered species that use cottonwood-willow, marsh, and backwaters resulting from the changes in points of diversions, extension of the interim surplus guidelines, and implementation of the shortage criteria.

   As total habitat loss is calculated for all of these actions, take is being documented as the amount and type of covered actions and activities being implemented.

   **Non-Flow-Related**

   Acreage or miles of habitats affected by non-flow-related actions.

   **Other Non-Flow-Related (Continuing Actions)**

   Acreage or miles of facilities affected by maintenance actions.

### Creation of Restoration Sites

Affected habitat acreage for the covered species with the understanding that, during creation of higher-value habitat, there may be harassment of individuals.

Attachment B summarizes the surrogate measures for incidental take for Federal flow-related actions, Federal non-flow-related actions, and non-Federal activities. Non-Federal flow-related activities are included as part of the Federal flow-related actions.

**Table 1-9a.—Summary of Fish Augmentation Conservation Measure RASU5**

| Reach | Number of Razorback Suckers, FY18 | Total Number of Razorback Suckers |
|---|---|---|
| 2 | 3,107 | 126,016[1] |
| **Total** | **3,107** | **126,016** |

[1] The total number of razorback suckers stocked into Reach 2 through FY17 was changed from 122,387 to 122,909 after an internal audit in July 2018. This increase is reflected in the total through FY18.

**Table 1-9b.—Summary of Fish Augmentation Conservation Measure RASU3**

| Reach | Number of Razorback Suckers, FY18 | Total Number of Razorback Suckers |
|---|---|---|
| 3 | 6,471 | 94,086 |
| 4 and 5 | 6,266 | 99,177[1] |
| **Total** | **12,737** | **193,263** |

[1] The total number of razorback suckers stocked into Reaches 4 and 5 through FY17 was changed from 93,112 to 92,911 after an internal audit in July 2018. This decrease is reflected in the total through FY18.

**Table 1-9c.—Summary of Fish Augmentation Conservation Measure BONY3**

| Reach | Number of Bonytail, FY18 | Bonytail Program |
|---|---|---|
| 2 | 513[1] | 2,110[1] |
| 3 | 4,061 | 59,039[2] |
| 4 and 5 | 8,039 | 39,112[3] |
| **Total** | **12,613** | **100,261** |

[1] Bonytail stocking into Reach 2 commenced in FY16 as part of a pilot study.
[2] The total number of bonytail stocked into Reach 3 through FY17 was changed from 54,976 to 54,978 after an internal audit in July 2018. This increase is reflected in the total through FY18.
[3] The total number of bonytail stocked into Reaches 4 and 5 through FY17 was changed from 32,460 to 31,073 after an internal audit in July 2018. This decrease is reflected in the total through FY18.

**Table 1-10.—Status of Conservation Measures**

| Species/Habitat/Action | Code | Description | FY18 Approved | FY19 Approved | FY20 Proposed |
|---|---|---|---|---|---|
| Yuma Clapper Rail | CLRA1 | Create habitat: 512 acres | C60 E9 E14 E16 E21 E28 E38 F1 G1 G4 G6 H2 | C60 E9 E14 E16 E21 E28 E38 F1 G1 G4 G6 H2 | C60 E9 E14 E16 E21 E28 E38 F1 G1 G4 G6 H2 |
| | CLRA2 | Maintain existing important habitat | G1 G4 G6 H1 | G1 G4 G6 H1 | G1 G4 G6 H1 |
| | MRM1 | Define habitat characteristics | C24 C66 D1 F7 G1 G4 G6 | D1 F7 G1 G4 G6 | D1 F7 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C24 C59 C60 C66 F1 F7 G1 G4 G6 | C59 C60 F1 F7 G1 G4 G6 | C59 C60 F1 F7 G1 G4 G6 |
| | MRM5 | Monitor selenium levels in backwater | C59 G1 G4 | C59 G1 G4 | C59 G1 G4 |
| | CMM1 | Reduce risk of loss to wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Southwestern Willow Flycatcher | WIFL1 | Create habitat: 4,050 acres | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 |
| | WIFL2 | Maintain existing important habitat | D2 E21 G1 G4 G6 H1 | D2 E21 G1 G4 G6 H1 | D2 E21 G1 G4 G6 H1 |
| | MRM1 | Define habitat characteristics | C24 D2 D5 F9 G1 G4 G6 | D2 D5 F9 G1 G4 G6 | D2 D5 F9 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C24 C60 D2 D5 F1 F9 G1 G4 G6 | C60 D2 D5 F1 F9 G1 G4 G6 | C60 D2 D5 F1 F9 G1 G4 G6 |
| | MRM4 | Brown-headed cowbird evaluation | D2 F9 G1 G4 | D2 F9 G1 G4 | D2 F9 G1 G4 |
| | CMM1 | Reduce risk of loss to wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Desert Tortoise | **DETO1** | **Acquire, protect 230 acres – Completed** | | | |
| | DETO2 | Avoid impacts on individuals and burrows | G1 G4 | G1 G4 | G1 G4 |

**Table 1-10.—Status of Conservation Measures**

| Species/Habitat/Action | Code | Description | FY18 Approved | FY19 Approved | FY20 Proposed |
|---|---|---|---|---|---|
| Bonytail | BONY1 | Coordinate conservation efforts with the USFWS and recovery programs | A1 | A1 | A1 |
| | BONY2 | Create 360 acres of bonytail habitat | C40 C60 E1 E14 E16 E21 E25 E35 G1 G4 G6 H2 | C60 E1 E14 E16 E21 E25 E35 E40 G1 G4 G6 H2 | C60 E1 E14 E16 E21 E25 E35 E40 E41 G1 G4 G6 H2 |
| | BONY3 | Rear/stock 620,000:<br><br>5,000 subadults per year for 40 years at Lake Mohave<br><br>4,000 subadults per year for 50 years from Davis Dam to Parker Dam<br><br>4,000 subadults per year – experimental augmentation from Parker Dam to Imperial Dam for 10 consecutive years<br><br>4,000 subadults per year from Parker Dam to Imperial Dam for 45 years | B2 B3 B4 B6 B7 B8 B12 C61 C63 C64 C65 G1 G4 H2 | B2 B3 B4 B6 B7 B8 B12 C61 C64 G1 G4 H2 | B2 B3 B4 B6 B7 B8 B12 C61 C64 G1 G4 H2 |
| | BONY4 | Develop (if necessary) additional rearing capacity | B2 B3 B4 B6 B7 B8 B12 C64 C65 G1 G4 | B2 B3 B4 B6 B7 B8 B12 C64 E40 G1 G4 | B2 B3 B4 B6 B7 B8 B12 C64 E40 G1 G4 |
| | BONY5 | Monitor, research, and adaptively manage augmentations and created habitat | B7 B8 C40 C59 C60 C61 C63 C64 C65 D8 F5 G1 G4 G6 | B7 B8 C59 C60 C61 C64 D8 F5 G1 G4 G6 | B7 B8 C59 C60 C61 C64 D8 D15 F5 G1 G4 G6 |
| | MRM5 | Monitor selenium levels in backwater | C59 G1 G4 | C59 G1 G4 | C59 G1 G4 |
| Humpback Chub | HUCH1 | $500,000 to existing programs | C14 | C14 | C14 |

**Table 1-10.—Status of Conservation Measures**

| Species/Habitat/Action | Code | Description | FY18 Approved | FY19 Approved | FY20 Proposed |
|---|---|---|---|---|---|
| Razorback Sucker | RASU1 | Coordinate conservation efforts with the USFWS and recovery programs | A1 | A1 | A1 |
| | RASU2 | Create 360 acres of razorback sucker habitat | C31 C40 C60 E1 E14 E16 E21 E25 E35 G1 G4 G6 H2 | C60 E1 E14 E16 E21 E25 E35 E40 G1 G4 G6 H2 | C60 E1 E14 E16 E21 E25 E35 E40 E41 G1 G4 G6 H2 |
| | RASU3 | Rear/stock 660,000:<br><br>6,000 subadults per year for 10 years from Davis Dam to Parker Dam and 6,000 subadults per year for 10 years from Parker Dam to Imperial Dam<br><br>6,000 subadults per year for 45 years from Davis Dam to Parker Dam<br><br>6,000 subadults per year for 45 years from Parker Dam to Imperial Dam | B1 B2 B3 B4 B5 B6 B7 B8 C31 C61 C63 C64 C65 G1 G4 H2 | B1 B2 B3 B4 B5 B6 B7 B8 C61 C64 G1 G4 H2 | B1 B2 B3 B4 B5 B6 B7 B8 C61 C64 G1 G4 H2 |
| | RASU4 | Develop (if necessary) additional rearing capacity | B2 B3 B4 B5 B6 B7 B8 C64 C65 G1 G4 | B2 B3 B4 B5 B6 B7 B8 C64 E40 G1 G4 | B2 B3 B4 B5 B6 B7 B8 C64 E40 G1 G4 |
| | RASU5 | Support ongoing Lake Mohave conservation efforts | B1 B2 B7 B8 C31 C61 C63 G1 G4 | B1 B2 B7 B8 C61 G1 G4 | B1 B2 B7 B8 C61 G1 G4 |
| | RASU6 | Monitor, research, and adaptively manage augmentations and created habitat | B7 B8 C31 C40 C59 C60 C61 C63 C64 C65 D8 F5 G1 G4 G6 | B7 B8 C59 C60 C61 C64 D8 F5 G1 G4 G6 | B7 B8 C59 C60 C61 C64 D8 D15 F5 G1 G4 G6 |
| | RASU7 | Funding for ongoing Reclamation/Southern Nevada Water Authority Lake Mead studies | B6 G1 G4 | B6 G1 G4 | B6 G1 G4 |
| | RASU8 | Continue razorback sucker conservation measure identified in the 2001 BO | B1 B6 G1 G4 | B1 B6 G1 G4 | B1 B6 G1 G4 |
| | MRM5 | Monitor selenium levels in backwater | C59 G1 G4 | C59 G1 G4 | C59 G1 G4 |

**Table 1-10.—Status of Conservation Measures**

| Species/Habitat/Action | Code | Description | FY18 Approved | FY19 Approved | FY20 Proposed |
|---|---|---|---|---|---|
| Western Red Bat | WRBA1 | Status/habitat surveys | D9 F4 G1 G4 G6 | D9 F4 G1 G4 G6 | D9 F4 G1 G4 G6 |
| | **WRBA2** | **Create 765 acres – Creditable acres established exceed requirement** | C60 E1 E4 E5 E14 E16 E21 E24 E33 E36 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E33 E36 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E33 E36 E37 E39 F1 G1 G4 G6 H2 |
| | MRM1 | Define habitat characteristics | D9 F4 G1 G4 G6 | D9 F4 G1 G4 G6 | D9 F4 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C60 F1 F4 G1 G4 G6 | C60 F1 F4 G1 G4 G6 | C60 F1 F4 G1 G4 G6 |
| | CMM1 | Reduce risk of loss of habitat to wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Western Yellow Bat | WYBA1 | Conduct surveys for species distribution | D9 F4 G1 G4 G6 | D9 F4 G1 G4 G6 | D9 F4 G1 G4 G6 |
| | WYBA2 | Avoid removal of roost trees (palms) | G1 G4 | G1 G4 | G1 G4 |
| | **WYBA3** | **Create 765 acres – Creditable acres established exceed requirement** | E1 E4 E5 E14 E16 E21 E24 E33 E36 E37 E39 F1 G1 G4 G6 H2 | E1 E4 E5 E14 E16 E21 E24 E33 E36 E37 E39 F1 G1 G4 G6 H2 | E1 E4 E5 E14 E16 E21 E24 E33 E36 E37 E39 F1 G1 G4 G6 H2 |
| | MRM1 | Define habitat characteristics | D9 F4 G1 G4 G6 | D9 F4 G1 G4 G6 | D9 F4 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C60 F1 F4 G1 G4 G6 | C60 F1 F4 G1 G4 G6 | C60 F1 F4 G1 G4 G6 |
| | CMM1 | Reduce risk of loss of habitat to wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Desert Pocket Mouse | DPMO1 | Locate occupied habitat and restore disturbed habitat | D10 F3 G1 G4 G6 | D10 F3 G1 G4 G6 | D10 F3 G1 G4 G6 |
| | MRM1 | Define habitat characteristics | D10 F3 G1 G6 | D10 F3 G1 G6 | D10 F3 G1 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | F3 G1 G6 | F3 G1 G6 | F3 G1 G6 |

**Table 1-10.—Status of Conservation Measures**

| Species/Habitat/Action | Code | Description | FY18 Approved | FY19 Approved | FY20 Proposed |
|---|---|---|---|---|---|
| Colorado River Cotton Rat | CRCR1 | Status/habitat surveys – define habitat first 5 years | D10 F3 G1 G4 G6 | D10 F3 G1 G4 G6 | D10 F3 G1 G4 G6 |
| | **CRCR2** | **Create 125 acres – Creditable acres established exceed requirement** | C60 E9 E16 E21 E24 E38 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E9 E16 E21 E24 E36 E38 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E9 E16 E21 E24 E36 E38 F1 G1 G4 G6 H2 |
| | MRM2 | Monitor and adaptively manage created habitat | C60 D10 F1 F3 G1 G4 G6 | C60 D10 F1 F3 G1 G4 G6 | C60 D10 F1 F3 G1 G4 G6 |
| | CMM1 | Reduce risk of loss of habitat to wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Yuma Hispid Cotton Rat | YHCR1 | Status/habitat surveys – define habitat first 5 years | D10 F3 G1 G4 G6 | D10 F3 G1 G4 G6 | D10 F3 G1 G4 G6 |
| | **YHCR2** | **Create 76 acres – Creditable acres established exceed requirement** | C60 E16 E27 E28 E31 F1 G1 G4 G6 H2 | C60 E16 E27 E28 E31 F1 G1 G4 G6 H2 | C60 E16 E27 E28 E31 F1 G1 G4 G6 H2 |
| | MRM2 | Monitor and adaptively manage created habitat | C60 D10 F1 F3 G1 G4 G6 | C60 D10 F1 F3 G1 G4 G6 | C60 D10 F1 F3 G1 G4 G6 |
| | CMM1 | Reduce risk of loss of habitat to wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Western Least Bittern | LEBI1 | Create 512 acres | C60 E9 E14 E16 E21 E28 E38 F1 G1 G4 G6 H2 | C60 E9 E14 E16 E21 E28 E38 F1 G1 G4 G6 H2 | C60 E9 E14 E16 E21 E28 E38 F1 G1 G4 G6 H2 |
| | MRM1 | Define habitat characteristics | C24 C66 D1 F7 G1 G4 G6 | D1 F7 G1 G4 G6 | D1 F7 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C24 C59 C60 C66 F1 F7 G1 G4 G6 | C59 C60 F1 F7 G1 G4 G6 | C59 C60 F1 F7 G1 G4 G6 |
| | MRM5 | Monitor selenium levels | C59 G1 | C59 G1 | C59 G1 |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |

**Table 1-10.—Status of Conservation Measures**

| Species/Habitat/Action | Code | Description | FY18 Approved | FY19 Approved | FY20 Proposed |
|---|---|---|---|---|---|
| California Black Rail | BLRA1 | Create 130 acres | C60 E9 E14 E16 E28 E38 F1 G1 G4 G6 H2 | C60 E9 E14 E16 E28 E38 F1 G1 G4 G6 H2 | C60 E9 E14 E16 E28 E38 F1 G1 G4 G6 H2 |
| | BLRA2 | Maintain existing occupied habitat | G1 G4 G6 H1 | G1 G4 G6 H1 | G1 G4 G6 H1 |
| | MRM1 | Define habitat characteristics | C24 C66 D1 F7 G1 G4 G6 | D1 F7 G1 G4 G6 | D1 F7 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C24 C59 C60 C66 D1 F1 F7 G1 G4 G6 | C59 C60 D1 F1 F7 G1 G4 G6 | C59 C60 D1 F1 F7 G1 G4 G6 |
| | MRM5 | Monitor selenium levels | C59 G1 G4 | C59 G1 G4 | C59 G1 G4 |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Yellow-billed Cuckoo | YBCU1 | Create 4,050 acres | E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 | E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 | E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 |
| | YBCU2 | Maintain existing habitat | C60 E21 G1 G4 G6 H1 | C60 E21 G1 G4 G6 H1 | C60 E21 G1 G4 G6 H1 |
| | MRM1 | Define habitat characteristics | C24 D5 D7 F10 G1 G4 G6 | D5 D7 F10 G1 G4 G6 | D5 D7 F10 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C24 C55 C60 D5 D7 F1 F10 G1 G4 G6 | C55 C60 D5 D7 F1 F10 G1 G4 G6 | C55 C60 D5 D7 F1 F10 G1 G4 G6 |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |

**Table 1-10.—Status of Conservation Measures**

| Species/Habitat/Action | Code | Description | FY18 Approved | FY19 Approved | FY20 Proposed |
|---|---|---|---|---|---|
| Elf Owl | **ELOW1** | **Create 1,784 acres in Reaches 3–5 – Creditable acres established exceed requirement** | C60 E1 E4 E5 E14 E16 E21 E24 E27 E33 E36 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E33 E36 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E33 E36 E37 E39 F1 G1 G4 G6 H2 |
| | ELOW2 | Install elf owl boxes before Gila woodpeckers established | G1 G4 | G1 G4 | G1 G4 |
| | MRM1 | Define habitat characteristics | C24 D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C24 C60 D5 F1 F2 G4 G6 | C60 D5 F1 F2 G4 G6 | C60 D5 F1 F2 G4 G6 |
| | MRM3 | Research nest competition of European starlings | G1 G4 G6 | G1 G4 G6 | G1 G4 G6 |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Gilded Flicker | GIFL1 | Create 4,050 acres in Reaches 3–7 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 |
| | GIFL2 | Install artificial snags until vegetation has matured | | | |
| | MRM1 | Define habitat characteristics | C24 D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C24 C60 D5 F1 F2 G1 G4 G6 | C60 D5 F1 F2 G1 G4 G6 | C60 D5 F1 F2 G1 G4 G6 |
| | MRM3 | Research nest competition of European starlings | G1 G4 G6 | G1 G4 G6 | G1 G4 G6 |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |

**Table 1-10.—Status of Conservation Measures**

| Species/Habitat/Action | Code | Description | FY18 Approved | FY19 Approved | FY20 Proposed |
|---|---|---|---|---|---|
| Gila Woodpecker | **GIWO1** | **Create 1,702 acres in Reaches 3–6 – Creditable acres established exceed requirement** | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 |
| | GIWO2 | Install artificial snags | | | |
| | MRM1 | Define habitat characteristics | C24 D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C24 C60 D5 F1 F2 G1 G4 G6 | C60 D5 F1 F2 G1 G4 G6 | C60 D5 F1 F2 G1 G4 G6 |
| | MRM3 | Research nest competition of European starlings | G1 G4 G6 | G1 G4 G6 | G1 G4 G6 |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Vermilion Flycatcher | VEFL1 | Create 5,208 acres | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E33 E36 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E33 E36 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E33 E36 E37 E39 F1 G1 G4 G6 H2 |
| | MRM1 | Define habitat characteristics | C24 D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C24 C60 D5 F1 F2 G1 G4 G6 | C60 D5 F1 F2 G1 G4 G6 | C60 D5 F1 F2 G1 G4 G6 |
| | MRM4 | Brown-headed cowbird evaluation | | | |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |

**Table 1-10.—Status of Conservation Measures**

| Species/Habitat/Action | Code | Description | FY18 Approved | FY19 Approved | FY20 Proposed |
|---|---|---|---|---|---|
| Arizona Bell's Vireo | BEVI1 | Create 2,983 acres | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E33 E36 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E33 E36 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E33 E36 E37 E39 F1 G1 G4 G6 H2 |
| | MRM1 | Define habitat characteristics | C24 D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C24 C55 C60 D5 F1 F2 G1 G4 G6 | C55 C60 D5 F1 F2 G1 G4 G6 | C55 C60 D5 F1 F2 G1 G4 G6 |
| | MRM4 | Brown-headed cowbird evaluation | | | |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Sonoran Yellow Warbler | YWAR1 | Create 4,050 acres | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E31 E37 E39 F1 G1 G4 G6 H2 |
| | MRM1 | Define habitat characteristics | C24 D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C24 C60 D5 F1 F2 G1 G4 G6 | C60 D5 F1 F2 G1 G4 G6 | C60 D5 F1 F2 G1 G4 G6 |
| | MRM4 | Brown-headed cowbird evaluation | | | |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |

**Table 1-10.—Status of Conservation Measures**

| Species/Habitat/Action | Code | Description | FY18 Approved | FY19 Approved | FY20 Proposed |
|---|---|---|---|---|---|
| Summer Tanager | **SUTA1** | **Create 602 acres – Creditable acres established exceed requirement** | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E37 E39 F1 G1 G4 G6 H2 | C60 E1 E4 E5 E14 E16 E21 E24 E27 E28 E37 E39 F1 G1 G4 G6 H2 |
| | MRM1 | Define habitat characteristics | C24 D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 | D5 D6 F2 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C24 C60 D5 F1 F2 G1 G4 G6 | C60 D5 F1 F2 G1 G4 G6 | C60 D5 F1 F2 G1 G4 G6 |
| | MRM4 | Brown-headed cowbird evaluation | | | |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Flat-tailed Horned Lizard | **FTHL1** | **Acquire and protect 230 acres – Completed** | | | |
| | FTHL2 | Implement conservation measures to avoid take | G1 G4 | G1 G4 | G1 G4 |
| Relict Leopard Frog | **RLFR1** | **$10,000 per year for 10 years to conservation program – Completed** | | | |
| Flannelmouth Sucker | FLSU1 | 85 acres – Reach 3 | C53 C60 E16 E25 E35 G1 G4 G6 H2 | C60 E16 E25 E35 G1 G4 G6 H2 | C60 E16 E25 E35 E41 G1 G4 G6 H2 |
| | **FLSU2** | **$80,000 per year for 5 years – Completed** | | | |
| | FLSU3 | Develop management needs/strategies | C53 G1 G4 | G1 G4 | G1 G4 |
| | MRM2 | Monitor and adaptively manage created habitat | C59 C60 G1 G4 G6 | C59 C60 G1 G4 G6 | C59 C60 G1 G4 G6 |
| | MRM5 | Monitor selenium levels in backwaters | C59 G1 G4 | C59 G1 G4 | C59 G1 G4 |

**Table 1-10.—Status of Conservation Measures**

| Species/Habitat/Action | Code | Description | FY18 Approved | FY19 Approved | FY20 Proposed |
|---|---|---|---|---|---|
| MacNeill's Sootywing Skipper | MNSW1 | Status surveys/habitat – define habitat first 5 years | F6 G1 G4 G6 | D14 F6 G1 G4 G6 | D14 F6 G1 G4 G6 |
| | **MNSW2** | **Create 222 acres – Creditable acres established exceed requirement** | C60 E1 E4 E5 E16 E37 E39 G1 G4 G6 H2 | C60 E1 E4 E5 E16 E37 E39 G1 G4 G6 | C60 E1 E4 E5 E16 E37 E39 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | C60 F1 F6 G1 G4 G6 | C60 D14 F1 F6 G1 G4 G6 | C60 D14 F1 F6 G1 G4 G6 |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 G6 | E18 G1 G4 G6 | E18 G1 G4 G6 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Sticky Buckwheat | STBU1 | $10,000 per year until 2030 to conservation program | C2 G1 | C2 G1 | C2 G1 |
| Threecorner Milkvetch | THMI1 | $10,000 per year until 2030 to conservation program | C2 G1 | C2 G1 | C2 G1 |
| California Leaf-nosed Bat | CLNB1 | Distribution surveys | G1 G4 G6 | G1 G4 G6 | G1 G4 G6 |
| | CLNB2 | Create habitat near roost sites (priority when creating cottonwood-willow and honey mesquite habitat for other species) | G1 G4 G6 | G1 G4 G6 | G1 G4 G6 |
| | MRM1 | Define habitat characteristics | D9 F4 G1 G4 G6 | D9 F4 G1 G4 G6 | D9 F4 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | F4 G1 G4 G6 | F4 G1 G4 G6 | F4 G1 G4 G6 |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habit affected by wildfire | G1 G4 | G1 G4 | G1 G4 |

**Table 1-10.—Status of Conservation Measures**

| Species/Habitat/Action | Code | Description | FY18 Approved | FY19 Approved | FY20 Proposed |
|---|---|---|---|---|---|
| Pale Townsend's Big-eared Bat | PTBB1 | Distribution surveys | G1 G4 G6 | G1 G4 G6 | G1 G4 G6 |
| | PTBB2 | Create habitat near roost sites | E16 G1 G4 G6 | E16 G1 G4 G6 | E16 G1 G4 G6 |
| | MRM1 | Determine habitat characteristics | D9 F4 G1 G4 G6 | D9 F4 G1 G4 G6 | D9 F4 G1 G4 G6 |
| | MRM2 | Monitor and adaptively manage created habitat | F4 G1 G4 G6 | F4 G1 G4 G6 | F4 G1 G4 G6 |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| Colorado River Toad | CRTO1 | Distribution surveys, habitat affinity, limiting factors | F8 G1 G4 G6 | F8 G1 G4 G6 | F8 G1 G4 G6 |
| | CRTO2 | Protect existing occupied habitat | G1 G4 G6 | G1 G4 G6 | G1 G4 G6 |
| | CRTO3 | Research to establish in unoccupied habitat | G1 G4 G6 | G1 G4 G6 | G1 G4 G6 |
| Lowland Leopard Frog | LLFR1 | Distribution surveys, habitat affinity, limiting factors | F8 G1 G4 G6 | F8 G1 G4 G6 | F8 G1 G4 G6 |
| | LLFR2 | Protect existing occupied habitat | G1 G4 G6 | G1 G4 G6 | G1 G4 G6 |
| | LLFR3 | Research to establish in unoccupied habitat | G1 G4 G6 | G1 G4 G6 | G1 G4 G6 |
| Northern Mexican Gartersnake | NMGS1 | Create 1,496 acres | E1 E28 G1 G4 | E1 E28 G1 G4 | E1 E28 G1 G4 |
| | NMGS2 | Implement measures to avoid/minimize take | G1 G4 | G1 G4 | G1 G4 |
| | MRM2 | Monitor and adaptively manage created habitat | F8 G1 G4 | F8 G1 G4 | F8 G1 G4 |
| | CMM1 | Reduce risk of loss of habitat affected by wildfire | E18 G1 G4 | E18 G1 G4 | E18 G1 G4 |
| | CMM2 | Replace created habitat affected by wildfire | G1 G4 | G1 G4 | G1 G4 |
| **Other** | | | | | |
| Topock Marsh Pumping | **AMM2** | **Avoid flow-related impacts on covered species – Completed** | E17 | E17 | E17 |
| Law Enforcement and Fire Suppression | CMM1 | Reduce effects of fire and vandalism on created habitats | E18 G1 | E18 G1 | E18 G1 |

4. *Any recommendation made by the USFWS or any State wildlife agency regarding the LCR MSCP*

   The July 16, 2018, approval letter from the USFWS for Minor Modifications to the LCR MSCP Habitat Conservation Plan: Implementation Agreement and Funding and Management Agreement and the November 2, 2018, consistency letter from the USFWS for the *Final Implementation Report, Fiscal Year 2019 Work Plan and Budget, Fiscal Year 2017 Accomplishment Report* are included in attachment C

5. *Approval or rejection of any minor modification described in Section 14.1 of the Implementation Agreement*

   The northern Mexican gartersnake was added as a covered species by an amendment to the Program Documents on March 5, 2018. Minor Modifications to the Implementing Agreement, Funding and Management Agreement, and Table 1-2 in the LCR MSCP Biological Assessment and Habitat Conservation Plan, as outlined in Program Decision Document 18-001, were approved on April 25, 2018.

## 2001 Biological Opinion

In addition to fulfilling the requirements in the LCR MSCP Habitat Conservation Plan, the work plans also satisfied conservation measures required in the 2001 BO. The requirements listed in the 2001 BO were integrated into this program and implemented by Reclamation in conjunction with the LCR MSCP. According to the Record of Decision signed on January 16, 2001, the ISC expired on December 31, 2015. Requirements under the 2001 BO specifically related to the Secretarial Implementation Agreements were completed in FY08. Monitoring under Conservation Measure 4, Tier 1a, was to continue until 5 years after implementation of all water transfers covered under the 2001 BO. A review of the monitoring program, including the methodology and results from the first 5 years, was completed, and a decision was made to discontinue this monitoring. A concurrence letter was received from the USFWS on August 14, 2012. Requirements under the 2001 BO specifically related to the ISC were completed when the ISC expired on December 31, 2015. Continuation of the ISC beyond December 31, 2015, is a covered action of the LCR MSCP.

## California Endangered Species Act Permit

In conjunction with Federal ESA coverage, California State law requires CESA permitting for California activities. The California partners applied for and received a CESA Incidental Take Permit pursuant to California Department of Fish and Game Code Sections 2081(a) and 2081(b). The California partners negotiated the terms of the CESA permit with the CDFW to be compatible with the LCR MSCP. The CESA permit provides compliance only for California partners.

The LCR MSCP conservation activities fulfill the requirements of the CESA permit; however, certain CESA permit requirements are more specific in relationship to location or timing. All other CESA permit requirements are otherwise the same as those for the LCR MSCP. By meeting LCR MSCP requirements in FY18, CESA program requirements were also met for FY18.

Listed below are the CESA requirements that are more detailed than those in the LCR MSCP Habitat Conservation Plan:

1. Requirements for various types of coordination with the CDFW during identification, development, construction, and maintenance of habitat created or restored within the State of California under the LCR MSCP.

2. Various reporting requirements to be made to the CDFW, including annual status reports and notifications.

3. Riparian, marsh, and backwater replacement plans are to be submitted to the CDFW for approval of riparian and marsh habitat creation and restoration within the State of California under the LCR MSCP.

4. Monitoring, research, and adaptive management plans for the replacement habitat created or restored under the LCR MSCP within the State of California are to be submitted to the CDFW for approval.

5. Locations of all habitats replaced or restored in the State of California under the LCR MSCP must be approved by the CDFW.

6. A minimum of 2,614 acres of the LCR MSCP riparian replacement habitat is to be located in the State of California, including 1,566 acres of cottonwood-willow and 1,048 acres of honey mesquite.

7. A minimum of 240 acres of LCR MSCP marsh habitat is to be created or restored within the State of California, including 170 acres for Yuma clapper rails and 70 acres for California black rails. The acreage shall also support at least 58 acres of Colorado River cotton rat habitat.

8. A minimum of 194 acres of LCR MSCP backwater habitat is to be created or restored within the State of California.

9. Habitat created within the State of California will be protected in perpetuity.

10. An endowment fee of $295 per acre (in 2005 dollars) will be provided to the CDFW for each acre of habitat that is transferred to them in Fee Title at the time of transfer.

11. A total of 270,000 razorback suckers and 200,000 bonytail of at least 12 inches (305 millimeters [mm]) in total length (TL) will be stocked into Reaches 4 and 5 of the LCR in California.

In fulfillment of item 6:

- Through FY18, 1,023 acres of riparian replacement habitat, including 945 acres of the cottonwood-willow and 78 acres of the honey mesquite land cover types at the Palo Verde Ecological Reserve (PVER), met all requirements for riparian replacement habitat under the CESA permit.

In fulfillment of item 11:

- Through FY18, 99,177 razorback suckers and 39,112 bonytail (305 mm or greater in TL) have been stocked into Reaches 4 and 5 (see tables 1-9b–c.). Since the start of the LCR MSCP, 138,289 native fishes have been stocked into Reaches 4 and 5 of the LCR in California.

# OVERVIEW OF WORK TASKS

Fish Augmentation, Monitoring, and Research

Monitoring and Research of Terrestrial, Riparian, and Marsh Habitats and Associated Covered Species

Conservation Area Development, Maintenance, and Adaptive Management

# FISH AUGMENTATION, MONITORING, AND RESEARCH

As described in the HCP, 17 conservation measures for 4 native fish species will be implemented under the LCR MSCP: 8 conservation measures for the razorback sucker, 5 for the bonytail, 3 for the flannelmouth sucker, and 1 for the humpback chub. These conservation measures are addressed through the numerous work plans presented in this report. A summary of the work completed, ongoing activities, and proposed future work is provided below.

The work accomplished in support of native fishes is divided into six sections: Fish Augmentation (Section B), Species Research (Section C), System Monitoring (Section D), Conservation Area Development and Management (Section E) (covered in the "Conservation Area Development, Maintenance, and Adaptive Management" overview), Post-Development Monitoring (Section F), and Adaptive Management Program (Section G). Each of these sections has an important relationship to the other sections. In general, Section B and species habitat goals tend to drive the efforts described in other sections. Under Section C, information is gathered on how to more efficiently augment native fish populations (Section B) and how to build effective habitats for native fishes (Section E). Section D provides feedback on the success of the Fish Augmentation Program and may also identify areas in which additional research is needed (Section C). Under Section F, the relative success of created habitats is evaluated and may also provide data to make adaptive management recommendations (Section G). The general progression of these work tasks is as follows: Valuable information gained from research (Section C) becomes incorporated into a regular process or protocol in augmentation activities (fish handling protocol, stocking technique, etc.), habitat creation (appropriate water depth, substrates, etc.), or management regimes (maintaining particular levels of water quality, water levels, etc.) through the adaptive management process (Section G). Similarly, a monitoring regime that is implemented within the system as part of research investigations may eventually become covered under Section D. When research-based monitoring, which has been conducted during the development of a conservation area (under Section C), evolves into a standardized set of protocols and the development phase of that conservation area is complete, this monitoring may continue as part of Section F. The frequency and intensity of this additional monitoring may be reduced as appropriate to meet the goals of the Section D and Section F work tasks. A number of these specific work task progressions are detailed in the sections below.

## Fish Augmentation (Section B)

The goal of the LCR MSCP Fish Augmentation Program is to provide the effort to stock 660,000 subadult razorback suckers and 620,000 subadult

bonytail for reintroduction into the Colorado River over a 50-year term. Between 2005 and the end of FY18, 293,524 native fishes have been stocked toward completing this goal. This includes 100,261 bonytail that have been stocked into Reaches 2–5 (BONY3) and 193,263 razorback suckers that have been stocked into Reaches 3–5 (RASU3). In addition, 126,016 razorback suckers have been stocked into Reach 2 during this period in support of maintaining a genetic refuge in Lake Mohave (RASU5) (see tables 1-9a–c). This rate of stocking is expected to meet augmentation program goals.

To obtain sufficient numbers of young fishes for grow-out and eventual stocking, an adult broodstock for each species must be maintained by the LCR MSCP. The adult razorback sucker population in Lake Mohave is the most genetically diverse among razorback sucker populations and is the primary broodstock for this species. Under the LCR MSCP, offspring from this stock are captured directly from the lake (Work Task B1) and reared at the Willow Beach National Fish Hatchery (Willow Beach NFH) in Arizona (Work Task B2) and the Lake Mead Fish Hatchery in Nevada (Work Task B6). The fish are then stocked into the LCR. A second broodstock of razorback suckers, developed by the USFWS from Lake Mohave offspring, is maintained at the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center) (Work Task B4). Additional fish rearing capacity is located at the Achii Hanyo Native Fish Rearing Facility in Arizona (Work Task B3), the Bubbling Ponds Fish Hatchery in Arizona (Work Task B5), and the Overton Wildlife Management Area in Nevada (Work Task B11 [closed]).

The Center maintains the only bonytail broodstock in the world used for species propagation (the parents of these fish also came from Lake Mohave). A genetic management plan for this stock has been developed and implemented by the USFWS. LCR MSCP funding is provided to the Center to (1) support the maintenance of this broodstock, (2) produce bonytail for augmentation needs, (3) deliver bonytail to other grow-out facilities, and (4) stock bonytail into the LCR. A second bonytail broodstock has been developed by the USFWS and is being maintained at the Mora National Fish Hatchery in Mora, New Mexico (Work Task B12). This second broodstock is intended to be used as a refuge population (not for additional bonytail production) at this time. Its purpose is to provide a backup to guard against any potential catastrophic event, such as disease outbreaks, that may limit production or result in the loss of the bonytail broodstock maintained at the Center.

## FY18 Accomplishments

A total of 28,457 native fishes were stocked into the LCR in FY18, which included 3,107 razorback suckers and 513 bonytail stocked into Reach 2; 6,471 razorback suckers and 4,061 bonytail stocked into Reach 3; and

6,266 razorback suckers and 8,039 bonytail stocked into Reaches 4 and 5 (see table 1-9a-c). Key accomplishments for FY18 fish augmentation have been summarized by work task.

- *Work Task B1 – Lake Mohave Razorback Sucker Larvae Collections*: A target of 30,500 larvae was established in FY18 to augment hatchery stocks, prepare for future increases in razorback sucker augmentation goals, and provide additional fish as a contingency for unforeseen events. A total of 30,604 wild razorback sucker larvae were successfully captured from four areas of Lake Mohave. Larvae were delivered to the Willow Beach NFH and Lake Mead Fish Hatchery for rearing.

- *Work Task B2 – Willow Beach National Fish Hatchery*: A total of 1,109 razorback suckers were stocked into Reach 2. The Willow Beach NFH received 24,378 razorback sucker larvae for further grow-out and transferred 7,080 and 6,226 razorback sucker fingerlings to the Achii Hanyo Native Fish Rearing Facility and Lake Mead Fish Hatchery, respectively.

- *Work Task B3 – Achii Hanyo Native Fish Rearing Facility*: A total of 413 bonytail were stocked into Reach 4. The Achii Hanyo Native Fish Rearing Facility transferred 2,500 bonytail to the Lake Mead Fish Hatchery for further grow-out and received 10,000 fingerling bonytail from the Center and 7,080 fingerling razorback suckers from the Willow Beach NFH.

- *Work Task B4 – Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico*: A total of 6,868 bonytail were stocked in FY18, which included 3,664 bonytail in Reach 3 and 3,204 bonytail in Reach 4. The Center maintained broodstocks of razorback suckers and bonytail held at this facility and transferred 60,000 larval razorback suckers to the Bubbling Ponds Fish Hatchery and approximately 10,000 fingerling bonytail to the Achii Hanyo Native Fish Rearing Facility for further grow-out.

- *Work Task B5 – Bubbling Ponds Fish Hatchery*: A total of 12,695 razorback suckers were stocked in FY18. This included 6,460 in Reach 3 and 6,235 in Reach 4. A draft Memorandum of Understanding (MOU) between the LCR MSCP and the Arizona Game and Fish Department (AZGFD) was completed; however, the MOU has not been finalized. The purpose of the MOU is to secure long-term, annual production of razorback suckers and allow for incremental additions and improvements to this hatchery. Funding for hatchery improvements in future years is contingent upon a signed MOU.

- *Work Task B6 – Lake Mead Fish Hatchery*: A total of 7,361 native fishes were stocked in FY18, which included 1,998 razorback suckers and 513 bonytail stocked into Reach 2; 397 bonytail stocked into Reach 3, and 31 razorback suckers and 4,422 bonytail stocked into Reaches 4 and 5. The Lake Mead Fish Hatchery received 11,526 razorback sucker larvae from Lake Mohave for further grow-out. The LCR MSCP and Nevada Department of Wildlife finalized a MOU in FY18, which established the commitment of both parties to rear native fish species at the Lake Mead Fish Hatchery for the 50-year life of the LCR MSCP. This memorandum provided the framework for coordination and cooperation between the parties, identified general partner responsibilities, and will help secure native fish rearing and production for the Fish Augmentation Program through 2055.

- *Work Task B7 – Lakeside Rearing Ponds*: A total of 312 razorback suckers were stocked into lakeside rearing ponds in early FY18. Spring and late summer pond harvests resulted in 83 razorback suckers captured and repatriated into Lake Mohave. Harvested fish ranged from 350–530 mm TL and had a mean TL of 437 mm.

- *Work Task B12 – Maintenance of Alternate Bonytail Broodstock*: Funding was provided to maintain the alternate bonytail broodstock (refuge population) at the Mora National Fish Hatchery. Broodstock survival was 99.1% through the end of FY18.

Stocked native fishes have been found to persist in some reaches of the LCR, but because research and monitoring information has indicated that post-stocking survival is still low, augmentation research needs to focus on improving post-stocking survival. Therefore, long-term research that targets improvements in augmentation effectiveness was continued in FY18 under work tasks described in "Species Research (Section C)" below.

## FY19 Activities

Fish augmentation activities will continue to focus on maximizing production, increasing the size (TL) of stocked fishes, preparing for future increases in native fish augmentation goals, augmenting current hatchery stocks, and safeguarding these stocks against unforeseen events.

Approximately 43,000 razorback sucker larvae will be captured from Lake Mohave and distributed to the Willow Beach NFH and Lake Mead Fish Hatchery. The Willow Beach NFH will transfer approximately 18,000 fingerling razorback suckers to the Achii Hanyo Native Fish Rearing Facility and Lake Mead Fish Hatchery for further grow-out.

The Willow Beach NFH will continue working toward meeting the current rearing goal of 8,000 razorback suckers per year with an average TL > 400 mm. Based on the fish currently on station, approximately 2,500 will be available for repatriation into Lake Mohave in FY19.

Production numbers at the Center are expected to be approximately 8,000 bonytail. The Center will continue to supply fingerling razorback suckers to the Bubbling Ponds Fish Hatchery and fingerling bonytail to the Achii Hanyo Native Fish Rearing Facility. Beginning in FY19, the Center will also begin providing approximately 10,000 fingerling bonytail to the Lake Mead Fish Hatchery each year.

The Bubbling Ponds Fish Hatchery will produce approximately 12,000 razorback suckers for augmentation in Reaches 3–5. Facility management and rearing improvements implemented by the AZGFD have also produced a surplus of approximately4,000 subadult fish that will be transferred to the Lake Mead Fish Hatchery for continued grow-out and future stocking. The LCR MSCP will continue working toward establishing a MOU with the AZGFD.

The Lake Mead Fish Hatchery is expected to produce up to 2,000 razorback suckers and approximately 3,500 bonytail toward annual augmentation goals. It will continue to expand production of native fishes with the goal of providing approximately 18,000 fishes per year. Efforts to expand the electrical capabilities at the hatchery, which will support additional razorback sucker larval rearing capacity, will continue in FY19. A MOU between the LCR MSCP and the Nevada Department of Wildlife was signed to secure the use of the Lake Mead Fish Hatchery to raise fishes for the Fish Augmentation Program for the term of the program. Hatchery improvements and increased annual production of fishes will require additional funding for operations and a corresponding increase in budget obligations in FY19 and future years.

## Proposed FY20 Activities

Fish augmentation activities will continue to focus on maximizing production to meet augmentation goals and improving rearing practices to safeguard current and future hatchery stocks. Routine fish augmentation plans for FY20 will repeat activities conducted in previous years and are described in Work Tasks – Section B. Infrastructure repairs, improvements, and expansion may be necessary at partnering facilities to secure current production and to meet the increases needed to support experimental stocking goals.

# Species Research (Section C)

Research is being conducted on covered fish species and their habitats to (1) inform selection and application of conservation techniques, (2) document fulfillment of conservation measures, and (3) develop alternatives to conservation actions through the Adaptive Management Program (AMP) that will allow researchers to quantify existing knowledge, identify data gaps, and design and implement species research to fill the data gaps. Conceptual ecological models (CEMs) have been developed for razorback suckers, bonytail, and flannelmouth suckers (under Work Tasks G4 and G6) and will further assist in identifying these data gaps and in helping to prioritize and redefine research topics.

## FY18 Accomplishments

Fish research work tasks presented in this section detail the accomplishments for FY18. Much of the research performed under Section C represents long-term research studies. In many cases, research under Section C has been ongoing, as several years of data may be necessary to adequately detect trends. Some of the more significant findings for FY18 native fish research include:

*Genetic and Demographic Research*

- *Work Task C31 – Razorback Sucker Genetic Diversity Assessment*: A total 1,301 larvae and 314 adult razorback sucker tissue samples were collected for genetic analyses in FY18 from Reaches 1–3. Larval and adult samples from Lake Mead exhibited only four of the more common mitochondrial deoxyribonucleic acid (mtDNA) haplotypes found in Lake Mohave and exhibited overall lower levels of genetic diversity than other populations. Analyses of larval and adult samples from Lake Mohave yielded 14–18 mtDNA haplotypes and showed levels of variation still comparable to the original source population (wild adults from the 1980s). Samples from Reach 3 were somewhat distinct from Lake Mohave, likely reflecting the mixed ancestry of this population (i.e., fish from both Lake Mohave and the broodstock at the Center). Larval and adult samples were characterized by 11–19 mtDNA haplotypes, and larval samples exhibited similar or higher levels of allelic and gene diversity than Lake Mohave, with no significant reduction in alleles when compared to the original Lake Mohave source population.

- *Work Task C40 – Genetic and Demographic Studies to Inform Conservation Management of Razorback Suckers and Bonytail in Off-Channel Habitats*: Analyses of genetic samples from off-channel habitats were limited in FY18, as protocols for a new genotyping method using single nucleotide polymorphisms (SNPs; “snips”) were in development. Genotyping was completed for 95 bonytail recruits sampled from Imperial Pond 2 in March 2018. Parentage analyses showed that

reproductive success was high for both genders, with more than 80% of individuals contributing offspring and most males and females mating with more than one individual. Genetic effective size of the population was high, and genetic diversity was preserved between parental and progeny generations, consistent with high reproductive success. More than 7,000 SNPs have been identified as suitable for (1) characterizing razorback sucker genetic variation in lower river populations and (2) lineage analyses in backwater ponds (replacing microsatellites). While this technology is still relatively new, the potential utility of these markers for parentage analyses and estimates of genetic variation and reproductive success may provide better inference of population structure and demography, improving long-term monitoring and management for both open and isolated (backwater) populations.

*Post-Stocking Distribution, Habitat Use, and Survival*

- *Work Task C53 – Sonic Telemetry of Juvenile Flannelmouth Suckers in Reach 3*: Flannelmouth suckers have persisted in Reach 3 for several decades without management; understanding how this species uses the available habitat may provide insights into improving post-stocking survival for other native species. Manual tracking efforts in FY18 focused on night and diurnal time periods. Flannelmouth suckers were located at night while utilizing open water areas in backwater and river channel habitats and tracked intensively through the morning to determine daytime habitat. Flannelmouth suckers were routinely observed using emergent vegetation during the day; however, once the fish entered these dense habitats they became very difficult to relocate. These observations suggest that emergent vegetation may provide beneficial cover for this species during the day and may potentially inform the selection of suitable habitat for future stockings of other native fishes.

- *Work Task C63 – Evaluation of Habitat Features that May Influence Success of Razorback Suckers and Bonytail in Backwater Environments*: Two experiments were completed in FY18. Research focused on (1) conditioning native fishes to recognize predators and (2) evaluating survival of native fishes in the presence of predators and different habitat structures. Conditioning trials were completed by exposing native fishes to zero, one, or three conditioning events, and then allowing native fishes and a predator to interact. Results from previous studies had suggested that survival of native fishes may be improved through multiple conditioning events; however, results from the three experimental trials ran in triplicate indicated no difference in survival between conditioning treatments for both razorback suckers and bonytail. Habitat trials were completed by exposing non-conditioned (naïve) native fishes to predators in the presence of no habitat (open water; control), artificial vegetation, or two different habitat structures. For razorback suckers, there was no

statistically detectable difference in survival between habitats; however, bonytail survival was higher for both artificial vegetation and one of the habitat structures. These results indicate that bonytail may take advantage of certain habitat features and that these features should be considered when determining stocking locations.

- *Work Task C64 – Post-Stocking Movement, Distribution, and Habitat Use of Razorback Suckers and Bonytail*: Ongoing work in Lake Mohave (Reach 2) indicated that sonic-tagged razorback suckers routinely move between lake zones and spawning areas, often traveling more than 20 miles within relatively short periods of time (5 days – 2 months). Active contacts provided information regarding seasonal habitat use, with fish using deeper, mid-channel habitat in late spring and summer and shallow inshore habitat in late fall and throughout the spawning season. Seventy-nine sonic-tagged bonytail have also been released into Reach 2 since FY16. Monitoring of these fishes provides an opportunity to evaluate post-stocking survival and habitat use within the lake and is conducted concurrently with razorback sucker work for efficient use of project resources. Telemetry and passive integrated transponder (PIT) scanning contacts suggested that post-stocking survival of bonytail was lower than the sonic-tagged razorback suckers and that movements of bonytail from the initial stocking location were much more restricted than those of razorback suckers.

  Sonic telemetry and remote PIT scanning surveys completed in Topock Marsh (Reach 3) indicated that fish use the entire marsh throughout the year but congregate around the main inflow into the marsh during the summer months. Remote scanning resulted in 1,116 contacts from 233 unique razorback suckers, which generated a population estimate of 798 individuals (95% confidence interval [CI] from 652 to 987). The continued presence of razorback suckers in the marsh prompted a stocking of 20 sonic-tagged bonytail to evaluate post-stocking habitat use and survival.

  In Reach 4, 18 subadult razorback suckers and 18 subadult bonytail were implanted with short-term (3-month) acoustic telemetry tags to examine dispersal patterns immediately following release. Ten adult razorback suckers were implanted with long-term (36-month) tags to examine dispersal over a longer period. Remote PIT scanning resulted in contacts with 1,234 razorback suckers and 535 bonytail. Many of these contacts were recorded shortly after release and were not used in FY18 data analyses. The razorback sucker population was estimated at 169 individuals (95% CI from 157 to 180). No bonytail population estimate could be generated due to limited recontacts.

*Habitat Requirements and Assessment*

- *Work Task C59 – Selenium Monitoring in Created Backwater and Marsh Habitats*: Quarterly sampling was conducted at all project sites in FY18. Whole-body fishes, invertebrates, periphyton, sediment, and water were collected, and final sample analyses will be completed and reported in early FY19.

The following research projects were closed in FY18:

- *Work Task C31 – Razorback Sucker Genetic Diversity Assessment* and *Work Task C40 – Genetic and Demographic Studies to Inform Conservation Management of Razorback Suckers and Bonytail in Off-Channel Habitats*: Genetic research conducted under these work tasks has helped refine traditional analyses, has provided data demonstrating effective augmentation and maintenance of Lake Mohave razorback sucker broodstock genetics, and has developed new tools and methods for long-term genetic monitoring and management of main stem and off-channel native fish populations. Research completed under these work tasks, in conjunction with the independent peer review of the LCR MSCP genetic management strategy, will be used to develop a long-term genetic monitoring and management plan for the LCR MSCP. Future work that builds off these efforts will be carried out under System Monitoring (Section D).

- *Work Task C53 – Sonic Telemetry of Juvenile Flannelmouth Suckers in Reach 3*: Habitat use studies conducted in Reach 3 have shown flannelmouth suckers consistently using both open water habitat and areas of emergent vegetation. Flannelmouth suckers tracked in the upper 20 river miles near Davis Dam tended to more often utilize stands of emergent vegetation within backwaters, while flannelmouth suckers in the lower 20-mile study area (Topock Gorge) tended to utilize shoreline vegetation. The difference observed in selected habitat may be due to availability, but both open water and vegetative cover appear to be important components for flannelmouth sucker habitat. These habitat components are likely important to other native fishes as well, and targeting areas of dense emergent vegetation for future stockings may help to improve post-stocking survival.

- *Work Task C63 – Evaluation of Habitat Features that may Influence Success of Razorback Suckers and Bonytail in Backwater Environments*: Research focused on conditioning native fishes to recognize predators did not provide consistent results. Future work under Work Task C61 will build off this project and evaluate predator-prey interactions in the presence of different artificial structures and how they may inform alternative stocking strategies.

- *Work Task C65 – Evaluation of Immediate Post-Stocking Survival of Razorback Suckers and Bonytail*: Data from this research confirms that bird predation on stocked fishes is occurring. Although the percentage of confirmed, initial post-stocking predation appears low (1–5% of stocked fishes consumed within 10 days of stocking), sampling efforts are likely underrepresenting mortality due to bird predation. Evidence of predation on fishes from past releases also suggests that predation pressure may be continuous. Data acquired through this work will be used to inform the fish augmentation schedule (i.e., shift stockings to areas or seasons with lower bird abundance to minimize these impacts). Any changes in these protocols or practices will be assessed and implemented through the adaptive management process (Section G). Long-term assessments of any changes will be evaluated through ongoing monitoring.

## FY19 Activities

Research in FY19 will continue to focus on evaluating post-stocking survival and habitat use and needs of native fishes. Because recontact rates for stocked fishes are low, intensive research will be coordinated with fish augmentation stockings to observe immediate post-stocking dispersal and habitat selection. These observations will help determine subsequent sampling locations, with the goal of maximizing recontacts. Native fishes, particularly subadult razorback suckers, are often not contacted for several years following stocking. Multi-year studies are typically needed to allow these fish to mature and incorporate with spawning aggregations so that survival and the effects of stocking treatments can be adequately assessed.

Recently acquired data have indicated that there is a large self-sustaining population of humpback chubs in the western Grand Canyon. This population may represent a significant contribution toward conservation efforts, but to date, no quantitative evaluation has been conducted in this large section of the river that is outside historic aggregation sites. The USFWS Arizona Fish and Wildlife Conservation Office has proposed conducting annual, closed mark-recapture efforts to estimate the abundance of humpback chubs in select reaches of the western Grand Canyon. This proposal will be evaluated in FY19, and support for this work will be provided through Work Task C14.

The Lake Mead Fish Hatchery is the only facility currently capable of completing pre-stocking flow conditioning of native fishes. Due to the limited number of stocking cohorts expected from the facility in FY19, no flow conditioning research will be completed under Work Task C61. Flow conditioning work is expected to resume as sufficient numbers of fishes become available.

Experimental trials evaluating a combination of predator avoidance conditioning and artificial habitat structures will be completed in FY19 under Work Task C61.

These trials will observe predator-prey interactions in the presence of several artificial structure types to evaluate survival and determine if trials can be scaled up for augmentation stockings.

Assessments of movement, distribution, and riverine habitat use by razorback suckers and bonytail will continue under Work Task C64. This work will include sonic telemetry and remote PIT scanning in coordination with research-specific or general augmentation stockings in Reaches 2-4. The results will be used to improve future monitoring strategies, suggest potential stocking locations, track post-stocking survival, and generate abundance estimates when possible.

Previous research findings that have identified ways of improving fish propagation and culturing will be incorporated into regular practices whenever possible and practical. As additional research is completed, study results will either warrant the implementation of new practices or will indicate that further investment in the research or implementation of new practices would not be worthwhile. Study results from long-term research may also generate additional work under Section C, and in some cases, a portion of the sampling conducted under a research work task will be continued as a monitoring effort under Section D or Section F.

No new Species Research (Section C) work tasks are beginning in FY19.

## Proposed FY20 Activities

The efforts in FY20 will continue to focus on three major research goals: (1) identifying areas where native fishes show persistence and capitalizing on these areas for future stocking and research efforts, (2) providing information to improve post-stocking survival, and (3) identifying important habitat and species needs to help inform backwater creation and management. Research to be conducted under Work Task C64 will help identify areas of persistence and will provide a means to monitor post-stocking treatments (C61) for their effect on survival. Genetic research has provided guidance for long-term management of the Lake Mohave razorback sucker genetic broodstock and native fish populations in created backwater habitat. A portion of the completed genetic research will transition into monitoring and will be conducted under Section D (Work Task D15) beginning in FY20. The appropriate level of effort and long-term needs for monitoring razorback sucker genetics in Lake Mohave and native fish population genetics in other LCR reaches and created backwater habitats will also be informed by results of the independent genetic review conducted under Section G.

# System Monitoring (Section D)

System-wide monitoring is conducted on existing populations of covered fish species to determine their population status, distribution, density, migration, productivity, and other ecologically important parameters. System-wide monitoring for razorback suckers and bonytail is completed under Work Task D8. Monitoring data for flannelmouth suckers were included in the research actions covered under Work Task C15 (closed). Additional flannelmouth sucker monitoring data will continue to be collected to support Conservation Measure FLSU3 and will be accomplished simultaneously through monitoring efforts under Work Tasks C64, D8, and F5.

## FY18 Accomplishments

Population estimates reported for razorback suckers in FY18 are provided in table 1-11. Some population estimates are calculated differently based on the availability of data. Reach 1 (Lake Mead) population estimates are calculated based on a mark-recapture estimator using multi-year netting captures only. The remaining reaches (Reaches 2–5) use PIT scanning to provide the population estimates reported in table 1-11. In all reaches, the population estimates use a mark-recapture estimator, which requires that a set of fish be marked and recaptured during a designated period. The population estimates provided are for the time period preceding the reporting date (FY18) and are based on the defined mark-recapture period (table 1-11).

**Table 1-11.—Population Estimates for Razorback Suckers by LCR MSCP River Reach in FY18**

| Reach | Mark-Recapture Period | Razorback Sucker Population Estimate |
|---|---|---|
| Reach 1 (Lake Mead) | 07/01/2016 to 06/30/2018 | 360 |
| Reach 2 (Lake Mohave) | 03/01/2017 to 08/31/2018 | 3,471 |
| Reach 3 | 11/01/2017 to 08/31/2018 | 3,803* |
| Reaches 4 and 5 | 10/01/2016 to 05/31/2018 | 169 |

* This population estimate is lower than previous estimates. The LCR MSCP has adopted new criteria to minimize a potential bias toward recently released fish.

Routine monitoring of the Lake Mead adult razorback sucker population was completed in FY18. Trammel netting conducted during the spawning season resulted in the capture of 64 razorback suckers: 8 from Las Vegas Bay, 13 from Echo Bay, 24 from the Muddy River/Virgin River inflow, and 19 from the Colorado River inflow area. Of the 64 razorback suckers captured, 30 were recaptured fish. The remaining fish were untagged and presumed to be wild-spawned individuals. The ages of wild razorback suckers captured from all monitoring areas ranged from 2 to 14 years old. The razorback sucker population in Lake Mead was estimated at 360 individuals (95% CI from 289 to 470) for

the 2016–18 data collection period (see table 1-11). Larvae and juvenile fish were observed, along with active spawning, in four separate areas in the lake. A total of 2,117 larvae were captured throughout the season. The majority of larvae were returned to the lake following each sampling period, as razorback sucker larval abundance was primarily used only as a means of identifying spawning locations during the FY18 field season. No bonytail were contacted in FY18, and they are considered absent from Reach 1.

Annual Lake Mohave razorback sucker roundups were conducted in December and March. During these efforts, a combined 187 razorback suckers were captured using trammel nets. Ten additional razorback suckers were captured during an April sampling event, and electrofishing surveys conducted in the river section above the Willow Beach NFH resulted in the capture of 91 razorback suckers. Remote PIT scanning efforts also continued in FY18, recording 131,131 PIT tag contacts throughout the lake. In the river section of Lake Mohave, 2,118 unique PIT tags were contacted. Results in the basin section were similar, with 1,976 unique PIT tag contacts recorded. Supplemental scanning in other areas of the lake (5,885 hours of scan time) resulted in 76 total contacts representing 42 unique PIT tags. After duplicate PIT tags contacted in multiple lake sections were removed from analyses, 3,835 unique fish were contacted in 37,903 hours of scan time during FY18.

Based on 2017–18 remote PIT scanning data, the Lake Mohave repatriate population was estimated at 3,471 individuals (95% CI from 3,365 to 3,576). This population estimate is slightly lower than the FY17 estimate of 3,815 individuals (2016–17 remote PIT scanning data) but well within the expected range.

Capture and contact data for Reach 3 were acquired through multiple work tasks, ongoing multi-agency native fish roundups, and from other annual surveys conducted by LCR MSCP partners. Fall and spring netting surveys were conducted throughout Topock Gorge and lower Lake Havasu. Bonytail contacts are still rare and typically occur only for the first few weeks to months post-release. All survey methods conducted in Reach 3 in FY18 resulted in the capture or contact of 3,371 unique razorback suckers, 225 bonytail, and 9 flannelmouth sucker contacts. Based on 2017–18 data, Reach 3 had a razorback sucker population estimate of 3,803 (95% CI from 3,616 to 4,024). This population estimate is lower than previous estimates due to a change in how it is calculated. The LCR MSCP has adopted new criteria for calculating population estimates in order to minimize a potential bias toward recently released fish.

A total of 6,266 razorback suckers and 8,039 bonytail were stocked into Reaches 4 and 5 during FY18. Capture and contact data for Reaches 4 and 5 are primarily obtained through work being conducted under Work Task C64, but supplemental PIT scanning and electrofishing are conducted under Work Task D8 in an effort to increase contacts and locate potential spawning aggregates. In FY18,

1,234 unique razorback suckers and 535 unique bonytail were contacted. Electrofishing was conducted from the I-10 Bridge to the wash fans below the C-10 backwater; no spawning aggregations were detected, but one adult male razorback sucker was contacted. Data from FY17 and FY18 were used to generate a razorback sucker population estimate of 169 individuals (95% CI from157 to 180). There were not enough bonytail contacts to generate a population estimate.

### FY19 Activities

Monitoring data will be collected from Reaches 1–5. Information will be gleaned from ongoing fish research activities as well as through fish monitoring field work. Field work will include collecting larvae, trammel netting, electrofishing, remote sensing of PIT-tagged fish, and active and passive tracking of sonic-tagged fishes. Monitoring will be conducted in Reaches 4 and 5, with an emphasis on remote sensing in available backwater locations, particularly in areas where previous contacts of native fishes were made.

### Proposed FY20 Activities

Monitoring will be conducted in all reaches, and participation in multi-agency field surveys will continue. Monitoring efforts will expand the use of remote PIT scanning technology, as this technology has proven effective in increasing both contact probabilities and the precision of population estimates. The use of sonic and radio telemetry tags will continue in Reaches 4 and 5 in order to help identify additional locations where native fishes might persist in these reaches.

In FY20, a new work task will be initiated under Section D in support of long-term genetic monitoring of native fishes (*Work Task D15: Genetic Monitoring and Management of Native Fish Populations*). The goals of this work task will be to (1) maintain the genetic quality of razorback suckers used by the LCR MSCP for fish augmentation, and (2) guide genetic management of native fish populations in the LCR and backwater habitats developed by the LCR MSCP. Short-term objectives for this work task have been described under Work Task D15.

## Post-Development Monitoring (Section F)

Post-development monitoring will be conducted at each conservation area following completion of habitat creation activities in order to evaluate both the maturation of the site as it develops into covered species habitat and the use of the habitat by the covered species. Under Work Task F5, funding is provided to support post-development monitoring of the Big Bend Conservation Area (BBCA), the Mohave Valley Conservation Area (MVCA), Beal Lake, and the Imperial ponds.

## FY18 Accomplishments

Monitoring at the BBCA resulted in netting captures of 13 razorback suckers and 1 bonytail. The captured fishes came from three stockings: one on March 22 at Laughlin Lagoon and two on April 5 at Laughlin Lagoon and the Big Bend boat ramp. Remote PIT scanning resulted in the contact of 80 razorback suckers and 10 bonytail. All bonytail contacted via netting and scanning were from the March 22 stocking. Larval razorback and flannelmouth sucker capture rates were lower than those in FY17 but similar to those in previous years. Water quality parameters remained within thresholds for all native fishes.

Water quality was monitored throughout Beal Lake using permanently deployed multi-parameter instruments. Low levels of dissolved oxygen and high temperatures were observed locally but not lake-wide. No golden algae have been detected in Beal Lake since May 2013, so no additional water samples were collected in FY18 for analyses.

Monitoring of the Imperial ponds consisted of surveys for larval, juvenile, and adult native fishes. Razorback suckers stocked into Ponds 1, 3, and 4 in December 2016 averaged 64% survival through September 2018. Bonytail stocked into Ponds 2, 5, and 6 in March 2017 averaged 22% survival. Recruits were captured in each of the bonytail ponds, and the low survival of adult bonytail may be a result of successful spawning and increased competition for food resources. A single razorback sucker recruit was captured in Pond 1.

## FY19 Activities

Due to sedimentation and reduced access in the BBCA backwater, trammel netting efforts will be discontinued until dredging activities are completed in FY21. To ensure adequate native fish monitoring is completed in the interim, additional remote PIT scanners will be deployed during each sampling trip to supplement the lack of netting. Larval sampling will be conducted as planned, and water quality will be monitored at a level similar to that in FY18.

Monitoring at Beal Lake has been postponed until dredging activities are completed.

Construction of the 60-acre MVCA backwater is expected to be completed in April 2019. Native fish monitoring will initially be completed using remote PIT scanners that were integrated into the northern and southern backwater inlets. Scanning data will be used to confirm the presence of native fishes, and supplemental sampling will be completed as needed. As this site matures, it will be evaluated as a potential future stocking location.

Monitoring of the Imperial ponds will continue to focus on population monitoring and the documentation of recruitment. Annual surveys of the Imperial ponds were completed in December 2018. Adults were contacted in each of the ponds, and all fishes exhibited good growth and appeared healthy. Razorback sucker recruitment was documented in Pond 1 (35 recruits) and Pond 3 (1 recruit). The young fish in Pond 1 are the first evidence of a substantial razorback sucker recruitment event in the ponds. Subadult bonytail were contacted in Ponds 2, 5, and 6, indicating another successful spawn in each of the bonytail ponds. The spawning event in Pond 2 appeared to be greater than the other ponds but less than it was in 2017. With a similar level of effort, the total catch decreased from 1,430 bonytail in 2017 to 331 bonytail in 2018; however, the pond continues to support a robust population of multiple year classes.

### Proposed FY20 Activities

Monitoring activities will be similar at the BBCA and MVCA and will include remote PIT scanning, larval surveys, and water quality monitoring.

Activities at the Imperial ponds will include population monitoring via remote PIT scanners, annual winter surveys using a variety of capture gear, larval/young-of-year monitoring through spring and summer, and continuous water quality monitoring. Genetic monitoring will continue in order to provide guidance for long-term management of fish populations in created backwater habitat. This information will help model population structures within isolated habitats and inform how often genetic material needs to be exchanged between habitats.

## Adaptive Management Program (Section G)

Under the Adaptive Management Program, uncertainties encountered during implementation of the conservation measures outlined in the HCP will be addressed. The program has three central components: (1) gauging the effectiveness of existing conservation measures, (2) proposing alternative or modified conservation measures as needed, and (3) addressing changed and unforeseen circumstances.

The *Final Science Strategy* details the AMP process for research and monitoring programs at the project and programmatic levels. Monitoring and Research priorities are assessed every 5 years and will include an analysis of new information and an explanation of resulting changes to design or direction that will be made.

Implementation of the AMP to address uncertainties, evaluate the effectiveness of research and monitoring activities, and improve management is allocated under Work Task G4. Data management (G1) is an integral component of any conservation program, including the LCR MSCP. Funds are allocated for

designing a data management system capable of tracking all information needed in the decisionmaking process. Funding allocated under Work Task G3 to begin research studies identified as priorities, when applicable, will continue.

The current needs under the AMP involve data collection and organization so that information can be readily accessed and used to make informed management decisions. Native fish stocking and tagging data obtained by the LCR MSCP are maintained in an electronic database. Another need is a toolbox of evaluation techniques that can gauge the effectiveness of conservation measures as they are completed. Work Task G3 will allow for the development of these tools. Funds allocated from this work task are used to initiate reconnaissance-level investigations. If more research is needed, the work is written up as a separate research study and submitted for funding under "Species Research (Section C)" above.

Fishery program activities under the LCR MSCP are coordinated with other recovery actions (Upper Colorado River Endangered Fish Recovery Program, San Juan River Basin Recovery Implementation Program, and Glen Canyon Dam Adaptive Management Program) through annual participation in meetings and presentations to research and management groups. These groups include local chapters of the American Fisheries Society, the Colorado River Aquatic Biologists, the Lake Mead Work Group, the Lake Mohave Native Fish Work Group, and the Lower Colorado River Native Fish Work Group.

Fisheries research investigations that are initiated through Work Task G3 can include periphery research that may be discreet and answer a simple question with no future commitments, be an additional part of a larger research effort captured under an existing work task, or lay the foundation for research to be conducted in a new work task.

## FY18 Accomplishments

The native fish databases continued to be maintained in their current formats (G1). These include the LCR Native Fish Database, which is used to store tagging, stocking, and recontact information for individual fish, and the Remote Scanning Database, which is used to store recontact information obtained through remote PIT scanning activities.

Scientific peer reviews were conducted for approximately five fisheries reports that were subsequently posted on the LCR MSCP website. These reviews ensured that all research and monitoring complies with program, bureau, and departmental scientific integrity policies. This process also ensures that research and monitoring meet the needs of the LCR MSCP as outlined in the HCP and other program documents.

The development of adaptive management plans for each research and monitoring effort began. Components of these plans will include a research or monitoring question, a summary of data to be collected to answer the research or monitoring question, how the data will be used to answer the question, adaptive management triggers/thresholds for monitoring efforts, and potential adaptive management actions.

A draft of the LCR MSCP *Five-Year Monitoring and Research Priorities Report 2018–22* was completed and distributed to the Steering Committee for their review. The final version of this report was published in early FY19.

Based on the results from the initial, independent review of genetic research (completed in FY16) for razorback suckers, an additional review was completed by an independent panel of five genetic experts. The purpose of this review was to identify the level of effort and long-term needs for monitoring fish genetics and to address any additional questions that resulted from the initial review. Next steps include developing plans for implementing the recommended genetics monitoring plan. The panel of experts will be available to review proposals to accomplish the provided recommendations.

The LCR MSCP participated in a workshop on how to use the species-specific CEMs to better understand the impacts of management actions on habitat created under the LCR MSCP and the relationship between these actions and their effect on covered species.

## FY19 Activities

During FY19, fisheries field data collection will begin the transition to the new platform that was selected in FY17. Maintenance of the native fish databases will continue.

The recommendations from the fish genetics panel will be reviewed, and a plan to implement recommendations will be developed.

Development of adaptive management plans for each research and monitoring effort continues.

Funding is available for emerging research needs under Work Task G3.

## Proposed FY20 Activities

Technical, independent, and peer reviews of fisheries projects, as part of the adaptive management process, will continue under the AMP.

Information from the CEMs will continue to be used for analyses of current and proposed management actions. Further development of decision support tools will also continue. Adaptive management plans will continue to be developed and refined for each monitoring and research effort. Information from these analyses and tools will be used to develop additional conservation area management plans and refine existing plans.

Funding is available for emerging research needs under Work Task G3.

# MONITORING AND RESEARCH OF TERRESTRIAL, RIPARIAN, AND MARSH HABITATS AND ASSOCIATED COVERED SPECIES

As described in the HCP, conservation measures for 23 covered and 5 evaluation wildlife species that rely on terrestrial, riparian, and marsh habitat will be implemented under the LCR MSCP. These conservation measures are addressed through the numerous work tasks presented in this report. A brief summary of the work completed, ongoing activities, and proposed future work is provided below.

The work accomplished in support of terrestrial wildlife and plants is divided into five sections: Species Research (Section C), System Monitoring (Section D), Conservation Area Development and Management (Section E) (covered in the "Conservation Area Development, Maintenance, and Adaptive Management" overview), Post-Development Monitoring (Section F), and Adaptive Management Program (Section G). Each of these sections has an important relationship to the other sections.

A habitat-based approach for the conservation of covered species is used by the LCR MSCP. It involves the maintenance of existing habitat and the development and management of habitats that are created under the program (Section E). This requires knowledge of the key environmental characteristics (vegetation and abiotic) important for each species. Species' populations are monitored to determine if and to what extent they are using the habitat (Section F) and includes monitoring to evaluate the ongoing status of covered species and their habitats in the LCR MSCP planning area (Section D). For some species, fundamental information is lacking, and research projects (Section C) are implemented to fill those data gaps. This includes identifying the types and frequency of management activities required to maintain functional habitats over the 50-year term of the LCR MSCP (Section C and Section G).

## Species Research (Section C)

Research is being conducted on covered wildlife species and their habitats to (1) inform the selection and application of conservation techniques, (2) document successful implementation of conservation measures, and (3) develop alternatives to conservation actions that prove ineffective. This strategy will allow for quantification of existing knowledge and the identification of data gaps. Species research projects will be designed to fill data gaps that will inform implementation of the conservation measures.

The LCR MSCP conservation measures direct that habitat characteristics should be characterized for 22 species either under Conservation Measure MRM1, species-specific conservation measures requiring distribution and/or habitat surveys (CRCR1, YHCR1, MNSW1, CRTO1, and LLFR1), or species-specific conservation measures requiring the creation and management of covered species habitat. These species include:

- Arizona Bell's vireo
- California black rail
- California leaf-nosed bat
- Colorado River cotton rat
- Colorado River toad
- Elf owl
- Gila woodpecker
- Gilded flicker
- Lowland leopard frog
- MacNeill's sootywing skipper
- Northern Mexican gartersnake
- Pale Townsend's big-eared bat
- Sonoran yellow warbler
- Southwestern willow flycatcher
- Summer tanager
- Vermilion flycatcher
- Western least bittern
- Western red bat
- Western yellow bat
- Yellow-billed cuckoo
- Yuma clapper rail
- Yuma hispid cotton rat

Species research work tasks focus on key priorities set in the *Five-year Monitoring and Research Priorities for the Lower Colorado River Multi-Species Conservation Program* report. This report was updated in 2018 with the priorities for FY18–FY22.

## FY18 Accomplishments

In 2018, the LCR MSCP completed two research projects focused on developing effective survey methods and on measuring characteristics of habitats to determine the components that are critical to support the elf owl, California black rail, and Yuma clapper rail.

*Work Task C24 – Avian Species Habitat Requirements*: This study tested the elf owl's responsiveness to call-playback at short distances (50–250 meters [m]) in obstructed habitats, recorded their use of riparian habitats, and, on a broad scale, documented the type of riparian habitat elf owls use. This information will be used to refine survey methods for elf owls, and it provided new information about the characteristics of elf owl habitat that can be used to manage created habitat on conservation areas. Prior to implementation of this study, only one elf owl detection was recorded over a 2-year survey period, and it was unknown whether this result was an indication of low elf owl populations or a flawed survey protocol.

*Work Task C66 – Marsh Bird Water Depth Analysis*: In FY18, the California black rail data from the Ciénaga de Santa Clara in Mexico were reviewed, but there were not sufficient data to make statistically sound conclusions regarding

the relationship of California black rail occupancy during breeding season and fluctuations in water depth at this marsh. Existing research on other California black rail populations in California support the hypotheses that California black rails can use areas with fluctuating water levels as long as the habitat has a gentle slope that allows the bird to move into areas of adequate water depth (averaging 0.83-inch) as water levels change. This information, added to the previous findings for Yuma clapper rails, indicates that both species breed in areas where water levels change throughout the breeding season. Yuma clapper rail nesting in Topock Gorge occurred each year with water depth fluctuations greater than 12 inches.

In addition to these research studies, LCR MSCP funds (Work Task C2) were provided to the National Park Service (NPS) at the Lake Mead National Recreation Area to support implementation of conservation measures for sticky buckwheat (STBU1) and threecorner milkvetch (THMI1). The FY18 funds were used to monitor sticky buckwheat and threecorner milkvetch populations and for invasive species control.

### FY19 Activities

The LCR MSCP will provide funds to the NPS at the Lake Mead National Recreation Area to support existing conservation activities for sticky buckwheat and threecorner milkvetch (C2) in accordance with Conservation Measures STBU1 and THMI1.

If additional research needs are identified, new work tasks will be initiated.

### Proposed FY20 Activities

The LCR MSCP will provide funds to the NPS at the Lake Mead National Recreation Area to support existing conservation activities for sticky buckwheat and threecorner milkvetch (C2) in accordance with Conservation Measures STBU1 and THMI1.

If additional research needs are identified, new work tasks will be initiated.

## System Monitoring (Section D)

System-wide monitoring is being conducted to evaluate the ongoing status of covered species and their habitats in the LCR MSCP planning area. Information from these projects provides context to population abundance and incidental observations of covered species on conservation areas.

System-wide monitoring for terrestrial and marsh species was planned to be implemented annually early in program implementation and then with decreasing intensity over the 50-year term of the LCR MSCP as data gaps are filled and as additional conservation areas are developed. In FY14–FY18, existing literature and program data were reviewed to identify if any efforts could be reduced, as sufficient knowledge had been gathered, or if the efforts should be focused to inform specific needs. Post-development monitoring has shown that many covered species are using the land covers types on the conservation areas without the need for additional research to inform habitat creation methods. As a result, in FY17, monitoring for bats (D9 and F4), yellow-billed cuckoos (D7), MacNeill's sootywing skippers (F6), and rodents (D10 and F3) focused on documenting presence and, when appropriate, breeding. In FY18, monitoring for southwestern willow flycatchers (D2) followed suit, and efforts were focused on documenting presence and breeding at the system-wide populations and historical nesting areas in Reaches 3–7 and along the Bill Williams River and Alamo Lake. This program level of analysis of system-wide monitoring will continue in FY19. System-wide monitoring objectives will be defined, and system-wide, post-development monitoring and any remaining research efforts will be divided into separate work tasks for FY19.

## FY18 Accomplishments

System-wide monitoring continued for marsh birds, southwestern willow flycatchers, yellow-billed cuckoos, riparian birds, bats, and rodents along the LCR and adjacent river systems.

Marsh bird surveys (D1) were conducted at Topock Gorge and the upper reaches of Lake Havasu during March, April, and May 2018 in coordination with the USFWS as part of a multi-agency, system-wide monitoring effort. Three covered species were encountered:

- Yuma clapper rails detected – 19 in March, 52 in April, and 54 in May
- Western least bitterns detected – 4 in March, 38 in April, and 43 in May
- California black rails detected – 3 in March, 0 in April, and 1 in May

Many refinements were made to how and where monitoring is conducted for southwestern willow flycatchers (D2 and F9) in FY18. Beginning in FY18, system-wide surveys were conducted under Work Task D2, and all monitoring at conservation areas was conducted under Work Task F9. System-wide survey locations were focused at certain areas of the LCR near to, or that could provide a source population for, conservation areas, including Topock Marsh, Alamo Lake, the Bill Williams River, and areas along the LCR. All surveys in southern Nevada were discontinued, as sufficient data have been collected from those populations. Activities such as color banding and nest monitoring will only be

conducted in the future when breeding southwestern willow flycatchers are detected at conservation areas (F9) and at system-wide sites (D2) when information is needed to help inform the potential for colonization at conservation areas or to supplement habitat studies.

In FY18, system-wide presence surveys for southwestern willow flycatchers were conducted at 60 sites along the LCR and its tributaries: Alamo Lake, the Bill Williams River (areas outside of areas creditable by the LCR MSCP), Topock Marsh, and the triannual survey areas in the southern portion of the LCR. A total of 124 southwestern willow flycatchers were detected at 11 of the 60 sites during presence surveys, and 72 territories were documented. Surveyors confirmed that southwestern willow flycatchers were resident or breeding at 11 of the sites within 3 study areas: Alamo Lake, the Bill Williams River National Wildlife Refuge, and Topock Marsh. Nest monitoring was only conducted at Topock Marsh. Nest success was calculated for two southwestern willow flycatcher nests at Topock Marsh that contained flycatcher eggs. Both nests were depredated during the nestling stage.

System-wide monitoring for yellow-billed cuckoos (D7) involved conducting followup visits to find cuckoos tagged with geolocator devices in FY14–FY15, developing the scope for yellow-billed cuckoo monitoring from FY19–FY23, and designing the second-generation mobile electronic field forms (MEFFs) that will be used for future system-wide yellow-billed cuckoo surveys. Geolocator results over the past 3 years confirmed the migration route and wintering grounds of four cuckoos nesting on the LCR. These birds traveled south in the fall, along the west coast of mainland Mexico to wintering grounds in the Gran Chaco Forest of southeastern Bolivia and northern Argentina. In spring, they took a more easterly route back through mainland Mexico to the PVER. While developing the scope of monitoring for FY19–FY23, the quality of system-wide habitat and occupancy potential was reviewed to assess the benefit of conducting system-wide surveys over the next 5 years. Cottonwood-willow habitat quality along the Bill Williams River and at Topock Marsh is still poor. Yellow-billed cuckoos continue to use created habitat at LCR MSCP conservation areas and continue to colonize new habitat. The LCR MSCP decided to focus monitoring efforts on documenting cuckoo presence at conservation areas (Work Task F10) for FY19–FY23. System-wide habitat will continue to be checked annually to see if habitat conditions improve and whether conducting yellow-billed cuckoo surveys at those areas could benefit the LCR MSCP.

Multi-species survey protocols have been developed to monitor other riparian birds covered under the LCR MSCP. Under Work Task D5, banding of migrating and breeding birds was conducted using the Monitoring Avian Productivity and Survivorship (MAPS) protocol to gather specific breeding and body condition information and compare species occurrence trends along the LCR with those throughout North America. Data collected were reported to the Institute for Bird Populations as part of their national bird monitoring effort. Data were also used on a site-specific level to provide insight on bird use within LCR MSCP

conservation areas. Banding was conducted at the Beal Lake Conservation Area (BLCA) and Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1). There were 226 birds captured at the BLCA and 222 captured at Cibola NWR Unit #1. This included three LCR MSCP species. At the BLCA, new captures included five Bell's vireos, six yellow warblers, and one summer tanager. Two previously color-banded yellow warblers were recaptured at the BLCA; their initial captures were in 2015 and 2018. There were also two color-banded summer tanagers recaptured at the BLCA: one from 2011 and one from 2015. New captures at Cibola NWR Unit #1 included one yellow warbler. Recaptures of previously banded birds at Cibola NWR Unit #1 included one ladder-backed woodpecker from 2013 and two from 2015. The covered species detected here are also being documented under post-development riparian bird surveys (F2).

Under Work Task D6, development began on MEFFs for gilded flicker surveys. Reconnaissance surveys were conducted along the Bill Williams River near Planet Ranch to identify potential future gilded flicker survey locations. No gilded flickers were detected. The monitoring protocol evaluation for Arizona Bell's vireos, elf owls, Gila woodpeckers, Sonoran yellow warblers, summer tanagers, and vermilion flycatchers continued. The goals and objectives for future system-wide riparian bird monitoring were verified. Work continued on updating the vegetation map and the associated survey plots, evaluating potential analysis and survey methods to determine what methods are the most cost efficient, and analyzing existing data to verify the number of samples to survey and how often they need to be surveyed in order to detect presence of territorial nesting riparian birds and measure their trends. This evaluation of the monitoring protocol for Work Tasks D6 and F2 will ensure that monitoring methods and statistical analyses are meeting the LCR MSCP objectives.

Under Work Task D9, acoustic monitoring stations were operated from June to August to detect bat presence at Havasu National Wildlife Refuge-Pintail Slough, the Bill Williams River National Wildlife Refuge, Cibola National Wildlife Refuge-Island Unit, the Picacho State Recreation Area, and the Mittry Lake Wildlife Area. Western red bats were detected at all five acoustic monitoring stations. Western yellow bats were detected at Havasu National Wildlife Refuge-Pintail Slough, the Bill Williams River National Wildlife Refuge, Cibola National Wildlife Refuge-Island Unit, and the Mittry Lake Wildlife Area but not detected at the Picacho State Recreation Area. California leaf-nosed bats were detected at the Bill Williams River National Wildlife Refuge, Cibola National Wildlife Refuge-Island Unit, the Picacho State Recreation Area, and the Mittry Lake Wildlife Area but not at Havasu National Wildlife Refuge-Pintail Slough. Pale Townsend's big-eared bat calls were only detected at the Bill Williams River National Wildlife Refuge.

Surveys were conducted at an island in the Picacho State Recreation Area to document the presence of Yuma hispid cotton rats in this portion of the watershed (D10). The area is approximately 24 miles north of Yuma, Arizona. No cotton rats or desert pocket mice were captured at the system-wide monitoring site.

## FY19 Activities

System-wide monitoring of marsh birds, southwestern willow flycatchers, yellow-billed cuckoos, riparian birds, bats, rodents, and MacNeill's sootywing skippers will continue along the LCR.

Marsh bird surveys (D1) will be conducted along the LCR in Topock Gorge and the upper reaches of Lake Havasu during March, April, and May as part of a multi-agency, system-wide monitoring effort in coordination with the USFWS.

System-wide surveys for southwestern willow flycatchers (D2) will be conducted at Topock Marsh, the Bill Williams River, and Alamo Lake. Nest monitoring will be conducted at Topock Marsh.

Yellow-billed cuckoo (D7) presence surveys will continue at LCR MSCP conservation areas but will not be conducted in system-wide existing habitat in FY19, as nesting continues to occur primarily on LCR MSCP conservation areas (F10). Habitat conditions within the Bill Williams River National Wildlife Refuge and Topock Marsh will be assessed.

Some multi-species surveys used to monitor other avian species covered under the LCR MSCP will continue in FY18. Under Work Task D5, the MAPS banding stations will continue to operate at Cibola NWR Unit #1 and the BLCA during the breeding season. Color banding of LCR MSCP covered species will continue to be implemented to evaluate the recapture rate.

System-wide breeding bird surveys (D6) will be conducted in FY19. The protocol will continue to be reviewed, and changes will be made, if necessary, to improve the accuracy of the monitoring methods and to focus the sampling on collecting the presence and trend data needed to inform the program.

Eight acoustic monitoring stations will be operated along the LCR (D9). Data will be collected and analyzed for covered and evaluation species presence during the summer peak activity periods. Monitoring will occur at Havasu National Wildlife Refuge-Pintail Slough, the Bill Williams River National Wildlife Refuge, the 'Ahakhav Tribal Preserve, the Cibola National Wildlife Refuge-Island Unit, the Picacho State Recreation Area, the Mittry Lake Wildlife Area, Yuma East Wetlands (YEW), and Hunters Hole. The acoustic stations at the 'Ahakhav Tribal Preserve, YEW, and Hunters Hole previously monitored under Work Task F4 will be reassigned to the system-wide monitoring network (D9) in FY19, as the 'Ahakhav Tribal Preserve is not on a LCR MSCP conservation area and YEW and Hunters Hole are located outside creditable Reaches 3–5.

System-wide rodent surveys (D10) will be conducted to detect the presence of Colorado River and Yuma hispid cotton rats within selected areas in LCR MSCP conservation areas that have the correct canopy type but are in habitat not

creditable for the Colorado River cotton rat or Yuma Hispid cotton rat. This will inform management of whether the rodents can be found in other land cover types with the right structure.

A new work task will open in FY19. System-wide monitoring of MacNeill's sootywing skippers (D14) will be conducted in occupied portions of conservation areas containing land cover types not creditable to the program under conservation measure MNSW2. If potential habitat is discovered in other areas that can inform LCR MSCP habitat creation, monitoring may be conducted to document their presence and habitat characteristics.

## Proposed FY20 Activities

System-wide monitoring of marsh birds, southwestern willow flycatcher, riparian birds, bats, rodent populations, and MacNeill's sootywing skippers along the LCR will continue.

Marsh bird surveys (D1) will be conducted along the LCR in Topock Gorge and the upper reaches of Lake Havasu during March, April, and May as part of a multi-agency, system-wide monitoring effort in coordination with the USFWS.

System-wide surveys for southwestern willow flycatchers (D2) will be conducted at Topock Marsh, the Bill Williams River, and Alamo Lake. Nest monitoring will be conducted at Topock Marsh.

Yellow-billed cuckoo (D7) presence surveys are not scheduled in system-wide existing habitat in FY19, as nesting continues to occur primarily on LCR MSCP conservation areas (F10). System-wide cottonwood-willow habitat will be checked to see if condition improves and whether conducting yellow-billed cuckoo surveys at those areas could benefit the LCR MSCP.

Multi-species surveys to monitor additional avian species covered under the LCR MSCP will continue. Under Work Task D5, collection of natural history data on avian species utilizing restoration sites will continue. System-wide breeding bird surveys under Work Task D6 will continue.

Eight acoustic monitoring stations will be operated along the LCR (D9). Data will be collected and analyzed for covered and evaluation species presence during the summer peak activity periods. Monitoring will occur at Havasu National Wildlife Refuge-Pintail Slough, the Bill Williams River National Wildlife Refuge, the 'Ahakhav Tribal Preserve, the Cibola National Wildlife Refuge-Island Unit, the Picacho State Recreation Area, the Mittry Lake Wildlife Area, YEW, and Hunters Hole.

System-wide rodent surveys (D10) will be conducted to meet system-wide monitoring objectives throughout the LCR system.

System-wide monitoring for MacNeill's sootywing skippers (D14) will be conducted in occupied portions of conservation areas containing land cover types not creditable to the program under conservation measure MNSW2. If potential habitat is discovered in other areas that can inform LCR MSCP habitat creation, monitoring may be conducted to document their presence and habitat characteristics.

## Post-Development Monitoring (Section F)

Extensive monitoring of created habitats is necessary to evaluate the implementation and effectiveness of habitat creation projects. To accomplish this task, pre-development monitoring is conducted to document baseline conditions prior to habitat creation. After habitat creation has been initiated, post-development monitoring for biotic and abiotic habitat characteristics is conducted to document implementation success and to record both the maturation of the site as it develops into covered species habitat and the use of the habitat by the covered species.

### FY18 Accomplishments

In FY18, monitoring for LCR MSCP covered species use was conducted at 13 conservation areas (table 1-12). Post-development monitoring was conducted for targeted covered species, including southwestern willow flycatchers (F9), yellow-billed cuckoos (F10), avian species (F2), marsh birds (F7), small mammals (F3), bats (F4), and insects (F6). In addition to the covered species post-development monitoring that took place during FY18, long-term vegetation monitoring was conducted at all conservation areas using lidar technology. These data were processed and analyzed using methods developed under Work Task C60. Conservation area vegetation will be evaluated on a periodic basis to ensure that the habitat is meeting species' requirements. This evaluation used several metrics, which are being developed under Work Task C60, that describe vegetation structure throughout the canopy with the ability to identify structural diversity and successional growth stages.

Presence surveys for southwestern willow flycatchers (F9) were conducted at the BLCA, the PVER, the Cibola Valley Conservation Area (CVCA), Cibola NWR Unit #1, the Middle Bill Williams River National Wildlife Refuge (Middle Bill Williams River NWR), Planet Ranch, the Laguna Division Conservation Area (LDCA), YEW, and Hunters Hole. Migratory willow flycatchers were detected at all of these conservation areas, but no resident southwestern willow flycatchers were detected. Nest monitoring and color banding activities were not conducted.

Post-development monitoring for yellow-billed cuckoos (F10) continued in FY18 with presence surveys at the BLCA, the PVER, the CVCA, Cibola NWR Unit #1,

**Table 1-12.—LCR MSCP Covered Species Post-Development Monitoring Conducted in FY18**

| Conservation Area | Marsh Birds | Southwestern Willow Flycatcher | Yellow-billed Cuckoo | Other Covered Riparian Birds | Bats | Rodents | MacNeill's Sootywing Skipper | Northern Mexican Gartersnake and Amphibians |
|---|---|---|---|---|---|---|---|---|
| Beal Lake Conservation Area | X | X | X | X | X | X | NS | NS |
| Big Bend Conservation Area | X | NS | NS | NS | NS | NS | NS | NS |
| Cibola National Wildlife Refuge Unit #1 Conservation Area | NS | X | X | X | X | X | NS | NS |
| Cibola Valley Conservation Area | NS | X | X | X | X | X | X | NS |
| Hart Mine Marsh | X | NS | NS | NS | NS | X | NS | NS |
| Hunters Hole | NS* | X | X | X | X | X | NS | NS |
| Imperial National Wildlife Refuge | X | NS | NS | NS | NS | NS | NS | NS |
| Laguna Division Conservation Area | X | X | X | X | NS | X | NS | NS |
| Palo Verde Ecological Reserve | NS | X | X | X | X | X | X | NS |
| Parker Dam Camp | NS | NS | NS | X | NS | NS | NS | NS |
| Planet Ranch and Middle Bill Williams River National Wildlife Refuge | NS | X | X | X | NS | NS | NS | NS |
| Pretty Water Conservation Area | NS | NS | NS | X | NS | NS | X | NS |
| Yuma East Wetlands | X | X | X | X | X | X | NS | NS |

X = surveyed, NS = not surveyed, and * = the marsh at Hunters Hole has transitioned from marsh to willow.

YEW, the LDCA, the Middle Bill Williams River NWR, Planet Ranch, and Hunters Hole. Followup visits to determine breeding status were conducted at conservation areas where breeding has yet to be documented, or has not been documented recently, including the LDCA, YEW, the CVCA, and Hippy Fire. There were 255 detections of cuckoos throughout the LCR MSCP conservation areas. Cuckoos were detected at the BLCA, the Middle Bill Williams River NWR, the PVER, the CVCA, Cibola NWR Unit #1, YEW, the LDCA, Planet Ranch, and Hunters Hole. Thirty-five confirmed breeding territories, 24 nests, and an additional 11 probable and 26 possible breeding territories were detected in FY18. One breeding territory was confirmed at the BLCA. There were 26 confirmed breeding territories and 19 nests at the PVER. Most nests found were in the 7-year old cottonwood-willow habitat in Phase 6. There was a total of five confirmed territories and three nests at Cibola NWR Unit#1 (within Crane Roost and Hippy Fire). Two nests were found at the CVCA and one nest at YEW, documenting nesting there for the first time.

Under Work Task D5, MAPS banding at the BLCA and Cibola NWR Unit #1 detected Bell's vireos, yellow warblers, and summer tanagers. At the BLCA, new captures included five Bell's vireos, six yellow warblers, and one summer tanager. Two previously color-banded yellow warblers were recaptured at the BLCA; their initial captures were in 2015 and 2018. There were also two color-banded summer tanagers recaptured at the BLCA: one from 2011 and one from 2015. New captures at Cibola NWR Unit #1 included one yellow warbler. The covered species detected here are also being documented under post-development riparian bird surveys (F2).

Under Work Task F2, a multi-species protocol and sample plan were used to document the presence of riparian bird species on conservation areas. In FY18, 80 plots were surveyed, and 95 bird species were detected, 79 of which were thought to be breeding.

- BLCA – There were 31 pairs of territorial breeding birds detected comprising 18 species. Three pairs of Arizona Bell's vireos and four pairs of Sonoran yellow warblers were confirmed breeding.

- Cibola NWR Unit #1 – There were 98 pairs of territorial breeding birds detected comprising 28 species. Gila woodpeckers and yellow warblers were detected; however, no pairs were confirmed breeding.

- Middle Bill Williams River NWR (E21) – There were 450 pairs of birds detected comprising 35 species. Twelve pairs of Arizona Bell's vireos, 12 pairs of Gila woodpeckers, 35 pairs of Sonoran yellow warblers, and 5 pairs of summer tanagers were confirmed breeding.

- CVCA – There were 216 pairs of territorial breeding birds detected comprising 27 species. One Arizona Bell's vireo pair was confirmed breeding. Yellow warblers and summer tanagers were detected; however, no pairs were confirmed breeding.

- Hunters Hole – There were 10 pairs of territorial breeding birds comprising 18 species detected. No LCR MSCP covered species were detected.

- LDCA – There were 286 pairs of territorial birds detected comprising 30 species. Seven pairs of Arizona Bell's vireo, two pairs of Gila woodpeckers, and four pairs of Sonoran yellow warblers were confirmed breeding.

- Parker Dam Camp –There were 49 pairs of birds detected comprising 22 species. Two pairs of Gila woodpeckers were confirmed breeding.

- PVER – There were 178 pairs of territorial breeding birds detected comprising 29 species. Three pairs of Sonoran yellow warblers and four pairs of summer tanagers were confirmed breeding. A Bell's vireo was detected; however, no pairs were confirmed breeding.

- Pretty Water Conservation Area – There 64 pairs of territorial birds detected comprising 26 species. Bell's vireos, Gila woodpeckers, and yellow warblers were detected; however, no pairs were confirmed breeding.

- YEW – There were 104 pairs of territorial breeding birds detected comprising 28 species. One pair of Gila woodpeckers and one pair of Sonoran yellow warblers were confirmed breeding. Bell's vireos were detected; however, no pairs were confirmed breeding.

Marsh bird surveys (F7) were conducted at the BBCA, the BLCA, Hart Mine Marsh (HMM), the LDCA, Field 18 in the IPCA, and YEW. Western least bitterns were detected at the BLCA, HMM, the IPCA, the LDCA, and YEW. Yuma clapper rails were detected at the BLCA (only at Beal Lake), HMM, the LDCA, and YEW. One California black rail was detected at the BBCA during the March 15 survey. This was the only detection of a California black rail at a conservation area in FY18 and the first time the species has been detected at the BBCA.

Live trapping surveys to detect Colorado River and Yuma hispid cotton rats (F3) were conducted in fall 2017 and spring 2018. Surveys were conducted at the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, HMM, YEW, the LDCA, and Hunters Hole. Colorado River cotton rats were captured at the PVER and HMM; none were captured at the BLCA, the CVCA, or Cibola NWR Unit #1. Yuma hispid cotton rats were captured at YEW and Hunters Hole; none were captured at the LDCA.

Bat presence was monitored at conservation areas (F4). Acoustic monitoring was conducted the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, YEW, and Hunters Hole. Western red bats and western yellow bats were detected at the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, YEW, and Hunters Hole. None were detected at the 'Ahakhav Tribal Preserve. California leaf-nosed bats were detected at the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, Hunters Hole, and the 'Ahakhav Tribal Preserve. None were detected at YEW. A new method for identifying pale Townsend's big-eared bats was adopted in FY18. This method, called the Analook Verification Method, is more conservative than prior methods and, when combined with the whispering calls emitted by the pale Townsend's big-eared bat, resulted in no verified detections at any location.

MacNeill's sootywing skippers were monitored (F6) at the PVER, CVCA, and the Pretty Water Conservation Area. They were detected at all three conservation areas.

## FY19 Activities

Post-development monitoring for LCR MSCP covered species will be conducted at conservation areas to evaluate how effective the program has been in providing the habitat requirements (F1) in conservation areas. Activities will focus on southwestern willow flycatchers (F9), yellow-billed cuckoos (F10), riparian birds (F2), marsh birds (F7), small mammals (F3), bats (F4), and insects (F6). MAPS banding stations (D5) will continue to operate at Cibola NWR Unit #1 and the BLCA during the FY19 breeding season. Pre-development surveys will be conducted for any new conservation areas.

Long-term vegetation monitoring will continue in FY19 using lidar technology (F1). Data will be processed and analyzed to provide metrics for vegetation structure analyses.

Surveys for northern Mexican gartersnakes, lowland leopard frogs and Colorado River toads (F8) are not anticipated at this time, but funding has been allocated in case pre-development clearance surveys or construction monitoring are required.

## FY20 Proposed Activities

Post-development monitoring for LCR MSCP covered species will be conducted at conservation areas to evaluate how effective the program has been in providing the habitat requirements (F1) in conservation areas. Activities will focus on southwestern willow flycatchers (F9), yellow-billed cuckoos (F10), riparian birds (F2), marsh birds (F7), small mammals (F3), bats (F4), and insects (F6). MAPS banding stations (D5) will continue to operate at Cibola NWR Unit #1 and the BLCA during the FY20 breeding season. Pre-development surveys will be conducted for any new conservation areas.

Long-term vegetation monitoring will continue in FY20 using lidar technology (F1). Data will be processed and analyzed to provide metrics for vegetation structure analyses.

Surveys for northern Mexican gartersnakes, lowland leopard frogs, and Colorado River toads (F8) are not anticipated at this time, but funding has been allocated in case pre-development clearance surveys or construction monitoring are required.

# Adaptive Management Program (Section G)

Under the AMP, uncertainties encountered during implementation of the conservation measures outlined in the HCP will be addressed. The program has three central components: (1) gauging the effectiveness of existing conservation measures, (2) proposing alternative or modified conservation measures as needed, and (3) addressing changed and unforeseen circumstances.

The *Final Science Strategy* details the AMP process for research and monitoring programs at the project and programmatic levels. Monitoring and research priorities are assessed every 5 years and will include an analysis of new information and explain resulting changes to design or direction that will be made.

Implementation of the AMP to address uncertainties, evaluate the effectiveness of research and monitoring activities, and improve management is allocated under Work Task G4. Data management (G1) is an integral component of any conservation program, including the LCR MSCP. Funds are allocated to design a data management system capable of tracking all information needed in the decisionmaking process. Funding allocated under Work Task G3 to begin research studies identified as priorities, when applicable, will continue.

## FY18 Accomplishments

A new platform was selected for field data collection in FY17. Several field surveys were transferred to this new platform, including those for rodents (D10 and F3), breeding birds (F2), southwestern willow flycatchers (D2), and MacNeill's sootywing skippers (F6).

Scientific peer reviews were conducted for 30 wildlife reports that were subsequently posted on the LCR MSCP website. These reviews ensured that all research and monitoring complies with program, bureau, and departmental scientific integrity policies. This process also ensured that research and monitoring meet the needs of the LCR MSCP as outlined in the HCP and other program documents.

The LCR MSCP completed reviews on study plan designs and statistical analyses. When appropriate, this information was shared with external partners to assist in their research, monitoring, and report writing activities.

The development of adaptive management plans for each research and monitoring effort began. Components of these plans will include a research or monitoring question, a summary of data to be collected to answer the research or monitoring question, how the data will be used to answer the question, adaptive management triggers/thresholds for monitoring efforts, and potential adaptive management actions.

A draft of the LCR MSCP *Five-Year Monitoring and Research Priorities Report 2018–22* was completed and distributed to the Steering Committee for their review. The final version of this report was published in early FY19.

CEMs for the five LCR MSCP evaluation species (Colorado River toad, lowland leopard frog, California leaf-nosed bat, pale Townsend's big-eared bat, and the desert pocket mouse) began being developed. The LCR MSCP participated in a workshop on how to use the species-specific CEMs to better understand the impacts of management actions on habitat created under the LCR MSCP and the relationship between these actions and their effect on covered species. The CEMs were used to identify knowledge gaps that were addressed in the 5-year monitoring and research priorities report.

## FY19 Activities

The field data collection processes continue to be updated and/or maintained. Additional projects will be transitioned to the second-generation MEFF platform and will include the yellow-billed cuckoo (D7 and F10) and gilded flicker (D6 and F2).

Research and monitoring activities continue to be reviewed and evaluated internally as well as through independent, external reviewers.

Development of adaptive management plans for each research and monitoring effort continue.

Funding is available for emerging research needs under Work Task G3.

## FY20 Proposed Activities

Technical, independent, and peer reviews of wildlife projects and habitat monitoring will continue under the AMP.

Any wildlife field data collection project not using current MEFFs will be updated to second-generation MEFFs.

Information from the CEMs will continue to be used for analyses of current and proposed management actions. Further development of decision support tools will also continue. Adaptive management plans will continue to be developed and refined for each monitoring and research effort. Information from these analyses and tools will be used to develop additional conservation area management plans and to refine existing plans.

Funding will be available for emerging research needs under Work Task G3.

# CONSERVATION AREA DEVELOPMENT, MAINTENANCE, AND ADAPTIVE MANAGEMENT

A major component of the LCR MSCP is the creation and management of habitat. Conservation Area Development and Management (Section E) addresses the identification, selection, development, and management of created habitat and any restoration research being conducted. In general, habitat creation projects target land cover types with the intent that the vegetation is managed for or developed into a species-specific habitat for covered species.

## Conservation Area Development and Management (Section E)

Cottonwood-willow, honey mesquite, marsh, and backwater are the land cover types to be created by the LCR MSCP. For terrestrial and marsh land cover types, trees, shrubs, and ground cover are typically planted or seeded to create the desired type. For backwater land cover types, which include open water and associated emergent marsh, the habitat is defined by the evaluation of the physical, chemical, and biological conditions suitable for the establishment and maintenance of healthy populations of fishes associated with backwaters. Maturation and management of the land cover types ultimately create the habitat.

As described in the HCP, habitat creation goals of the LCR MSCP include establishing:

1. 5,940 acres of cottonwood-willow
2. 1,320 acres of honey mesquite
3. 512 acres of marsh
4. 360 acres of backwater

   8,132 total acres

To the extent practicable based on site conditions, cottonwood-willow, honey mesquite, marsh, and backwaters will each be restored in proximity to other land cover types to create integrated mosaics of habitat that approximate the relationships among aquatic and terrestrial communities historically present along the LCR floodplain. The selection process is described in the *Draft Guidelines for the Screening and Evaluation of Potential Conservation Areas*, which is available on the LCR MSCP website (www.lcrmscp.gov). These conservation areas are discrete areas of conserved habitats managed as a single unit by the LCR MSCP. Conservation areas include LCR MSCP created habitats as well as buffer areas and other lands that may be included in the conservation area design.

Conservation areas developed primarily for riparian and marsh species followed a different selection and evaluation process from those established primarily for native fishes.

Conservation areas developed primarily for riparian and honey mesquite land cover types, such as the PVER (E4), the CVCA (E5), and Cibola NWR Unit #1 (E24), involve the conversion of existing land cover types (such as active agricultural, fallow agricultural, and undeveloped land) to land covers consisting of native riparian species.

Conservation areas that are being developed primarily as disconnected backwaters for native fishes prioritize (1) delivery of non-native fish-free replacement water and (2) the ability to completely drain and renovate ponds without the use of piscicides. There is also value in connected backwaters, and the creation of connected backwaters is an option in Reaches 3–5. Backwaters created in Reach 3 will continue to be connected to the mainstem river to address the life history requirements of flannelmouth suckers. Restoration research priorities for backwater development are expected to include researching the screening of water to exclude non-native fishes, maintaining water quality in isolated backwaters, and controlling non-native fish species.

Developing, maintaining, and managing the appropriate habitats as dictated by the conservation measures presents several challenges. Present flow regimes of the LCR have been altered considerably from dynamic pre-development flows. Introduced and invasive species exist throughout the LCR MSCP planning area. Approaches to habitat creation must not only acknowledge the differences from historical conditions but must also be able to work effectively within the context of current conditions. In addition, existing knowledge and practices must be incorporated to take advantage of appropriate available technologies. An example of this is the use of agricultural technology and infrastructure to deliver water and simulate flooding events for riparian habitat creation projects.

To meet these challenges and the goals of the LCR MSCP, five components of habitat creation have been developed: (1) site identification, (2) site selection, (3) development, (4) maintenance, and (5) adaptive management of conservation areas. The following sections describe the distinctions among the components of habitat creation and how they are interconnected within the context of an adaptive management approach.

## Site Identification and Selection

A logical process for identifying and selecting locations for habitat creation projects contributes to the overall success of the LCR MSCP. In general, ideal sites are those that have the greatest potential for successfully achieving the desired habitat in the most cost-effective manner. Although this objective appears obvious, it is obscured by a number of variables that can affect both cost-effective development and habitat success: (1) logistical – site accessibility, available

infrastructure, and availability of sufficient resources (water); (2) physical – depth to groundwater, soil texture and chemistry, water quality, and eutrophic stage; and (3) administrative – potential impacts to other species or habitats, permitting requirements, and landowner/partner support. This represents only a portion of the known variables that must be considered when identifying and selecting sites, as unforeseen factors can contribute to greater costs and may limit success in habitat creation. As the LCR MSCP proceeds, this newly acquired knowledge will be incorporated into the site selection processes. Appropriate adaptations are being made through the AMP to properly address and apply newly acquired information, allowing for a more accurate assessment of development costs and success potential of future habitat creation projects.

## FY18 Accomplishments

Coordination with resource agencies and attendance at planning meetings was a similar effort to that of previous years. In FY18, two proposed conservation areas officially became LCR MSCP conservation areas: Three Fingers Lake and the Yuma Meadows Conservation Area (YMCA).

*Reach 3 Cadastral Surveys*: A cadastral report, including maps, was drafted for the area within Township 8N, Range 23E, Section 26, San Bernardino Meridian within the State of California. The results from this survey report indicate that this area is Reclamation withdrawn land, with the surrounding land being managed by the Bureau of Land Management. The parcels appear to be large enough to create a 20–40 acre disconnected backwater.

*Wetland Delineations:* Surveys to delineate wetlands at the YMCA (433 acres), Beal Lake Expansion Area (1,000 acres), the Cibola NWR Unit #1 Expansion Area (1,200 acres), Three Fingers Lake (697 acres), and Township 8N, Range 23E, Section 26, San Bernardino Meridian within the State of California (218 acres) were initiated and funded through Work Task E16. The delineations are typically funded through a specific work task; however, these projects did not have a FY18 budget or a signed Land Use Agreement. To facilitate the investigations, work was funded through Work Task E16.

*Class III Cultural Pedestrian Surveys:* Surveys to identify culturally sensitive areas at the YMCA (433 acres), Beal Lake Expansion Area (1,000 acres), the Cibola NWR Unit #1 Expansion Area (1,200 acres), Three Fingers Lake (680 acres), Palo Verde Ecological Reserve-South (PVER-South) (250 acres), and Township 8N, Range 23E, Section 26, San Bernardino Meridian within the State of California (218 acres) were initiated and funded through Work Task E16. The cultural surveys are typically funded through a specific work task; however, these projects did not have a FY18 budget or a signed Land Use Agreement, so work was funded through Work Task E16.

*Yuma Meadows Conservation Area*: The YMCA is located on Reclamation withdrawn lands in California approximately 10 miles north of Yuma, Arizona.

The property contains an office and warehouse complex known as the Laguna Field Office. The YMCA did not have an approved FY18 budget, as it was expected to be a new start in FY19, but the engineering design was started in FY18 using Work Task E16 funds. The design includes engineering drawings for twelve 1-acre grow-out ponds and 111 acres of disconnected backwater. Final engineering plans are anticipated in FY19.

## FY19 Activities

Coordination with resource agencies will continue. It is anticipated that both the proposed PVER-South and proposed Dennis Underwood Conservation Area will become formally established conservation areas.

*Hydraulic Dredge*: Additional support equipment was acquired for the dredge. Some equipment, such as a telehandler to support movement of dredge pipe, was obtained from Government excess equipment lists at minimal cost to the program, and a new D-6 high track dozer was purchased using Work Task E16 funds.

*Reach 3 Cadastral Surveys*: Based on the cadastral work completed in FY18 to define Reclamation's withdrawn lands in Section 26, additional investigation, such as obtaining topographic data through lidar, soil sampling, installation of groundwater wells, and development of a restoration concept, is underway.

*Reach 4 Cadastral Surveys*: Record searches for an area within Reach 4 that may be suitable for either a backwater or marsh complex identified land status within Township 9S, Range 22E Sections 5, 7, and 8, San Bernardino Meridian within the State of California. The final report and map are expected in FY19.

## FY20 Proposed Activities

Coordination efforts with resource agencies will be reduced as lands become available to the program for restoration. Work Task E41– Section 26 Conservation Area has been proposed to track the development of the lands identified for restoration since FY18. It is anticipated that all cadastral surveys will be completed and that enough land will have been identified to meet the minimum land cover required by the end of FY20. However, this work task will remain open at a reduced funding level.

Figure 1-1 depicts the geographical distribution of 16 established and 2 proposed conservation areas by the end of FY18. Figures 1-2 through 1-19 depict each existing or proposed conservation area.

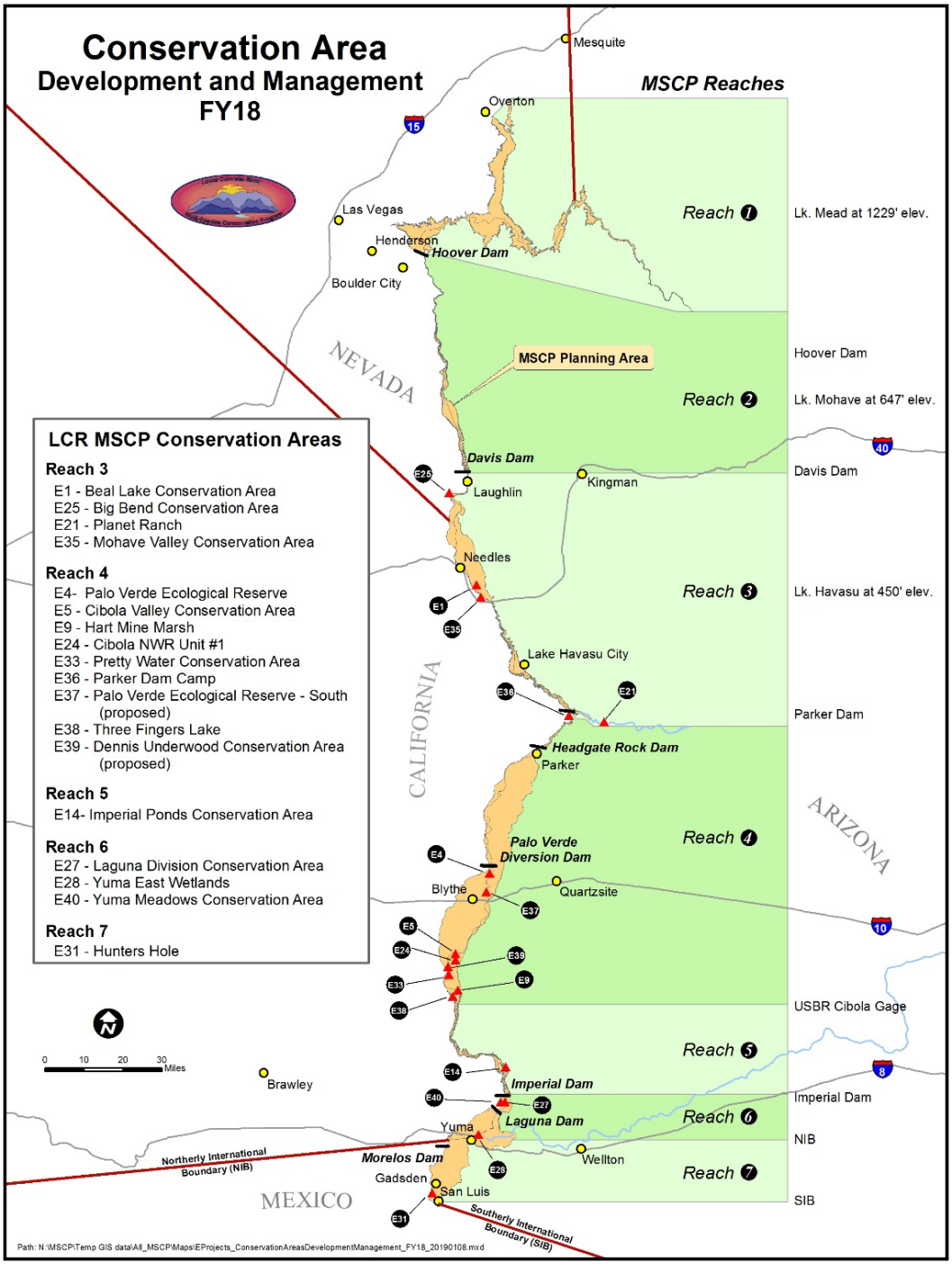



**Figure 1-1.—Conservation area development and management, 2018.**

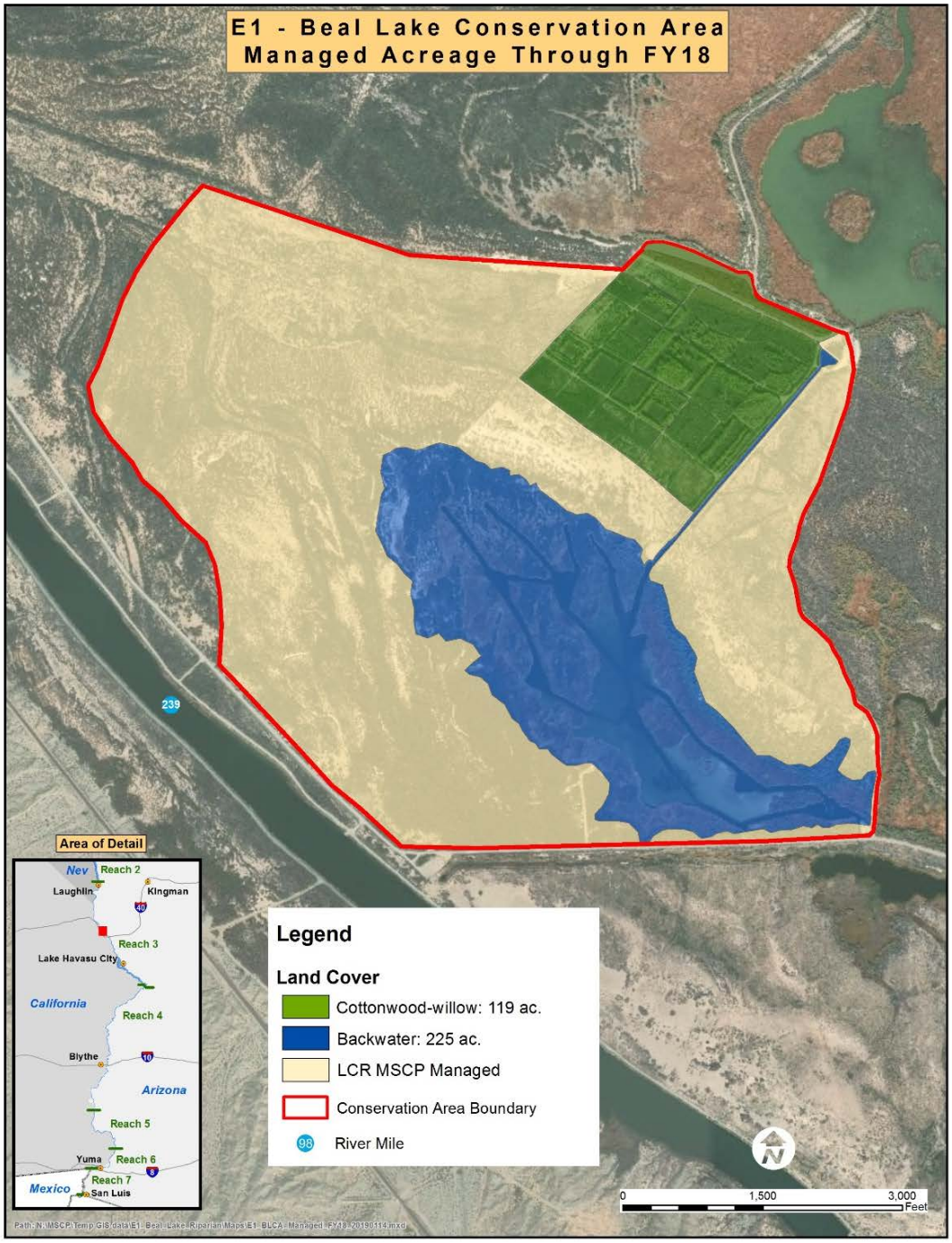



**Figure 1-2.—E1 – Beal Lake Conservation Area managed acreage through FY18.**

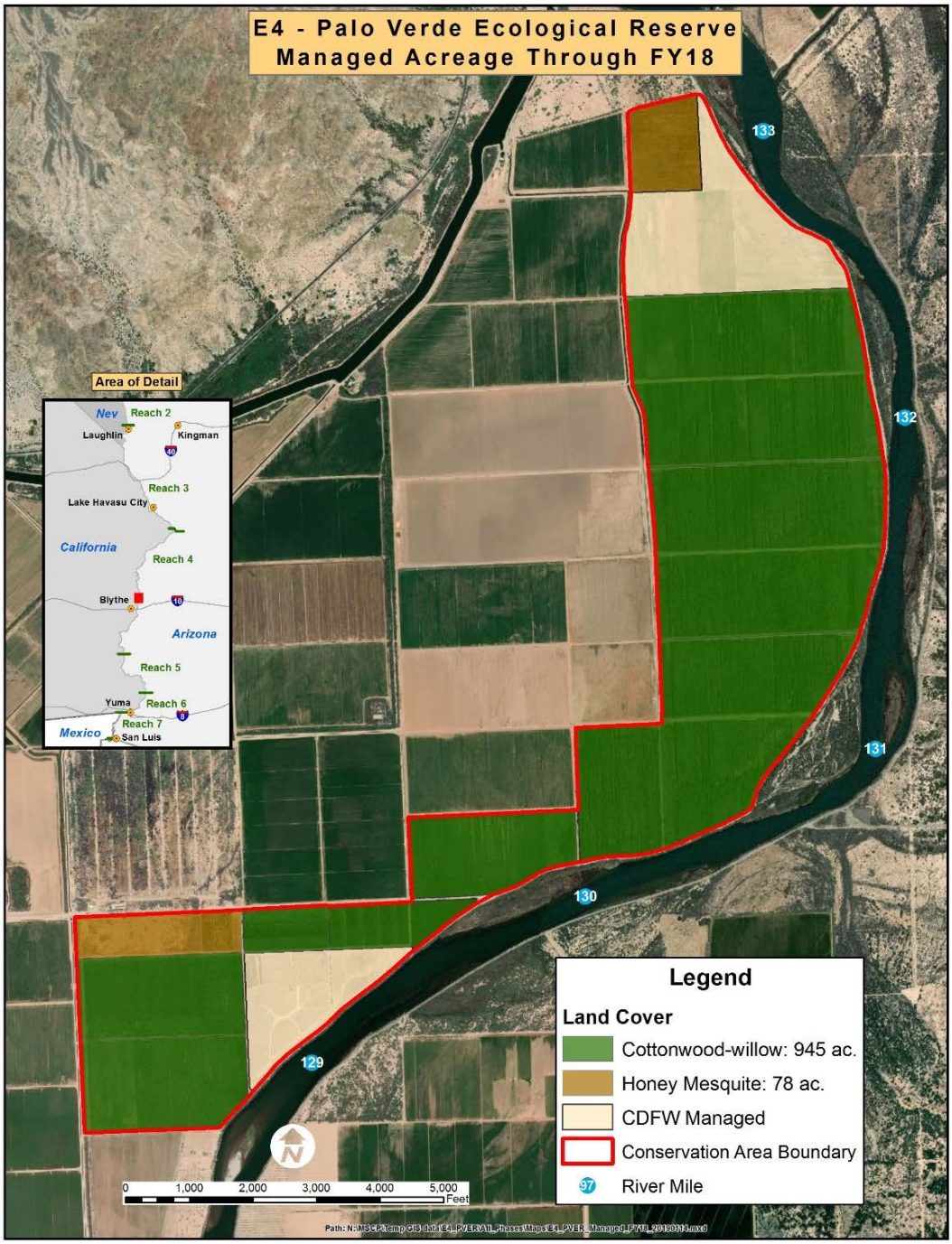
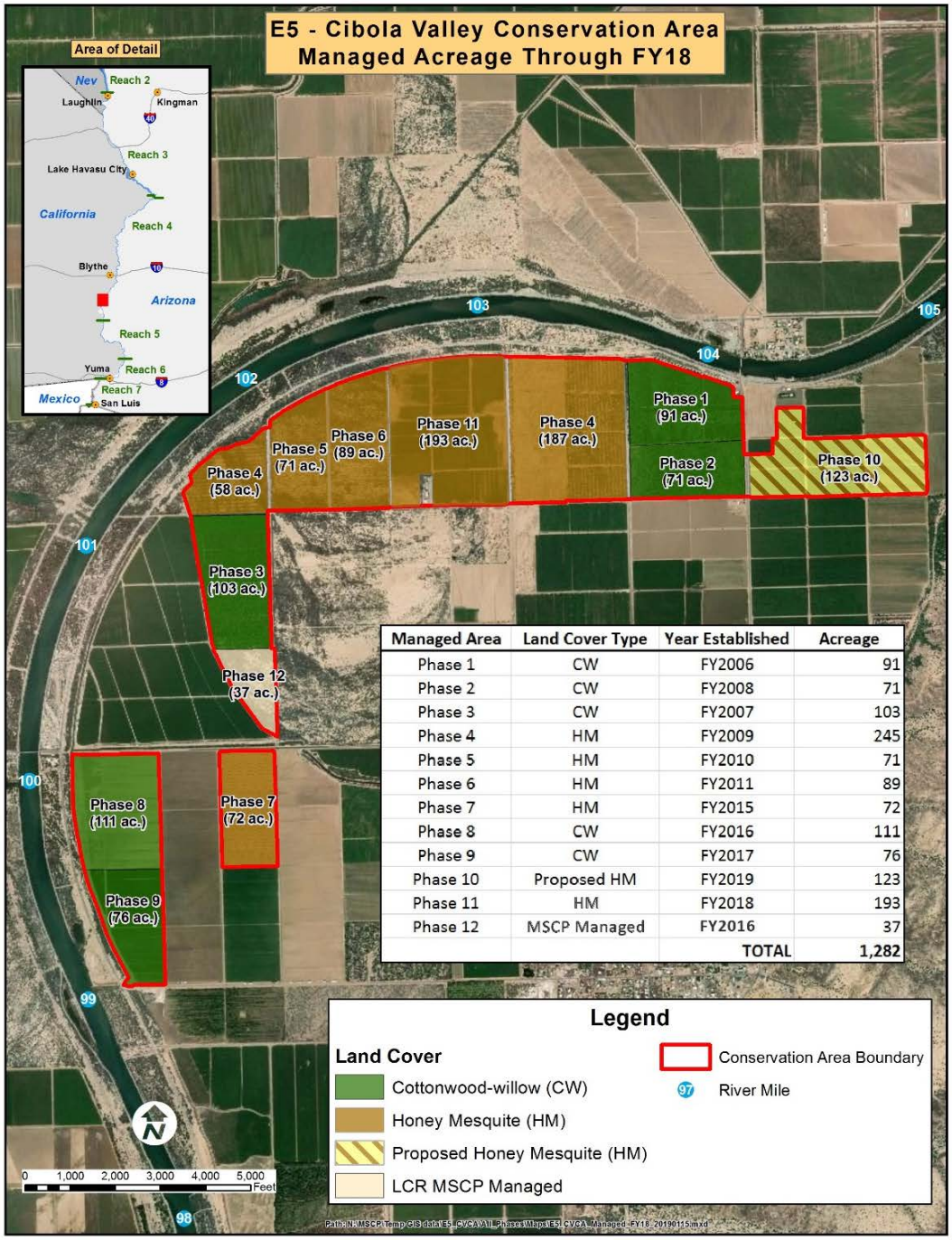



**Figure 1-3.—E4 – Palo Verde Ecological Reserve managed acreage through FY18.**




| Managed Area | Land Cover Type | Year Established | Acreage |
|---|---|---|---|
| Phase 1 | CW | FY2006 | 91 |
| Phase 2 | CW | FY2008 | 71 |
| Phase 3 | CW | FY2007 | 103 |
| Phase 4 | HM | FY2009 | 245 |
| Phase 5 | HM | FY2010 | 71 |
| Phase 6 | HM | FY2011 | 89 |
| Phase 7 | HM | FY2015 | 72 |
| Phase 8 | CW | FY2016 | 111 |
| Phase 9 | CW | FY2017 | 76 |
| Phase 10 | Proposed HM | FY2019 | 123 |
| Phase 11 | HM | FY2018 | 193 |
| Phase 12 | MSCP Managed | FY2016 | 37 |
| | | TOTAL | 1,282 |

**Figure 1-4.—E5 – Cibola Valley Conservation Area managed acreage through FY18.**

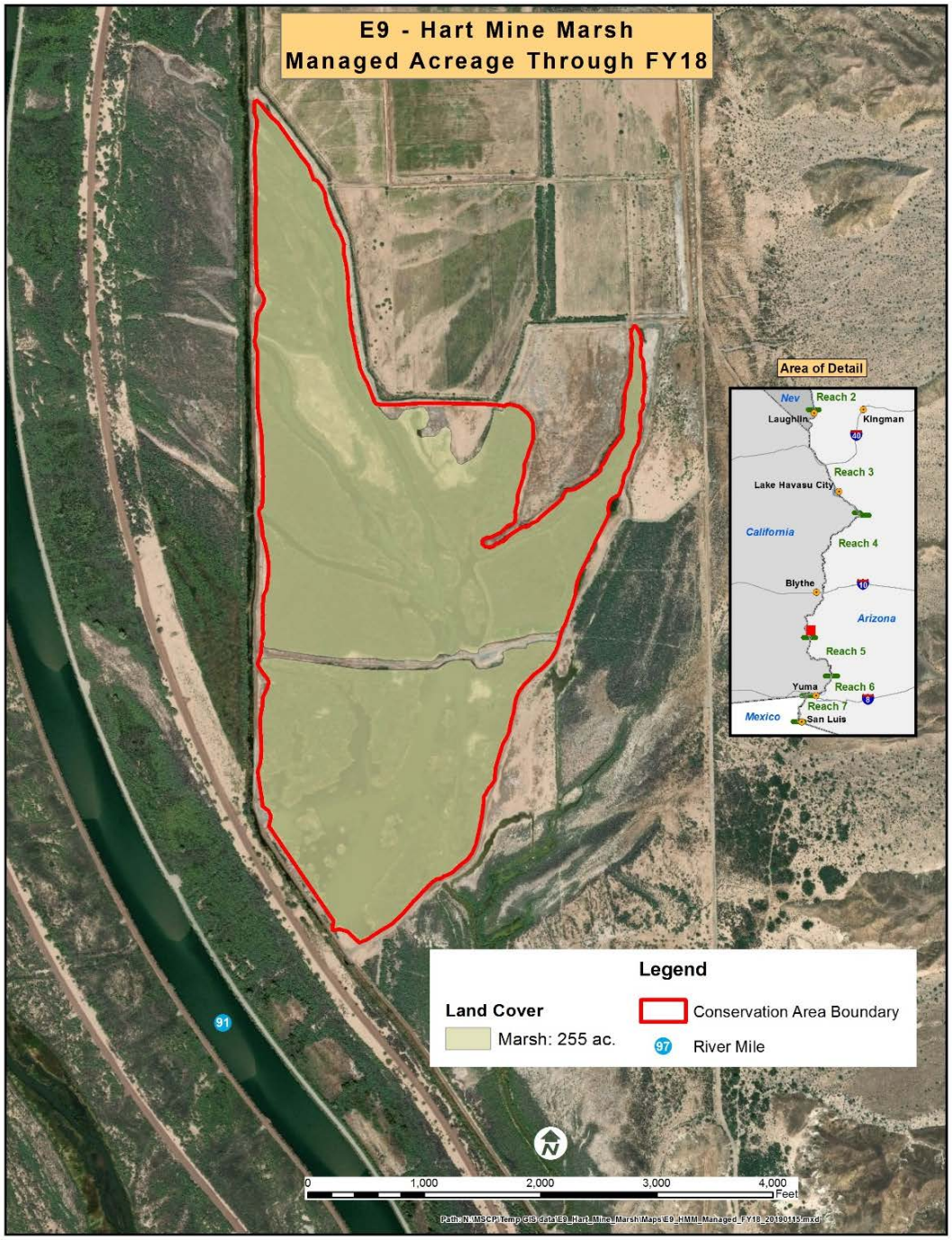



**Figure 1-5.—E9 – Hart Mine Marsh managed acreage through FY18.**

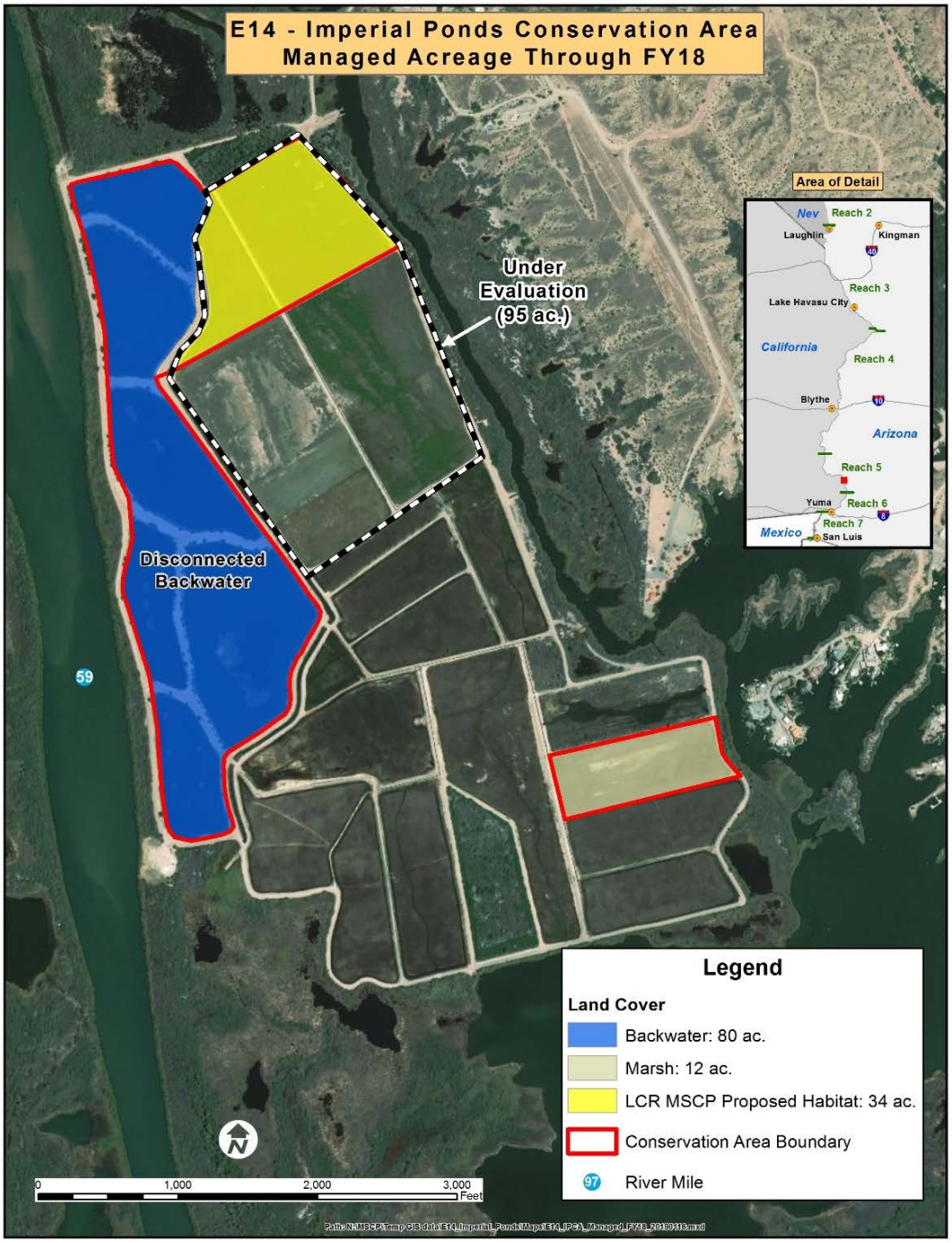



**Figure 1-6.—E14 – Imperial Ponds Conservation Area managed acreage through FY18.**

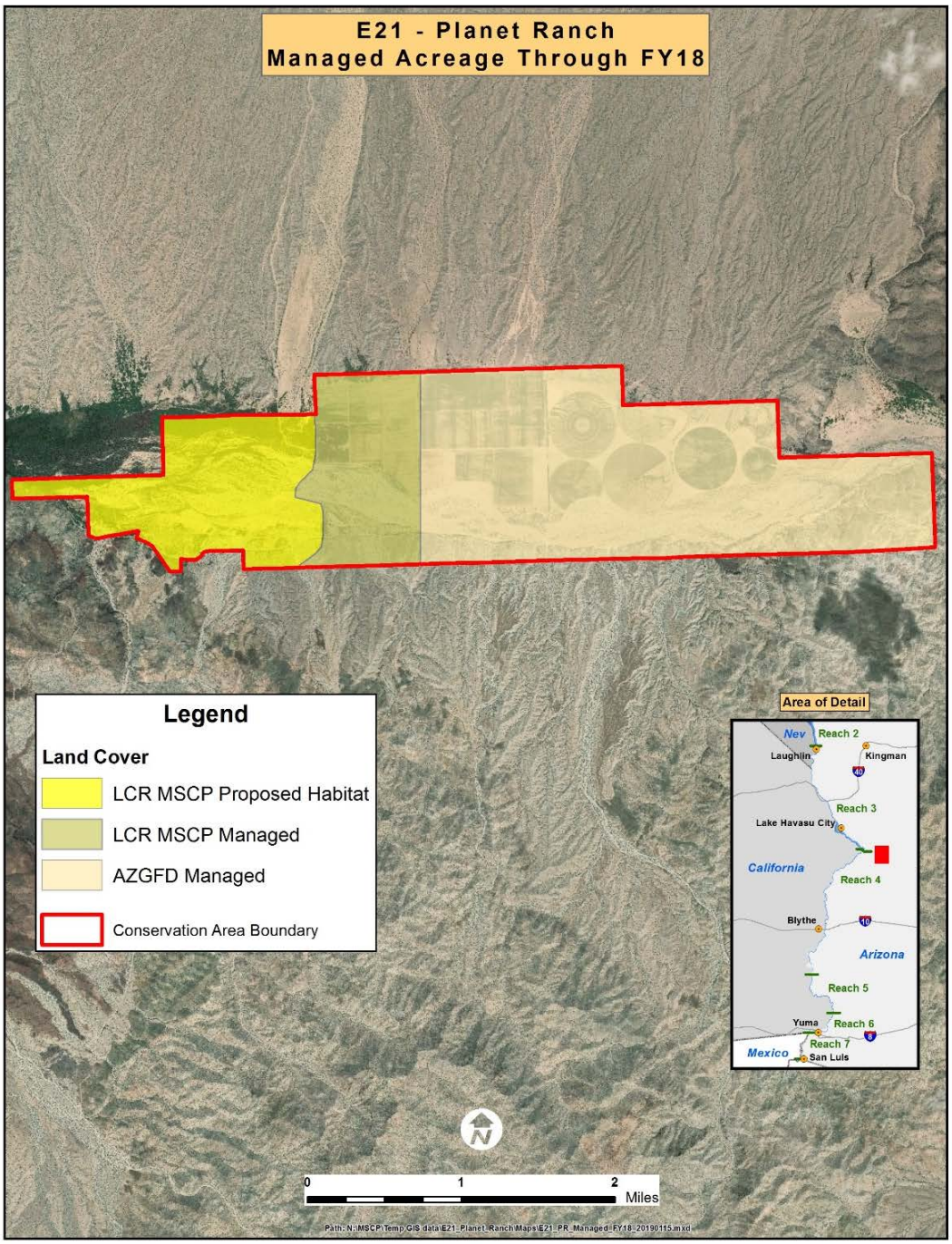



**Figure 1-7.—E21 – Planet Ranch managed acreage through FY18.**

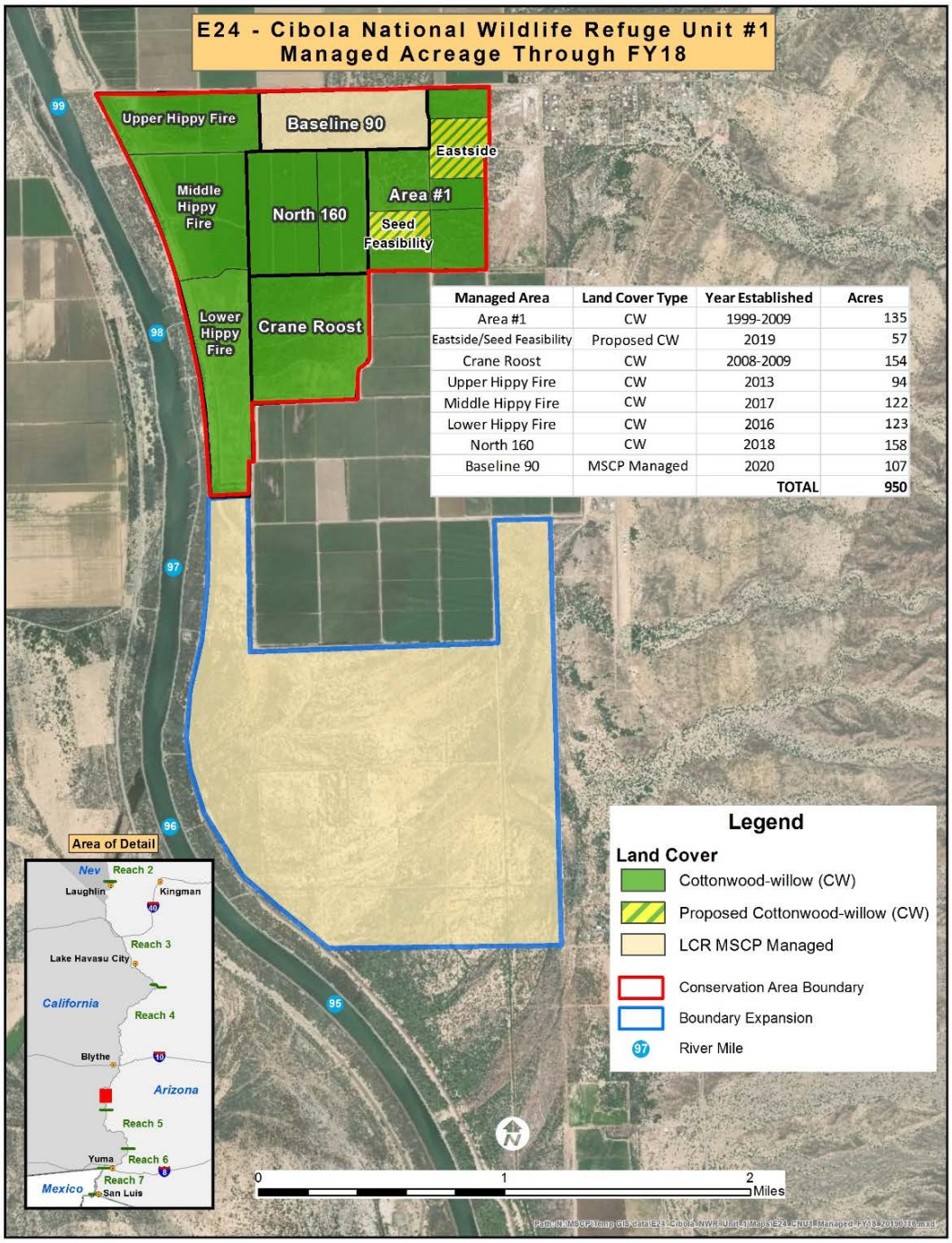



**Figure 1-8.—E24 – Cibola National Wildlife Refuge Unit #1 Conservation Area managed acreage through FY18.**

**Figure 1-9.—E25 – Big Bend Conservation Area managed acreage through FY18.**

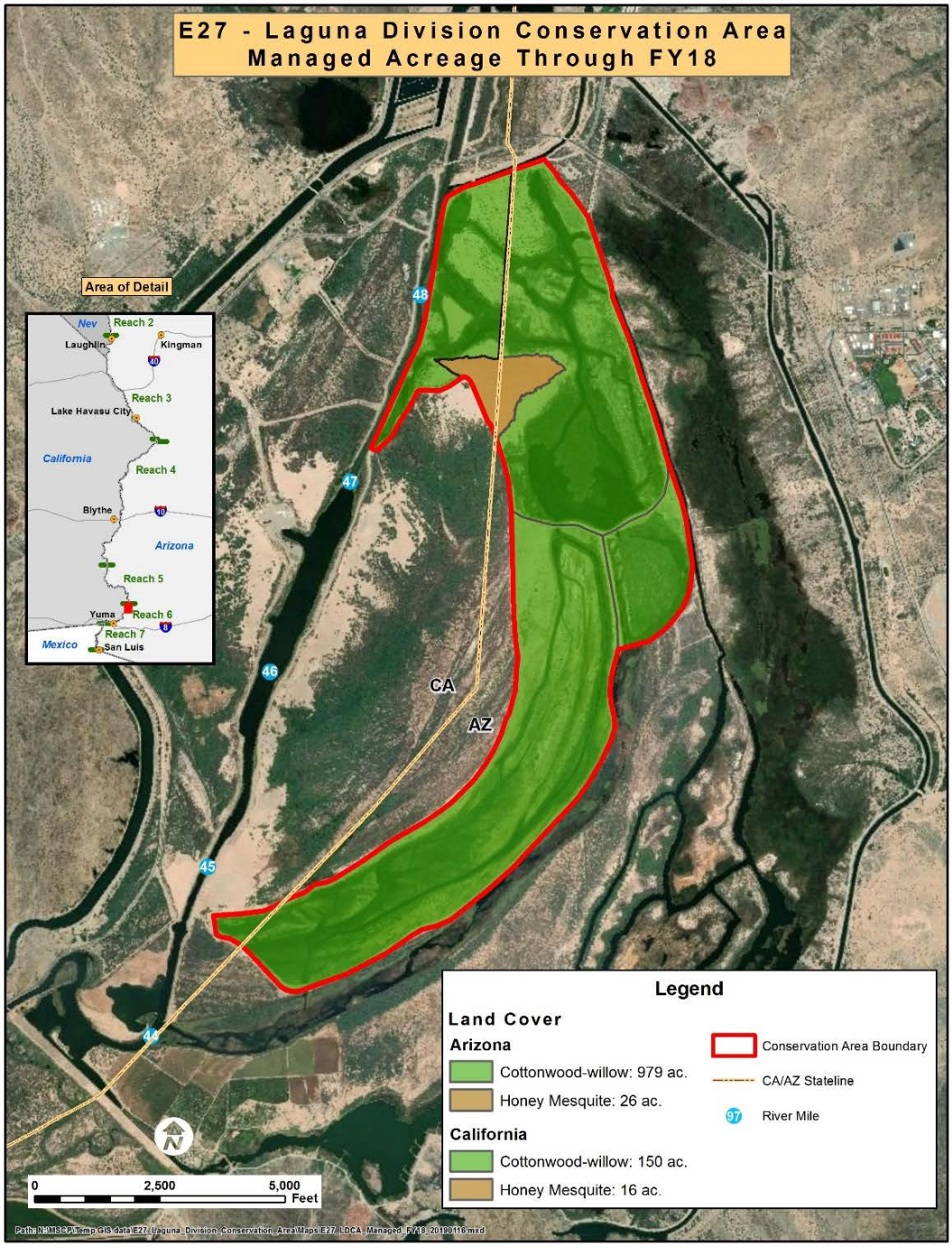



**Figure 1-10.—E27 – Laguna Division Conservation Area managed acreage through FY18.**

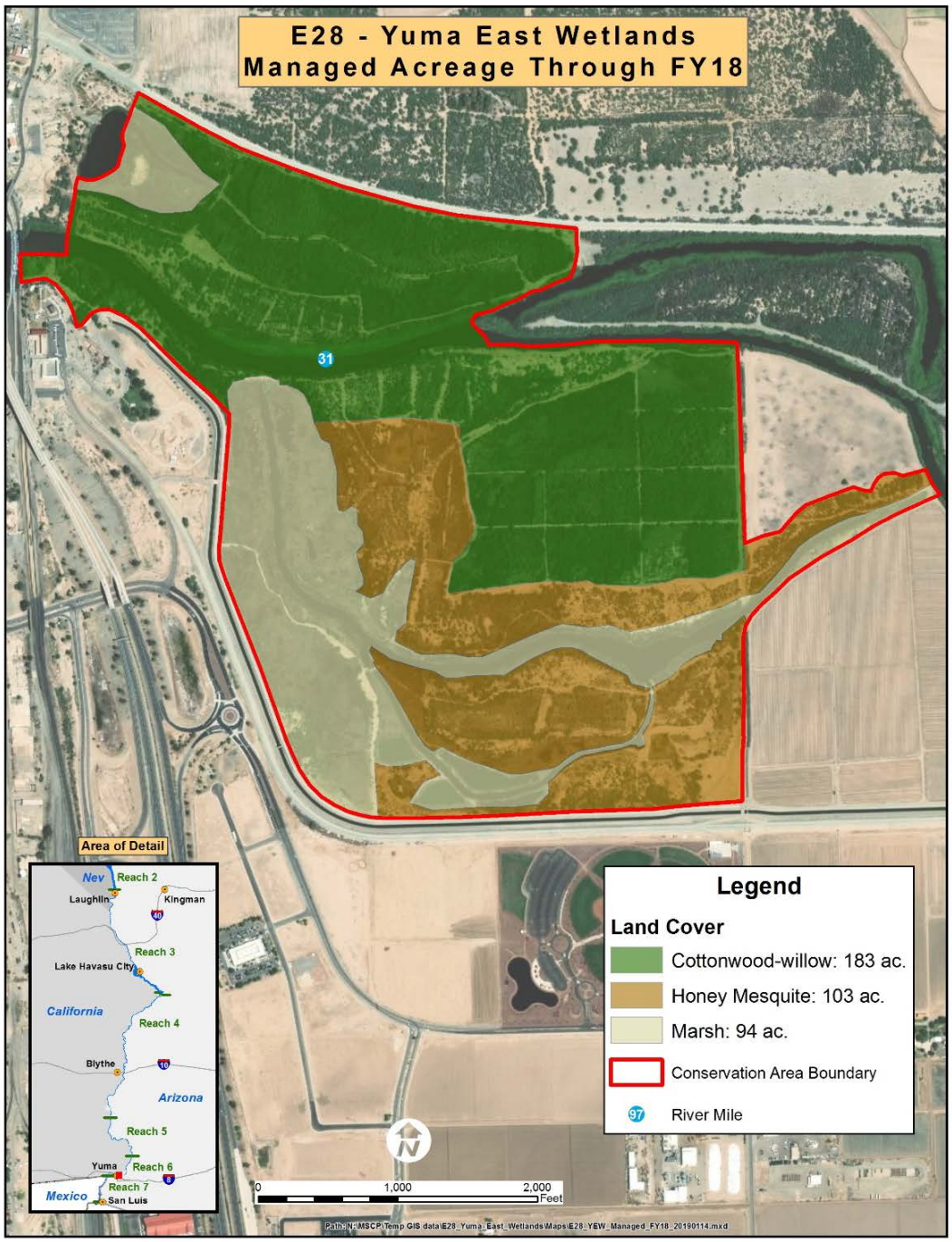



**Figure 1-11.—E28 – Yuma East Wetlands managed acreage through FY18.**

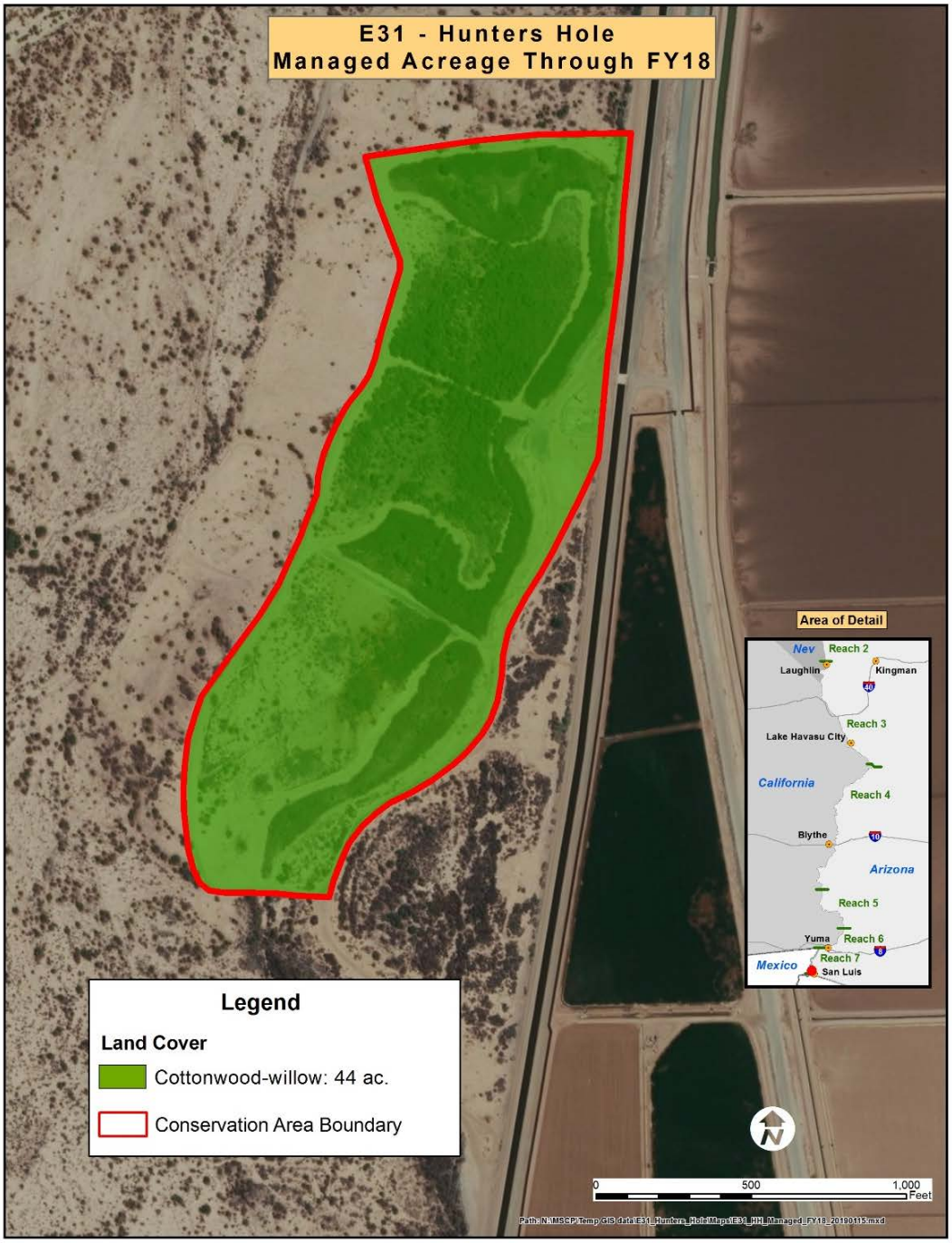



**Figure 1-12.—E31 – Hunters Hole managed acreage through FY18.**

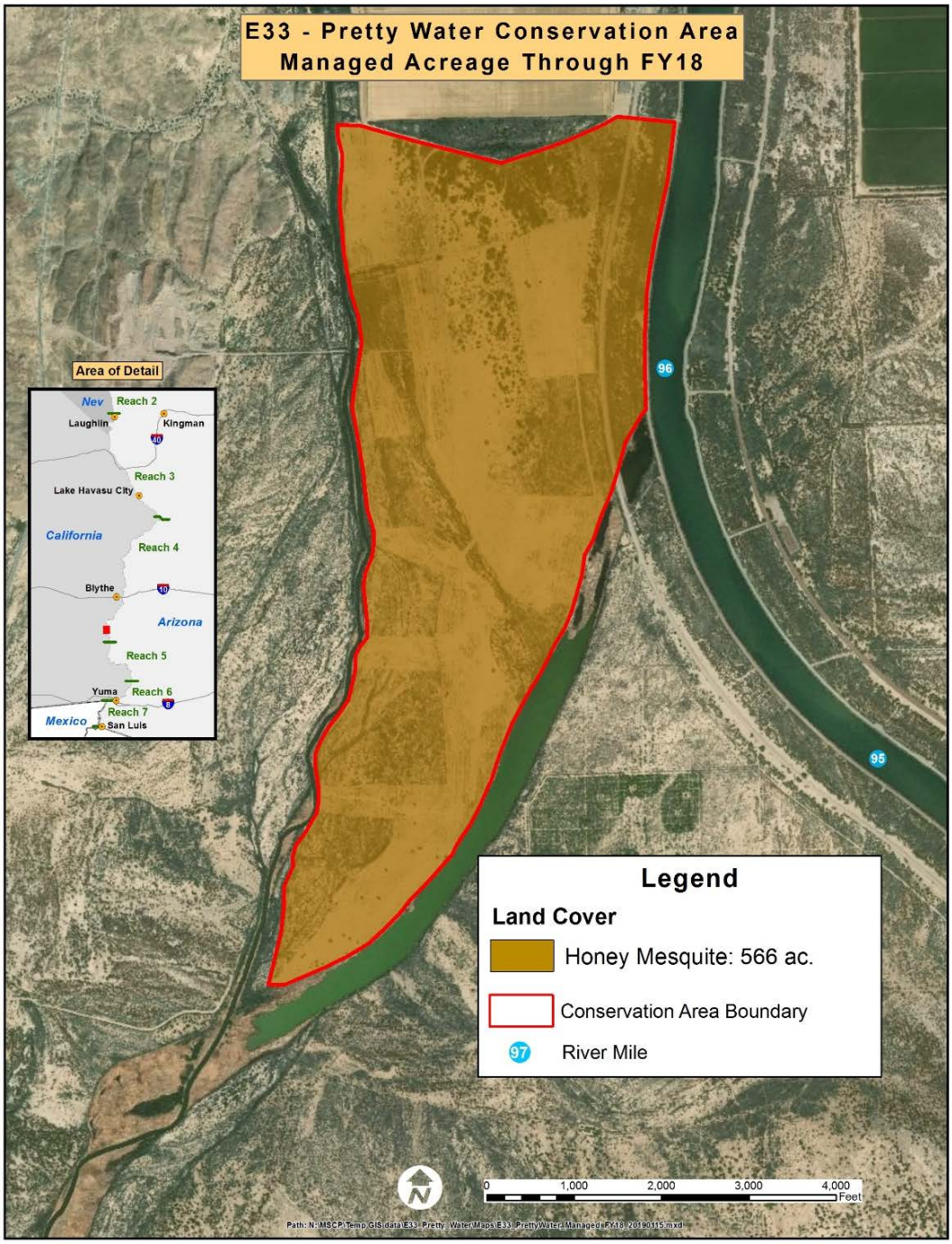



**Figure 1-13.—E33 – Pretty Water Conservation Area managed acreage through FY18.**

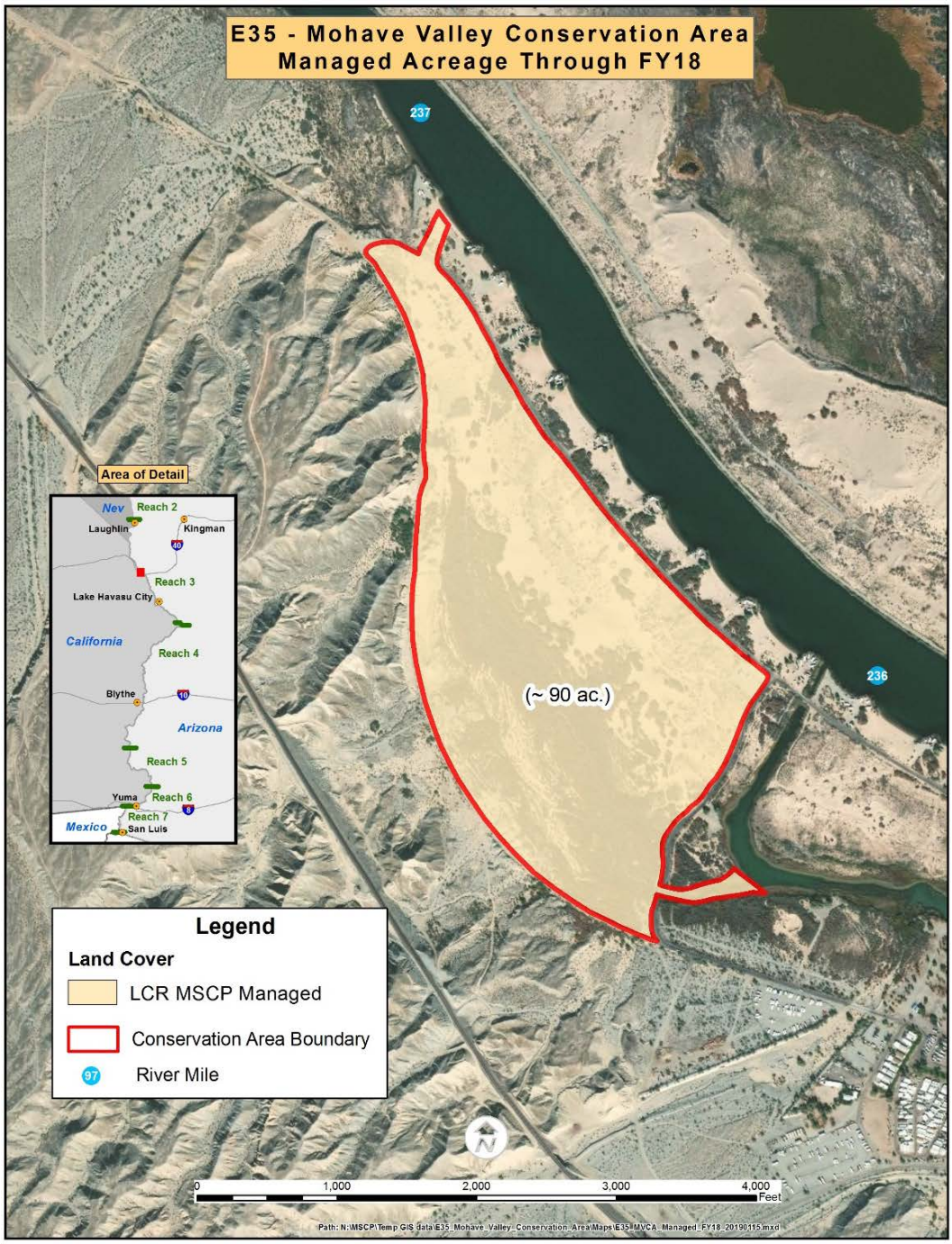



**Figure 1-14.—E35 – Mohave Valley Conservation Area managed acreage through FY18.**

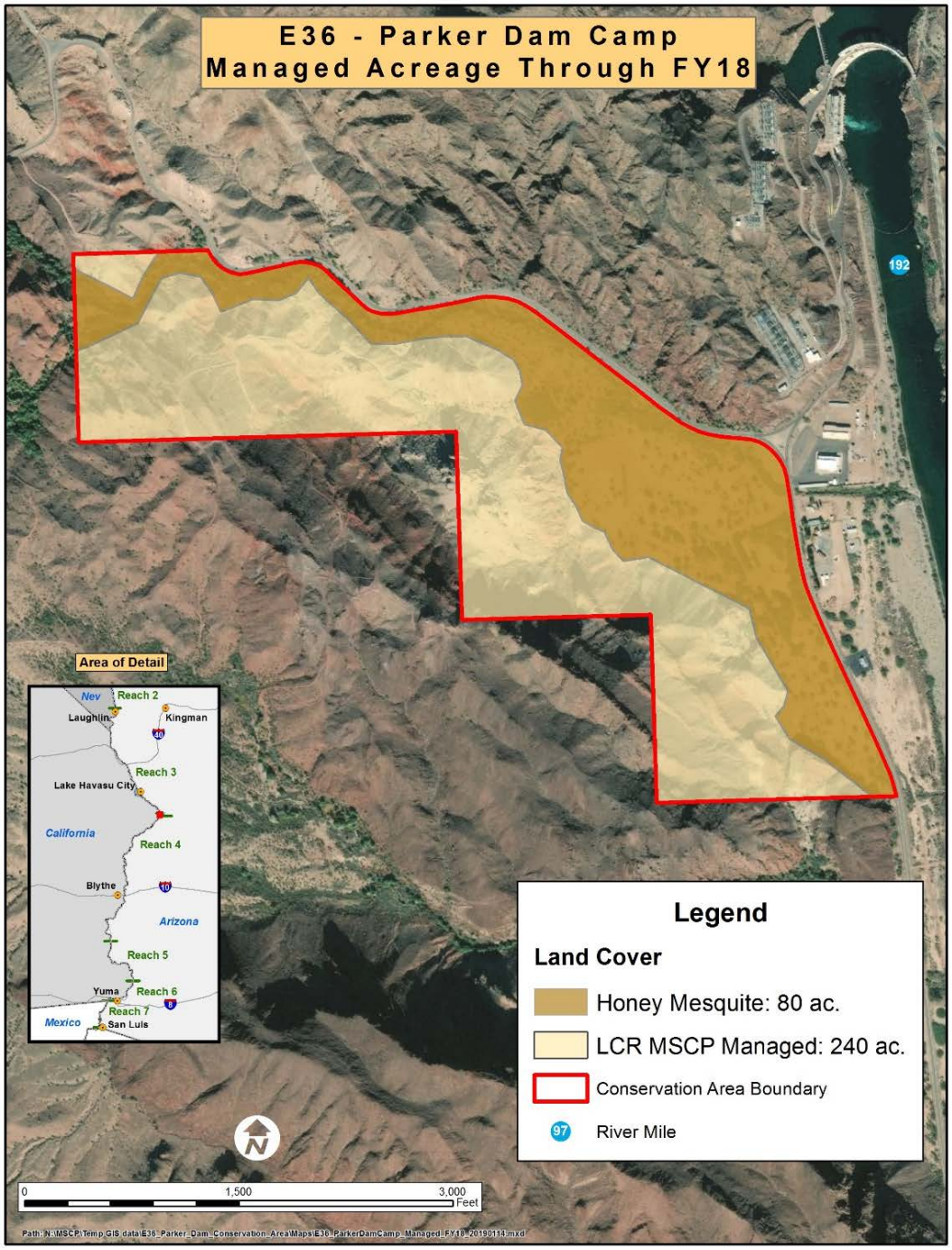



**Figure 1-15.—E36 – Parker Dam Camp managed acreage through FY18.**

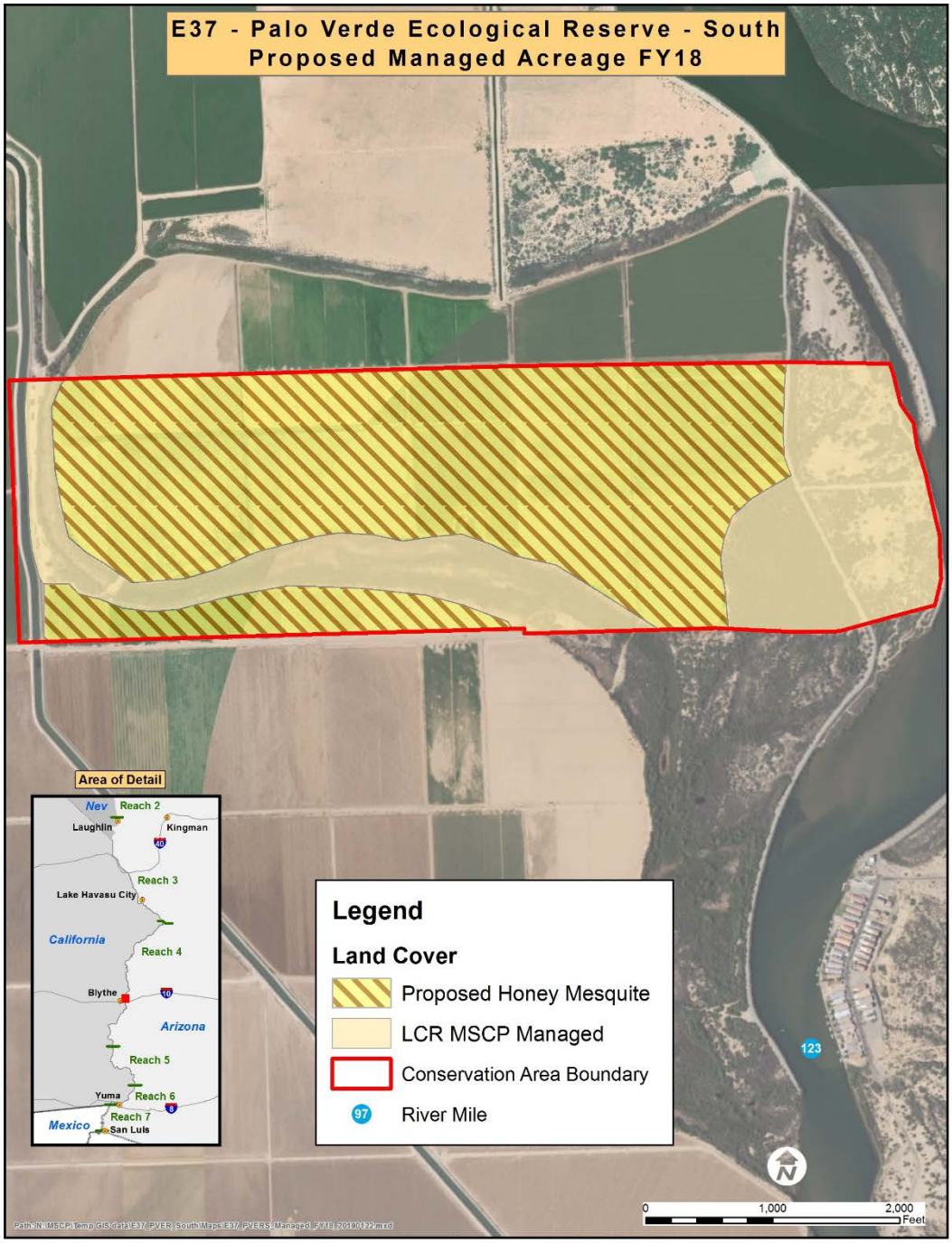



**Figure 1-16.—E37 – Palo Verde Ecological Reserve-South proposed conservation area boundary.**

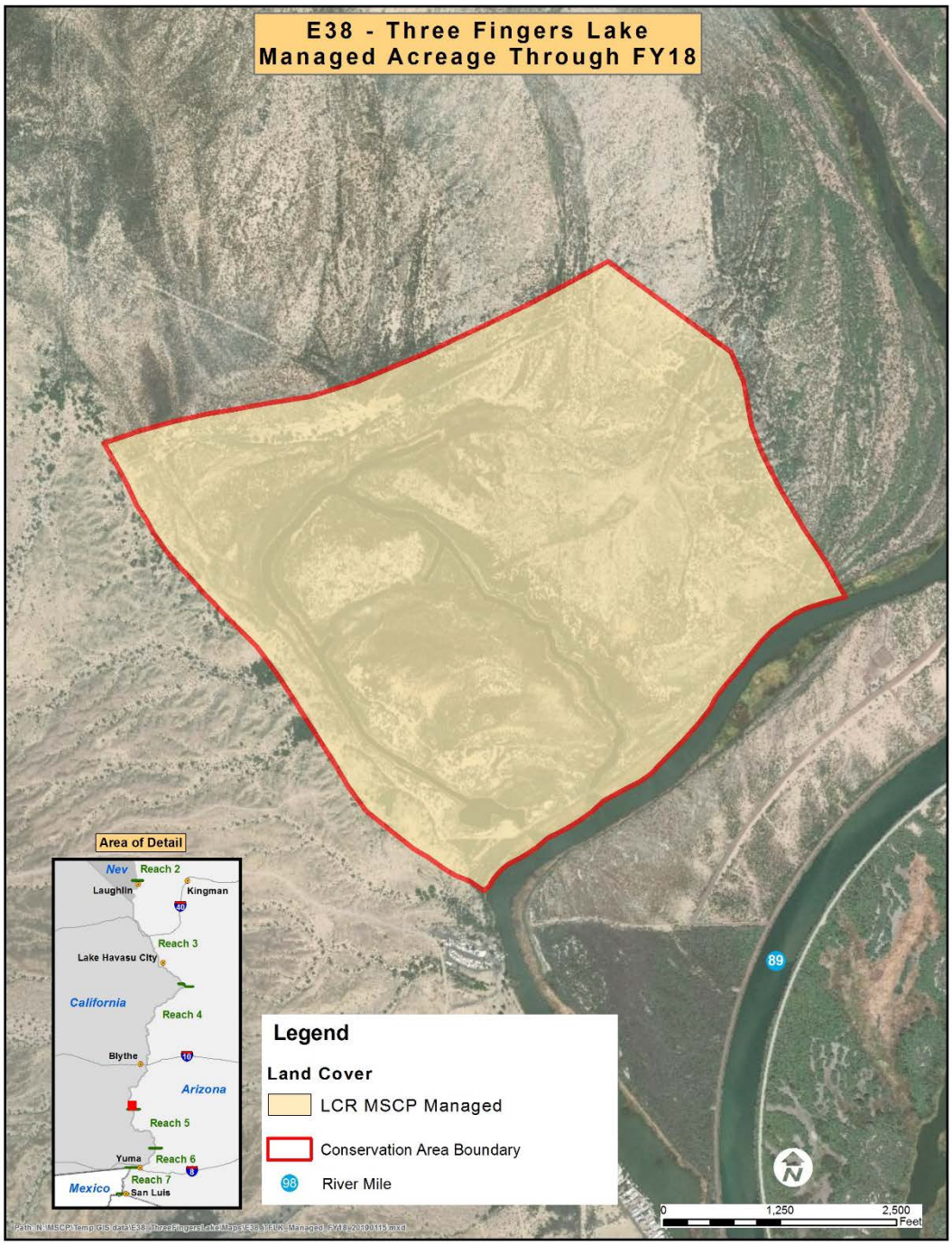



**Figure 1-17.—E38 – Three Fingers Lake proposed conservation area boundary.**

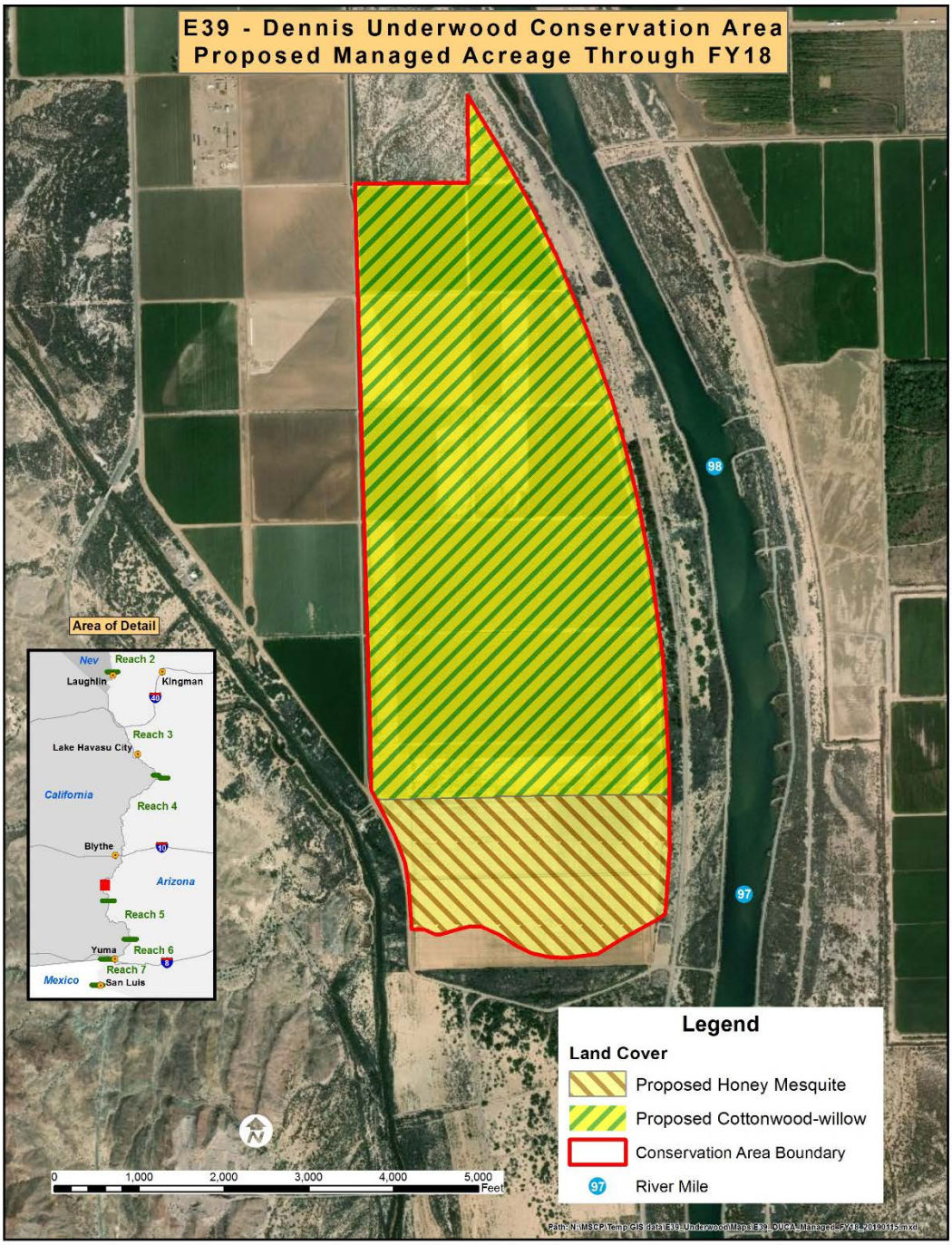



**Figure 1-18.—E39 – Dennis Underwood Conservation Area proposed conservation area boundary.**

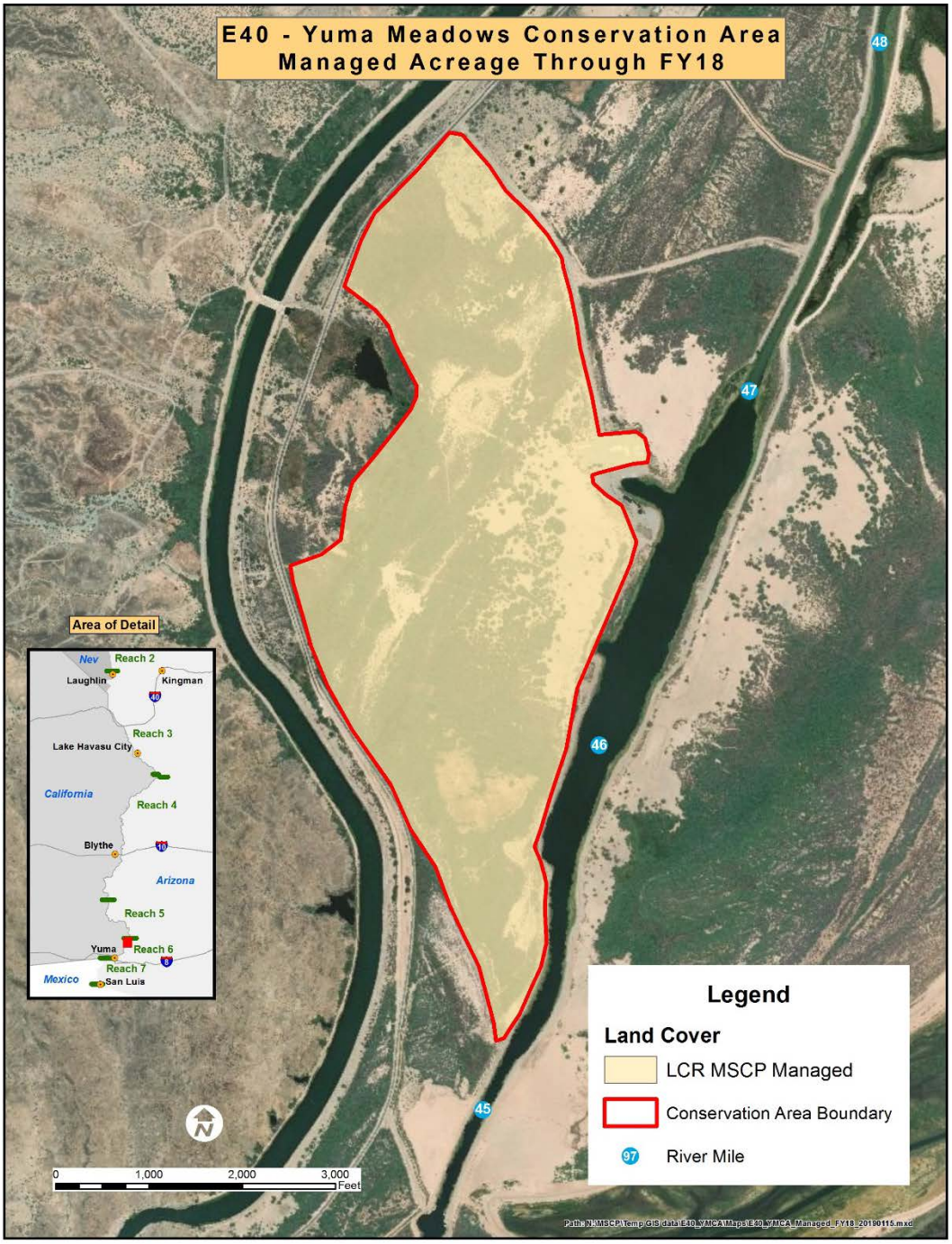



**Figure 1-19.—E40 – Yuma Meadows Conservation Area proposed conservation area boundary.**

## Development and Maintenance

Habitat development and maintenance are strongly connected. Created habitat is achieved through the process of development, establishment, and modification of a site as well as growth (maturation) of the land cover type. Subsequent management of that land cover type either maintains the specific requirements necessary for that created habitat or moves that land cover type toward achievement of those specific habitat requirements.

Habitats, both aquatic and terrestrial, are dynamic. They are better described as a continuum rather than a stage of development or succession. By using knowledge gained from research, demonstrations, and experience, sites with the greatest potential for success can be identified, and the most effective designs and approaches can be employed to create the targeted land cover type.

In the context of current conditions, achieving the desired habitat under the LCR MSCP calls for establishing and managing for a snapshot in time and ecological succession, which may require actively creating disturbances to reset or maintain the land cover type in the proper seral stage (in the case of some riparian habitat). For a backwater, it may involve removing organic matter from the bottom surface to reduce biological oxygen demand and maintaining acceptable levels of water quality. In any case, habitat creation does not necessarily end with the initial establishment of the proper vegetation type or isolation of a backwater.

Over the course of identifying and selecting sites, conducting research studies and demonstration projects, and developing and managing created land cover types, information is gathered that may help to better understand these processes. This feedback, in turn, may serve to modify site selection or establishment approaches for future projects. The information can also reveal program needs not previously anticipated. For example, during collections for Work Task E7 (closed), it became apparent that establishment of native plant nurseries would be needed to supply an adequate source of cuttings for future large-scale propagation and establishment of riparian vegetation. A centralized location with an easily accessible supply of riparian species would also reduce the time and costs associated with collection. These nurseries were incorporated into the phased development plans for Work Tasks E4 and E5.

Each site, whether identified as a marsh, backwater, honey mesquite, or cottonwood-willow cover type, will have its own set of site-specific challenges to overcome.

The HCP includes schedules for development of all four land cover types through 2035. However, funding allocated toward conservation area development is reduced after FY25 because it was assumed efficient habitat creation techniques would be implemented and the majority of the habitat creation would be completed. To balance the available resources needed to complete the conservation measure requirements in the HCP, habitat creation will continue

until 2030. To accomplish this task, long-term planning will be conducted and a schedule created through 2030. Also, projects will be selected for implementation within the next 5 years to allow time for planning, site evaluation, coordination with partners, design, permitting, and sequencing into the program.

### *FY18 Accomplishments*

The focus of development in FY18 was the planting of honey mesquite at Phase 11 of the CVCA, planting of cottonwood-willow at the North 160 area at Cibola NWR Unit #1, and construction of a backwater at the MVCA.

#### Cibola Valley Conservation Area

One hundred ninety-three acres of honey mesquite were established in Phase 11. To date, 452 acres of cottonwood-willow and 670 acres of honey mesquite have been established at the CVCA. Annual plantings are expected to continue, with complete development in FY19.

#### Cibola National Wildlife Refuge Unit #1 Conservation Area

The North 160 area, approximately 158 acres, was planted with cottonwood-willow. Of the available 950 acres at Cibola NWR Unit #1, 786 acres of cottonwood-willow have been established. Annual plantings will continue.

#### Planet Ranch

Irrigation of the alfalfa ceased on December 15, 2017, since the water right has been secured until 2022. Power lines and infrastructure connected to the irrigation system were disconnected, and the irrigation system (center pivots and wheel lines) was removed. Removal of the system to occurred in January 2019.

To inform design efforts, several reports, studies, and analyses were conducted. These efforts included modeling the surface water flows on the Bill Williams River and adjacent drainages; conducting hydrologic, hydraulic, and geotechnical investigations to develop geologic design data for pond design and flood control; and collecting infiltration data to assist in the design of the ponds and identify potential methods to reduce permeability. The analysis of water infiltration indicated synthetic lining of the ponds may not be necessary if existing in situ silty material is compacted and used to line the ponds. With the data collected and information provided, engineering design drawings were advanced to 30% completion.

#### Mohave Valley Conservation Area

Land-based construction activities finished in May 2018. Roughly 1.15 million cubic yards were moved, in total, using heavy equipment. The northern inlet and southern outlet bridges were constructed to allow vehicles to cross over the

channel allowing the backwater to be connected to the river. The dredge operations began in May 2018. The as-built survey of the open water created indicate that just over 60 acres of connected backwater have been created.

### Acreage by Conservation Area Through FY18

The total number of acres managed by land cover type and by reach and State on established conservation areas is shown in tables 1-13 and 1-14. Through FY18, the LCR MSCP actively manages 9,745 acres with 6,634 acres available for habitat creation (table 1-13). Not all acreage can or will be converted into either of the four land cover types due to resource limitations or the habitat creation needs of the program.

**Table 1-13.—Acreage by Conservation Area Through FY18**

| Conservation Area | Established Land Cover[1] | LCR MSCP Managed Acreage[2] | Available Acreage[3] | Total Conservation Area Acreage[4] |
|---|---|---|---|---|
| Beal Lake Conservation Area (Arizona) | 119 | 434 | 119 | 434 |
| Big Bend Conservation Area (Nevada) | 15 | 15 | 15 | 15 |
| Cibola National Wildlife Refuge Unit #1 Conservation Area (Arizona) | 786 | 950 | 950 | 950 |
| Cibola Valley Conservation Area (Arizona) | 1,122 | 1,159 | 1,245 | 1,309 |
| Hart Mine Marsh (Arizona) | 255 | 255 | 255 | 255 |
| Hunters Hole (Arizona) | 44 | 44 | 44 | 44 |
| Imperial Ponds Conservation Area (Arizona) | 92 | 126 | 126 | 126 |
| Laguna Division Conservation Area (Arizona and California) | 1,171 | 1,171 | 1,171 | 1,171 |
| Palo Verde Ecological Reserve (California) | 1,023 | 1,023 | 1,023 | 1,352 |
| Parker Dam Camp (California) | 80 | 204 | 80 | 204 |
| Planet Ranch Conservation Area (Arizona) | 396* | 3,418** | 660 | 3,418*** |
| Pretty Water Conservation Area (California) | 566 | 566 | 566 | 566 |
| Yuma East Wetlands (Arizona) | 380 | 380 | 380 | 380 |
| Yuma Meadows Conservation Area (California) | | | | |
| **Total** | **6,049** | **9,745** | **6,634** | **10,224** |

[1] **Established Land Cover** is the acreage restored as either the cottonwood-willow, honey mesquite, marsh, or backwater land cover type.

[2] **LCR MSCP Managed Acreage** is the acres of land controlled by the LCR MSCP. Not all managed acres can be converted to a land cover type.

[3] **Available Acreage** is the acreage already restored or anticipated to be restored as a land cover type.

[4] **Total Conservation Area Acreage** is the total acreage of all conservation areas combined regardless if they are managed by the LCR MSP or by a partner.

* The LCR MSCP receives credit for 396 acres of the cottonwood-willow land cover type at the Middle Bill Williams River NWR.

** This is 3,418 acres during FY18, as this acreage was being farmed. The total managed acres are anticipated to decrease in the future, when the LCR MSCP turns a portion of the farmed acres over to AZGFD management.

*** This total does not include acreage at the Middle Bill Williams River NWR.

**Table 1-14.—Land Cover Type by Reach and State Through FY18**

| | Cottonwood-Willow | Honey Mesquite | Marsh | Backwaters | TOTAL |
|---|---|---|---|---|---|
| **Arizona** | | | | | |
| Reaches 1 and 2 | 0 | 0 | 0 | 0 | 0 |
| Reach 3 | 515 | 0 | 0 | 0 | 515 |
| Reach 4 | 1,238 | 670 | 255 | 0 | 2,163 |
| Reach 5 | 0 | 0 | 12 | 80 | 92 |
| Reach 6 | 1,162 | 129 | 94 | 0 | 1,385 |
| Reach 7 | 44 | 0 | 0 | 0 | 44 |
| **Total** | **2,959** | **799** | **361** | **80** | **4,199** |
| | | | | | |
| **California** | | | | | |
| Reaches 1 and 2 | 0 | 0 | 0 | 0 | 0 |
| Reach 3 | 0 | 0 | 0 | 0 | 0 |
| Reach 4 | 945 | 724 | 0 | 0 | 1,669 |
| Reach 5 | 0 | 0 | 0 | 0 | 0 |
| Reach 6 | 150 | 16 | 0 | 0 | 166 |
| Reach 7 | N/A | N/A | N/A | N/A | N/A |
| **Total** | **1,095** | **740** | **0** | **0** | **1,835** |
| | | | | | |
| **Nevada** | | | | | |
| Reaches 1 and 2 | 0 | 0 | 0 | 0 | 0 |
| Reach 3 | 0 | 0 | 0 | 15 | 15 |
| Reaches 4–7 | N/A | N/A | N/A | N/A | N/A |
| **Total** | **0** | **0** | **0** | **15** | **15** |
| | | | | | |
| **TOTAL** | **4,054** | **1,539** | **361** | **95** | **6,049** |

Of the 9,745 acres being actively managed by the LCR MSCP, the four land cover types have been established on approximately 6,049 acres. Acreages at conservation areas in which an agreement was signed in FY18, such as at the Cibola NWR Unit #1 Expansion Area, the Beal Lake Conservation Area Expansion Area, Three Fingers Lake, and the YMCA, are included in tables 1-13 and 1-14. Acreages at conservation areas still in the planning phase, or for which there was no signed agreement in FY18, such as at PVER-South and the Dennis Underwood Conservation Area, are not included in tables 1-13 or 1-14 at this time. The MVCA acreage will be included when construction is complete.

### *FY19 Activities*

Final planting at the CVCA and Cibola NWR Unit #1 is scheduled and will complete development of both conservation areas. Honey mesquite will be planted at the Dennis Underwood Conservation Area. Dredging at the MVCA will be completed. Construction activities will begin at Planet Ranch.

#### Cibola Valley Conservation Area

Phase 10, approximately 123 acres, will be planted with the honey mesquite land cover type.

#### Cibola National Wildlife Refuge Unit #1 Conservation Area

Fifty-Seven acres will be planted with the cottonwood-willow land cover type.

#### Planet Ranch

A Value Engineering Study on the 30% design was completed, and the final engineering plan sets have been drafted. The study provided several options to minimize seepage from the ponds after construction.

Construction activities are anticipated to begin in early 2019; planned work includes mobilization of heavy equipment; clearing of vegetation from the pond's footprint; excavation of a 3- to 5-acre test pond; the procurement, transportation and installation of sheet pile for the flood control structure; and the drilling of new production and domestic wells.

#### Mohave Valley Conservation Area

Dredging is expected to be finished by April 2019. Native vegetation may be planted on some of the spoil material to reduce the movement of sand.

**Dennis Underwood Conservation Area**

Planting of honey mesquite is anticipated to create 167 of the honey mesquite land cover type.

### *FY20 Proposed Activities*

**Dennis Underwood Conservation Area**

Approximately 231 acres will be planted with the cottonwood-willow land cover type.

**Planet Ranch**

Construction activities, including installation of the sheet piling and excavation of the ponds, is scheduled to be completed in late FY20 but may extend into early FY21. Completion of the ponds is anticipated to create 60 acres of disconnected backwater for the program.

### *Planned Conservation Area Development*

Conservation areas are scheduled to be developed and adaptively managed from FY21–FY30 to meet the minimum required land cover type creation as described in the HCP. The following is the anticipated work scheduled in sequential order:

(1) Excavation of grow-out ponds at the YMCA

(2) Development of cottonwood-willow at the Cibola Unit #1 Expansion Area

(3) Development of cottonwood-willow at the Beal Lake Expansion Area

(4) Dredging of the BBCA

(5) Excavation and dredging of the Section 26 Conservation Area to create a connected backwater within Reach 3

(6) Creation of a seventh disconnected backwater at the IPCA

(7) Development of Three Fingers Lake as a marsh complex

(8) Excavation and dredging of disconnected backwaters at the YMCA

These projects may be completed in a different sequential order, or other opportunities may be substituted, if necessary.

# Adaptive Management Program (Section G)

Restoration research and demonstration projects help supply new information to adaptively manage habitat creation projects, making them more effective in meeting species-specific habitat requirements and managing costs to meet those requirements. In general, adaptive management research projects are those that have specific research questions and are supported by a robust, replicated study design in which some level of analysis can be conducted and inferences made. These projects may include, but are not limited to, research directed at habitat development to meet species needs, improving vegetation growth and survival, testing alternate propagation and habitat establishment techniques, habitat manipulation, determining habitat creation potential at identified sites based on current ecological functions, and evaluating technologies to assist in meeting specific habitat requirements.

Work tasks can address specific research questions or use demonstration projects to assess a particular technique to determine whether the technique might be feasible and effective. These projects may have vegetation that matures into a land cover type that meets the specific criteria for created habitat for the covered species. Until that time, these projects will be referred to as research or demonstration projects. Both of these types of investigations increase knowledge of habitat creation and will be used to inform management and future selection and implementation of habitat creation projects.

## FY18 Accomplishments

### *Salinity and Soil Moisture Monitoring Network*

The salinity and soil moisture monitoring network provides data to be used for making habitat management decisions related to (1) the soil moisture needs for avian habitat requirements and (2) vegetation health requirements – sufficient soil moisture to meet evapotranspiration needs and maintain soil and groundwater salinity levels within established thresholds.

The salinity and soil moisture monitoring network was established at six conservation areas. Soil moisture data were also collected at several occupied southwestern willow flycatcher sites outside of the LCR MSCP planning area. The soil moisture data collected during FY18 will be used with lidar vegetation monitoring data to evaluate the habitat conditions at sites with and without observed southwestern willow flycatcher breeding.

### *Habitat Manipulation*

Several covered avian species require habitat with early- to mid-successional stages of native riparian trees. In natural systems where periodic flooding is a component of the system, portions of the natural habitat are typically disturbed on

a periodic basis and reset to earlier successional stages and associated structural diversity. Vegetation at LCR MSCP conservation areas is planted densely to reduce invasive species competition with native species and to provide habitat for covered species. Over time, some of the habitat at LCR MSCP conservation areas may no longer provide suitable habitat for some covered species unless management actions are taken since overbank flooding does not occur.

Without the disturbance events that were once more common in the historic river hydrograph, direct manipulation of portions of these conservation areas may be required. Information collected will be used to perform assessments and provide protocols to inform deliberate habitat manipulations to enhance structural diversity and to produce the appropriate serial stages of habitat for covered species.

Work continued for the cottonwood-willow component of Work Task C60, including collection of additional vegetation structure data (lidar) and soil moisture data. These data will be used for refining the vegetation structure models, the habitat suitability models, and for updating the LCR MSCP planning area vegetation classification.

Followup monitoring was completed at HMM. Even though the mechanical disturbance manipulation was deemed ineffective, additional data were collected to further evaluate the monitoring techniques. Unmanned aerial system-based lidar data were collected, which will provide vegetation structure data throughout the canopy in contrast to the photogrammetric data that only provided information about the canopy surface data. Additional photogrammetric and multispectral data were also collected.

## FY19 Activities

### *Salinity and Soil Moisture Monitoring Network*

The salinity and soil moisture monitoring network was expanded during FY19 to include monitoring at newly planted phases of existing conservation areas, at expansion areas of existing conservation areas, and at new conservation areas.

### *Habitat Manipulation*

Lidar data collected at LCR MSCP conservation areas and southwestern willow flycatcher-occupied sites throughout the Southwestern United States will be analyzed to evaluate vegetation structure. The data from the southwestern willow flycatcher-occupied sites will be used to develop ranges for each of the vegetation metrics. A similar process will be used for evaluating soil moisture requirements; ranges will be developed using data from the southwestern willow flycatcher-occupied sites. LCR MSCP conservation areas will then be evaluated against these ranges to make recommendations on whether some level of habitat manipulation is warranted.

Vegetation structure data collected at HMM using photographic, multispectral, and lidar sensors will be analyzed to evaluate which tool is the most appropriate for evaluating marsh vegetation habitat structure. Additional remote sensing and ground-based tools and techniques will continue to be evaluated. Additional marsh habitat manipulation techniques are being evaluated, and if appropriate, field tests will be planned and designed to evaluate their inclusion in the long-term marsh habitat manipulation toolbox.

An irrigation management study will begin at Phase 8 of the PVER. The objective of the study is to evaluate the effects that reduced irrigation will have on volunteer cottonwoods that have established in a stand of planted honey mesquite trees.

## FY20 Proposed Activities

### *Salinity and Soil Moisture Monitoring Network*

The soil salinity and soil moisture monitoring network will continue to operate at established locations and will be expanded as needed to include all conservation areas where these parameters are of concern for evaluating species' habitat requirements and maintaining vegetation health.

### *Habitat Manipulation*

Lidar data will be acquired in FY20. Soil moisture data will also be collected at southwestern willow flycatcher-occupied sites and at LCR MSCP conservation areas. Long-term monitoring will help inform the LCR MSCP about the level of active habitat manipulation that is necessary. Initial planning and design will be conducted to implement pilot habitat manipulation tests at select LCR MSCP conservation areas. The goal of these tests will be to evaluate techniques for inclusion in the long-term riparian forest habitat manipulation toolbox.

Vegetation response monitoring will continue at HMM. This monitoring will assist in evaluating whether these monitoring techniques are appropriate. Additional marsh habitat manipulation techniques may be evaluated, and if appropriate, field tests will be planned and designed to evaluate their inclusion in the long-term marsh habitat manipulation toolbox.

The irrigation management study at the PVER will continue.

Restoration research in future years may focus on (1) the efficient use of Colorado River water, (2) ensuring moist soil conditions are maintained when necessary and practical, (3) planting and/or seeding techniques, and (4) the protection and long-term management of conservation areas for covered species.

# WORK TASKS – SECTION A

Program Administration

## Work Task A1: Program Administration

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $1,435,380 | $1,288,045.42 | $14,567,331.25 | $1,467,956 | $1,528,018 | $1,528,018 | $1,528,018 |

**Contact:** John Swett, (702) 293-8555, jswett@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Program administration

**Conservation Measures:** N/A

**Location:** N/A

**Purpose:** Program administration

**Connections with Other Work Tasks (Past and Future):** N/A

**Project Description:** Under this work task, senior and administration staff receive support to manage implementation of the LCR MSCP. The Program Manager directs functions and activities associated with implementation of the Habitat Conservation Plan to ensure completion of activities in accordance with the program documents.

**Previous Activities:** The LCR MSCP Office was established in the Bureau of Reclamation's Lower Colorado Region (Boulder City, Nevada) in 2005. The Steering Committee was established in accordance with the Funding and Management Agreement, and the bylaws for the Steering Committee were approved.

**FY18 Accomplishments:** Under Work Task A1 for FY18, management of the LCR MSCP continued. Ongoing administrative activities included financial, human resources, and other support for the program. The Steering Committee met on October 25, 2017, and April 25, 2018, and had a conference call on June 27, 2018. At the April 25 meeting, the Steering Committee approved Program Decision Document 18-001, *Minor Modifications – Implementation Agreement, Funding and Management Agreement*, and Table 1-2 LCR MSCP Biological Assessment and Habitat Conservation Plan. These modifications were needed after the northern Mexican gartersnake was added as a covered species and the Habitat Conservation Plan permit amended on March 5, 2018. During the

June 27 Steering Committee conference call, the Steering Committee approved Resolution 18-002 to approve the *Final Implementation Report, Fiscal Year 2019 Work Plan and Budget, Fiscal Year 2017 Accomplishment Report*. Financial tracking of the program continued, and the annual financial work group meeting was held as a conference call on February 22, 2018.

**FY19 Activities:** Under Work Task A1 for FY19, management of the LCR MSCP will continue. Ongoing administration activities will include financial, human resources, and other support for the program. Coordination with the Steering Committee continued with meetings held on October 24, 2018, and April 24, 2019. Technical work group meetings were held 1 month prior to these dates to review upcoming actions of the Steering Committee. The *Draft Implementation Report, Fiscal Year 2020 Work Plan and Budget, Fiscal Year 2018 Accomplishment Report* was prepared. Financial tracking for the program will continue, and the annual financial work group meeting was held.

**Proposed FY20 Activities:** Under Work Task A1 for FY20, management of the LCR MSCP will continue. Ongoing administration activities will include financial, human resources, and other support for the program. Coordination with the Steering Committee will continue with biannual Steering Committee meetings, specific work group meetings, and email announcements. The *Final Implementation Report, Fiscal Year 2021 Work Plan and Budget, Fiscal Year 2019 Accomplishment Report* will be prepared. Financial tracking of the program will continue, and the annual financial work group meeting will be held.

**Pertinent Reports:** The *Final Implementation Report, Fiscal Year 2019 Work Plan and Budget, Fiscal Year 2017 Accomplishment Report* is posted on the LCR MSCP website. The *Final Implementation Report, Fiscal Year 2020 Work Plan and Budget, Fiscal Year 2018 Accomplishment Report* will be posted upon completion.

# WORK TASKS – SECTION B

Fish Augmentation

## Work Task B1: Lake Mohave Razorback Sucker Larvae Collections

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $215,000 | $211,549.45 | $2,758,292.26 | $215,000 | $215,000 | $215,000 | $215,000 |

**Contact:** Patricia Delrose, (702) 293-8202, pdelrose@usbr.gov

**Start Date:** FY04

**Expected Duration:** FY55

**Long-Term Goal:** Fish augmentation

**Conservation Measures:** RASU3, RASU5, and RASU8

**Location:** Reach 2, Lake Mohave, Arizona/Nevada

**Purpose:** To develop the razorback sucker broodstock in Lake Mohave, maintain the broodstock, and harvest offspring for rearing as needed for the LCR MSCP Fish Augmentation Program

**Connections with Other Work Tasks (Past and Future):** Work Tasks B2, B3, B6, and B7 are related to this work task, as the razorback suckers to be reared under these work tasks originate from Lake Mohave. Other research related to larvae collection, handling, and genetics include Work Tasks C30 (closed), C31, and C40.

**Project Description:** The razorback sucker broodstock in Lake Mohave provides a level of genetic diversity found nowhere else in the world. Under this project, wild-born razorback sucker larvae from Lake Mohave are captured and delivered to the Willow Beach National Fish Hatchery (Willow Beach NFH) and Lake Mead Fish Hatchery for initial rearing. The work involved under this work task includes surveys to locate spawning groups, nighttime larvae collection, and maintaining the boat fleet and field station at Cottonwood Cove. Larvae are captured one at a time, making this a labor-intensive program.

Work coincides with the razorback sucker spawning season and normally commences in January and extends into late April or early May. Equipment is delivered to and staged at Cottonwood Cove, where a field station is established. The lake's shoreline is surveyed, and locations of spawning aggregations of

razorback suckers are recorded. Razorback sucker larvae attracted to submerged lights suspended from boats are captured by net and counted. This work occurs up to four nights per week during the spawning season. Captured larvae are transferred to the Willow Beach NFH and Lake Mead Fish Hatchery, where they are logged in by date received, number collected, and location. Research under Work Task C31 assisted in defining larvae collection protocols, and in order to maximize the genetic diversity of razorback sucker larvae used for future augmentation, collection efforts will continue to be distributed both temporally throughout the spawning season and spatially among the known spawning areas on Lake Mohave.

**Previous Activities:** This work task is part of a program started by the Lake Mohave Native Fish Work Group in 1989 to rebuild the adult stock of razorback suckers in Lake Mohave so that these fish could be used as brood fish for razorback sucker conservation and recovery. A portion of the larvae collected is used to sustain the broodstock, and the remaining larvae are reared for release into Reaches 2–5 to accomplish the augmentation goals of the program. In 2007, an invasive species, the quagga mussel, was found within the Lake Mead National Recreational Area, which includes Lake Mohave. To avoid transferring this species into other waters where they currently do not exist, larvae are no longer transported outside the lower Colorado River. The Southwestern Native Aquatic Resources and Recovery Center (Work Task B4) and the Bubbling Ponds Fish Hatchery (Work Task B5) are therefore no longer associated with this work. Beginning in FY17, an additional safety measure was implemented for this work that included the use of check-in/check-out protocols with National Park Service radio dispatch to ensure nighttime crews were off the water safely. Funding to support this additional measure is provided through this work task.

**FY18 Accomplishments:** A target of 30,500 larvae was established for FY18 in coordination with LCR MSCP partner agencies. This quantity was established to replace hatchery stocks at the Willow Beach NFH due to losses experienced in early FY17, provide additional fish as a contingency for other unforeseen events, and to prepare for future increases in razorback sucker augmentation goals. Of these larvae, 24,500 were targeted for rearing at the Willow Beach NFH, and 6,000 were targeted for rearing at the Lake Mead Fish Hatchery.

A total of 30,604 wild larvae were collected from four areas of Lake Mohave. The Willow Beach NFH received 24,378 larvae for further grow-out. The remaining 6,226 were delivered to the Lake Mead Fish Hatchery for further grow-out. The contribution from each zone of Lake Mohave by month of capture is presented in table 1.

**Table 1.—Larval Razorback Suckers Collected from Lake Mohave, 2018***

| Location | January | February | March | April | May | Total |
|---|---|---|---|---|---|---|
| Nine Mile | 195 | 389 | 5,936 | 1,542 | 0 | 8,062 |
| Tequila | 555 | 5,118 | 2,066 | 194 | 0 | 7,933 |
| Yuma | 600 | 4,614 | 2,344 | 984 | 0 | 8,542 |
| Above Owl Point | 925 | 1,577 | 460 | 2,750 | 355 | 6,067 |
| **Total** | **2,275** | **11,698** | **10,806** | **5,470** | **355** | **30,604** |

* Larvae collection numbers should be considered approximations. Larvae are collected by hand and counted during collection; however, exact counts of larvae are not verified.

**FY19 Activities:** A target of 43,000 larvae has been established for FY19 in coordination with LCR MSCP partner agencies. Distribution of larvae will be as follows: 16,000 larvae will be delivered to the Lake Mead Fish Hatchery, and 27,000 larvae will be delivered to the Willow Beach NFH. Of these 27,000 larvae, 11,000 will remain on station for rearing, 9,000 will be delivered to the Achii Hanyo Native Fish Rearing Facility, and 7,000 will be transferred to the Lake Mead Fish Hatchery following initial rearing. In an effort to better represent the Lake Mohave riverine subpopulation in hatchery stocks, additional larvae will be collected from this area in FY19. Increasing the collection effort in this area may provide a better representation of the total genetic composition of razorback suckers within Lake Mohave.

**Proposed FY20 Activities:** Razorback sucker larvae collections will continue. The target level for FY20 is expected to be 30,000 larvae.

**Pertinent Reports:** The status report titled *Five-Year Summary of Razorback Sucker (Xyrauchen texanus) Larval Collections on Lake Mohave*: *2015–2019* will be posted on the LCR MSCP website upon completion.

## Work Task B2: Willow Beach National Fish Hatchery

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $325,000 | $324,870.50 | $4,285,114.94 | $325,000 | $325,000 | $325,000 | $325,000 |

**Contact:** Ty Wolters, (702) 293-8463, twolters@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Fish augmentation

**Conservation Measures:** BONY3, BONY4, RASU3, RASU4, and RASU5

**Location:** Reach 2, Willow Beach, Arizona

**Purpose:** To annually contribute razorback suckers and bonytail to the LCR MSCP Fish Augmentation Program

**Connections with Other Work Tasks (Past and Future):** The Willow Beach National Fish Hatchery (Willow Beach NFH) receives larval razorback suckers under Work Task B1 and bonytail under Work Task B4. Some of these fishes are transferred to the Achii Hanyo Native Fish Rearing Facility (B3) and the Lake Mead Fish Hatchery (B6) for rearing. Some fishery research actions described in Species Research (Section C) have occurred at the Willow Beach NFH, including Work Tasks C10 (closed) and C30 (closed).

**Project Description:** The Willow Beach NFH is managed by the U.S. Fish and Wildlife Service. The hatchery receives program funding to rear razorback suckers and bonytail for the LCR MSCP Fish Augmentation Program. There are three primary tasks at this hatchery:

1. **Receive fishes to be reared.** The Willow Beach NFH annually receives wild razorback sucker larvae collected from Lake Mohave and fingerling bonytail (25–75 millimeters [mm] total length [TL]) from the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center) (B4).

2. **Provide fishes to other hatcheries.** The Willow Beach NFH will annually provide approximately 10,000 fingerling bonytail to the Achii Hanyo Native Fish Rearing Facility and will distribute approximately 15,000 fingerling razorback suckers between the Achii Hanyo Native Fish Rearing Facility and the Lake Mead Fish Hatchery.

3. **Annually rear razorback suckers for release into the lower Colorado River.** The Willow Beach NFH will rear 8,000 subadult razorback suckers for stocking into Reaches 2–5 and up to 1,000 razorback suckers greater than 400 mm TL for repatriation into Lake Mohave. All razorback suckers stocked into Reaches 2 and 3 will be a minimum of 300 mm TL. All razorback suckers stocked into Reaches 4 and 5 will be a minimum of 305 mm TL.

**Previous Activities:** This cold-water hatchery began operation in 1962 to produce rainbow trout for recreational fishing. Between 1994 and 1997, the U.S. Fish and Wildlife Service and the Bureau of Reclamation cooperatively added solar heating systems to the hatchery, converting 50% of its rearing capacity to warm-water fish production. Each year since 1996, the hatchery has received wild razorback sucker larvae, reared juvenile razorback suckers, and repatriated fishes back into Lake Mohave.

## FY18 Accomplishments:

**On Station:** Approximately 24,000 razorback suckers were on station at the beginning of FY18 (table 1).

**Table 1.—Year Class and Approximate Number of Razorback Suckers on Station in Early FY18**

| Year Class | Approximate Number |
|---|---|
| 2014 | 1,000 |
| 2016 | 10,000 |
| 2017 | 13,000 |
| **Total** | **24,000** |

**Received:** The Willow Beach NFH received 24,378 razorback sucker larvae from Lake Mohave.

**Stocked:** Lakeside rearing ponds were stocked with 312 razorback sucker juveniles (B7), and 797 razorback suckers were repatriated into Lake Mohave (Reach 2) during FY18.

**Transferred:** A total of 7,080 razorback suckers and 10,000 bonytail were transferred to the Achii Hanyo Native Fish Rearing Facility, and approximately 5,000 razorback sucker fingerlings were transferred to the Lake Mead Fish Hatchery for further grow-out.

**Improvements:** The indoor tank room was renovated during FY18. Additional circular tanks were purchased and installed for rearing of razorback suckers and bonytail. Four fiberglass tanks were also purchased for the creation of an outdoor recirculating aquaculture system.

### FY19 Activities:

**On Station:** At the start of FY19, the Willow Beach NFH had approximately 9,500 year-class 2016, 13,000 year-class 2017, and 10,000 year-class 2018 razorback suckers on station.

**Received:** The Willow Beach NFH will receive approximately 25,000 year-class 2019 razorback sucker larvae from Lake Mohave and rear and distribute them for the LCR MSCP Fish Augmentation Program.

**Stocked:** The Lake Mohave backwaters will be stocked with approximately 300 subadult razorback suckers from the Willow Beach NFH, and approximately 1,000 razorback suckers will be stocked into Lake Mohave to augment the existing population.

**Transferred:** Approximately 15,000 razorback sucker fingerlings will be distributed between the Achii Hanyo Native Fish Rearing Facility and the Lake Mead Fish Hatchery. Bonytail received from the Center may be temporarily housed at the Willow Beach NFH before transfer to other facilities.

**Improvements:** Minor hatchery improvements will be implemented in FY19 and will include the installation of steel grating and four fiberglass tanks to create an outdoor recirculating aquaculture system. The steel grating will span a set of raceways, providing a platform for the fiberglass tanks. These tanks will replace the rearing space of one set of recirculation raceways, providing enhanced water reuse and the ability to filter and isolate individual tanks. The indoor tank room renovation will also be completed this fiscal year.

**Proposed FY20 Activities:** The Willow Beach NFH will continue to receive razorback sucker larvae from Lake Mohave and rear and distribute razorback suckers for the LCR MSCP Fish Augmentation Program. Bonytail may be temporarily housed at the Willow Beach NFH before transfer to other facilities.

**Pertinent Reports:** Annual administrative reports are available upon request.

## Work Task B3: Achii Hanyo Native Fish Rearing Facility

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $170,000 | $166,345.03 | $1,718,575.78 | $170,000 | $170,000 | $170,000 | $170,000 |

**Contact:** Ty Wolters, (702) 293-8463, twolters@usbr.gov

**Start Date:** FY04

**Expected Duration:** FY55

**Long-Term Goal:** Fish augmentation

**Conservation Measures:** BONY3, BONY4, RASU3, and RASU4

**Location:** Reach 4, Colorado River Indian Tribe Reservation, Parker, Arizona

**Purpose:** To support operation and maintenance of fish rearing facilities in order to annually contribute razorback suckers and bonytail to the LCR MSCP Fish Augmentation Program in Reaches 2–5 of the lower Colorado River

**Connections with Other Work Tasks (Past and Future):** This project is related to Work Tasks B2 and B4, as fishes from both the Willow Beach National Fish Hatchery (Willow Beach NFH) and the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center) may be transferred to the Achii Hanyo Native Fish Rearing Facility. This project is also related to Work Task B6, as fish may be transferred to the Lake Mead Fish Hatchery for additional grow-out. Native fish research may also be accomplished at this facility.

**Project Description:** This project supports both the development and maintenance of the Achii Hanyo Native Fish Rearing Facility (a satellite facility managed by the Willow Beach NFH). This facility is used to produce razorback suckers and bonytail to meet a portion of the augmentation goals of the LCR MSCP and as a grow-out station for bonytail (supplied from the Center) and razorback suckers (Lake Mohave origin larvae transferred from the Willow Beach NFH). The numbers of razorback suckers and bonytail reared at this facility are adjusted in response to stocking needs and space limitations at other facilities. Funds are used for staff salaries, facility operation and maintenance, fish feed and chemicals, and fish distribution.

This facility is located on the Colorado River Indian Tribe Reservation, near Parker, Arizona. There are nine earthen ponds that receive Colorado River water from an irrigation canal. A metal building was constructed to house 4 flow-through raceways and 3 circular tanks; in addition, 12 circular tanks are housed under an outside canopy, and there is 1 large, outside research tank.

Fish rearing operations are seasonal, producing one crop per year. Bonytail are brought in from the Center in winter. In most cases, these fish are first held at the Willow Beach NFH before being transferred to Achii Hanyo Native Fish Rearing Facility. Razorback suckers are delivered from the Willow Beach NFH in early spring. These fish are fed through spring and summer. In fall, the ponds are drained, and fishes are harvested, tagged, and stocked. Fishes under target size (< 300 millimeters [mm] total length [TL]) are returned to a pond for continued rearing. New fishes are then brought on station, and the process is repeated.

**Previous Activities:** In cooperation with the U.S. Fish and Wildlife Service, upgrades to this facility have occurred since FY04. The work completed includes the construction of a metal tank house, an office, a feed storage room, restrooms, and fiberglass fish tanks; electrical upgrades; aeration system upgrades for fish tanks; and the purchase of a backup generator.

## FY18 Accomplishments:

**On Station:** Approximately 25,000 native fishes were on station at the beginning of FY18 (table 1).

**Table 1.—Year Class and Approximate Number of Native Fishes on Station in Early FY18**

| Year Class | Species | Approximate Number |
|---|---|---|
| 2014 | BONY | 2,000 |
| 2016 | BONY | 4,000 |
| 2017 | BONY | 10,000 |
| 2017 | RASU | 9,000 |
| | **Total** | **25,000** |

**Received:** The Achii Hanyo Native Fish Rearing Facility received approximately 7,080 razorback suckers from the Willow Beach NFH and 10,000 bonytail from the Center. Razorback suckers were stocked at approximately 60 mm TL and averaged 175 mm TL at the end of FY18. Bonytail were stocked into rearing ponds at approximately 20 mm TL and averaged 75 mm TL at the end of FY18.

**Stocked:** Fishes were harvested from hatchery ponds in December and marked with passive integrated transponder tags prior to being released into the lower Colorado River. A total of 413 bonytail were stocked into Reach 4. Harvested fish that were under target size were returned to ponds for continued rearing.

**Transferred:** A total of 502 bonytail were transferred to the Lake Mead Fish Hatchery (Work Task B6) for further grow-out.

**Improvements:** Facility maintenance activities and improvements to rearing ponds were completed throughout the year. Net supports were installed, and protective netting was placed over Ponds 1, 2, and 3. Pond 6 was dried, disked, and graded to aid future harvests.

### FY19 Activities:

**On Station:** At the start of FY19, approximately 2,500 year-class 2017 razorback suckers, 4,500 year-class 2018 razorback suckers, and 9,800 year-class 2018 bonytail were on station.

**Received:** The Achii Hanyo Native Fish Rearing Facility will receive approximately 9,000 razorback suckers from the Willow Beach NFH and 10,000 bonytail from the Center to support production goals. Netting will be placed over all large ponds prior to stocking in an effort to reduce predation.

**Stocked:** In December 2018, 876 razorback suckers were stocked into Reach 2, 999 razorback suckers were stocked into Reach 3, and 866 bonytail were stocked into Reach 4.

**Transferred:** Approximately 2,500 bonytail were transferred to the Lake Mead Fish Hatchery (Work Task B6) for further grow-out.

**Improvements:** Levee repairs will be completed, which will allow for improved access throughout the facility during periods of wet weather. Drainage is lacking at the facility, and a plan will be devised to increase drainage of all ponds. Work will likely include clearing drainage canals of debris and vegetation, and completing other minor improvements as needed.

**Proposed FY20 Activities:** Razorback suckers and bonytail left on station from previous years will continue to be reared to target size. Additional fishes of both species will be delivered from the Willow Beach NFH and the Center.

**Pertinent Reports:** Annual administrative reports are available upon request.

## Work Task B4: Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $260,000 | $259,697.43 | $2,995,990.79 | $260,000 | $260,000 | $260,000 | $260,000 |

**Contact:** Ty Wolters, (702) 293-8463, twolters@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Fish augmentation

**Conservation Measures:** BONY3, BONY4, RASU3, and RASU4

**Location:** Dexter, New Mexico

**Purpose:** To support operation and maintenance at the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center), support maintenance of the bonytail broodstock, and to annually provide razorback suckers and bonytail for the LCR MSCP Fish Augmentation Program

**Connections with Other Work Tasks (Past and Future):** This work task is related to Work Tasks B2, B3, B5, and B6, as fishes from the Center will be delivered to the Willow Beach National Fish Hatchery, Achii Hanyo Native Fish Rearing Facility, Bubbling Ponds Fish Hatchery, and the Lake Mead Fish Hatchery. Fish rearing research activities may also be conducted at the Center similar to work outlined in Work Tasks C10 (closed), C11 (closed), C14, and C30 (closed). A humpback chub refugium has been established at the Center as a safeguard in case of catastrophic events in the wild (C14).

**Project Description:** The Center is managed and operated by the U.S. Fish and Wildlife Service. It maintains one of only two refuge populations of bonytail in the world and has the only broodstock maintained and managed for bonytail production. The Center also retains a razorback sucker broodstock. Funds provided will be used to maintain the extant broodstocks, produce bonytail and razorback suckers for distribution to other hatcheries, and to annually rear bonytail for distribution within Reaches 2–5. The Center plans to target a

305 millimeter (mm) total length (TL) for all bonytail stocked in FY16–18; however, fishes with TLs of 300 mm or larger may be stocked into Reach 3. Fishes stocked into Reaches 4 and 5 will be 305 mm TL or larger.

**Previous Activities:** Prior to FY14, the Center raised and stocked subadult b razorback suckers and bonytail into the lower Colorado River as part of the LCR MSCP fish Augmentation Program. In FY14, a decision was made to use the available grow-out space at the Center to raise subadult bonytail exclusively, rather than raise razorback suckers for stocking directly into the river. Razorback sucker production continued but was transitioned to short-term grow-out geared toward producing larval and fingerling fish for distribution to other hatchery facilities.

## FY18 Accomplishments:

### On Station:

*Bonytail* – The Center maintained approximately 2,800 adult bonytail as broodstock that comprised six year classes of Lake Mohave origin fish. Adult broodfish were hormonally induced to spawn, and bonytail females collectively produced over 300,000 eggs. Approximately 34,000 bonytail were maintained on station for future stocking (table 1).

**Table 1.—Year Class and Approximate Number of Bonytail on Station in Early FY18**

| Year Class | Approximate Number |
|---|---|
| 2014 | 9,500 |
| 2015 | 3,500 |
| 2016 | 6,000 |
| 2017 | 15,000 |
| **Total** | **34,000** |

*Razorback Suckers* – The Center maintained a broodstock of 950 adult razorback suckers that comprised nine year classes of Lake Mohave origin fish. Adult broodfish were hormonally induced to spawn, and razorback sucker females collectively produced approximately 300,000 eggs.

**Received:** The Center produced approximately 45,000 year-class 2018 bonytail for grow-out and future stocking in the lower Colorado River.

**Stocked:** The Center harvested, tagged (with passive integrated transponders), hauled, and stocked 3,664 subadult bonytail (300+ mm TL) into Reach 3 and 3,204 subadult bonytail (305+ mm TL) into Reach 4.

**Transferred:** The Center transferred approximately 60,000 razorback sucker larvae to the Bubbling Ponds Fish Hatchery (B5), 10,000 bonytail fry to the Achii Hanyo Native Fish Rearing Facility (B3), and 3,000 bonytail fry to the Lake Mead Fish Hatchery (B6).

### FY19 Activities:

**On Station:** Razorback sucker and bonytail broodstocks will be maintained. At the start of FY19, the Center had approximately 6,000 year-class 2016, 15,000 year-class 2017, and 45,000 year-class 2018 bonytail on station.

**Received:** The Center will produce up to 50,000 year-class 2018 bonytail for on station grow-out and future stocking into the lower Colorado River.

**Stocked:** The Center will rear 12,000–13,000 bonytail to 305 mm TL in FY19 for distribution within the lower Colorado River. From October to December 2018, 1,584 bonytail were stocked into Reach 4.

**Transferred:** The hatchery will produce and deliver approximately 60,000 larval razorback suckers to the Bubbling Ponds Fish Hatchery (B5) and approximately 100,000 larval or fingerling bonytail for distribution to the Arizona Game and Fish Department's Aquatic Research and Conservation Center, Willow Beach National Fish Hatchery (B2), Achii Hanyo Native Fish Rearing Facility (B3), and the Lake Mead Fish Hatchery (B6).

**Proposed FY20 Activities:** Razorback sucker and bonytail broodstocks will be maintained. Razorback sucker larvae will be produced and delivered to the Bubbling Ponds Fish Hatchery for grow-out and future stockings. Up to 100,000 larvae or fingerling bonytail will be produced for distribution to various rearing/research facilities, and approximately 12,000–13,000 bonytail will be reared to 305 mm TL for distribution within Reaches 2–5.

**Pertinent Reports:** Annual administrative reports are available upon request.

## Work Task B5: Bubbling Ponds Fish Hatchery

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $330,000 | $541,538.62 | $4,035,820.22 | $475,000 | $475,000 | $475,000 | $475,000 |

**Contact:** Ty Wolters, (702) 293-8463, twolters@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Fish augmentation

**Conservation Measures:** RASU3 and RASU4

**Location:** Cornville, Arizona

**Purpose:** To operate and maintain the Bubbling Ponds Fish Hatchery and annually contribute razorback suckers to the LCR MSCP Fish Augmentation Program

**Connections with Other Work Tasks (Past and Future):** Activities at the Bubbling Ponds Fish Hatchery are related to Work Task B4; the hatchery receives razorback suckers from the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center). A portion of the fish rearing and predator-conditioning research activities outlined in Work Tasks C10 (closed) and C11 (closed) were conducted at the research center (Aquatic Research and Conservation Center at Bubbling Ponds) associated with this hatchery.

**Project Description:** The Bubbling Ponds Fish Hatchery is managed and operated by the Arizona Game and Fish Department (AZGFD). This is a warm-water rearing facility that is supplied by a continuous, year-round, 0.28-cubic-meter-per-second spring flow of 20-degree Celsius water. The hatchery has 10 acres of production ponds, a workshop, a storage shed, a small laboratory, and sufficient fish distribution equipment to meet the delivery requirements of the LCR MSCP. Program funds provide for salaries, fish feed and supplies, hatchery operation and maintenance, and delivery of fish. The annual production goal is 12,000 razorback suckers of 305 millimeters (mm) minimum total length (TL) for release into Reaches 3–5.

**Previous Activities:** In cooperation with AZGFD, a number of infrastructure and facility improvements have been made to the Bubbling Ponds Fish Hatchery since 2005. These improvements include a new pipe for the hatchery water supply, replacement of overflow and inflow piping for nine rearing ponds, renovation of outside raceways, perimeter fencing for the facility and spring source for improved bio-security, construction of a new feed storage area, and acquisition of a tractor/backhoe for maintenance work. The work completed to date has helped to accommodate and improve razorback sucker rearing at this facility, and each year since 2005, the Bubbling Ponds Fish Hatchery has successfully produced and stocked razorback suckers for the LCR MSCP.

## FY18 Accomplishments:

**On Station:** The Bubbling Ponds Fish Hatchery began FY18 with approximately 78,000 razorback suckers on station (table 1). All razorback suckers were previously supplied by the Center as fry or fingerlings.

**Table 1.—Year Class and Approximate Number of Razorback Suckers on Station in Early FY18**

| Year Class | Approximate Number |
|---|---|
| 2014 | 2,500 |
| 2015 | 8,200 |
| 2016 | 25,000 |
| 2017 | 42,000 |
| **Total** | **78,000** |

**Received:** The Bubbling Ponds Fish Hatchery received approximately 60,000 year-class 2018 razorback suckers from the Center in April.

**Stocked:** A total of 12,695 razorback suckers were harvested, tagged (with passive integrated transponders), and stocked into the lower Colorado River; 6,460 razorback suckers were stocked into Lake Havasu (Reach 3), and 6,235 were stocked below Parker Dam (Reach 4).

**Improvements:** Facility maintenance activities and improvements were completed throughout the year. New, automatic entry gates were acquired and installed to improve security of the hatchery ponds. Minor equipment purchases were also completed to support operations.

Obligations for FY18 exceeded the estimate; these additional funds were used to support supplemental pond harvests for sorting and redistributing fish on station, as well as for compliance activities associated with the ongoing spring source pipeline repair. The following work was completed for the pipeline repair project in FY18: (1) completion and review of the 98% construction design, (2) the environmental assessment (EA), (3) the State Historic Preservation Office

consultation, and (4) the cultural survey. The final Biological Opinion has been issued by the U.S. Fish and Wildlife Service, and the environmental assessment Finding of No Significant Impact has been released. The AZGFD is also providing funds for this project to cover any remaining costs for the replacement of this pipeline.

A draft Memorandum of Understanding (MOU) between the LCR MSCP and AZGFD was written in FY18; however, the MOU has not been finalized. The purpose of the MOU is to secure long-term, annual production of razorback suckers and allow for incremental additions and improvements to this hatchery. Funding for hatchery improvements in future years is contingent upon the MOU being signed.

### FY19 Activities:

**On Station:** At the start of FY19, approximately 2,000 year-class 2015, 15,000 year-class 2016, and 36,000 year-class 2017 razorback suckers were on station.

**Received:** The Bubbling Ponds Fish Hatchery will receive up to 60,000 razorback sucker fry from the Center.

**Stocked:** As of November 2018, 3,075 razorback suckers with a TL of ≥ 300 mm were stocked into Reach 3 and 2,946 razorback suckers with a TL of ≥ 305 mm were stocked into Reach 4. The Bubbling Ponds Fish Hatchery is expected to stock an additional 6,000 fishes by the end of FY19.

**Transferred:** Facility management and rearing improvements implemented by the AZGFD have produced a surplus of approximately 4,000 additional subadult fish. These additional fish will be moved off station to provide rearing space and to maintain target rearing densities for existing and additional year classes. These fish will be transferred to the Lake Mead Fish Hatchery (Work Task B6) for continued grow-out and future stockings.

**Improvements:** The spring source pipeline replacement project will continue. The AZGFD will be completing this work independently and will provide funding for all remaining costs associated with this project.

**Proposed FY20 Activities:** Razorback sucker larvae will continue to be received from the Center. Razorback suckers from previous year classes will continue to be reared. Approximately 12,000 razorback suckers > 305 mm TL are expected to be produced at the Bubbling Ponds Fish Hatchery for the LCR MSCP in FY20. Annual administrative progress reports and production numbers will also be provided.

**Pertinent Reports:** Annual administrative reports are available upon request.

## Work Task B6: Lake Mead Fish Hatchery

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $400,000 | $324,717.13 | $1,581,681.06 | $350,000 | $525,000 | $585,000 | $585,000 |

**Contact:** Jim Stolberg, (702) 293-8206, jstolberg@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Fish augmentation

**Conservation Measures:** BONY3, BONY4, FLSU2, RASU3, RASU4, RASU5, RASU7, and RASU8

**Location:** Reach 1, Lake Mead, Boulder City, Nevada

**Purpose:** To support Lake Mead razorback sucker studies and contribute bonytail and razorback suckers to the LCR MSCP Fish Augmentation Program

**Connections with Other Work Tasks (Past and Future):** The Lake Mead Fish Hatchery receives larval razorback suckers under Work Task B1, fingerling razorback suckers from Willow Beach National Fish Hatchery (Willow Beach NFH; B2), bonytail from the Achii Hanyo Native Fish Rearing Facility (B3) and the Southwestern Native Aquatic Resources and Recovery Center (Center; B4), and razorback suckers from the Bubbling Ponds Fish Hatchery (B5). Activities at the Lake Mead Fish Hatchery also contribute to other LCR MSCP work tasks, including closed work tasks B11, C13, C25, C32, C39, C41, C49, C57, and ongoing work tasks C53, C61, C63, C64, D8, and F5.

**Project Description:** The Lake Mead Fish Hatchery is managed and operated by the Nevada Department of Wildlife (NDOW). The LCR MSCP and NDOW are cooperatively rearing razorback suckers and bonytail at this hatchery in support of the LCR MSCP Fish Augmentation Program. Razorback suckers are wild-caught individuals from Lake Mead and Lake Mohave, and bonytail for this work task are produced and supplied by the Center. Funds from this work task provide for the salaries, equipment, feed, and chemicals necessary to rear these fishes. Fishes produced through this work task will be used to support research and augmentation in Reaches 1–5.

**Previous Activities:** A number of infrastructure and facilities improvements were made to the Lake Mead Fish Hatchery prior to 2007 to accommodate native fish production for the LCR MSCP. Since 2007, larval and fingerling razorback suckers, from Lake Mead and Lake Mohave, have been brought into the Lake Mead Fish Hatchery for rearing. These fish have subsequently been transferred to ponds at the Overton Wildlife Management Area for additional grow-out, used for Lake Mead research and monitoring projects, and stocked into Reaches 2–5. Additional rearing space was made available at the hatchery in 2012 in continued support of the LCR MSCP Fish Augmentation Program. The additional space is being used to rear razorback suckers, bonytail, and flannelmouth suckers, and will continue to be necessary in future years when the number of fishes stocked annually into Reaches 3–5 is expected to increase.

## FY18 Accomplishments:

**On Station:** The Lake Mead Fish Hatchery continued rearing the approximately 20,000 razorback suckers and 20,000 bonytail that were on station from previous years (table 1).

**Table 1.—Year Class and Approximate Number of Native Fishes on Station in Early FY18**

| Year Class | Species | Approximate Number |
|---|---|---|
| 2013 | BONY | 16,500 |
| 2015 | BONY | 3,500 |
| 2015 | RASU | 4,700 |
| 2016 | RASU | 6,300 |
| 2017 | RASU | 8,700 |
| | **Total** | **39,700** |

**Received:** The Lake Mead Fish Hatchery received 5,300 razorback sucker fingerlings from the Willow Beach NFH, 6,226 razorback sucker larvae from Lake Mohave, 502 bonytail fingerlings from the Achii Hanyo Native Fish Rearing Facility, and approximately 3,000 bonytail fry from the Center.

**Stocked:** A number of stockings occurred in FY18 in support of ongoing LCR MSCP work task activities. These stockings have been organized by river reach and include their associated work tasks where applicable. A total of 1,998 razorback suckers and 513 bonytail were stocked into Reach 2 as part of complementary sonic telemetry studies being conducted under Work Task C64. Twenty bonytail from these cohorts received sonic tags prior to stocking and were tracked throughout the year. A total of 397 bonytail were also stocked into Reach 3 to meet augmentation goals. Reach 4 received 31 razorback suckers and 4,422 bonytail in support of new research monitoring the population status

and distribution of both species in the lower Colorado River between the Palo Verde and Imperial Diversion Dams (C64). Twenty of the razorback suckers and 10 of these bonytail and received sonic tags prior to stocking. Post-stocking distribution and survival will be evaluated through Work Task C64. In summary, 2,029 razorback suckers and 5,332 bonytail were stocked from the Lake Mead Fish Hatchery in FY18.

The NDOW and LCR MSCP finalized a Memorandum of Understanding in FY18 that established the commitment of both parties to rear native fish species at the Lake Mead Fish Hatchery. This memorandum provided the framework for coordination and cooperation between the parties, identified general partner responsibilities, and will secure native fish rearing and production for LCR MSCP fish augmentation through 2055.

### FY19 Activities:

**On Station:** At the start of FY19, 2,500 year-class 2015, 2,000 year-class 2016, 7,300 year-class 2017, and 5,600 year-class 2018 razorback suckers, and approximately 6,500 year-class 2013 and 500 year-class 2017 bonytail were on station.

**Received:** The Lake Mead Fish Hatchery will receive 7,000 razorback suckers from the Willow Beach NFH, up to 16,000 razorback sucker larvae from Lake Mohave, and approximately 10,000 fingerling bonytail from the Center.

**Stocked:** The Lake Mead Fish Hatchery will stock up to 3,500 bonytail to supplement stockings from the Center. Razorback suckers are also available and will be stocked to meet augmentation goals if needed.

**Improvements:** Electrical upgrades will be completed in the larval fish room, which will allow for increased annual rearing of Lake Mohave razorback sucker larvae. These upgrades will support additional pumps, aerators, tanks, and in-tank heaters, and will increase the annual rearing capacity from 6,000 to 12–16,000 larvae.

**Proposed FY20 Activities:** Rearing and stocking of native fishes from previous year classes will continue. The Lake Mead Fish Hatchery will receive and rear up to 20,000 additional razorback suckers from Lake Mohave and 10,000 additional fingerling bonytail from the Center. It is anticipated that the Lake Mead Fish Hatchery will annually rear over 80,000 native fishes of multiple year classes in preparation of LCR MSCP experimental augmentation. Funding proposed for FY20–FY22 reflects costs associated with rearing these additional fishes.

**Pertinent Reports:** Annual activities reports are available upon request.

## Work Task B7: Lakeside Rearing Ponds

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $200,000 | $183,822.20 | $2,562,442.70 | $200,000 | $150,000 | $150,000 | $150,000 |

**Contact:** Eric Loomis, (702) 293-8519, eloomis@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Maintain fish rearing capability, provide razorback suckers and bonytail for the LCR MSCP Fish Augmentation Program, and accomplish species research

**Conservation Measures:** BONY3, BONY4, BONY5, RASU3, RASU4, RASU5, and RASU6

**Location:** Reach 2, Lake Mohave, Arizona/Nevada

**Purpose:** To operate and maintain fish grow-out areas along the Lake Mohave shoreline to contribute to razorback sucker broodstock development

**Connections with Other Work Tasks (Past and Future):** Activities are related to Work Tasks B2 and B4, as fish for grow-out ponds come from the Willow Beach National Fish Hatchery (Willow Beach NFH) and the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico. In addition, some of the fish rearing research activities outlined in Work Tasks C34 (closed), C40, C44 (closed), C63, D8, and F5 may be conducted at these ponds.

**Project Description:** Lake Mohave is operated by the Bureau of Reclamation as a reregulation reservoir. It fluctuates annually within a 15-foot vertical range, filling by mid-May and lowering to an annual minimum in October. Wave actions redistribute sediment deposits from desert washes and shape these deposits into sandbars or natural berms. In some areas, these sandbars isolate the lower portions of the desert washes from the lake proper, and when the lake is at full pool, lakeside ponds form at many of these washes. The Bureau of Reclamation and its partners in the Lake Mohave Native Fish Work Group have been using these lakeside ponds since 1992 as rearing and grow-out areas for razorback suckers and bonytail. The ponds are stocked with juvenile fishes as the reservoir fills (typically stocked in late January through the middle of March).

The LCR MSCP monitors and manages the ponds throughout the growing season. This work includes periodic monitoring of plankton production, removal of weeds and debris, population monitoring through the use of remote sensing technologies, and routine monitoring of physical, chemical, and biological parameters. The ponds are normally harvested in fall as the lake elevation declines. The fishes from these ponds are then released back into Lake Mohave. The LCR MSCP anticipates the need for these ponds to support razorback sucker and bonytail conservation through FY55.

**Previous Activities:** These ponds have been in use since 1992, and over 33,000 razorback suckers have been reared and repatriated into Lake Mohave. Beginning in 2007, management of these ponds shifted toward rearing larger-sized fish for the LCR MSCP. Typically, razorback suckers > 300 millimeters (mm) in total length (TL) were stocked into the ponds and then harvested later that year. Since 2012, surplus in situ spawned fish have been harvested, fin clipped and/or marked with a passive integrated transponder (PIT) tag, and transferred to Reach 3 below Davis Dam.

**FY18 Accomplishments:** Four ponds were stocked at the beginning of the calendar year with 312 juvenile razorback suckers (table 1). These fish were originally collected from Lake Mohave as larvae and then reared at the Willow Beach NFH. All fish were stocked at a size of at least 300 mm TL to be consistent with the minimum release target length. The Nevada Egg and Willow lakeside ponds were each stocked with a single sex of the species to assess growth in the absence of reproductive behavior. While all stockings of the lakeside rearing ponds were supported under Work Task B7, two of the ponds (Arizona Juvenile and Dandy) were also used to conduct concurrent species research (Work Task C40).

**Table 1.—2018 Stocked Adult Razorback Suckers Repatriated into Lake Mohave from Lakeside Rearing Ponds**

| Lakeside Pond | | Number Stocked | | Mean TL at Stocking (mm) | | Number Harvested | | Mean TL at Harvest (mm) | | Percent Harvested from 2017 Stocking |
|---|---|---|---|---|---|---|---|---|---|---|
| Nevada Egg | | 62 | | 390 | | 0 | | N/A | | 0.0 |
| Willow | | 53 | | 431 | | 42 | | 489 | | 79.2 |
| Arizona Juvenile | | 99 | | 412 | | 29 | | 455 | | 29.3 |
| Dandy | | 98 | | 412 | | 12 | | 445 | | 12.2 |
| | | | | | | | | | | |
| **Total or Overall Mean Value** | **Total** | **312** | **Mean** | **411** | **Total** | **83** | **Mean** | **471** | **Mean** | **26.6** |

In FY18, 83 razorback suckers were harvested from the ponds and repatriated into Lake Mohave. All fish were PIT tagged prior to initial stocking into the ponds; however, harvested fish were rescanned at the time of harvest, and a new tag was inserted if the original PIT tag was not detected. The mean TL for fish during this harvest was 471 mm (see table 1), with a range of 370–598 mm. Observations from individual ponds suggest that stocking ponds with a single sex of the species may improve growth. Willow pond was stocked with all females, and growth averaged 57 mm, while ponds stocked with both sexes (Arizona Juvenile and Dandy) showed an average growth of 27 mm.

Harvest efforts can be variable from year to year depending on fish survival and other contributing factors. Flash flooding compromised the berm at Arizona Juvenile in July 2018, causing the pond to form a surface water connection with the lake. As a result, up to 70 razorback suckers originally stocked in the pond likely entered Lake Mohave following the flood event. While confirmed pond repatriation numbers were low, lake-wide monitoring has consistently shown higher long-term contact rates for pond-reared versus hatchery-reared fish in Lake Mohave. Pond rearing provides an opportunity for fish to attain larger sizes prior to release into the lake, and contact data suggest that this larger size may improve post-stocking survival, increasing the likelihood that these fish will contribute to the adult brooodstock. Through FY18, over 20% of lakeside pond-reared fish released into Lake Mohave after 2006 have been contacted.

Obligations in FY18 were less than anticipated, as some labor costs were covered under concurrent research (Work Task C40), and partners provided in-kind participation for pond maintenance.

**FY19 Activities:** Lakeside rearing ponds will again be used for razorback sucker broodstock maintenance and development. A total of 500 fish will be stocked into lakeside ponds in FY19. Davis Cove pond will be stocked with 150 razorback suckers; Arizona Juvenile, Dandy, and North Chemehuevi will be stocked with 100 razorback suckers each; and Willow will be stocked with 50 razorback suckers. Despite the flash flooding that compromised the Arizona Juvenile pond in FY18, lakeside wave action has rebuilt the natural barrier to the pond, and fish will continue to be reared at this location.

An experimental, supplemental feeding regime will be implemented in FY19 using formulated razorback sucker feed to help promote additional growth of stocked razorback suckers prior to harvest. Pond maintenance, including the removal of surface algal mats and dense submerged vegetation, will be completed as needed to promote water quality suitable for native fishes.

Remote sensing technology will be expanded to all rearing ponds in the form of continuous PIT tag scanning from the time of initial stocking until the final

harvest. Data collected from this continuous monitoring will be used to address spatial and temporal variability in survival rates, and to suggest improvements in pond management.

**Proposed FY20 Activities:** Lakeside ponds along the shoreline of Lake Mohave will be operated and maintained for rearing native fishes. All ponds will be monitored regularly to ensure survivorship is maximized throughout the year. Continuous proactive measures will need to be implemented to ensure ponds are free of surface algal mats and dense submerged vegetation that has likely impacted the water quality of various ponds in past years. Fish spawned in situ will continue to be transported and stocked downstream from Davis Dam.

**Pertinent Reports:** N/A

## Work Task B8: Fish Tagging Equipment

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $135,000 | $137,535.12 | $1,233,857.39 | $135,000 | $135,000 | $135,000 | $135,000 |

**Contact:** Jon Nelson, (702) 293-8046, jnelson@usbr.gov

**Start Date:** FY04

**Expected Duration:** FY55

**Long-Term Goal:** Acquire and maintain a supply of fish-tagging materials and equipment for marking fishes to be released for research and augmentation stockings

**Conservation Measures:** BONY3, BONY4, BONY5, RASU3, RASU4, RASU5, and RASU6

**Location:** N/A

**Purpose:** To mark fishes released into the lower Colorado River (LCR) for identification purposes to assess survival and distribution

**Connections with Other Work Tasks (Past and Future):** Activities are related to all work tasks that result in fish stocking for augmentation, fish research, and fish monitoring.

**Project Description:** Under the LCR MSCP, more than 1.2 million native fishes will be reared and stocked into the LCR. Fishes will be marked to assess distribution and survival and for effective research and decisionmaking. Funds provide for both tagging materials and detection equipment needed during monitoring and research. The LCR MSCP anticipates the need for fish tags and tagging equipment throughout the 50-year term of the program.

**Previous Activities:** Fishes released into the LCR have been tagged with 400-kilohertz (kHz) passive integrated transponder (PIT) tags (Lake Mead and Lake Mohave, Reaches 1 and 2), 125-kHz PIT tags (Davis Dam to Parker Dam, Reach 3), and wire tags (Davis Dam to Imperial Dam, Reaches 3, 4, and 5). Recaptured fishes below Parker Dam have been retagged with 125-kHz PIT tags. In addition, both radio tags and sonic tags have been implanted in fishes used for

research on Lake Mead, Lake Mohave, and Lake Havasu. Fin clipping and Floy tags have been used for short-term survival studies in some rearing and grow-out ponds.

In 2006, the LCR MSCP began using 134.2-kHz frequency PIT tags. These tags have a greater detection range than the previously used tags (12 versus 2 inches away from fishes) and allow for testing and deployment of remote monitoring stations within spawning areas and other locations along the LCR. Purchase of the PIT tags, tag readers, and antennas began in 2006.

**FY18 Accomplishments:** PIT tags, tagging equipment, and tag readers were purchased as needed to mark fishes for monitoring and research. A total of 15,844 razorback suckers and 12,613 bonytail were PIT tagged and released into the LCR during FY18. These numbers represent the total number of fishes implanted with tags and repatriated, not the number of fishes credited under the LCR MSCP Fish Augmentation Program. They include fishes used for research, smaller volunteer spawned fishes that have been translocated into other areas, fishes that have been retagged due to tag loss or to replace older frequency tags, and razorback suckers released into Reach 2 (Lake Mohave).

**FY19 Activities:** PIT tags, tagging equipment, and tag readers will be purchased as needed to mark fishes for monitoring and research. The budget estimates reflect current stocking goals and the need for supplies and equipment to support ongoing tagging and remote sensing research and monitoring efforts.

**Proposed FY20 Activities**: PIT tags, tagging equipment, and tag readers will continue to be purchased as needed to mark fishes for monitoring and research.

**Pertinent Reports:** N/A

## Work Task B12: Maintenance of Alternate Bonytail Broodstock

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $65,000 | $65,881.81 | $195,152.93 | $70,000 | $70,000 | $70,000 | $70,000 |

**Contact:** Ty Wolters, (702) 293-8463, twolters@usbr.gov

**Start Date:** FY16

**Expected Duration:** FY55

**Long-Term Goal:** Fish augmentation

**Conservation Measures:** BONY3 and BONY4

**Location:** Mora National Fish Hatchery (Mora NFH), Mora, New Mexico

**Purpose:** To support maintenance of the alternate bonytail broodstock

**Connections with Other Work Tasks (Past and Future):** This work task is connected to Work Task B4, as bonytail for this broodstock were acquired from the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center).

**Project Description:** Bonytail are federally listed as endangered under the Endangered Species Act; they are considered functionally extirpated from their historical range, and their persistence in the Colorado River Basin now relies entirely on stocking. Prior to 2016, the Center maintained the only bonytail broodstock in the world. This broodstock has been the source of all bonytail for the LCR MSCP Fish Augmentation Program. To guard against a catastrophic event and to secure the species' genetics, a second broodstock was developed and moved to the Mora NFH in March 2016. The LCR MSCP will benefit by having a redundant location to safeguard this species against future events that may limit the ability to meet program augmentation goals.

The relocation and maintenance of the second broodstock was completed through a cost-share agreement with the U.S. Fish and Wildlife Service. Budget estimates for this work task will reflect LCR MSCP contributions toward continuing broodstock maintenance activities.

**Previous Activities:** In 2011, a multi-agency meeting was held to prioritize the creation of new refuge populations for Colorado River fishes to safeguard

species against catastrophic events. Given that the only bonytail broodstock population was maintained at a single facility, and no wild population exists to provide founders for a new population, development of an additional bonytail refuge population was prioritized. The Center developed the second bonytail broodstock population during FY12–FY14.

A recommendation was made in FY15 to relocate this second bonytail broodstock to another facility. A review team was subsequently formed to select the location for the second broodstock based on criteria developed by the Center. The Mora NFH was selected to house the second broodstock. The U.S. Fish and Wildlife Service has indicated that this new broodstock is not intended to provide additional production fish to any conservation/recovery programs in the near future but would function as a "refuge population" to provide redundancy for securing and conserving the genetics of this species.

**FY18 Accomplishments:** Survival of the second bonytail broodstock was 99.1% through the end of FY18. Bonytail continue to be maintained in six 6-foot-diameter circular tanks. Bonytail diets were transitioned to improve the removal of fecal material in the recirculating systems, and it appears that this diet change has had a positive effect on growth. The bonytail grew approximately 36 millimeters (mm) in 2018, compared to 11 mm in 2017, on a maintenance diet of 0.5% of total body weight at an average water temperature of 11 degrees Celsius. The average total length of the bonytail broodstock was > 290 mm by the end of the fiscal year.

**FY19 Activities:** Funds will be supplied to help cover the costs of maintaining the second bonytail broodstock at the Mora NFH. This cost may vary depending on contributions made through other recovery and conservation programs.

**Proposed FY20 Activities:** Funding will be provided to help support maintenance of the second bonytail broodstock at the Mora NFH. Annual costs may vary depending on contributions made through other recovery and conservation programs.

**Pertinent Reports:** N/A

# WORK TASKS – SECTION C

Species Research

## Work Task C2: Sticky Buckwheat and Threecorner Milkvetch Conservation

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $11,000 | $11,101.09 | $149,108.25 | $11,000 | $11,000 | $11,000 | $11,000 |

**Contact:** Carrie Ronning, (702) 293-8106, cronning@usbr.gov

**Start Date:** FY06

**Expected Duration:** FY30

**Long-Term Goal:** Support existing conservation programs for covered plant species

**Conservation Measures:** STBU1 and THMI1

**Location:** Reach 1, Nevada

**Purpose:** To provide funding to support existing conservation programs for sticky buckwheat and threecorner milkvetch

**Connections with Other Work Tasks (Past and Future):** These are stand-alone conservation measures as described in the LCR MSCP Habitat Conservation Plan.

**Project Description:** Sticky buckwheat and threecorner milkvetch are covered species within the LCR MSCP. Funding in the amount of $10,000 per year will be provided for an ongoing conservation program or to another entity approved by the U.S. Fish and Wildlife Service (USFWS) to implement conservation activities for these two plant species. Funding may be advanced for up to 5 years, depending on availability, to keep administrative costs at a minimum.

**Previous Activities:** From 2008 to 2017, the National Park Service (NPS) monitored select populations of sticky buckwheat and threecorner milkvetch within the Lake Mead National Recreation Area. Monitoring included presence/absence surveys from 2008 to 2017 and invasive weed removal in 2013 to 2017 at select sites.

A minor modification to the conservation measures for both plants was approved by the USFWS on January 4, 2011, following approval by the Steering Committee. The language was changed to state that funding would go "to an ongoing conservation program or other entity approved by the USFWS to implement conservation activities for the threecorner milkvetch and sticky buckwheat."

**FY18 Accomplishments:** Conservation activities for these two plant species were supported under the LCR MSCP in accordance with the NPS' *Lake Mead National Recreation Area Resource Stewardship Strategy, November 2014*. Threecorner milkvetch populations at Sandy Cove were monitored. Eighty of the 204 plots surveyed contained threecorner milkvetch, with 3,382 plants recorded overall. Additional habitat surveys in a 20-acre survey area at Lime Cove documented nine threecorner milkvetch plants. Sticky buckwheat populations located at Lime Cove were monitored in a 20-acre survey area, and 1,771 sticky buckwheat plants were documented. Seventy-eight acres of dunes and sandy areas at Sandy Cove were surveyed for invasive Sahara mustard, and 2.21 acres were treated to remove the weeds. The NPS detected that the invasive Mediterranean grass infestation has expanded over the past 10 years in sticky buckwheat and threecorner milkvetch habitat. The NPS plans to investigate the feasibility of mechanical or chemical control methods for Mediterranean grass.

**FY19 Activities:** Funds in the amount of $10,000 will be transferred to the NPS per the above-described agreement to implement conservation activities for sticky buckwheat and threecorner milkvetch. An annual report will be provided to the LCR MSCP that summarizes the achievements made toward the conservation goals for these two plant species.

**Proposed FY20 Activities:** Funds in the amount of $10,000 will be transferred to the NPS per the above-described agreement to implement conservation activities for sticky buckwheat and threecorner milkvetch. An annual report will be provided to the LCR MSCP that summarizes the achievements made toward the conservation goals for these two plant species.

**Pertinent Reports:** The report titled *Surveys of Threecorner Milkvetch* (*Astragalus geyeri* var. *triquetrus*) *and Sticky Buckwheat* (*Eriogonum viscidulum*) *in Fiscal Year 2018 – Lake Mead National Recreation Area* is posted on the LCR MSCP website.

## Work Task C14: Humpback Chub Program Support

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $57,000 | $0 | $288,216.61 | $1,000 | $60,000 | $60,000 | $60,000 |

**Contact:** Ty Wolters, (702) 293-8463, twolters@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Support humpback chub conservation

**Conservation Measures:** HUCH1

**Location:** Grand Canyon, Arizona; Willow Beach, Arizona; Dexter, New Mexico

**Purpose:** To provide support for the Glen Canyon Dam Adaptive Management Program (Glen Canyon Dam AMP) to conserve the humpback chub

**Connections with Other Work Tasks (Past and Future):** N/A

**Project Description:** A total of $500,000 over the 50-year term of the LCR MSCP will be provided for the Glen Canyon Dam AMP, or other programs approved by the U.S. Fish and Wildlife Service (USFWS), to support implementation of planned, but unfunded, humpback chub conservation measures.

**Previous Activities:** Approximately one-half of the overall $500,000 commitment has been spent funding broodstock development in addition to the previous support of humpback chub initiatives of the Glen Canyon Dam AMP. A captive broodstock/refugium population of Grand Canyon humpback chubs was established at the Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico (Center) during FY12–FY14. During FY14 and FY15, the Center successfully maintained 1,024 humpback chubs from the Little Colorado River, Grand Canyon.

**FY18 Accomplishments:** No research or support needs were identified during FY18.

**FY19 Activities:** No support needs were identified for FY19. A proposal for humpback chub research in the western Grand Canyon has been submitted for review, and if approved, this work may begin in FY20.

**Proposed FY20 Activities:** Funding has been proposed for initiating a potential research project for humpback chubs in the western Grand Canyon. Recent capture and recruitment data suggest there is a new, self-sustaining population in western Grand Canyon below Diamond Creek, but to date no quantitative evaluation has been conducted. The USFWS will be seeking cost-sharing opportunities for this project as part of the planning phase, and field activities may begin as early as FY20.

Additionally, the USFWS proposes to have an environmental DNA (eDNA) marker developed to aid in monitoring of humpback chubs in remote or newly repatriated locations. This work will be completed with other ongoing efforts to use eDNA technologies in the Grand Canyon.

**Pertinent Reports:** Progress reports are available upon request.

## Work Task C24: Avian Species Habitat Requirements

| FY18 Estimates | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $150,000 | $124,254.93 | $2,557,998.38 | $0 | $0 | $0 | $0 |

**Contact:** Beth Sabin, (702) 293-8435, lsabin@usbr.gov

**Start Date:** FY08

**Expected Duration:** FY18

**Long-Term Goal:** Identify covered bird species' habitat characteristics to inform conservation area management

**Conservation Measures:** MRM1 and MRM2 (BEVI, BLRA, CLRA, ELOW, GIFL, GIWO, LEBI, SUTA, VEFL, WIFL, YBCU, and YWAR)

**Location:** Reaches 1–7 from Lake Mead to the Southerly International Boundary with Mexico, Bill Williams River, and other river systems in Arizona

**Purpose:** Investigate the habitat requirements of covered marsh and riparian bird species. Research questions will be focused on habitat elements that can be managed at the conservation areas.

**Connections with Other Work Tasks (Past and Future):** Information gained from this work task will be used to conduct pre- and post-monitoring at conservation areas under Work Tasks F2, F7, and F10 that target covered bird species and system-wide monitoring of avian species under Work Tasks D1, D6, and D7. Information gained from this work task will be incorporated into Conservation Area Development and Management (Section E) work tasks and adaptive management (Section G).

**Project Description:** Studies will be conducted to investigate the habitat elements of the following covered bird species that can be managed at habitat conservation areas: yellow-billed cuckoo, Arizona Bell's vireo, California black rail, elf owl, Gila woodpecker, gilded flicker, Sonoran yellow warbler, summer tanager, vermilion flycatcher, western least bittern, and Yuma clapper rail.

**Previous Activities:**

**Yellow-billed Cuckoo:** A geographic information system-based model of yellow-billed cuckoo breeding habitat was developed.

**Arizona Bell's vireo, Gila woodpecker, Sonoran yellow warbler, and summer tanager:** From FY08 to FY14, habitat data were collected and summarized. This included collection of vegetation measurements to detect vegetation differences where birds did and did not nest. An audit of the data from FY11 to FY14 was conducted to verify its completeness and quality.

**Restoration of Managed Marsh Units to Benefit California Black Rails and Other Marsh Birds:** In 2009, vegetation surveys were conducted, water depth data were monitored at wells, and biweekly marsh bird surveys for California black rails, Yuma clapper rails, and western least bitterns were conducted throughout the breeding season at the Imperial National Wildlife Refuge in Fields 16 and 18. In 2011, a final report was prepared, giving recommendations on the creation of marshes for both California black rails and Yuma clapper rails. Further research on marsh bird habitat requirements will be conducted under Work Tasks C60 and C66.

**Elf Owl:** A study was conducted from FY14 to FY18 to locate elf owls in order to confirm that they use riparian habitat, identify birds that could be used to test the accuracy of the call-playback survey method in dense riparian conditions, and to identify nesting territories to inform where nest boxes should be installed on conservation areas. Discovery surveys were conducted in 121 unique locations in riparian areas in 9 major watersheds in Arizona and resulted in the detection of 590 elf owls. Elf owls were confirmed at four study areas along the Santa Cruz watershed (Cienega Creek, Posta Quemada Canyon, Rincon Creek, and Tumamoc Hill Washes), one study area along Arivaca Creek in the Buenos Aires National Wildlife Refuge, two study areas along the San Pedro watershed (Upper San Pedro and Lower San Pedro), one study area along Aravaipa Creek, and four study areas along the Bill Williams River watershed (Bill Williams River, Santa Maria River, Big Sandy River, and Date Creek). Additional passive observation surveys and radio telemetry confirmed 151 elf owl territories and 106 nest cavities. A total of 148 territories were assessed using territory delineation methods, and it was found that 89 territories were comprised mostly of riparian habitat, and an additional 9 territories were completely within riparian habitat. A total of 200 valid response tests were collected in 2016 and 2017 and analyzed with an additional 55 valid response tests collected in 2010 and 2011 to test the accuracy of the call-playback survey method in dense riparian conditions.

## FY18 Accomplishments:

**Elf Owl:** Data management, processing, and analyses were completed, and the final reports were prepared. The key findings of the study included the following:

- The presence of saguaro cacti was one of the best indicators of elf owl occurrence.

- Elf owls were present in mesic riparian (including cottonwood-willow) and xeric riparian woodlands (including honey mesquite) habitat types. They were not often detected in adjacent exotic riparian woodland habitat (containing saltcedar).

- Elf owl territory size was relatively consistent across the study area. Most territories were 0.5–1.5 hectares, although there were a small number of much larger territories in the western part of the study area.

- There was suggestive evidence that elf owls in the hotter, western part of the study area that is most similar to the LCR MSCP planning area prefer more northerly facing nest cavities, presumably as a thermoregulatory behavior.

- Most confirmed nest cavities were in saguaro cacti, though nest cavities in trees were relatively common in the eastern part of the study area.

- If suitable cavities were present, and if riparian areas were available, elf owls in the study area appeared to have relatively wide habitat tolerances.

- Particularly in the western part of the study area, elf owls showed a strong "edge" orientation, with many territories overlapping the riparian/upland ecotone.

- Detection probabilities to call-playback varied along several gradients but were less sensitive to vegetation obstruction than expected. Accounting for this variability in defining a standardized survey approach is important.

In addition, project results formed the basis for recommending a standardized survey protocol for elf owls in the LCR MSCP planning area, along with other recommended protocols for confirming and characterizing elf owl nests, territories, and habitat use.

Microclimate data collected under Work Task F1 were consolidated and prepared for analysis in FY18 to identify if portions of conservation areas maintain temperature and humidity suitable for elf owls to nest. The C24 work task was closed in FY18. Any remaining data management, modeling, or monitoring activities for elf owls, including microclimate analysis, will take place under Work Tasks D6, F1, and F2.

**FY19 Activities:** This work task was closed in FY18.

**Proposed FY20 Activities:** This work task was closed in FY18.

**Pertinent Reports:** The 2015 annual report is posted on the LCR MSCP website. The *Elf Owl Home Range and Habitat Study 2015-2018: Comprehensive Project Report* will be posted on the LCR MSCP website upon completion.

## Work Task C31: Razorback Sucker Genetic Diversity Assessment

| FY18 Estimate | FY18 Actual Obligations | Cumulative Accomplishment Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $160,000 | $149,136.13 | $1,001,788.53 | $0 | $0 | $0 | $0 |

**Contact:** Jeff Lantow, (702) 293-8557, jlantow@usbr.gov

**Start Date:** FY09

**Expected Duration:** FY18

**Long-Term Goal:** Maintain the genetic quality of razorback suckers used by the LCR MSCP for native fish population augmentation

**Conservation Measures:** RASU2, RASU3, RASU5, and RASU6

**Location:** Reaches 1–5 of the LCR MSCP planning area

**Purpose:** To develop and maintain a genetic management program for razorback suckers

**Connections with Other Work Tasks (Past and Future):** This work task is related to larval razorback sucker collections (B1) and management of fish habitat creation sites (e.g., C40, E14, and F5). Larval and adult tissue samples are collected from each reach of the LCR MSCP planning area wherever razorback suckers are captured, and this includes work accomplished under Work Tasks C13 (closed), C33 (closed), C45 (closed), C49 (closed), C64, and D8.

**Project Description:** The genetic structure of razorback sucker communities in reservoirs, river reaches, and off-channel habitats within the lower Colorado River will be monitored, and these various razorback sucker stocks will be characterized relative to the founder population from Lake Mohave. Under the LCR MSCP Fish Augmentation Program, the production of large numbers of fish will continue annually; these large pulses of fish have the potential to change the genetic diversity of a population in a short period of time. It is therefore important to monitor the genetic structure of the various razorback sucker communities over many years in order to detect changes in genetic diversity.

Larval fish and adult fin clips will be collected and preserved from each stock during numerous annual surveys and the continuing Lake Mohave larvae collections. These samples will be delivered to a genetics research laboratory

for analyses. The results will be used to determine the genetic health of these communities, assess the effectiveness of the LCR MSCP Fish Augmentation Program, assess the effectiveness of the Lake Mohave repatriation effort, and inform management of the razorback sucker populations developing in newly constructed floodplain habitats within the LCR MSCP planning area.

**Previous Activities:** Samples of larvae and adult fin clips were obtained on an annual basis from multiple time periods and from various spawning areas, reservoirs, river reaches, and off-channel habitats within the LCR MSCP planning area. Deoxyribonucleic acid (DNA) was extracted and samples characterized for mitochondrial deoxyribonucleic acid (mtDNA) and microsatellite variation. Analyses of microsatellite data collected over the past 20 years are consistent with those from mtDNA, indicating that the razorback sucker conservation strategy employed in Lake Mohave is maintaining genetic diversity in the nuclear genome as well. Interpretation of the data in the context of effective numbers of breeders and size identifies the importance of increasing the population size in Lake Mohave.

**FY18 Accomplishments:** Within Lake Mohave, 144 fin clips and 433 larval samples were collected from the main basin and analyzed for levels of mtDNA variation, yielding 14 and 18 haplotypes, respectively. The levels of variation are still comparable to the original source population (wild adults from the 1980s). The levels of genetic diversity rebounded slightly this year and are comparable to levels observed around 2010. These findings are consistent with continued maintenance of molecular variation by the current management program. An additional 65 fin clips and 231 larvae were obtained from the area above the Willow Beach National Fish Hatchery. Unlike last year, a comparison of mtDNA variation among larval samples failed to identify significant differences between these two geographic areas of the lake.

From Lake Mead, 54 adult fin clips and 310 larvae were collected. Samples have been extracted, sequenced, genotyped, and analyzed using genetic software. Larval samples from Lake Mead exhibit only four of the more common mtDNA haplotypes found in Lake Mohave and overall exhibit lower levels of genetic diversity. Adults exhibited similar patterns of mtDNA variation to larvae, with the exception of four individuals that possessed Lake Mohave mtDNA haplotypes not previously seen. Two of these individuals were stocked with sonic tags, while the other two appear to have come from the Grand Canyon.

From Reach 3, 51 adult fin clips and 327 larvae (from 14 spatial and/or temporally distinct samples) were collected, yielding 11 and 19 haplotypes, respectively. All have been characterized for mtDNA variation but not microsatellites. The larval samples exhibited similar or higher levels of allelic and gene diversity than those from Lake Mohave, with no samples exhibiting a significant reduction in the expected number of alleles when compared to the original Lake Mohave source population. Samples from Reach 3 were somewhat

distinct from those of Lake Mohave, likely reflecting the mixed ancestry of this population (i.e., fish from both the Lake Mohave larval program and Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico.

**FY19 Activities:** This work task was closed in FY18. Current and future genetic monitoring will be conducted under System Monitoring (Section D).

**Proposed FY20 Activities:** This work task was closed in FY18.

**Pertinent Reports:** The 2013–2018 annual reports titled *Razorback Sucker Genetic Diversity Assessment* will be posted on the LCR MSCP website upon completion.

# Work Task C40: Genetic and Demographic Studies to Inform Conservation Management of Razorback Suckers and Bonytail in Off-Channel Habitats

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $415,000 | $413,755.84 | $1,374,916.70 | $0 | $ 0 | $0 | $0 |

**Contact:** Jeff Lantow (702) 293-8557, jlantow@usbr.gov

**Start Date:** FY10

**Expected Duration:** FY18

**Long-Term Goal:** Effective fishery management of backwater habitats developed by the LCR MSCP

**Conservation Measures:** BONY2, BONY5, RASU2, and RASU6

**Location:** Backwater habitats (Reaches 2–5)

**Purpose:** To quantify genetic and demographic parameters that are necessary for informed, long-term management of razorback suckers and bonytail in off-channel habitats

**Connections with Other Work Tasks (Past and Future):** This work task is related to Work Tasks B4, B6, B7, C25 (closed), C31, C56 (closed), F5, and G3.

**Project Description:** In Lake Mohave and elsewhere, razorback suckers and bonytail demonstrate a group spawning behavior whereby a female will spawn with multiple partners many times over a period of a few weeks. These observations led biologists to believe that all possible genetic crosses were being made during the spawn. However, analyses of adult razorback suckers placed into the Yuma Cove backwater in 1991 and 1992, along with analyses of the larval razorback suckers produced each year, showed that not all of the adults contributed genetic material to the next generation. It is possible that individual adults do not spawn every year, or that even if they do, they do not always contribute genetic material to the next generation. This hypothesis needs to be tested in order to model a population structure within these isolated habitats over subsequent generations and to predict at what frequency genetic material needs to be exchanged between habitats to maintain the diversity of the overall razorback sucker and bonytail populations within the LCR MSCP planning area.

Demographic and genetic information will be collected that will lead to recommendations to optimize long-term management of off-channel habitats for these two critically endangered fishes. Genetic data will be captured from larval, juvenile, and adult razorback suckers and bonytail from at least two replicate groups from off-channel habitats. Characterization of deoxyribonucleic acid (DNA) variation will be used to assign the parentage of individual larvae to specific adults. The data can then be compared and contrasted to (1) determine the actual number of individuals that participate in annual spawning activities, (2) census the populations, and (3) quantify patterns of survivorship.

**Previous Activities:** Multiple iterations of in situ spawning occurred in the Arizona Juvenile (AJ), Dandy, and Yuma Cove backwaters along Lake Mohave, and adult, juvenile, and larval razorback suckers were genotyped. Collections from FY10 to FY17 were analyzed, identifying considerable variability in individual reproductive success within, and especially among, different lakeside ponds.

In FY14, three Lake Mohave backwaters were dedicated to bonytail genetic experiments. The North Nine Mile, Nevada Egg, and Nevada Larvae backwaters were each stocked with 160 adult bonytail in an approximately even ratio of males to females. The Nevada Larvae backwater experienced a fishkill shortly after stocking, and it was removed from the study. However, spawning was successful in the North Nine Mile and Nevada Egg backwaters. Parentage analyses were conducted for these backwaters from FY14 to FY17 by genotyping 4,130 adults and offspring. Across years and backwaters there was a very high contribution of adults (82–97%) to progeny, with a single exception (FY16 – North Nine Mile). Individuals of both genders mated with multiple partners, and there was a strong correlation between the number of mates and family size. There was no difference in measures of reproductive success between genders, with males and females making essentially equal contributions within backwaters and years. High variance in reproductive success among individuals did occur, but the main source of variance was the interaction between year and backwater, suggesting a strong effect of environmental factors.

In 2017, 1,800 native fishes were stocked into 6 ponds at the Imperial Ponds Conservation Area. Razorback suckers were stocked into Ponds 1, 3, and 4, and bonytail were stocked into Ponds 2, 5, and 6; each pond received 150 male and 150 female adults of the respective species. Genetic data were obtained from all 1,800 adults prior to release. Monitoring was conducted throughout the spawning season to document reproduction and collect larvae or juvenile fishes for genetic assessment. No spawning activity or reproduction was observed in the razorback sucker ponds. Substantial reproduction occurred in Pond 2, with bonytail larvae and juveniles collected from April to June. In Ponds 5 and 6, larvae were not detected, but sampling found a small number of bonytail juveniles in both ponds. In 2017, genetic data were obtained from 552 bonytail larvae and juveniles during the sampling year.

**FY18 Accomplishments:** No genetic samples were obtained from razorback suckers in AJ or the Imperial Ponds Conservation Area in 2018, but 258 larvae were sampled from the Yuma Cove backwater. DNA has been extracted from these larvae, and they will be characterized with the new single nucleotide polymorphism (SNP; "snip") markers. A paper detailing results of the bonytail research in Lake Mohave backwaters was published in *Transactions of the American Fisheries Society*, 147(6), 1100–1114.

Of the more than 40,000 available SNPs, more than 7,000 were identified as suitable for characterizing levels of genetic variation in lower river populations and lineage analyses in backwater ponds (replacing microsatellites). Initial analyses of selected SNPs from small numbers of larvae and their parents from AJ, as previously identified by microsatellites, identified the potential utility of these markers for maternity/paternity analyses and estimates of genetic variation and reproductive success. Initial tests of optimization of a small number of SNPs indicated that these markers can be amplified, and a full set of primers (approximately 120 pairs) were ordered. These will be tested and used for generating SNP data from the Yuma Cove backwater in early 2019.

Initial screening of AJ samples also identified three male-specific markers, with amplified bands present in > 90% of the 64 males and 64 females surveyed. These male-specific markers were tested against individuals of known sex, and the results were similar: > 90% of the males were identified correctly. The utility of these markers was also demonstrated by characterizing 48 larvae captured throughout the 2018 spawning season, with a sex ratio of 1:1. Generation and assembly of the razorback sucker genome sequence is well underway, providing information on the location (and independence) of markers and their location relative to genes performing specific functions.

Genotyping was completed for 95 bonytail recruits sampled from Imperial Ponds Conservation Area Pond 2 in March 2018. Parentage analyses conducted for bonytail larvae and recruits in Pond 2 showed that reproductive success was high for both genders, with more than 80% of individuals contributing offspring and the majority of males and females mating with more than one individual. Genetic effective size of the population was high, and genetic diversity was preserved between parental and progeny generations, consistent with high reproductive success.

**FY19 Activities:** This work task was closed in FY18. Current and future genetic monitoring will be conducted under System Monitoring (Section D).

**Proposed FY20 Activities:** This work task was closed in FY18.

**Pertinent Reports:** The 2010–2015 report titled *Genetic and Demographic Studies to Guide Conservation Management of Razorback Suckers in Off-Channel Habitats* is posted on the LCR MSCP website. The 2016–2018 annual reports of the same title, the 2014–2018 reports titled *Genetic and Demographic Studies to Guide Conservation Management of Bonytail in Off-Channel Habitats*, and the 2017 annual report titled *Development of SNP Markers for Sex Determination, Parentage Assessment, and Population Genetics of Razorback Suckers* will also be posted upon completion.

## Work Task C53: Sonic Telemetry of Juvenile Flannelmouth Suckers in Reach 3

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $40,000 | $42,475.54 | $674,709.08 | $0 | $0 | $0 | $0 |

**Contact:** Jeff Lantow, (702) 293-8557, jlantow@usbr.gov

**Start Date:** FY12

**Expected Duration:** FY18

**Long-Term Goal:** Support flannelmouth sucker conservation

**Conservation Measures:** FLSU1 and FLSU3

**Location:** Reach 3

**Purpose:** To evaluate juvenile flannelmouth sucker habitat selection and use in Reach 3 and provide recommendations to enhance juvenile flannelmouth sucker habitats as a requirement of LCR MSCP habitat creation goals

**Connections with Other Work Tasks (Past and Future):** Work conducted under this task is related to Work Tasks C15 (closed) and C45 (closed).

**Project Description:** Flannelmouth suckers were reintroduced into the Colorado River below Davis Dam in 1976. This stock has persisted for four decades and represents the only known population of this native species in the Colorado River downstream from Hoover Dam. Under this work task, juvenile flannelmouth sucker habitat selection will be evaluated using radio and sonic telemetry. Observations will be used to identify important habitat elements for inclusion in LCR MSCP created and managed backwaters in Reach 3.

**Previous Activities:** The LCR MSCP completed 5 years of research on the Reach 3 flannelmouth sucker population from FY06 to FY10 (Work Task C15 [closed]). All life stages of the species were captured during the study; however, captures of juvenile fish were rare. Telemetry of adult fish provided insight on the movements and habitat use of this life stage, but inference for other life stages may be limited. Similar difficulties contacting juveniles were encountered during studies undertaken by the U.S. Geological Survey in the 20 river miles above

Lake Havasu, but the majority (85%) of flannelmouth suckers captured in this area consisted of smaller size classes. These captures suggested that habitat features in this area of the river may also be important for this life stage.

Due to the difficulty in locating juvenile flannelmouth suckers in Reach 3, surrogate juvenile flannelmouth suckers have been captured from the Colorado River inflow area of Lake Mead and used for this telemetry work since FY13. Large numbers of telemetered fish (20–42) have been released annually with either sonic or radio tags. From FY13 to FY15, all fish were released in or near Laughlin Lagoon. Fish were detected in a mix of backwater and riverine habitats and remained concealed during daylight hours. In both riverine and backwater habitats, flannelmouth suckers were primarily associated with emergent vegetation. However, the association with emergent vegetation was not seen in habitats with higher turbidity; fish in these environments remained stationary in open water areas.

Efforts in FY16 shifted to the large backwater/marsh habitats found in the 20 river miles immediately upstream of Lake Havasu in Topock Gorge. Based on recent telemetry research and available habitats, this section of the river may serve as nursery habitat for the Reach 3 flannelmouth sucker population. Thirty subadult flannelmouth suckers were surgically implanted with 90-day sonic tags, and 12 were implanted with 100-day low-frequency radio transmitters. Annual tracking and deployment of submersible ultrasonic receivers was initiated immediately following release of the fish. Sonic and radio tags were both effective in this lower stretch of the river, and habitat data were collected on four radio- and seven sonic-tagged fish. Active tracking and submersible ultrasonic receivers indicated that the majority of movements in channel and backwater habitats were at night, and fish would return to stands of emergent vegetation during daylight hours.

In FY17, manual tracking efforts were redirected to take place at night and into early morning. This change in methodology increased detections of fish that were using open water habitats at night. These fish were subsequently followed during crepuscular periods into their daytime habitats consisting of thick stands of emergent vegetation adjacent to the river channel. Flannelmouth suckers are difficult to detect with sonic telemetry equipment in these daytime habitats, and nighttime tracking proved to be productive for the collection of habitat data. Movements were observed to be relatively short and direct once fish chose to move from the channel to vegetated shoreline habitat. Often flannelmouth suckers would return to their same daytime location after moving throughout the main channel or backwater habitats during the night.

**FY18 Accomplishments:** Manual tracking efforts focused on night and diurnal time periods. Flannelmouth suckers were located at night while utilizing open water areas in backwater and river channel habitats, and as morning approached, several fish were selected to be tracked more intensively to

determine where they would move to during daylight hours. This was effective in determining habitat selection for flannelmouth suckers during the day; however, once fish entered dense stands of emergent vegetation they became very difficult to relocate with telemetry gear unless they were in close proximity.

Habitat use studies conducted in Reach 3 have observed flannelmouth suckers consistently using both open water habitat and areas of emergent vegetation. Flannelmouth suckers tracked in the upper 20 river miles near Davis Dam tended to more often utilize stands of emergent vegetation within backwaters, while flannelmouth suckers in the lower 20-mile study area (Topock Gorge) tended to utilize shoreline vegetation. Stands of shoreline vegetation are much less common along the armored banks of the upper river reach, but sizeable stands can be found in two large, mostly undeveloped backwaters where most of the fish were detected during the day. The lower 20 miles of river consist of large numbers of backwaters and marsh where flannelmouth suckers mostly selected stands adjacent to the river channel. The difference observed in selected habitat is most likely a function of availability, but both open water and vegetative cover appear to be important components for flannelmouth sucker habitat.

**FY19 Activities:** This work task was closed in FY18.

**Proposed FY20 Activities:** This work task was closed in FY18.

**Pertinent Reports:** The 2013–2015 and 2016–2018 project reports titled *Habitat Use and Movement of Juvenile Flannelmouth Suckers in the Lower Colorado River* will be will be posted on the LCR MSCP website upon completion.

## Work Task C59: Selenium Monitoring in Created Backwater and Marsh Habitats

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $160,000 | $153,470.62 | $337,926.20 | $160,000 | $160,000 | $160,000 | $160,000 |

**Contact:** Jim Stolberg, (702) 293-8206, jstolberg@usbr.gov

**Start Date:** FY13

**Expected Duration:** FY25

**Long-Term Goal:** To develop a long-term selenium monitoring plan for the LCR MSCP

**Conservation Measures:** BONY5, MRM2 (BLRA, CLRA, FLSU, and LEBI), MRM5 (BLRA, BONY, CLRA, FLSU, LEBI, and RASU), and RASU6

**Location:** Big Bend Conservation Area (BBCA), Hart Mine Marsh, Imperial Ponds Conservation Area (IPCA), and McAllister Lake

**Purpose:** To evaluate the baseline selenium levels within created backwater and marsh habitats to help establish a selenium monitoring plan as required by the Habitat Conservation Plan

**Connections with Other Work Tasks (Past and Future):** Monitoring for selenium will be conducted for habitat created through Conservation Area Development and Management (Section E) work tasks (E1, E9, E14, E15 [closed], E16, E25, E27, and E28) and will be incorporated into Post-Development Monitoring (Section F) work tasks (F1, F3, F5, and F7).

**Project Description:** As described in the Habitat Conservation Plan conservation measures, 512 acres of marsh and 360 acres of backwaters are being developed under the LCR MSCP as part of its habitat creation goals. These created habitats will be monitored over the 50-year term of the program to ensure that they maintain their function for all associated covered species. Sampling efforts will be implemented or continued at designated project sites for the purpose of determining the baseline or changes in selenium concentrations. The initial sampling phase is expected to provide a representative baseline sample and assessment of variability across each site. Once this information is known, a long-term selenium monitoring plan can be recommended for each specific conservation area to be carried out under the appropriate Post-Development

Monitoring (Section F) work task. If initial levels of selenium are well below thresholds of concern, a long-term selenium monitoring plan may be developed that requires less sampling over time. If monitoring results indicate that management of conservation areas increases levels of selenium, the LCR MSCP will undertake research to develop feasible methods to manage conservation areas in a manner that will eliminate or compensate for the effects. A multi-year sampling design may be needed to provide a larger dataset on which management decisions can be based through the adaptive management process. Subsequent years' sampling may be reduced as appropriate, and the frequency and levels of sampling intensity are expected to vary from site to site. Accordingly, annual expenditures are also expected to vary based on these levels of effort. As new conservation areas are developed, this exploratory sampling phase will continue to be accomplished under this work task.

**Previous Activities:** Sampling sites were identified in FY14 and included the BBCA, Hart Mine Marsh, the IPCA, and McAllister Lake. Selenium monitoring was conducted in FY15–FY17 with the collection of water, substrate, plankton, and whole-body fish samples from these sites. Analyses from the IPCA determined that the current level of selenium was well below threshold water quality standards for fishes and wildlife. Similar results were observed at Hart Mine Marsh and McAllister Lake, with dissolved selenium concentrations below 4 parts per million (ppm) and selenite and selenate concentrations below 1 ppm. The BBCA had the highest reported concentration of dissolved selenium (12 ppm), but selenite and selenate concentrations were similar to those found at Hart Mine Marsh (1 ppm). Analyses of sediment samples from the BBCA and McAllister Lake were above 4 ppm, the dry weight threshold for high-hazard toxicity in sediment. All other sediment samples were below the moderate toxicity threshold. Selenium concentrations in FY17 were highest in invertebrate and fish tissue samples from the BBCA. Mysid shrimp collected at the BBCA were above the high-hazard threshold for macroinvertebrates, and a bluegill whole-body sample had a selenium concentration of 13.6 ppm dry weight, which is above the 8.5 ppm selenium concentration Environmental Protection Agency criterion and above the high-hazard threshold for fishes. All other invertebrate and fish samples had selenium concentrations lower than the criterion and the moderate threat level threshold.

**FY18 Accomplishments:** Quarterly sampling was conducted at all project sites in FY18. Whole-body fish, invertebrates, periphyton, sediment, and water were collected, and final sample analyses will be completed and reported in FY19.

**FY19 Activities:** Selenium monitoring will continue, with quarterly sampling events at the BBCA, Hart Mine Marsh, the IPCA, and McAllister Lake. Laboratory analyses of the full sample suite will be compared to selenium

thresholds suggested by the U.S. Fish and Wildlife Service for aquatic species, and quarterly activity reports will summarize data as they become available. An annual report will be prepared following receipt of all laboratory analyses.

**Proposed FY20 Activities:** Selenium monitoring will continue at identified LCR MSCP conservation areas. Specific work proposed will be similar to the previous year and will include collecting samples from each site, analyzing collected samples, comparing extant selenium levels to known thresholds, and summarizing data. Additional sites may also be included for pre- and/or post-development sampling as they are identified. Individual site evaluations will be conducted for each new site in order to determine sampling locations, numbers of samples, and expected level of effort.

**Pertinent Reports:** A monitoring plan will be posted on the LCR MSCP website upon completion.

## Work Task C60: Habitat Manipulation

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $175,000 | $156,839.19 | $341,788.77 | $175,000 | $175,000 | $175,000 | $175,000 |

**Contact:** Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

**Start Date:** FY13

**Expected Duration:** FY26

**Long-Term Goal:** Develop cost-effective management techniques and determine the timing and extent of management actions necessary for ensuring that species-specific habitat characteristics are being maintained in all created habitats

**Conservation Measures:** BEVI1, BLRA1, BONY2, BONY5, CLRA1, CRCR2, ELOW1, FLSU1, GIFL1, GIWO1, LEBI1, MNSW2, MRM2 (BEVI, BLRA, CLRA, CRCR, ELOW, GIFL, GIWO, LEBI, MNSW, SUTA, VEFL, WIFL, WRBA, WYBA, YBCU, YHCR, and YWAR), RASU2, RASU6, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, YHCR2, and YWAR1

**Location:** All current and future LCR MSCP conservation areas

**Purpose:** The purposes of this work task are to develop monitoring protocols to evaluate species-specific habitat requirements of created habitat; develop protocols to manage LCR MSCP conservation areas, ensuring that these habit requirements are being maintained; identify sections of conservation areas in need of habitat manipulation; and carry out pilot studies in these areas. The intent is to use the results of this research to appropriately manage habitat characteristics that are required by covered species and thereby meet established management guidelines.

**Connections with Other Work Tasks (Past and Future):** Research and monitoring data obtained from Work Tasks D1, D2, D3 (closed), E34 (closed), F1, F2, F7, G3, and G4 are used.

**Project Description:** In natural riparian systems where periodic flooding is a component of the system, habitat is periodically disturbed and “reset” to earlier seral stages with increased structural diversity. Several covered species require habitat that is in the early to mid-seral stages of riparian habitat succession. Without the disturbance events that were once more common in the historic

Colorado River system, direct manipulation of portions of these conservation areas may be required. Information will be provided to not only perform assessments but to provide protocols, which will guide the deliberate manipulation of these habitats to enhance structural diversity and ensure that species-specific habitat requirements are present.

Studies will initially be carried out for created habitats with the cottonwood-willow and marsh land cover types. Future studies conducted may address honey mesquite and backwater land cover types.

The objectives of these initial studies for the cottonwood-willow and marsh land cover types are to:

1. Develop a protocol for evaluating the structural diversity and habitat characteristics at conservation areas and identify areas that may require enhancement to meet management objectives for pilot studies.

2. Develop a protocol to guide cost-effective and appropriate manipulations of identified riparian habitats in order to reset portions of these areas to earlier seral stages.

3. Evaluate the timing and extent of manipulation necessary for maintaining riparian habitat that provides the species-specific habitat characteristics.

**Previous Activities:** Literature reviews were completed on cottonwood-willow and marsh habitat manipulations to determine the best approaches for achieving the desired habitat structure and to determine the measured parameters needed to indicate success.

Following the literature review, two strategies using light detection and ranging (lidar) technology were investigated to assess structural diversity: (1) field-based methods (terrestrial laser scanning [TLS]) and (2) airborne-based methods (aerial laser scanning [ALS]). In FY17, models and statistical tools were developed to assess the diversity of this vegetation data at multiple spatial scales (e.g., plot, patch, restoration area, etc.). It was determined that for the cottonwood-willow analysis, ALS provided the necessary detail to evaluate structural diversity of the vegetation and topography. However, ALS does not provide adequate spatial resolution for evaluation of marsh habitat analysis.

Vegetation structure (lidar) data collection began at several southwestern willow flycatcher-occupied locations (within and outside the Lower Colorado River Basin) in 2015. Soil moisture data collection began at the Palo Verde Ecological Reserve and two southwestern willow flycatcher-occupied locations outside of the Lower Colorado River Basin in 2015.

A pilot habitat manipulation study was conducted at Hart Mine Marsh testing one of the marsh habitat manipulation techniques identified in the literature review. This was done in cooperation with the U.S. Fish and Wildlife Service. Mechanical disturbance was performed, and baseline vegetation data were collected using unmanned aerial systems (UASs) equipped with multispectral and photographic sensors. The data from the sensors were used to create three-dimensional models of the vegetation to describe structure and species composition.

**FY18 Accomplishments:** Work continued for the cottonwood-willow component of this work task, including collection of additional vegetation structure data (lidar) and soil moisture data. Lidar data were collected for the entire LCR MSCP planning area under this work task and Work Task F1 (Habitat Monitoring at Conservation Areas). These data will be used for refining the vegetation structure models and for updating the vegetation classification. Soil moisture data were also collected at two southwestern willow flycatcher-occupied locations outside of the Lower Colorado River Basin: the Rockhouse Riparian Demonstration Project, located near Roosevelt Lake in Arizona, and three survey sites on the Middle Rio Grande River in New Mexico.

The methods previously developed to process and analyze ALS data to describe vegetation structure were automated to facilitate future processing.

Followup monitoring was completed at Hart Mine Marsh. Even though mechanical disturbance manipulation was deemed ineffective, additional data were collected to further evaluate the monitoring techniques. UAS-based lidar data were collected, which will provide vegetation structure data throughout the canopy, in contrast to the photogrammetric data that only provided information about the canopy surface data. Additional photogrammetric and multispectral data were also collected.

**FY19 Activities:** The automated procedure developed during FY17 will be used for processing and analyzing the ALS data collected at LCR MSCP conservation areas (with the cottonwood-willow land cover type) and southwestern willow flycatcher-occupied locations throughout the Southwestern United States. The data from the southwestern willow flycatcher-occupied locations will be used to develop ranges for each of the vegetation metrics. A similar process will be used for evaluating soil moisture requirements; ranges will be developed using data from the southwestern willow flycatcher-occupied locations. LCR MSCP conservation areas will then be evaluated against these ranges to make recommendations on whether some level of habitat manipulation is warranted or not.

Vegetation structure data collected at Hart Mine Marsh using photographic, multispectral, and lidar sensors will be analyzed to evaluate which tool is the most appropriate for evaluating marsh vegetation habitat structure. If these data

products do not provide the necessary information, additional remote sensing and ground-based tools and techniques will continue to be evaluated. Additional marsh habitat manipulation techniques are being evaluated, and if appropriate, field tests will be planned and designed to evaluate their inclusion in the long-term marsh habitat manipulation toolbox.

An irrigation management study will begin at Phase 8 of the Palo Verde Ecological Reserve. The objective of the study is to evaluate the effects that reduced irrigation will have on volunteer cottonwoods that have established in a stand of planted honey mesquite trees. This study will help evaluate what the effect of reduced irrigation on cottonwood health and productivity is in areas where moist soils are not necessarily required for species habitat requirements.

**Proposed FY20 Activities:** ALS data will continue to be acquired in FY20 under Work Task F1 and will be processed and analyzed using the techniques developed in FY17. Soil moisture data will also continue to be collected at southwestern willow flycatcher-occupied locations under this work task, while soil moisture data at LCR MSCP conservation areas will be collected under Work Task F1. The long-term monitoring under this research work task will help inform the LCR MSCP about the level of active habitat manipulation that is necessary. If habitat manipulation is deemed necessary, the Habitat Conservation Plan and the literature review conducted under this work task will be consulted to identify appropriate habitat manipulation techniques. Initial planning and design will be conducted to implement habitat manipulation tests at select LCR MSCP conservation areas. The goal of these tests will be to evaluate techniques for inclusion in the long-term riparian forest habitat manipulation toolbox.

Vegetation response monitoring will continue at Hart Mine Marsh using data acquired with UASs and other platforms. This monitoring will continue to inform the LCR MSCP on whether mechanical disturbance should continue to be included in the long-term marsh habitat manipulation toolbox and will also assist in evaluating whether these monitoring techniques are appropriate. Additional marsh habitat manipulation techniques will be evaluated, and if appropriate, field tests will be planned and designed to evaluate their inclusion in the long-term marsh habitat manipulation toolbox.

The irrigation management study at the Palo Verde Ecological Reserve will continue.

**Pertinent Reports:** The report titled *Integrating Terrestrial Laser Scanning* (*TLS*) *and Aerial Laser Scanning* (*ALS*) *to Describe Physiognomic Vegetation Structure in Riparian Forests* and *Options for Managing Emergent Wetlands as Marsh Bird Habitat along the Lower Colorado River* will be posted on the LCR MSCP website upon completion.

# Work Task C61: Evaluation of Alternative Stocking Methods for Fish Augmentation

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $300,000 | $288,857.26 | $608,840.13 | $10,000 | $10,000 | $10,000 | $0 |

**Contact:** Jim Stolberg, (702) 293-8206, jstolberg@usbr.gov

**Start Date:** FY14

**Expected Duration:** FY21

**Long-Term Goal:** Maintain the effectiveness of the LCR MSCP Fish Augmentation Program

**Conservation Measures:** BONY3, BONY5, RASU3, RASU5, and RASU6

**Location:** The lower Colorado River within the LCR MSCP planning area, including reservoirs and connected channels from Lake Mead downstream to Imperial Dam

**Purpose:** To evaluate the effects that alternative stocking methods have on the survival of razorback suckers and bonytail stocked within the LCR MSCP planning area

**Connections with Other Work Tasks (Past and Future):** Related work tasks include B2, B3, B4, B5, B6, C10 (closed), C11 (closed), C26 (closed), C31, C33 (closed), C39 (closed), C46 (closed), C63, C64, D8, and G3. In FY16, documentation of soft release experiments was moved from Work Task C65 to Work Task C61, as soft release research is essentially a type of stocking treatment and aims to assess long-term survival through recontact probabilities.

**Project Description:** Extensive monitoring of Colorado River native fishes is a commitment of the LCR MSCP, and in accordance with the Habitat Conservation Plan, several monitoring and research elements have been included as part of the LCR MSCP Fish Augmentation Program. Two of these research elements will be addressed, including (1) understanding and minimizing adverse effects of stocking and (2) understanding post-stocking distribution and survival. Alternative stocking methods will be evaluated for razorback suckers and bonytail within the LCR MSCP Fish Augmentation Program boundaries and may include stocking during different seasons, stocking at night, stocking cohorts of various quantities, and stocking at specific locations. These alternative methods will

generally be evaluated through multiple iterations of paired stockings, with one group representing the more traditional stocking and one representing the alternative method being investigated.

In addition to these alternative stocking methods, fishes reared by alternative means may also be evaluated through these efforts. These treatments will then be used to test whether different types of conditioning will translate to improved survival of stocked fishes. To test the effectiveness of these alternate rearing treatments, stockings would be completed in paired groups and may include fishes that have been either flow conditioned or trained to recognize predators. Information regarding post-stocking distribution and survival will be obtained through ongoing research and monitoring work tasks (C64 and D8). As information on these stockings becomes available, different combinations of these alternative stocking methods and treatments may also be evaluated.

**Previous Activities:** Previous research related to this work task was conducted under Work Task C26 (closed) in FY09–FY11. Feeding rates, efficiency of food conversion, growth, swimming performance, and physical condition of razorback suckers reared in flowing raceways at the Lake Mead Fish Hatchery were evaluated. The results from multiple iterations of this research showed that razorback suckers reared at the highest velocity flows evaluated, 38 and 39 centimeters per second, exhibited the most growth, highest food conversion efficiency, and best swimming performance. Monitoring data from flow-conditioned and static-reared cohorts will be analyzed as they become available to evaluate differential survival.

A total of 37,723 razorback suckers were repatriated into Lake Mohave during FY13–FY15 as 18 paired cohorts released in day and night stocking events. All efforts associated with these stocking events were captured under Work Task B2. Approximately 2.3% of FY13, < 1% of FY14, and 1% of FY15 releases had been captured or contacted through monitoring efforts by the end of FY17; however, little overall difference in survival has been observed between day and night releases.

Trials to condition razorback suckers and bonytail to avoid predation at the Valle Vista Golf Course in Kingman, Arizona, were conducted from FY13 through FY16. Results from FY16 trials showed that survival was higher among bonytail that received three conditioning trials over bonytail that received one or zero conditioning trials. Predator avoidance trials were ended in FY17 due to public tampering with the ponds. Data from these trials could not be used for analyses because of suspected fishing and confirmed stocking of additional largemouth bass into trial ponds. Experimental trials were moved to the Arizona Game and Fish Department's Aquatic Research Conservation Center (ARCC) to provide a secure site for research to continue. Experiments to condition bonytail for predator recognition and avoidance began in late FY17.

Soft release treatments for razorback suckers were conducted in three backwaters within Topock Gorge in FY16 and FY17. These treatments consisted of fishes being released in paired cohorts of 300 to 600 fish. One cohort was released into a netted off portion of a selected backwater and held for 72 hours, and the other cohort was released directly into the backwater and allowed to disperse without restrictions. Telemetered fishes were released with each group, and remote passive integrated transponder (PIT) tag scanning was conducted to look at immediate dispersal. The relative survival rate will be evaluated after several years of contact data have been collected.

FY16 was the first of three study years in which the survival of razorback suckers stocked into Lake Mohave was compared using cohorts of different quantities. Approximately 7,000 razorback suckers were stocked at 4 locations over a 3-week period, with each location receiving a different-sized cohort of fish (250, 500, or 1,000) each week. The total number of razorback suckers stocked at each location was the same; however, cohort stockings were staggered so that no more than two locations received the same number of fish during any one week. Through the end of FY16, < 1% of these cohorts had been captured or contacted. Capture and contact data will continue to be analyzed as they become available through monitoring efforts.

Paired stockings of flow-conditioned and static-reared razorback suckers and bonytail were completed in FY17. Approximately 1,200 razorback suckers released into Reach 4 and 1,000 bonytail released into Reach 3 were flow conditioned prior to release. Capture and contact data for these cohorts will continue to be collected through ongoing monitoring.

**FY18 Accomplishments:** Data collected through ongoing monitoring efforts were analyzed during FY18 to evaluate the results from previous year day/night paired releases in Lake Mohave. Through FY18, approximately 2.8% of FY13, < 1% of FY14, and 1.6% of FY15 releases had been captured or contacted through monitoring efforts. Monitoring data collected through Work Task D8 have demonstrated that stocked fishes are often not contacted for up to 3 years post-release. These cohorts will continue to be tracked through monitoring in future years, as it may require multiple years of data to evaluate this alternative stocking method.

Capture and contact data were also analyzed for fishes released in FY16 that will be used to evaluate the relationship between cohort stocking quantity and survival. Through the end of FY18, approximately 1% of stocked fishes had been captured or contacted, and little difference was observed between contact rates and cohort quantities. These cohorts will continue to be tracked in future years, and capture and contact data will continue to be analyzed as they become available through monitoring efforts.

Reach 3 soft release treatments for razorback suckers continued in FY18. Due to a lack of fish in the hatcheries, the cohorts for the paired releases were again about one-half the numbers utilized in FY16. Future monitoring of these cohorts as they mature and arrive on the spawning grounds will provide comparisons on survivorship of the individual treatments. Data will be collected through detections derived from PIT scanning recontacts.

**FY19 Activities:** The potential benefits of alternative stocking methods will continue to be analyzed using data from fishes stocked during previous years.

Predator avoidance trials, previously completed under Work Task C63, will continue at the ARCC. Experimental trials evaluating survival of conditioned native fishes in the presence of predators and artificial habitat are expected to be completed in spring 2019, when razorback sucker and bonytail fry become available from the Southwestern Native Aquatic Resources and Recovery Center, Dexter, New Mexico. Results from this and additional related research will be reported under this work task through FY21.

**Proposed FY20 Activities:** Longer-term evaluation of various stocking treatments will be conducted using data derived from PIT scanning recontacts. This recontact information will be acquired through research and monitoring efforts conducted under Work Tasks C64 and D8. Relative recontact rates of treatment versus control fishes will be queried and used to evaluate the effectiveness of each treatment.

Funds to support predator avoidance research through FY21 were obligated in FY18. Results from the predator avoidance research conducted at the ARCC will continue to be reported under this work task.

**Pertinent Reports:** Summary reports for predator avoidance experiments will be completed and available upon request. A final project report for predator avoidance research will be posted on the LCR MSCP website upon completion.

## Work Task C63: Evaluation of Habitat Features that May Influence Success of Razorback Suckers and Bonytail in Backwater Environments

| FY18 Estimate | FY18 Actual Obligations | Cumulative Accomplishment Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $150,000 | $98,270.13 | $329,291.30 | $0 | $0 | $0 | $0 |

**Contact:** Jim Stolberg, (702) 293-8206, jstolberg@usbr.gov

**Start Date:** FY15

**Expected Duration:** FY18

**Long-Term Goal:** To inform future design and management of created backwater habitats

**Conservation Measures:** BONY3, BONY5, RASU3, RASU5, and RASU6

**Location:** Reaches 2–5

**Purpose:** To evaluate how natural and artificial habitat features are used by razorback suckers and bonytail and their relative importance for influencing survival and long-term success

**Connections with Other Work Tasks (Past and Future):** This work task represents the merger of two previously funded work tasks: C41 (closed) and C58 (closed). This work task is related to all work tasks in Fish Augmentation (Section B) that provide razorback suckers and bonytail for augmentation stocking, specifically Work Tasks B7, C23 (closed), and F5. The results of investigations that occur under this work task may indicate that future stocking treatments will need to be tested (C61) or modified (Section B work tasks).

**Project Description:** The activities covered under this work task both consolidate and build on the work that has been undertaken and accomplished under Work Tasks C41 (closed) and C58 (closed).

Habitat features are important to success (growth, survival, and reproduction) of fishes in aquatic environments. In particular, structural features such as submerged woody debris, reefs, rock cavities, and submerged vegetation can provide cover for multiple life stages of fishes. Cover allows fishes to hide and rest and can be vital to survival by allowing them to avoid predation through both concealment and direct protection. The types of features (both artificially

constructed and those that are existing/natural) that may be used by native fishes will be investigated. The use of other forms of cover, such as aquatic vegetation and turbidity, may also be investigated to determine which of these types of features plays a more important role as cover for razorback suckers and bonytail. These features may be important, especially in created backwater environments, where they may not be present or may not be in sufficient quantities, to promote the success of these species. By including these features in created backwaters, both immediate and long-term survival and success may improve. This work task was created to:

- Inform managers of habitat structures to include when designing and creating backwaters

- Help improve existing created backwaters by providing options for adding structural elements (both "natural" and artificial) to afford adequate cover

- Potentially assist in improving post-stocking survival by suggesting stocking sites with adequate cover or adding features to stocking locations to provide cover from predatory fishes and/or piscivorous birds

**Previous Activities:** Detailed accounts of work and accomplishments covered under Work Tasks C41 (closed) and C58 (closed) have been reported under these tasks and in their associated technical reports. This work included monitoring the use of artificial habitat features in Davis Cove (Lake Mohave) by native fishes. Investigations were also conducted to characterize existing riprap shoreline at High Levee Pond due to documented use of its cavities by bonytail. Preliminary investigations suggested that bonytail used both artificial and more "natural" existing structures (riprap) as cover. No difference has been detected in the use of these features by razorback suckers, suggesting that this species may use other forms of cover – aquatic vegetation and/or turbidity.

A cavity preference trial was conducted in FY15 to assess if bonytail show a stronger affinity for a particular cavity size. Bonytail (100–150 millimeters [mm] total length [TL]) were exposed to artificial structures offering cavity openings of 50, 75, or 100 mm in diameter. Trial observations suggested a higher frequency in selection of the artificial structure with cavity openings of 50 mm in diameter. Bonytail took about 30 days to get acclimated to the structure before entering and used it almost exclusively except while feeding.

Artificial habitat selection trials were conducted in the Davis Cove backwater and at the Lake Mead Fish Hatchery in FY16. Native fishes of multiple size classes were exposed to various artificial structures and artificial structures with organic components (brush bundles) to assess habitat selection. Passive integrated transponder (PIT) scanners were incorporated into each artificial structure type to

monitor usage. While native fishes were observed using each artificial habitat type, contact data were either too limited or variable between treatments and locations to determine a preference for the habitat features assessed.

Evaluation of artificial structures at the Lake Mead Fish Hatchery continued in FY17. Structures consisted of 20-gallon storage bins with 5 x 5-inch openings cut into the lids. The bins were weighted down and submerged in a raceway that held about 450 bonytail (> 305 mm TL). Bonytail were observed occupying the interior space and the immediate area near and under the structures over a 2-month period. Large amounts of organic waste accumulated on and near the structures during deployment, so additional structures were not deployed in order to maintain water quality.

**FY18 Accomplishments:** Experimental trials were initiated at the Arizona Game and Fish Department's Aquatic Research and Conservation Center (ARCC), with the goal of improving post-stocking survival of razorback suckers and bonytail. Two experiments were completed in FY18. Research focused on (1) conditioning native fishes to recognize predators and (2) evaluating survival of native fishes in the presence of predators and different habitat structures. Conditioning trials were completed by exposing native fishes to zero, one, or three conditioning events, and then allowing native fishes and a predator to interact. Results from previous studies had suggested that survival of native fishes may be improved through multiple conditioning events; however, results from the three experimental trials ran in triplicate indicated no difference in survival between conditioning treatments for either razorback suckers or bonytail. Habitat trials were completed by exposing non-conditioned (naïve) native fishes to predators in the presence of no habitat (open water; control), artificial vegetation, or two different habitat structures. For razorback suckers, there was no statistically detectable difference in survival between habitats; however, bonytail survival was higher for both artificial vegetation and one of the habitat structures. These results indicate that bonytail may take advantage of certain habitat features and that these features should be considered when determining stocking locations.

Obligations were less than estimated, as statistical power was sufficiently high for detecting treatment effects in initial habitat trials, eliminating the need for additional trial periods.

**FY19 Activities:** This work task was closed in FY18. Predator avoidance trials will continue at the ARCC under Work Task C61.

**Proposed FY20 Activities:** This work task was closed in FY18.

**Pertinent Reports:** A summary report for each experiment has been completed and is available upon request. A final project report will be produced under Work Task C61 and posted on the LCR MSCP website upon completion.

## Work Task C64: Post-Stocking Movement, Distribution, and Habitat Use of Razorback Suckers and Bonytail

| FY18 Estimate | FY18 Actual Obligations | Cumulative Accomplishment Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $750,000 | $451,416.35 | $1,824,358.15 | $450,000 | $450,000 | $450,000 | $450,000 |

**Contact:** Jeff Lantow, (702) 293-8557, jlantow@usbr.gov

**Start Date:** FY15

**Expected Duration:** FY27

**Long-Term Goal:** To maintain an effective LCR MSCP Fish Augmentation Program

**Conservation Measures:** BONY3, BONY 4, BONY5, RASU3, RASU4, and RASU6

**Location:** Reaches 2–5

**Purpose:** To provide information on the movement, distribution, and habitat use of stocked razorback suckers and bonytail, and to use this information to develop an appropriate monitoring network to suggest potential stocking locations and track post-stocking survival

**Connections with Other Work Tasks (Past and Future):** This work task represents the merger of three previously funded work tasks: C39 (closed), C45 (closed), and C49 (closed). The intent of this combination was to capture the activities with similar purposes and scope into a consolidated, multi-reach effort for both razorback suckers and bonytail. This work task is related to Work Tasks B2, B3, B4, and B6, all of which provide razorback suckers and bonytail for augmentation stocking and which may also build on information gained in Reach 1 through Work Tasks C13 (closed) and C57 (closed). Information collected under this work task will be added to the database used to complete Work Task D8. Information obtained from Work Task C8 (closed) and C61 will be used in this study. Funds from Work Task G3 were provided in FY14 to accomplish preliminary work in Reach 2, which was covered by this work task in FY15.

**Project Description:** Information on post-stocking distribution, habitat selection and use, and survival will be collected and can then be used to (1) establish a more appropriate monitoring network in terms of where to locate remote sensing equipment or other sampling gear with higher probabilities for contacts, (2) indicate locations that may be better suited for stocking fishes throughout Reaches 2–5, and (3) possibly identify additional aggregations of native fishes.

The networks that are established under this work task will also provide monitoring information on the effectiveness of different stocking treatments (conducted under Work Task C61) as well as longer-term information on survival, habitat use, and movement of native fishes in Reaches 2–5. These long-term monitoring networks may be used for system-wide monitoring and would be covered under Work Task D8.

**Previous Activities:** Detailed accounts of work and accomplishments covered under closed Work Tasks C39, C45, and C49 have been reported under these tasks and in their associated technical reports. They include the tracking and monitoring of stocked razorback suckers and bonytail in specific areas in Reaches 3 and 4. Post-stocking movement and habitat use have been documented, and post-stocking survival estimates have been developed for razorback suckers and/or bonytail in these reaches.

**Reach 2:** A sonic telemetry study was initiated in FY15 with the stocking of 19 adult razorback suckers into Lake Mohave. Razorback suckers were tracked monthly, and 25 submersible ultrasonic receivers were deployed, allowing for continuous surveillance throughout the year. Fish movements and habitat use were identified through analyses of active and passive contacts. In FY16, 39 sonic-tagged bonytail were released into Lake Mohave. Active tracking was conducted intensively for 3–6 weeks after release in an effort to maintain contact with these fish. Despite these intensive efforts, recontact rates remained low throughout the year. At the conclusion of the 9-month study period (battery life of the tags), only four fish were still considered active. In FY17, an additional 15 razorback suckers were implanted with 3-year sonic tags and released with 2 cohorts of 250 fish to allow for continued sonic surveillance through FY19. Passive and active tracking allowed for the identification of both large-scale movements and the use of specific spawning locations. Fish used deeper, mid-channel habitat in late spring and summer and shallow inshore habitat in late fall and through the spawning season.

An additional 20 sonic-tagged bonytail were released into Lake Mohave in January 2017 with a cohort of 684 passive integrated transponder (PIT)-tagged bonytail. Monitoring of these fish followed the same general format as previous stockings, with short-term intensive tracking followed by monthly tracking trips. Low recontact rates were observed immediately following stockings. Only 3 of

20 fish were contacted via active or passive tracking 1 month after stockings. At the conclusion of this 9-month study period, 4 fish were confirmed as mortalities, and 16 had an unknown status.

**Reach 3:** Habitat use by razorback suckers was studied in the lower Colorado River from Park Moabi downstream to the Lake Havasu Delta. During 5 years of trammel netting and 3 years of remote PIT scanning, both trammel nets and PIT scanners predominantly contacted recently released fish (< 3 years). Of the backwaters being monitored, the razorback sucker catch per unit effort for trammel nets and PIT scanners was on average seven times higher in Park Moabi. Water quality (primarily temperature) and the composition of aquatic vegetation were identified as the greatest distinguishing factors in Park Moabi.

Bonytail survival, distribution, and habitat use have been assessed at three different locations: the Bill Williams River in fall 2014, Park Moabi in spring 2015, and Laughlin Lagoon in winter 2015. Information was obtained through the use of sonic telemetry and remote PIT scanning.

In Laughlin Lagoon, actively tracked bonytail were found associated with California or softstem bulrush habitats 15% of the time. This was the highest association with any habitat type for all actively tracked fish. PIT scanning indicated some level of survival in Laughlin Lagoon based on the detection of 13 bonytail that were stocked 3 months prior to the beginning of this study. Nevertheless, unique PIT tag detections from the first week to the second week dropped 30% at Laughlin Lagoon, compared to a 60% drop observed in Park Moabi and a 90% decline in detections recorded at other release sites based on similar scanning efforts at all locations.

In FY17, native fish work in Topock Marsh was initiated to track survival and distribution of new and existing cohorts of stocked razorback suckers. A total of 1,186 razorback suckers were released with PIT tags, and 40 sonic-tagged razorback suckers were released into Topock Marsh and tracked throughout the year.

**Reaches 4 and 5:** In FY16, monthly PIT tag scanning surveys scanned for 9,675.3 hours and resulted in nearly 350 unique razorback sucker contacts and 46 unique bonytail contacts. All of the bonytail originated from a single release on September 23, 2015; 29 were detected in October, 12 were detected in November, and 5 more were detected through January. The majority of razorback suckers contacted also originated from recent stocking events; however, 13 of these fish were released prior to 2015, 10 of which were from 2007.

In FY17, remote PIT scanners scanned for 22,328.8 hours and resulted in 443 unique razorback sucker contacts and 279 unique bonytail contacts. The majority of fishes originated from recent stockings, with the exception of

142 razorback suckers and 1 bonytail, which were contacted more than a year post-release. Acoustic telemetry of adult and subadult razorback suckers and adult bonytail is ongoing.

**FY18 Accomplishments:** Accomplishments for this work task have been summarized by river reach.

**Reach 2:** Tracking of sonic-tagged razorback suckers released in FY15 and FY17 continued through seasonal monitoring trips and year-round passive tracking. An additional 20 sonic-tagged bonytail were released in May with a cohort of approximately 500 fish. Bonytail were intensively monitored using remote PIT scanning and active and passive telemetry for 1 month following stocking. Subsequent telemetry surveys for bonytail were conducted monthly; however, active telemetry efforts were reduced due to low contact rates.

**Reach 3:** Remote PIT scanning and sonic telemetry surveys continued in Topock Marsh. Remote PIT scanners scanned for 3,533 hours, which resulted in 1,116 contacts from 233 unique razorback suckers and 2 bonytail. Mark recapture data were used to evaluate razorback sucker abundance and generated a population estimate of 798 individuals (95% confidence interval [CI] from 652 to 987) in Topock Marsh. Sonic telemetry indicates that the fish use the entire marsh, but during the summer months, they congregate around Firebreak Canal (the main inflow into the marsh). The continued presence of razorback suckers in the Marsh prompted a stocking of 20 sonic-tagged bonytail to determine if they would survive and find suitable habitat within the marsh.

**Reaches 4 and 5:** In Reach 4, PIT tag scanning surveys were conducted throughout the October 2017 through September 2018 study year but occurred with greater frequency in winter and spring. Remote PIT scanners were deployed for 12,597.1 hours which, resulted in 1,792 unique contacts from 1,234 razorback suckers, 535 bonytail, and 23 individuals with no database record. A total of 206 razorback suckers and 1 bonytail were contacted more than 1 year after release. Fifteen unique fishes, nine razorback suckers and six bonytail, were contacted in the main channel during the study year. No bonytail contacted during the marking period (October 1, 2016, to May 31, 2017) were contacted again in the capture period (October 1, 2017, to May 31, 2018); therefore, no population estimate was possible. The razorback sucker population was estimated at 169 individuals (95% CI from 157 to 180).

Evidence of long-term persistence (more than 1 year following release) of either razorback suckers or bonytail in the study area is lacking despite contacting thousands of razorback suckers and bonytail post-release. Most contacts with either species occur within 30 days of release and are acquired from a single backwater complex (A10 upper and A10 lower).

Sonic telemetry of FY17 implanted fishes continued. An additional 18 subadult razorback suckers and 18 subadult bonytail were implanted with short-term (3-month) acoustic telemetry tags to examine dispersal patterns immediately following release. Ten adult razorback suckers were implanted with longer-term (36-month) tags to examine dispersal over a longer period.

Obligations in FY18 were less than expected, as Reach 2 telemetry surveys were reduced due to low contact rates for bonytail, and additional research proposed for Reach 3 was cancelled.

**FY19 Activities:** Activities for this work task have been summarized by river reach.

**Reach 2:** Sonic-tagged razorback suckers released in FY17 will continue to be tracked as part of this effort. This work can be performed concurrently with bonytail tracking and will help to maximize resources and the use of acquired equipment. Tracking of razorback suckers will be used to evaluate movement patterns, seasonal habitat use or preference, and spawning site fidelity. Contacts with sonic-tagged razorback suckers will also be used to inform sampling locations for ongoing monitoring efforts.

Twenty bonytail will be obtained from the Lake Mead Fish Hatchery, implanted with 9-month sonic tags, and released into Lake Mohave. These fish will be stocked with a cohort of 500–1,000 fish. Intensive active tracking will be conducted immediately following stocking. Less intensive active tracking and continuous passive tracking will continue throughout FY19. Continuous PIT tag scanning in the vicinity of the FY19 stocking location will monitor bonytail movement as was done in FY18.

**Reach 3:** Razorback suckers and bonytail will continue to be monitored in Topock Marsh, and subsequent stocking events will be scheduled as needed.

**Reaches 4 and 5:** Monthly scanning surveys and sonic telemetry will continue in Reach 4 in an effort to increase recontact rates with stocked fishes and locate potential riverine spawning aggregates. Scanning locations will be based on the distribution of the telemetered fishes. Additional adult razorback suckers will be captured from the river and implanted with sonic tags to aid in the detection of spawning aggregates in the river. Scanning will be limited in Reach 5 unless the distribution of sonic-tagged fishes suggests that a substantial amount of stocked fishes are dispersing into this reach.

**Proposed FY20 Activities:** Proposed activities for this work task have been summarized by river reach.

**Reach 2:** Monitoring of sonic-tagged razorback suckers will continue. Additional releases of sonic-tagged bonytail may also occur.

**Reach 3:** The monitoring of native fishes in Topock Marsh will continue.

**Reach 4:** Surveys and monitoring efforts will continue. All data will be used to inform managers of potentially favorable release locations and relative survival in Reach 4.

**Reach 5:** Surveys will be limited unless the distribution of sonic-tagged fishes from Reach 4 suggests that a substantial amount of stocked fishes are dispersing into this reach and forming spawning aggregates.

**Pertinent Reports:** The report titled *Population Status and Distribution of Razorback Suckers and Bonytail Downstream from Palo Verde Diversion Dam 2018 Interim Report* will be posted on the LCR MSCP website upon completion.

# Work Task C65: Evaluation of Immediate Post-Stocking Survival of Razorback Suckers and Bonytail

| FY18 Estimate | FY18 Actual Obligations | Cumulative Accomplishment Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $120,000 | $44,359.14 | $254,014.94 | $0 | $0 | $0 | $0 |

**Contact:** Jeff Lantow, (702) 293-8557, jlantow@usbr.gov

**Start Date:** FY15

**Expected Duration:** FY18

**Long-Term Goal:** To maintain an effective LCR MSCP Fish Augmentation Program

**Conservation Measures:** BONY3, BONY4, BONY5, RASU3, RASU4, and RASU6

**Location:** Reaches 2–5

**Purpose:** To identify the most important sources of immediate post-stocking mortality and to inform managers of how to best target and prioritize solutions

**Connections with Other Work Tasks (Past and Future):** This work task is related to Work Tasks B2, B3, B4, C10 (closed), C11 (closed), C25 (closed), C46 (closed), and C61. Preliminary planning, acquisition of materials, and study design development occurred in FY14 with funds from Work Task G3. In FY16, documentation of soft release experiments was moved to Work Task C61. Because soft release research is essentially a type of stocking treatment and aims to assess long-term survival through recontact probabilities, it is more appropriately covered under Work Task C61.

**Project Description:** Observations from past stocking events have indicated relatively high and immediate post-stocking mortality of razorback suckers and bonytail. This pattern appears more commonly in backwater situations and occurs even in instances where no or low numbers of predatory fishes are present and where water quality parameters should not be a source of mortality. Transport and handling stress and predation by piscivorous birds have been suspected as causes of this low survival. Only anecdotal evidence exists to support the

speculation that piscivorous birds are the major cause of this mortality, and although handling and transport stress have been measured for stocked fishes, little evidence exists that connects this stress to actual latent mortality.

This work task builds directly on the knowledge gained from Work Task C46 (closed) and takes the next step from observing stress indicators in stocked fishes to investigating how they translate into actual latent post-stocking mortality. This work may involve holding a subset of stocked fishes in a protected area for observation and recording survival rates after 24, 48, and 72 hours; longer durations may also be explored if deemed necessary. A subsample of these fishes may also have their blood tested for levels of stress-indicating compounds.

In addition, a bioenergetics model of piscivorous bird predation will be further developed and tested, and observational studies may be employed to help calibrate the model. These studies may include performing counts of confirmed feeding of piscivorous birds on stocked razorback suckers and bonytail. This model is intended to help inform managers of the relative pressure that bird predation may be having on stocked native fishes.

Data collected during this study will be used to assess the effect of stocking treatments relative to stress-related mortality, bird predation, or other factors that may be accounting for immediate post-stocking mortality and will allow managers to better prioritize and target solutions or find new ways to improve survival of stocked fishes by identifying what factors are the greatest sources of immediate mortality.

**Previous Activities:** The development of a bioenergetics model was initiated in FY14 under Work Task G3. The purpose of the model was to suggest the potential pressure that available piscivorous birds could exert on stocked fishes.

In FY15, efforts to document bird predation on native fishes using remote passive integrated transponder (PIT) tag scanners were initiated in Laughlin Lagoon following a bonytail release in September. Scanners were deployed on known bird roosts, and game cameras were attached to document bird usage and correlate any PIT tag contacts with a particular bird species. Two PIT tags were detected on multiple scanners within 24 hours post-release, and cameras confirmed that the fishes were consumed by cormorants. Additional scanning beneath the known roost sites documented 23 stationary tags that were from fishes released throughout Reach 3, dating back to 2003.

Scanning of known bird roosts immediately following stocking events continued in FY16 and FY17. Continuous avian scanning for 10 days following a December 2015 release of bonytail resulted in the detection of 24 tags, which was 2.53% of the stocked fishes. Scanning following the May release of bonytail detected seven tags (1%) consumed by avian predators. Bird activity was

noticeably different during the May trial. Efforts in FY17 consisted of avian predation monitoring for 10 days following the December and May bonytail stockings in Laughlin Lagoon. Following the December stocking event, 90 unique PIT tags (approximately 5% of stocked fishes) were scanned at avian roosts. Motion detection cameras assisted in identification of avian predators, and of the 90 PIT tags scanned, 72 were associated with cormorants, 11 with great blue herons, and 7 with an unknown avian predator (no image was captured). In May, no PIT tags from the 852 bonytail that were stocked were recorded. Scanners did, however, record five tags from previous stocking events; four of these tags came from bonytail stocked on April 4, 2017.

Avian predation monitoring was also initiated following the stocking of razorback suckers and bonytail at the Imperial Ponds Conservation Area. Pole-mounted scanners were deployed within each pond and allowed to operate for 10 days post-stocking. Avian point counts were also completed three times per day in conjunction with the scanning. No piscivorous birds were observed in or around the ponds during this time, and no tags were detected on the pole-mounted scanners following the 10-day survey.

This study confirms that bird predation on stocked fishes is occurring. Although the percentage of confirmed initial post-stocking predation appears low, sampling efforts are likely underrepresenting bird predation mortality. Evidence of bird predation on fishes from previous releases (roost-scanned PIT tags) suggests that bird predation may be continuous on stocked fishes. These data will help inform a bioenergetics model that will provide a more quantitative assessment of the potential magnitude and variability of bird predation on stocked fishes.

**FY18 Accomplishments:** Additional avian predation monitoring was conducted to refine the bioenergetics model. Six roost-mounted PIT scanners were used to scan for 10 days after fishes were stocked in December 2017. Anecdotally, biologists observed that the recently stocked bonytail were present in a large school intermixed with rainbow trout 1 week following stocking and that striped and largemouth bass were actively preying on fishes from the school. The bioenergetics model was completed in FY18 and was integrated into the final project draft report. Obligations for this work were less than estimated, as no additional avian monitoring was conducted at the Imperial Ponds Conservation Area due to limited observations of piscivorous birds.

**FY19 Activities:** This work task was closed in FY18.

**Proposed FY20 Activities:** This work task was closed in FY18.

**Pertinent Reports:** A final project report for avian predation monitoring will be posted on the LCR MSCP website upon completion.

## Work Task C66: Marsh Bird Water Depth Analysis

| FY18 Estimates | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $20,000 | $25,505.31 | $152,601.41 | $0 | $0 | $0 | $0 |

**Contact:** Chris Dodge, (702) 293-8115, cdodge@usbr.gov

**Start Date:** FY16

**Expected Duration:** FY18

**Long-Term Goal:** Define marsh water depth requirements for covered marsh birds

**Conservation Measures:** MRM1 and MRM2 (BLRA, CLRA, and LEBI)

**Location:** LCR MSCP planning area

**Purpose:** To identify the range of acceptable water depths in California black rail and Yuma clapper rail breeding sites, and ranges of acceptable daily, monthly, and annual variability

**Connections with Other Work Tasks (Past and Future):** Marsh bird habitat was studied previously under Work Task C24. The first year of funding was provided through Work Task G3.

**Project Description:** The Habitat Conservation Plan requires the creation of a minimum of 512 acres of marsh habitat for three LCR MSCP covered marsh bird species. All 512 marsh acres should have water depths no greater than 12 inches to provide habitat for Yuma clapper rails and western least bitterns, while 130 acres of marsh is required with water depths no greater than 1 inch to provide habitat for California black rails.

Water depths in California black rail and Yuma clapper rail existing breeding sites along the lower Colorado River will be evaluated. Data will be analyzed to identify the range of water depths in California black rail and Yuma clapper rail breeding sites throughout the breeding season and to identify the ranges of daily, monthly, and annual variability that can occur and still have successful breeding.

**Previous Activities:** Yuma clapper rail breeding data from 52 monitoring points and existing daily river gauge data collected from FY06 to FY14 in Topock Gorge

and Topock Marsh were compiled and analyzed. Detections of Yuma clapper rails at each monitoring point during the three surveys conducted each year (known occupancy) were compared to the range of water depth fluctuation occurring during that monitoring period to determine whether the presence of Yuma clapper rails was influenced by water level fluctuations in each survey period. The data were analyzed using occupancy modeling techniques in Program Presence (Version 9.0). Models were compared using Akaike's information criterion. The results did not support the hypothesis that the per-period levels of water fluctuation as recorded in Topock Gorge affect the presence of Yuma clapper rails, and nesting occurred each year with greater than 12-inch fluctuations in water depth. There is very strong evidence that detectability of Yuma clapper rails varies by year and survey period.

A literature search for the California black rail was conducted across its entire range. Published literature was reviewed from the lower Colorado River (United States and Mexico), the San Francisco Bay area, and in Yuba County, California, where the Sierra Nevada foothills meet the Sacramento Valley. In the areas outside the United States portion of the lower Colorado River, there are much larger populations of this species, and the bird's use of water depths has been well documented. In Yuba County, California, a population of California black rails use areas of irrigated, created marsh that can provide relevant data for LCR MSCP creation and management of their habitat. The birds were detected at water depths averaging 0.83 inch. The researchers recommended shallow water, gently sloping landscapes, and variable water levels when managing created marsh for California black rails.

California black rail data were obtained from ProNatura Noroeste for the population located in the Ciénaga de Santa Clara in Mexico. This area has the largest population of the species on the lower Colorado River and will help better define the population parameters of this species in this region.

**FY18 Accomplishments:** California black rail data from the Ciénaga de Santa Clara were reviewed, and it was determined that there was not sufficient data to be able to make a statistically significant determination for this population; therefore, a report was prepared based on findings from existing scientific literature. Existing research findings appear to be sufficient to support the hypotheses that California black rails can use areas with fluctuating water levels as long as the habitat has a gentle slope that allows them to move into area of adequate water depth as water levels change.

**FY19 Activities:** This work task was closed in FY18.

**Proposed FY20 Activities**: This work task was closed in FY18.

**Pertinent Reports:** The *Marsh Bird Water Depth Analysis 2016 Progress Report* is posted on the LCR MSCP website. The final report will also be posted upon completion.

# WORK TASKS – SECTION D

System Monitoring

## Work Task D1: Marsh Bird Surveys

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $40,000 | $40,504.44 | $404,881.27 | $40,000 | $40,000 | $40,000 | $40,000 |

**Contact:** Joe Kahl, Jr. (702) 293-8568, jkahl@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** System monitoring for marsh birds

**Conservation Measures:** MRM1 (BLRA, CLRA, and LEBI)

**Location:** Reach 3, Havasu National Wildlife Refuge, Arizona and California

**Purpose:** The purpose of this work task is to monitor Yuma clapper rails, California black rails, and western least bitterns along a designated reach of the lower Colorado River as part of the interagency system monitoring program. The information obtained through this task may be used in managing marsh bird habitat creation areas.

**Connections with Other Work Tasks (Past and Future):** Data obtained from Work Task F7 may also be used in the marsh bird system monitoring program described in this work task. The protocol developed for this work task will also be used for Work Task F7.

**Project Description:** Marsh bird surveys will be conducted in coordination with the U.S. Fish and Wildlife Service (USFWS) as part of a multi-agency, system-wide monitoring effort that has been ongoing annually since 1980. LCR MSCP surveys are conducted along the lower Colorado River between the I-40 Bridge, near Needles, California, and Lake Havasu, including Topock Gorge in the Havasu National Wildlife Refuge.

Prior to implementation of the LCR MSCP, a study was conducted to determine whether Yuma clapper rail surveys could be expanded to a multi-species protocol without compromising their detection rates. Information obtained from this study has helped to produce a multi-species protocol for marsh birds, including the LCR MSCP covered species (Yuma clapper rails, California black

rails, and western least bitterns). Marsh bird surveys, using the multi-species protocol, will continue at designated survey points in order to track detections of covered species.

**Previous Activities:** The Bureau of Reclamation has monitored Yuma clapper rails within Topock Gorge since 1996 in coordination with the USFWS as part of a multi-agency, system-wide monitoring effort.

**FY18 Accomplishments:** Marsh bird surveys were conducted between the I-40 Bridge, near Needles, California, and Lake Havasu during March, April, and May 2018 in coordination with the USFWS as part of a multi-agency, system-wide monitoring effort. All three covered species were encountered: 19 Yuma clapper rails were detected in March, 52 in April, and 54 in May; 4 western least bitterns were detected in March, 38 in April, and 43 in May; and 3 California black rails were detected in March, 0 in April, and 1 in May. Data were compiled and entered into the Avian Knowledge Network (AKN) database.

**FY19 Activities:** Marsh bird surveys will be conducted in Topock Gorge and the upper reaches of Lake Havasu using the multi-species marsh bird survey protocol in coordination with the USFWS as part of a multi-agency, system-wide monitoring effort. Surveys may also be conducted at the Havasu National Wildlife Refuge as needed. Data will be submitted to the USFWS and the entered into the AKN database.

**Proposed FY20 Activities:** Marsh bird surveys will be conducted in Topock Gorge, the upper reaches of Lake Havasu, and other sites using the multi-species marsh bird survey protocol in coordination with the USFWS as part of a multi-agency, system-wide monitoring effort. Data will be submitted to the USFWS and entered into the AKN database.

**Pertinent Reports:** The report titled *Marsh Bird Surveys – 2015–2017* is posted on the LCR MSCP website, and the report titled *Marsh Bird Surveys in Topock Gorge, FY2018 Annual Report* will also be posted upon completion.

## Work Task D2: Southwestern Willow Flycatcher Presence/Absence Surveys

| FY18 Estimates | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $650,000 | $706,478.94 | $9,985,453.06 | $200,000 | $340,000 | $340,000 | $340,000 |

**Contact:** Chris Dodge, (702) 293-8115, cdodge@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** System monitoring of southwestern willow flycatchers

**Conservation Measures:** MRM1, MRM2, and MRM4 (WIFL)

**Location:** Reaches 1–7 along the lower Colorado River (LCR), southern Nevada, the Bill Williams River, and the lower Gila River. Life history study sites are located along (1) Topock Marsh on the Havasu National Wildlife Refuge, Arizona, (2) the Bill Williams River watershed, Arizona, and (3) Alamo Lake State Park near Wenden, Arizona.

**Purpose:** To monitor southwestern willow flycatcher populations along the LCR, describe demographics, and identify riparian habitat characteristics in locations occupied by the species

**Connections with Other Work Tasks (Past and Future):** Closed Work Task D3 provided information on southwestern willow flycatcher population numbers and demographics along the LCR. Post-development monitoring conducted in FY16–FY17 is now captured under Work Task F9.

**Project Description:** Presence surveys are conducted along the LCR and its tributaries from the Southerly International Boundary with Mexico to southern Nevada, the Bill Williams River, and the lower Gila River. Life history studies are conducted at known breeding areas when needed.

**Previous Activities:** Presence surveys and life history studies for southwestern willow flycatchers have been conducted along the LCR and its tributaries since 1996 and include approximately 100 sites. Starting in 2013, the sites south of Parker Dam were only surveyed triennially rather than annually; sites on the triennial schedule were surveyed in 2015. Through FY17, searches were conducted for nests in all areas occupied by territorial flycatchers, and flycatcher

nests were monitored to document nest fate, brood parasitism, and causes of nest failure. As many flycatchers as possible were captured and color banded, and attempts were made to resight as many flycatchers as possible to determine the breeding status of territorial flycatchers and to document movement and recruitment. At the end of FY17, the LCR MSCP determined that sufficient data had been collected to understand general recruitment trends and threats affecting nest fate, brood parasitism, and nest failure. Data collected also indicated that adult birds are most likely to return to their prior breeding areas, and many juvenile birds will also return to their natal area. Some juvenile flycatchers will disperse to new areas, and that age class appears to be more likely than adults to do so. The study plan was subsequently refined to focus on searching for and monitoring flycatchers in occupied and potential habitat, which would most likely be the source of birds that would colonize LCR MSCP conservation areas, and occupied sites that could help inform habitat management, such as wet conditions. All surveys in southern Nevada were discontinued at the end of FY17. System-wide surveys continued at Topock Marsh; Alamo Lake State Park, Arizona; the portions of the Bill Williams River not creditable by the LCR MSCP; and areas south of Parker Dam (only every third year). Activities such as color banding and nest monitoring of conservation areas will only be conducted as needed.

**FY18 Accomplishments:** System-wide presence surveys for southwestern willow flycatchers were conducted at 60 sites along the LCR and its tributaries in FY18. System-wide surveys were conducted at Alamo Lake, the Bill Williams River (areas outside of areas creditable by the LCR MSCP), Topock Marsh, and the areas in the southern portion of the LCR below Parker Dam that are surveyed only every third year.

A total of 124 southwestern willow flycatchers were detected at 11 of the 60 sites during presence surveys, and 72 territories were documented (table 1). Surveyors confirmed that southwestern willow flycatchers were resident or breeding at 11 of the sites (within 3 study areas): Alamo Lake, the Bill Williams River National Wildlife Refuge, and Topock Marsh. Please note that due to the changes in methodology and survey effort, these numbers are not comparable to previous years.

**Table 1.—Study Areas Where Resident Adult Southwestern Willow Flycatchers were Observed**

| Study Area | Number of Residents |
|---|---|
| Alamo Lake | 119 |
| Bill Williams River National Wildlife Refuge | 1 |
| Topock Marsh | 4 |
| **Total** | **124** |

Nest success was calculated for two southwestern willow flycatcher nests at Topock Marsh that contained flycatcher eggs. Both nests were depredated during the nestling stage, and nest success was 0%. Nest monitoring was only conducted at Topock Marsh.

FY18 obligations exceeded estimates, as the majority of field surveys and project oversight was tied to contract obligations under Work Task D2, including costs incurred for tasks outlined in Work Task F9.

**FY19 Activities:** Presence surveys for southwestern willow flycatchers will be conducted at Topock Marsh, the Bill Williams River, and Alamo Lake. Nest monitoring will be conducted at Topock Marsh.

**Proposed FY20 Activities:** Presence surveys for southwestern willow flycatchers will be conducted at Topock Marsh, the Bill Williams River, and Alamo Lake. Nest monitoring will be conducted at Topock Marsh.

**Pertinent Reports:** The 2018 annual report will be posted on the LCR MSCP website upon completion.

## Work Task D5: Monitoring Avian Productivity and Survivorship

| FY18 Estimates | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $250,000 | $269,757.00 | $3,589,680.22 | $250,000 | $250,000 | $250,000 | $250,000 |

**Contact:** Chris Dodge, (702) 293-8115, cdodge@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** System monitoring of avian species by conducting intensive monitoring of conservation areas and sites that typify current conditions along the lower Colorado River (LCR)

**Conservation Measures:** MRM1 and MRM2 (BEVI, ELOW, GIFL, GIWO, SUTA, VEFL, WIFL, YBCU, and YWAR)

**Location:** Reach 3, Beal Lake Conservation Area (BLCA), Havasu National Wildlife Refuge, Arizona; and Reach 4, Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1)

**Purpose:** To collect intensive, site-specific data on avian species' demographics, physical condition, species composition and diversity, and site persistence at existing and created habitat sites

**Connections with Other Work Tasks (Past and Future):** Data from this work task are used in conjunction with data collected from the system-wide bird monitoring program (D6) to monitor overall bird use of the LCR. Data collected at Monitoring Avian Productivity and Survivorship (MAPS) banding stations located at conservation areas may also be used for post-development monitoring (F2, F9, and F10).

**Project Description:** Under this work task, conservation areas and existing habitat sites along the LCR that represent typical avian riparian habitat will be monitored. Banding allows for the collection of detailed information about avian species' use patterns and demographics, and this site-specific data can be used to characterize habitats and monitor habitat use, population trends, and demographics of avian species along the LCR.

Avian populations throughout the United States, Canada, and Mexico are monitored using the MAPS protocol. Long-term population trend data are collected by conducting intensive banding throughout breeding seasons. Data collected are analyzed by the Institute for Bird Populations, and long-term population trends are determined on a regional and continental level, as the larger database has increased statistical power that cannot be economically duplicated at a site-specific level.

The Bureau of Reclamation established a MAPS banding station at the Cibola NWR Unit #1 Nature Trail in 2002 prior to LCR MSCP implementation. In 2005, an additional station was established on the Havasu National Wildlife Refuge, at the New South Dike, in mixed Fremont cottonwood-saltcedar habitats. These sites provided data from different reaches of the LCR to allow for comparisons among areas more typically found along the LCR and habitat creation sites like the LCR MSCP conservation areas.

**Previous Activities:** MAPS banding along the LCR has been conducted during different seasons since 2000 to provide information on habitat use by birds during the breeding and non-breeding seasons. Color banding target species such as Bell's vireos, yellow warbler, and summer tanager was initiated in August 2008 at the banding sites to monitor site persistence during the breeding and winter banding seasons.

**FY18 Accomplishments:** Banding was conducted at the BLCA and Cibola NWR Unit #1 during summer using the MAPS protocol. Banding is normally conducted once during every 10-day banding period for 5 hours a day, beginning 1/2 hour before sunrise. Only nine sessions were completed in 2018 due to inclement weather. During the breeding season, there were 226 captures at the BLCA and 222 captures at Cibola NWR Unit #1.

Three LCR MSCP species were captured and banded during the MAPS season. At the BLCA, five Bell's vireos, six yellow warblers, and one summer tanager were captured and color banded. One yellow warbler was captured and color banded at Cibola NWR Unit #1.

Two color-banded yellow warblers were recaptured at the BLCA; their initial captures were in 2015 and 2018. There were two color-banded summer tanagers recaptured at the BLCA: one from 2011 and one from 2015. The summer tanager from 2011 was also resighted. At Cibola NWR Unit #1, one ladder-backed woodpecker from 2013 and two from 2015 were recaptured. A Kentucky warbler was captured and banded at the BLCA in June.

**FY19 Activities:** MAPS banding stations will continue to operate at the BLCA and Cibola NWR Unit #1 during the FY19 breeding season. Color banding of LCR MSCP covered species will continue to be implemented to increase the effective recapture rate. A visual identification of a color-banded bird qualifies as a recapture for statistical purposes. An evaluation will be conducted to

identify if the information gathered from the MAPS banding stations is meeting LCR MSCP system-wide and conservation area monitoring needs. If the MAPS stations meet monitoring needs, the sampling intensity (number of stations) will be evaluated.

**Proposed FY20 Activities:** Breeding season monitoring will continue in FY19 based on the recommendations from the project evaluation.

**Pertinent Reports:** The *2018 MAPS Summary Banding Report* will be posted on the LCR MSCP website upon completion.

## Work Task D6: System Monitoring of Riparian Obligate Avian Species

| FY18 Estimates | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $480,000 | $94,088.91 | $2,729,976.71 | $500,000 | $500,000 | $500,000 | $500,000 |

**Contact:** Beth Sabin, (702) 293-8435, lsabin@usbr.gov

**Start Date:** FY06

**Expected Duration:** FY55

**Long-Term Goal:** System monitoring of avian covered species

**Conservation Measures:** MRM1 (BEVI, ELOW, GIFL, GIWO, SUTA, VEFL, and YWAR)

**Location:** LCR MSCP planning area and the Bill Williams River

**Purpose:** To monitor riparian obligate avian species covered under the LCR MSCP in order to document the current population abundance, long-term population trends, habitat use, and distribution within the LCR MSCP planning area and the Bill Williams River

**Connections with Other Work Tasks (Past and Future):** Data collected during post-development monitoring of habitat conservation areas (F2) may also be used under this work task. Information obtained through Work Tasks C24, C36 (closed), and C52 (closed) will be used to help define habitat requirements for riparian obligate bird species and improve the survey methods for monitoring elf owl and gilded flicker breeding populations within the LCR MSCP planning area.

**Project Description:** Riparian habitat along the lower Colorado River and the Bill Williams River below Alamo Dam will be monitored for Arizona Bell's vireos, elf owls, Gila woodpeckers, gilded flickers, Sonoran yellow warblers, summer tanagers, and vermilion flycatchers. It is inefficient to monitor all covered species individually throughout the entire LCR MSCP planning area. Many bird populations can be monitored effectively using multi-species survey protocols. Arizona Bell's vireos, Gila woodpeckers, Sonoran yellow warblers,

summer tanagers, and vermilion flycatchers will be monitored together using standard breeding bird survey methods. Elf owls will be monitored using a species-specific call-playback method. Gilded flickers will be monitored separately during the height of their breeding activity using a similar protocol as the other species and incorporating call-playback. The presence and breeding of the covered species will be documented and analyzed to estimate species' distribution and abundance throughout the lower Colorado and Bill Williams Rivers.

**Previous Activities:** Surveys for Arizona Bell's vireos, Gila woodpeckers, gilded flickers, Sonoran yellow warblers, summer tanagers, and vermilion flycatchers were conducted using random point-count transects from FY05 to FY06 and a double sampling rapid/intensive area search protocol from FY07 to FY15. Surveys were conducted in the riparian habitat of the lower Colorado and Bill Williams Rivers. The surveys from FY07 to FY15 estimated that Arizona Bell's vireos and Sonoran yellow warblers were the LCR MSCP covered bird species with the largest population sizes within the study area, Gila woodpeckers and summer tanagers were present within the study area in lesser numbers, and gilded flickers and vermilion flycatchers were rarely detected. Gilded flickers were only detected breeding along the Bill Williams River east of Planet Ranch. An evaluation of the survey protocol for gilded flickers was initiated under Work Task C52 (closed) to improve the survey method for this species.

Elf owls were monitored separately during the breeding season from FY08 to FY10. Only one elf owl was detected near Blankenship Bend during that 3-year period.

Monitoring methods have been regularly reviewed and improved since FY06 to increase detection of Arizona Bell's vireos, elf owls, Gila woodpeckers, gilded flickers, Sonoran yellow warblers, summer tanagers, and vermilion flycatchers:

- Two weeks were added to the beginning of the field season to more accurately estimate the population of early-nesting species.

- The number of intensive area searches was analyzed to ensure the method was achieving a sufficient census of breeding territories.

- Life history information was gathered for many of the riparian species in the planning area, including more accurate arrival and departure times for migrants, unique calls and songs not previously documented, information about second clutches and renesting attempts, and information about territory sizes.

- The statistical analysis was improved.

- Field crew training was improved.

- Some processes, such as data entry and analyses, were automated.

- An evaluation of the survey protocol for gilded flickers was initiated under Work Task C52 (closed) to improve the survey method for this species.

- An evaluation of the protocol was initiated under Work Tasks C24 and C36 (closed) to improve the survey methods for Arizona Bell's vireos, Gila woodpeckers, Sonoran yellow warblers, summer tanagers, and vermilion flycatchers.

- An evaluation of the monitoring protocol was initiated in FY16 to update the monitoring questions, update the vegetation layer used to define survey plots, and ensure that the size and number of plots are sufficient to address the monitoring questions.

**FY18 Accomplishments:** Development began on mobile electronic field forms for gilded flicker surveys. Reconnaissance surveys were conducted along the Bill Williams River near Planet Ranch to identify future gilded flicker survey locations. No gilded flickers were detected.

The monitoring protocol evaluation for Arizona Bell's vireos, elf owls, Gila woodpeckers, Sonoran yellow warblers, summer tanagers, and vermilion flycatchers continued. The goals and objectives for future system-wide riparian bird monitoring were verified. Work continued on updating the vegetation map and the associated survey plots; evaluating potential analysis and survey methods to determine what methods are the most cost efficient; and analyzing existing data to verify the number of samples to survey and how often they need to be surveyed in order to detect presence of territorial nesting riparian birds and measure their trends. This evaluation of the monitoring protocol for Work Tasks D6 and F2 will ensure that monitoring methods and statistical analyses are meeting the LCR MSCP long-term objectives.

Obligations were less than anticipated as the majority of the monitoring protocol evaluation was funded through Work Task G4.

**FY19 Activities:** System-wide surveys for gilded flickers will be conducted using the point count call-playback method developed under Work Task C52 (closed). Surveys will be conducted in high potential habitat locations along the Bill Williams River NWR and near Parker Dam to identify populations that may colonize created habitat at Planet Ranch and Parker Dam Camp in the future.

The monitoring protocol evaluation for Arizona Bell's vireos, elf owls, Gila woodpeckers, Sonoran yellow warblers, summer tanagers, and vermilion flycatchers will continue. Once complete, a long-term monitoring plan will be

prepared, as well as updated survey protocols and training materials. Refinement of mobile electronic field forms will continue so that all data are collected and summarized in ArcGIS Online.

**Proposed FY20 Activities:** System-wide monitoring to detect the presence and trends of Arizona Bell's vireos, Gila woodpeckers, Sonoran yellow warblers, summer tanagers, and vermilion flycatchers will be conducted. System-wide surveys for the gilded flickers will be conducted in high potential habitat locations along the lower Colorado River to identify populations that may colonize created habitat at LCR MSCP conservation areas. Data and record management activities will continue.

**Pertinent Reports:** The *Lower Colorado River Riparian Bird Surveys, Summary Report, 2011–2015* is posted on the LCR MSCP website.

## Work Task D7: Yellow-billed Cuckoo Presence/ Absence Surveys

| FY18 Estimates | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | F21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $50,000 | $62,281.40 | $6,984,786.34 | $50,000 | $50,000 | $50,000 | $50,000 |

**Contact:** Barbara Raulston, (702) 293-8396, braulston@usbr.gov

**Start Date:** FY06

**Expected Duration:** FY55

**Long-Term Goal:** System-wide monitoring of yellow-billed cuckoos

**Conservation Measures:** MRM1 and MRM2 (YBCU)

**Location:** Protocol-level surveys are conducted in suitable habitat within the LCR MSCP planning area

**Purpose:** To conduct system-wide surveys to monitor yellow-billed cuckoo populations along the lower Colorado River from the Grand Canyon to the Southerly International Boundary with Mexico

**Connections with Other Work Tasks (Past and Future):** Under Work Task C37 (closed), the hydrologic conditions preferred by southwestern willow flycatchers and yellow-billed cuckoos have been measured. Monitoring of yellow-billed cuckoos was split into separate work tasks beginning in FY18, with system-wide monitoring continuing under Work Task D7 and post-development monitoring conducted under Work Task F10.

**Project Description:** Yellow-billed cuckoos use Fremont cottonwood-Goodding's willow (hereafter cottonwood-willow) habitat and may act as an umbrella species for other covered avian species that use these habitats. A standardized survey protocol (issued by the U.S. Fish and Wildlife Service on April 22, 2015) will be used to determine the presence of yellow-billed cuckoos at system-wide sites consisting of cottonwood-willow habitat at least 2 years old.

**Previous Activities:** Yellow-billed cuckoo life history and monitoring studies began in FY06. Prior to the creation of riparian habitats by the LCR MSCP, the only large breeding population of yellow-billed cuckoos was on the Bill Williams River National Wildlife Refuge, with a few scattered pairs elsewhere along the lower Colorado River. The wide-ranging behavior and lack of strict territory

boundaries of yellow-billed cuckoos precludes the confirmation of nesting with surveys alone. Instead, criteria (timing, location, and persistence of all detected yellow-billed cuckoos) defining "possible," "probable," and "confirmed" nesting have been developed based on survey results and observed behaviors of this species. Confirmed breeding of yellow-billed cuckoos has been documented at the Palo Verde Ecological Reserve every year beginning in 2009, with nesting activity documented late into September. Nesting has also been confirmed at the Cibola Valley Conservation Area (2008–14 and 2016), the Cibola National Wildlife Refuge Unit #1 Conservation Area (2010–12 and 2014–18), and at the Beal Lake Conservation Area (2010, 2011, 2013, and 2015). In FY16, the level of effort and scope of the project were reduced. Intensive nest monitoring and capture and banding of birds to document activities of specific individuals was not conducted, as successful breeding and nesting have been documented within LCR MSCP created habitats, and birds have continued to use the habitats for multiple years.

**FY18 Accomplishments:** Followup visits to find cuckoos tagged with geolocator devices in previous years were conducted. Geolocator results over the past 3 years confirmed the migration route and wintering grounds of cuckoos nesting on the LCR. These birds traveled south in fall, along the west coast of mainland Mexico to wintering grounds in the Gran Chaco Forest of southeastern Bolivia and northern Argentina. In spring, they took a more easterly route back through mainland Mexico to the Palo Verde Ecological Reserve.

Yellow-billed cuckoo monitoring data collected from FY14 to FY18 was analyzed in preparation for the 2014–18 summary report. In addition, the scope of yellow-billed cuckoos monitoring from FY19-FY23 was developed. While developing the scope, the quality of system-wide habitat and occupancy potential was reviewed to assess the benefit of conducting system-wide surveys from FY19 to FY29. Cottonwood-willow habitat quality along the Bill Williams River has not recovered from impacts due to drought, and Topock Marsh has not recovered from a fire. Yellow-billed cuckoos continue to utilize created habitat at the LCR MSCP conservation areas and continue to colonize new habitat. LCR MSCP decided to focus monitoring efforts on documenting cuckoo presence at conservation areas under Work Task F10. System-wide habitat will be checked annually to see if habitat conditions improve and whether conducting yellow-billed cuckoo surveys at those areas could benefit the LCR MSCP. A sampled design or rotating schedule will be considered in the future to reduce annual costs.

**Proposed FY19 Activities:** System-wide yellow-billed cuckoo presence/absence surveys are not scheduled in FY19. Habitat conditions within the Bill Williams River National Wildlife Refuge and Topock Marsh will be assessed.

**Proposed FY20 Activities:** System-wide yellow-billed cuckoo presence/absence surveys are not scheduled in FY20. System-wide cottonwood-willow habitat will be checked to see if conditions improve and whether conducting yellow-billed cuckoo surveys at those areas could benefit the LCR MSCP.

**Pertinent Reports:** The *Yellow-billed Cuckoo Surveys on the Lower Colorado River, 2017 Annual Report* is posted on the LCR MSCP website. The 2014–18 summary report will also be posted upon completion.

## Work Task D8: Razorback Sucker and Bonytail Stock Assessment

| FY18 Estimate | F18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $925,000 | $1,043,344.18 | $8,469,354.63 | $1,125,000 | $1,125,000 | $1,125,000 | $1,125,000 |

**Contact:** Jim Stolberg, (702) 293-8206, jstolberg@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Conduct long-term system monitoring of razorback suckers and bonytail

**Conservation Measures:** BONY5 and RASU6

**Location:** The lower Colorado River within the LCR MSCP planning area, including reservoirs and connected channels, from Lake Mead downstream to Imperial Dam

**Purpose:** To supplement and maintain sufficient knowledge and understanding of razorback sucker and bonytail populations within the LCR MSCP planning area in order to have an effective Adaptive Management Program

**Connections with Other Work Tasks (Past and Future):** Monitoring data for razorback suckers and bonytail have been, or will be, acquired from work accomplished under Work Tasks C8 (closed), C12 (closed), C13 (closed), C15 (closed), F5, and G3.

**Project Description:** Under this work task, razorback sucker and bonytail population and distribution data will be collected and organized to maintain up-to-date, system-wide, stock assessments for these species. Data acquisition work is accomplished by one of two strategies: (1) gleaning information from ongoing fish monitoring and fish research activities and (2) direct data collection through field surveys within the LCR MSCP planning area not covered under other work tasks. Additionally, as short-term research activities are completed under separate work tasks, a portion of those activities may transition into or be included as part of ongoing, long-term monitoring projects under this work task.

Work routinely includes trammel netting and electrofishing, but visual surveys and surveys using specialized equipment and techniques (e.g., scuba divers,

underwater photography, and video recordings) are also conducted periodically. Funding described under this work task provides for all costs associated with conducting field surveys, including salaries, travel, and materials necessary to accomplish this work. Funding for monitoring agreements, gleaning, or capturing data from ongoing research actions and monitoring programs; transferring the data into record archives; and organizing the data into a cohesive report is also provided under this work task.

**Previous Activities:** Fall fish surveys on Lake Mead have been conducted since 1999 in cooperation with the Arizona Game and Fish Department and Nevada Department of Wildlife. The Bureau of Reclamation has also participated in interagency cooperative native fish roundups on Lake Mohave since 1987 and on Lake Havasu (including the river reach below Davis Dam) since 1999. This participation has continued under the LCR MSCP, beginning in 2005, when the program was implemented. Additional monitoring of native fish populations outside of these annual events has also been conducted under this work task, as short-term research activities have transitioned into long-term monitoring projects.

**FY18 Accomplishments:** Accomplishments for this work task have been summarized by river reach.

**Reach 1:** Wild-born razorback sucker larvae collection took place at all major spawning sites (Las Vegas Bay, Echo Bay, and the Muddy River/Virgin River inflow) over the course of the spawning season. A total of 2,117 larvae were captured, with 1,980 larvae from Las Vegas Bay, 136 larvae from Echo Bay, and 1 larva from the Muddy River/Virgin River inflow area. The majority of larvae were returned to the lake following each sampling period, as razorback sucker larval abundance was primarily used only as a means of identifying spawning locations during the FY18 field season.

Monitoring of the Lake Mead adult razorback sucker population also continued in FY18. Seven sonic-tagged fish were contacted and monitored throughout the year using active (manual tracking) and passive (stationary submersible ultrasonic receivers) telemetry. Sonic-tagged fish provided the general location of razorback sucker populations and spawning sites, habitat association data within the long-term monitoring study area, and lake-wide and seasonal movement patterns within and among spawning areas. Trammel netting conducted during the spawning season resulted in the capture of 64 razorback suckers: 8 from Las Vegas Bay, 13 from Echo Bay, 24 from the Muddy River/Virgin River inflow, and 19 from the Colorado River inflow area. Of the 64 razorback suckers captured, 30 were recaptured fish. The remaining razorback suckers captured were untagged, presumed to be wild-spawned, and included two juvenile fish. Based on capture data, the razorback sucker population in Lake Mead was estimated at 360 individuals (95% confidence interval [CI] from 289 to 470) in FY18. Aging information was also obtained from 26 razorback suckers

during the 2018 study year, bringing the total number of razorback suckers aged lake-wide to 596. The ages of wild razorback suckers captured from all monitoring areas in 2018 ranged from 4 to 14 years old.

**Reach 2:** A total of 3,107 razorback suckers were repatriated into Lake Mohave in FY18. A total of 513 bonytail were also released into Lake Mohave, 20 of which were sonic tagged as part of ongoing research being carried out under Work Task C64.

Annual razorback sucker roundups were conducted in December and March. During these efforts, 187 razorback suckers were captured using trammel nets. Five additional razorback suckers were captured during April gill net surveys. Electrofishing surveys were conducted in the river section of Lake Mohave above the Willow Beach National Fish Hatchery (Willow Beach NFH) in October through December and again in June through September, resulting in the capture of 91 razorback suckers. The use of remote sensing, which was expanded in 2011 to include the lotic portion of Lake Mohave upstream of the Willow Beach NFH, was also continued. Continued improvements in remote passive integrated transponder (PIT) tag antenna design have allowed for sampling in the high flow conditions of that reach, thereby contacting a large number of razorback suckers that had been previously undetected through other sampling methods.

In FY18, remote PIT scanning recorded 131,131 contacts throughout Lake Mohave. In the river section of the lake above the Willow Beach NFH, 9,280 hours of scan time resulted in 33,781 total contacts representing 2,118 unique PIT tags. In the basin section of Lake Mohave, an effort of 22,737 hours of scan time resulted in 97,274 contacts representing 1,976 unique PIT tags. Supplemental scanning was also conducted in the Liberty Cove to Chalk Cliffs area of the lake, with 5,885 hours of scan time resulting in 76 total contacts representing 42 unique PIT tags. After duplicate PIT tags contacted in multiple lake sections were removed from analyses, 3,835 unique fish were contacted in 37,903 hours of scan time during FY18. This is a 3% increase over the 3,707 unique PIT tags contacted in 54,850 hours of scan time in 2017.

The razorback sucker population in Lake Mohave was estimated from two data sources in FY18: (1) trammel net capture data obtained during the annual, multi-agency March roundup and (2) remote PIT scanning data collected during the sample year. Based on trammel net data from the FY18 field season, the repatriate population estimate for the basin section of Lake Mohave was 841 (95% CI from 694 to 4,487). Based on 2017–18 remote PIT scanning, the lake-wide Lake Mohave repatriate population was estimated at 3,471 individuals (95% CI from 3,365 to 3,576). Subpopulation estimates using zone-specific scanning were also calculated and estimated the basin (River Miles 13–29) population at 1,872 (95% CI from 1,804 to 1,940) and the river (River Mile 43–63) population at 2,093 (95% CI from 1,966 to 2,220).

**Reach 3:** A total of 6,471 razorback suckers and 4,061 bonytail were released into Reach 3 during FY18; all fishes were released with a PIT tag.

Capture/contact data were acquired through Work Tasks C53, C65, F5, ongoing multi-agency native fish roundups, and from other annual surveys conducted by LCR MSCP partners. Fall and spring netting surveys were conducted throughout Topock Gorge and lower Lake Havasu.

All survey methods conducted in Reach 3 in FY18 resulted in 3,371 unique razorback suckers, 225 bonytail, and 9 flannelmouth sucker contacts. Reach 3 had a razorback sucker population estimate of 3,803 (95% CI from 3,616 to 4,024). This population estimate is lower than previous estimates due to a change in how it is calculated. The LCR MSCP has adopted new criteria for calculating population estimates in order to minimize a potential bias toward recently released fishes. Bonytail contacts are rare in this reach and typically only occur for the first several months post-release.

**Reaches 4 and 5:** A total of 6,266 razorback suckers and 8,039 bonytail were stocked into Reaches 4 and 5 during FY18; all fishes were released with a PIT tag.

Capture/contact data for Reaches 4 and 5 are obtained primarily through work being conducted under Work Task C64. Supplemental scanning and electrofishing is conducted in an effort to increase contacts and locate potential spawning aggregates.

In FY18, 1,234 unique razorback suckers and 535 unique bonytail were contacted. Electrofishing was conducted from the I-10 Bridge to the wash fans below the C-10 backwater; no spawning aggregations were detected, but one adult male razorback was contacted. Data from FY17 and FY18 were used to generate a razorback sucker population estimate of 169 individuals (95% CI from 157 to 180). There were not enough bonytail contacts to generate a population estimate.

**FY19 Activities:** Monitoring data will be collected for Reaches 1–5. Information will be gleaned from ongoing fish research activities as well as through fish monitoring field work. Field work will include trammel netting, electrofishing, remote sensing of PIT-tagged fishes, and active and passive tracking of sonic-tagged fishes. Genetic monitoring of native fish species will be reported under this work task in FY19.

**Proposed FY20 Activities:** Monitoring efforts will continue in all river reaches as previously outlined, and participation in multi-agency field surveys will continue. As research-based work tasks are completed in Reaches 1–5, gaps in native fish community sampling data are expected. Efforts under Work Task D8 will fill a portion of these gaps by maintaining the appropriate level of system-wide monitoring of native fishes in the lower Colorado River for the 50-year term of the LCR MSCP. An evaluation of the razorback sucker and

bonytail sampling design will be initiated after receiving the results of the genetic review (Work Task G4). The continuation of genetic monitoring of native fish species will be accomplished under Work Task D15 beginning in FY20.

**Pertinent Reports:** The *Razorback Sucker Studies on Lake Mead, Nevada and Arizona 2017–2018 Final Annual Report* and the *Demographics and Monitoring of Repatriated Razorback Sucker in Lake Mohave 2018–Annual Report* will be posted on the LCR MSCP website following review.

## Work Task D9: System Monitoring of Covered Bat Species

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $140,000 | $129,056.63 | $2,466,618.17 | $100,000 | $100,000 | $100,000 | $100,000 |

**Contact:** Carrie Ronning, (702) 293-8106, cronning@usbr.gov

**Start Date:** FY04

**Expected Duration:** FY55

**Long-Term Goal:** System-wide monitoring and species research will be conducted for LCR MSCP bat species in order to monitor distribution and evaluate habitat implementation success (FY04–17), and system-wide monitoring and species research will be conducted for LCR MSCP bat species in order to monitor their distribution (FY18–55).

**Conservation Measures:** MRM1 (CLNB, PTBB, WRBA, and WYBA), WRBA1, and WYBA1

**Location:** System-wide along the lower Colorado River (LCR) below Hoover Dam

**Purpose:** To conduct system-wide monitoring of covered bat species to document their habitat use

**Connections with Other Work Tasks (Past and Future):** System-wide monitoring data will be used in conjunction with post-development monitoring (F4) in order to document habitat use of covered bat species.

**Project Description:** Covered and evaluation bat species will be monitored along the LCR to document their presence and habitat use. Acoustic surveys will be used to document their presence in existing riparian habitats. Roost surveys will be conducted to track bat populations and to survey species such as the pale Townsend's big-eared bat and California leaf-nosed bat, which are not readily detected by acoustic technology. Individual bats will be captured using techniques such as mist netting to obtain reference calls for bat identification and to verify reproductive status.

**Previous Activities:** An LCR bat monitoring protocol was produced to assist in the development of a system-wide distribution and demography monitoring plan for covered bat species.

Presence was monitored using acoustic monitoring stations along the LCR from FY02 to FY16. Individual bats were captured from FY07 to FY16 using techniques such as mist netting to obtain reference calls for bat identification and to verify species' presence, reproductive status, and demographics along the river.

Surveys were conducted from FY02 to FY16 to identify pale Townsend's big-eared bat and California leaf-nosed bat roost sites along the LCR MSCP planning area (to fulfill conservation measures CLBN1 and PTBB1) and to learn more about the species' distribution and habitat. An inventory of all bats banded at mines and foraging habitat along the LCR from 1958 to 2016 was compiled.

A foraging distance study was conducted to further clarify if habitat created within 5 miles of California leaf-nosed bat roosts (CLNB1) and within 10 miles of pale Townsend's big-eared bat roosts (PTBB1) could be used for foraging. California leaf-nosed bat males were observed during the study flew at least 10.3 miles between roost and foraging areas, while females flew at least 8.7 miles. The maximum straight line distance that a pale Townsend's big-eared bat was tracked was 9.5 miles. Although distances were reported as straight lines, the total travel distance was often much longer, including one California leaf-nosed bat with a minimum travel distance of 50 miles in 4.5 hours and a pale Townsend's big-eared bat that was tracked for 10.8 miles.

The results of acoustic monitoring data from FY17 were:

- Western red bats and California leaf-nosed bats were detected at all five acoustic monitoring stations.

- Western yellow bats were detected at Havasu National Wildlife Refuge-Pintail Slough, the Cibola National Wildlife Refuge-Island Unit, the Picacho State Recreation Area, and the Mittry Lake Wildlife Area, but they were not detected at the Bill Williams National Wildlife Refuge (Bill Williams River NWR) station.

- No pale Townsend's big-eared bat calls were recorded during FY17.

**FY18 Accomplishments:** The five permanent acoustic monitoring stations were operated from June to August in order to detect bat presence. The stations were located at Havasu National Wildlife Refuge-Pintail Slough, the Bill Williams River NWR, the Cibola National Wildlife Refuge-Island Unit, the Picacho State Recreation Area, and the Mittry Lake Wildlife Area.

- Western red bats were detected at all five acoustic monitoring stations.

- Western yellow bats were detected at Havasu National Wildlife Refuge-Pintail Slough, the Bill Williams River NWR, the Cibola National Wildlife Refuge-Island Unit, and the Mittry Lake Wildlife Area, but they were not detected at the Picacho State Recreation Area.

- California leaf-nosed bats were detected at the Bill Williams River NWR, the Cibola National Wildlife Refuge-Island Unit, the Picacho State Recreation Area, and the Mittry Lake Wildlife Area, but they were not detected at Havasu National Wildlife Refuge-Pintail Slough.

- Pale Townsend's big-eared bat calls were only detected at the Bill Williams River NWR.

**FY19 Activities:** The acoustic stations at the 'Ahakhav Tribal Preserve, Yuma East Wetlands, and Hunters Hole previously monitored under Work Task F4 will be reassigned to the Work Task D9 system-wide monitoring network in FY19, as the 'Ahakhav Tribal Preserve is not on a LCR MSCP conservation area, and Yuma East Wetlands and Hunters Hole are located outside creditable Reaches 3–5.

The eight permanent acoustic monitoring stations will be operated along the LCR. Data will be collected and analyzed for covered and evaluation species presence during the summer peak activity periods. Monitoring will occur at Havasu National Wildlife Refuge-Pintail Slough, the Bill Williams River NWR, the 'Ahakhav Tribal Preserve, the Cibola National Wildlife Refuge-Island Unit, the Picacho State Recreation Area, the Mittry Lake Wildlife Area, Yuma East Wetlands, and Hunters Hole.

**Proposed FY20 Activities:** The eight permanent acoustic monitoring stations will continue to operate, and data will be analyzed for covered and evaluation species presence during the summer peak activity periods. Bat captures may be conducted to validate the presence of covered and evaluation species.

**Pertinent Reports:** The report titled *2017 System-Wide Acoustic Monitoring of LCR MSCP Bat Species* is posted on the LCR MSCP website. The 2018 report will also be posted upon completion.

## Work Task D10: System Monitoring of Rodent Populations

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $40,000 | $31,374.56 | $320,302.97 | $40,000 | $0 | $0 | $0 |

**Contact:** Jeff Hill, (702) 293-8163, jhill@usbr.gov

**Start Date:** FY11

**Expected Duration:** FY20

**Long-Term Goal:** System-wide monitoring to document the presence of possible source populations of LCR MSCP covered rodents along the lower Colorado River (LCR)

**Conservation Measures:** CRCR1, MRM1 (DPMO), MRM2 (CRCR, DPMO, and YHCR), and YHCR1

**Location:** System-wide along the LCR, including the Bill Williams River

**Purpose:** The purpose of this work task is to conduct presence surveys of Colorado River cotton rats, Yuma hispid cotton rats, and desert pocket mice within existing habitat along the LCR.

**Connections with Other Work Tasks (Past and Future):** System-wide monitoring will be used in conjunction with post-development monitoring (F3) and small mammal research (C27 [closed]) to document habitat at capture locations.

**Project Description:** Surveys will be conducted to detect the presence of Colorado River cotton rats, Yuma hispid cotton rats, and desert pocket mice within selected areas that have potential habitat along the LCR. Surveys may be conducted in the extreme edges of each species' range in an attempt to document the outer limits of their respective distributions within the LCR MSCP planning area.

**Previous Activities:** Presence surveys were conducted in potential Colorado River and Yuma hispid cotton rat habitat within the LCR MSCP planning area from FY11 to FY17 to document each species' range and to collect genetic samples.

Colorado River cotton rats were detected in Reaches 3–4, and Yuma hispid cotton rats were detected in Reaches 6–7. Desert pocket mice were detected at many survey areas, but the subspecies cannot be determined.

**FY18 Accomplishments:** Rodent live trapping surveys were conducted at an island in the Picacho State Recreation Area to document the presence of Yuma hispid cotton rats in this portion of the watershed. The area is approximately 24 miles north of Yuma, Arizona. No cotton rats or desert pocket mice were captured at the system-wide monitoring site. No system-wide surveys were conducted for Colorado River cotton rats in FY18.

**FY19 Activities:** System-wide surveys will be conducted to detect the presence of Yuma hispid cotton rats within marsh areas at Yuma East Wetlands to determine if this species can be found in other land cover types with the right structure. Conservation measure YHCR1 only includes the cottonwood-willow land cover type, but it is possible that this species may use marsh vegetation like Colorado River cotton rats. This work task will close in FY19. Monitoring will continue at LCR MSCP conservation areas under Work Task F3.

**Proposed FY20 Activities:** This work task will be closed in FY19.

**Pertinent Reports:** The spring 2016 and FY17 reports are posted on the LCR MSCP website. The FY18 annual report will also be posted upon completion.

## Work Task D14: System-Wide Monitoring of MacNeill's Sootywing Skippers

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $0 | $0 | $0 | $20,000 | $20,000 | $20,000 | $0 |

**Contact:** Carrie Ronning, (702) 293-8106, cronning@usbr.gov

**Start Date:** FY19

**Expected Duration:** FY21

**Long-Term Goal:** System-wide monitoring of MacNeill's sootywing skippers (sootywings)

**Conservation Measures:** MNSW1

**Location:** Existing habitat in Reaches 1–7, including conservation areas created in Reaches 5–7, which are not creditable under conservation measure MNSW2

**Purpose:** To monitor the presence of sootywing, vegetation, and plant quality in cottonwood-willow habitat along the lower Colorado River to inform management of creditable habitat

**Connections with Other Work Tasks (Past and Future):** Habitat requirements were studied under Work Task C7 (closed) and Work Task F6. Sootywing presence at conservation areas and system-wide habitats were monitored under Work Task F6.

**Project Description:** Sootywings can be found in many land cover types along the lower Colorado River if quailbush are present. Under this work task, the LCR MSCP will monitor for presence and habitat use of sootywings to document their presence in association with varying irrigation amounts to identify the range of irrigation that maintains quailbush occupied by this species.

**Previous Activities:** This is a new start in FY19.

**FY18 Accomplishments:** This is a new start in FY19.

**FY19 Activities:** Riparian areas with a quailbush component will be surveyed for the presence of sootywings during March, April, May, and June. If sootywings are detected before the June survey, surveys in the remaining months will not be conducted.

**Proposed FY20 Activities:** Riparian areas with a quailbush component will be surveyed for the presence of sootywings during March, April, May, and June. If sootywings are detected before the June survey, surveys in the remaining months will not be conducted.

**Pertinent Reports:** Annual reports will be posted on the LCR MSCP website upon completion.

## Work Task D15: Genetic Monitoring and Management of Native Fish Populations

| FY18 Estimate | FY18 Actual Obligations | Cumulative Accomplishment Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $0 | $0 | $0 | $0 | $600,000 | $600,000 | $400,000 |

**Contact:** Jeff Lantow, (702) 293-8557, jlantow@usbr.gov

**Start Date:** FY20

**Expected Duration:** FY55

**Long-Term Goal:** Maintain the genetic quality of razorback suckers used by the LCR MSCP for fish augmentation and guide genetic management of native fish populations in backwater habitats developed by the LCR MSCP

**Conservation Measures:** BONY2, BONY5, RASU2, RASU3, RASU5, and RASU6

**Location:** Reaches 1–6 of the LCR MSCP planning area

**Purpose:** To monitor the genetic composition and implement a long-term genetic management program for native fishes

**Connections with Other Work Tasks (Past and Future):** This work task is related to Fish Augmentation (Section B), previously completed genetic research under Work Tasks C31, C40, and G3, and ongoing research and monitoring work that includes the collection of larval fish and tissue samples from adult native fishes (Work Tasks C64, D8, and F5).

**Project Description:** The genetic structure of native fish communities in hatcheries, reservoirs, river reaches, and off-channel habitats within the lower Colorado River will be monitored, and the various stocks will be characterized, compared to source or founder populations, and managed through augmentation. The annual production and stocking of large numbers of native fishes under the LCR MSCP Fish Augmentation Program has the potential to change the genetic diversity of resident populations in a short period of time, so it will be necessary to monitor the genetic structure of the various native fish communities over many years in order to detect changes in genetic diversity and guide genetic management as these populations mature.

Under this work task, the use of new genotyping methods will be expanded, a central repository for tissue samples will be established and maintained, and a widely accessible genetic database will be developed. Larval fish and tissue samples from adults will be collected and preserved from each stock during numerous annual surveys and Lake Mohave larvae collections. These samples will be delivered to a genetics research laboratory for analyses using newly developed genetic markers – single nucleotide polymorphisms (SNPs; "snips"). The development of SNPs as genetic markers for native fishes began in FY17 (Work Task G3), and initial analyses were completed the following year under Work Task C40. This genotyping method provides considerably more power over the use of microsatellites in estimating genetic similarity and evaluating demographic aspects of populations. The results of genetic analyses will be used to determine the genetic health of native fish communities, assess the effectiveness of the LCR MSCP Fish Augmentation Program, assess the effectiveness of the Lake Mohave repatriation effort, and inform management of the populations developing in newly constructed floodplain habitats within the LCR MSCP planning area. Information gleaned from these analyses will be used to model a population structure within isolated habitats over subsequent generations and to predict at what frequency genetic material needs to be exchanged between razorback sucker and bonytail populations to maintain the overall diversity within the LCR MSCP planning area.

**Previous Activities:** This will be a new start in FY20.

**FY18 Accomplishments:** This will be a new start in FY20.

**FY19 Activities:** This will be a new start in FY20.

**Proposed FY20 Activities:** The genetic structure of native fish communities will continue to be monitored. It is anticipated that a protocol for genotyping approximately 300 SNP loci of each native fish species will be developed, and inheritance of SNP markers will be confirmed through parent-offspring analyses. To facilitate future genetic analyses of numerous and diverse population samples, a central tissue archive and genetic database will be designed. The archive will consolidate and catalog existing samples and associated collection data and will be linked to associated genetic information in the database. The database will incorporate both historic and new genotypic data and store genetic profiles of each individual sampled. The scope of this work task may be further defined in FY20.

**Pertinent Reports:** N/A

# WORK TASKS – SECTION E

Conservation Area Development and Management

## Work Task E1: Beal Lake Conservation Area

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $250,000 | $220,524.14 | $4,627,611.10 | $900,000 | $900,000 | $750,000 | $400,000 |

**Contact:** Laken Anderson, (702) 293-8153, landerson@usbr.gov

**Start Date:** FY04

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BEVI1, BONY2, CRCR2, ELOW1, GIFL1, GIWO1, MNSW2, NMGS1, RASU2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

**Location:** Reach 3, Havasu National Wildlife Refuge, Arizona, 0.5 mile east of River Miles 238 and 239

**Purpose:** To create and manage a mosaic of native land cover types for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** This work task and Work Task E2 (closed) have been combined into a single work task: Work Task E1 – Beal Lake Conservation Area (BLCA). Vegetation and species monitoring are being addressed under Section F work tasks. Portions of restoration research at the BLCA have been funded under Work Task G3.

**Project Description:** The BLCA was established on lands made available by the U.S. Fish and Wildlife Service on the Havasu National Wildlife Refuge. The 225-acre disconnected backwater is managed for native fishes, and the adjacent 119 acres of cottonwood-willow habitat areas are managed for LCR MSCP covered species.

**Annual Maintenance and Management:**

*Cottonwood-Willow*: Irrigation is provided to the riparian fields from March through mid-September using a diesel-powered pump and a series of alfalfa valves, which deliver water to individual cells. The system requires onsite personnel to fuel, start, and maintain the pump as well as to manually open and close the valves. The swale receives surface water from Topock Marsh through a

gravity flow connection but can also be managed with the diesel-powered pump. Access roads through the conservation area are bladed and maintained with type-2 road base.

*Beal Lake*: Maintenance and manual cleaning of the screens that allow surface flows to move from Topock Marsh into Beal Lake occur biweekly from March to mid-September. In 2017, the downstream wedge-wire screen was replaced with a small mammal screen during the annual removal and cleaning process. This new maintenance strategy has resulted in a 1-foot increase in water surface elevation of Beal Lake. Water surface elevations within Beal Lake and Topock Marsh are monitored using the established gauging stations, which can be accessed remotely. A series of water control structures, which have been installed to allow connection to, or isolation of, Beal Lake from Topock Marsh, require annual maintenance. Using these structures, the lake can also be drawn down for fisheries or salinity management using either a dewatering system installed at the south end of the lake or the diesel-powered pump.

**Previous Activities:** Beal Lake was a 225-acre shallow, low-quality aquatic habitat that was dredged in 2001 and stocked with native fishes. Management of the lake is a continuation of the commitment to construct habitat for native fishes under the 1997 Biological and Conference Opinion. Continued maintenance and management obligations for the lake, as well as research and development of the backwater as native fish habitat, were subsumed by the LCR MSCP in 2005. Adjacent riparian habitat was restored as a habitat demonstration area in 2001 and resulted in 119 acres of the cottonwood-willow cover type. In 2010, the Beal Lake riparian (E1) and backwater (E2 [closed]) work tasks were combined when the Steering Committee formally adopted the work tasks as the Beal Lake Conservation Area. This area includes both the 225-acre backwater and 119 acres of cottonwood-willow habitat, including a mosaic of cottonwood-willow, honey mesquite, and marsh.

*Cottonwood-Willow*: The riparian area has been irrigated and managed since 2001.

*Beal Lake*: Previous native fish stockings had maintained a population of approximately 100 razorback suckers. However, a fishkill was observed in February 2013 after a golden algae outbreak. There were no detections of any fishes while using electrofishing or remote passive integrated transponder scanning surveys for several months following the toxic algae event. By mid-summer, young-of-year largemouth bass were observed in the backwater. The backwater was hydrologically isolated from Topock Marsh following the fishkill; this closure resulted in a rapid increase in specific conductivity, which approached 11,000 microsiemens per centimeter (µS/cm) in FY14. Conductivity decreased to nearly 6,000 µS/cm after the lake was reconnected to Topock Marsh in FY15, and it has been maintained at approximately 2,200 µS/cm since FY16. Since 2013,

native fishes have not been contacted in the lake, and native fish stockings have not yet resumed. The lake has been monitored monthly, and no golden algae have been detected since May 2013.

## FY18 Accomplishments:

**Maintenance and Management:** Routine maintenance and management of the cottonwood-willow and Beal Lake were completed; however, the interior and levee road maintenance activities were conducted in 2018, resulting in obligations being less than estimated.

*Cottonwood-Willow*: A total of 1,159 acre-feet of water was delivered to the BLCA (119 acres) and included an annual flush for salinity control in February.

*Beal Lake*: A drawdown of Beal Lake was conducted in February 2018 using the existing pump stand, which eliminated the need to bring in a large portable pump, reducing obligations. During the drawdown, the four upstream wedge-wire screens on the Beal Lake rock structure were removed, pressure washed, and reinstalled. The downstream cages, which were placed to exclude small mammals from the culverts in the rock structure, were also checked and cleaned.

**Restoration:**

*Cottonwood-Willow*: A Land Use Agreement was signed with the U.S. Fish and Wildlife Service to expand the BLCA to approximately 1,000 acres. The habitat creation concept includes establishing approximately 300–400 acres of additional cottonwood-willow, honey mesquite, and marsh land cover types to be managed for LCR MSCP covered species. This would include areas that can be flood irrigated as well as areas that would take advantage of the high water table. Honey mesquite, in addition to cottonwood-willow areas planted in low densities, will only be irrigated until their roots can reach the water table. Cottonwood-willow areas planted in high density will be flood irrigated to create moist soil conditions. Three shallow groundwater wells were used to track depth to groundwater within the expansion area.

*Beal Lake:* National Environmental Policy Act compliance for dredging of Beal Lake was completed. A U.S. Army Corps of Engineers Section 404 Clean Water Act Permit and a Section 10 Rivers and Harbors Act Permit were obtained.

**Monitoring:**

*Cottonwood-Willow*: Vegetation data were collected using light detection and ranging (lidar) remote sensing techniques. Monitoring stations as part of the salinity and soil moisture monitoring network were installed during FY18 to

assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health.

Riparian bird surveys were conducted between April 10 and June 5 using the LCR MSCP's double sampling protocol. Arizona Bell's vireos and Sonoran yellow warblers were confirmed breeding. Avian mist netting following the Monitoring Avian Productivity and Survivorship protocol was conducted from early May to early August. Five Arizona Bell's vireos, six Sonoran yellow warblers, and one summer tanager were captured and color banded. In addition, two Sonoran yellow warblers and two summer tanagers that were banded in prior years were recaptured. Southwestern willow flycatcher surveys were conducted between May 15 and July 17, and no resident or breeding individuals were detected. Yellow-billed cuckoo surveys were conducted between late June and early August. Yellow-billed cuckoos were detected, and one pair was confirmed breeding.

A long-term acoustic bat station detected the presence of LCR MSCP bat species from June to August. Western red bats, western yellow bats, and California leaf-nosed bats were detected.

Rodent trapping was conducted in fall and spring. No Colorado River cotton rats were captured, but desert pocket mice were captured (possibly the *sobrinus* subspecies based on range).

*Beal Lake*: Water quality and native fish monitoring were not conducted in FY18 and have been postponed until dredging activities are completed in FY21.

Marsh bird surveys were conducted on three occasions in March and April. Western least bitterns were detected and are presumed to be breeding at the site.

**FY19 Activities:** Routine maintenance and management of the cottonwood-willow and Beal Lake is ongoing.

**Maintenance and Management:**

*Cottonwood-Willow*: Riparian fields will be irrigated from March through September and in January to manage salinity.

*Beal Lake*: The annual removal, cleaning, and replacement of the wedge-wire screens along the rock structure were conducted in Beal Lake's unlined ditch in January 2019.

**Restoration:**

*Cottonwood-Willow*: National Environmental Policy Act compliance, a Cultural Class III Pedestrian Survey, and a preliminary wetlands delineation are being conducted on the expansion area. Transects were cleared to allow access for soil sampling and installation of groundwater monitoring wells within the expansion area. Development of a conceptual design for restoration of the expansion area in coordination with the U.S. Fish and Wildlife Service is anticipated.

*Beal Lake:* Renovations of Beal Lake will begin in order to increase its depth. Dredging of between 250,000 and 450,000 cubic yards is authorized under a Clean Water Act nationwide permit and is scheduled to begin in April. To facilitate access to the lake, a launching site was built, and the inlet canal was widened using land-based equipment.

**Monitoring:**

*Cottonwood-Willow*: Vegetation data will be collected using lidar remote sensing techniques. Additional monitoring stations will be added to the salinity and soil moisture monitoring network to collect baseline data in the expansion area. Data from the existing monitoring stations will be used to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. General bird surveys will be conducted from April to June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Avian mist netting will be conducted from May to August. Bat acoustic monitoring will be conducted during summer. Rodent monitoring will be conducted in fall and spring.

*Beal Lake*: Monitoring activities at Beal Lake will be focused on marsh bird surveys in March and April to detect possible presence of Yuma clapper rails prior to dredging activities. Water quality and native fish monitoring have been postponed until dredging activities are completed in FY21.

## Proposed FY20 Activities:

**Maintenance and Management:** Routine maintenance and management of the cottonwood-willow and Beal Lake is planned.

*Cottonwood-Willow*: Riparian fields will be irrigated from March through September and in January to manage salinity.

*Beal Lake*: Maintenance, cleaning, and rotation of the wedge-wire screens within the unlined ditch are anticipated.

**Restoration:**

*Cottonwood-Willow*: Design, permitting, and compliance activities are expected to be completed in FY20. Control of saltcedar in the recently burned portions of the expansion area is planned in order to reduce sprouting. Fire breaks may also be created to allow for controlled burns, which will reduce the biomass of the existing saltcedar within the expansion area.

*Beal Lake:* Dredging is anticipated to be completed in FY21. When completed, approximately 40 acres of the lake will have been deepened, with a goal of obtaining a depth of 12 feet.

**Monitoring:**

*Cottonwood-Willow*: Vegetation data will be collected using lidar remote sensing techniques. The data collected from the salinity and soil moisture monitoring network will be used to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. General bird surveys will be conducted from April to June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Avian mist netting will be conducted from May to August. Bat acoustic monitoring will be conducted during summer. Rodent monitoring will be conducted in fall and spring.

*Beal Lake*: No monitoring will be conducted; it will resume following dredging activities.

**Pertinent Reports:** The 2014–17 annual reports are posted on the LCR MSCP website. The *2018 Beal Lake Conservation Area Annual Report* will also be posted once all data are available.

## Work Task E4: Palo Verde Ecological Reserve

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $600,000 | $644,951.71 | $10,712,137.86 | $500,000 | $650,000 | $650,000 | $650,000 |

**Contact:** Andrea Finnegan, (702) 293-8203, afinnegan@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BEVI1, CRCR2, ELOW1, GIFL1, GIWO1, MNSW2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

**Location:** Reach 4, River Miles 129–133, California

**Purpose:** To create and manage a mosaic of native land cover types for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** Vegetation and species monitoring are being addressed under Section C and Section F work tasks.

**Project Description:** The Palo Verde Ecological Reserve (PVER) encompasses more than 1,300 acres. This property has been made available for LCR MSCP habitat restoration activities by the California Department of Fish and Wildlife. Development of the project is intended to satisfy both the LCR MSCP Habitat Conservation Plan requirements and California Endangered Species Act Incidental Take Permit No. 2081-2005-008-06.

The eastern boundary of the property (more than 4 miles) is adjacent to the Colorado River, and the western boundary is adjacent to active agricultural fields. The PVER has an extensive infrastructure consisting of miles of lined irrigation ditches, roads, and a pump. Each year, a portion of the active crop acreage was taken out of production to develop the next phase of native habitat. The intent was to create as much riparian habitat as practical. Generally, all phases at the PVER are targeted for southwestern willow flycatchers, yellow-billed cuckoos, and other covered species. The final phase was planted in FY13. The Palo Verde Irrigation District (PVID) provides water to the PVER. Since the California

Department of Fish and Wildlife manages a portion of the PVER for their purposes, the costs associated with irrigation, electricity, and water is proportional to the amount of acreage that has been converted to habitat.

Riparian planting has resulted in the establishment of 945 acres of cottonwood-willow and 78 acres of honey mesquite, which are both managed for LCR MSCP covered species.

**Annual Maintenance and Management:** A local farmer irrigates the various phases based on site conditions and species planted. This provides local knowledge of weather and farming practices, which are applied to the management of the conservation area. The farmer and his employees are an onsite presence and provide early recognition of issues or concerns. The farmer is also responsible for assessing the water needs of the trees and, in coordination with the PVID and the LCR MSCP, orders and delivers the water. Removal of vegetation along the roadside and ditches is typically performed quarterly to reduce the potential of wildfires and is done in conjunction with maintenance of the irrigation canals, gates, and roads.

The annual costs associated with operating the PVER within the PVID, such as water taxes, water tolls, electrical power utility bills, and assessments for district operation, are included in the annual maintenance costs.

*Cottonwood-Willow*: Water is ordered through and provided by the PVID. At the PVER, two pump platforms deliver water to individual fields through J and K Canals. Checks, which are small borders placed within a given field, allow for flooding of only a portion of a field and provide additional flexibility to create and maintain standing water or saturated soil areas for covered species. The PVID provides water order data monthly to the LCR MSCP; using these data has increased the accuracy of water usage within the conservation area. Irrigation does not occur from November through January, unless irrigation is needed for salinity management, because the trees are dormant.

*Honey Mesquite*: For honey mesquite, water is typically only used for establishment. Irrigation is reduced or concluded when the roots have reached the groundwater table. The exception is the honey mesquite habitat in the northern portion of the property where volunteer cottonwoods have become established.

**Previous Activities:** Over 1.8 million native trees and shrubs have been established on 1,023 acres at the PVER. Native trees have been irrigated and managed since 2006. The replacement of an existing pump with two 30-cubic-foot-per-second electric irrigation pumps, installation of delivery pipes and a pump stand, and an electrical upgrade were completed in January 2015.

## FY18 Accomplishments:

**Maintenance and Management:** The PVER is fully developed; therefore, management activities have transitioned into maintenance and monitoring. Annual management and maintenance was conducted through the year. The annual costs associated with operating the PVER, such as contract farming, delivery of water, water taxes, water tolls, electrical power utility bills, and assessments for district operation, have increased over the last few years. The obligations in FY18 reflects these rising costs.

Volunteer cottonwoods have become established in the northern portion of the PVER, which was planted with honey mesquite in FY15. A research study has been developed to monitor and evaluate the effects of a gradual reduction and cessation of applied water on the health and productivity of these volunteer cottonwoods.

**Monitoring:** Vegetation data were collected using light detection and ranging (lidar) remote sensing techniques. Monitoring stations as part of the salinity and soil moisture monitoring network were installed during FY18 to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health.

Riparian bird surveys were conducted at the PVER between April 10 and June 5 using the LCR MSCP double sampling protocol. Sonoran yellow warblers and summer tanagers were detected breeding at the site. Southwestern willow flycatcher surveys were conducted between May 15 and July 17, and no resident or breeding individuals were detected. Yellow-billed cuckoo surveys were conducted between June 16 and August 3. Yellow-billed cuckoos were detected in all of the cottonwood-willow fields, and nesting was confirmed in the southwestern and eastern portions of the conservation area. Twenty-six confirmed, 17 possible, and 8 probable breeding territories were found.

Two long-term acoustic bat stations detected the presence of LCR MSCP bat species from June to August. Western red bats, western yellow bats, and California leaf-nosed bats were detected.

Rodent trapping was conducted in fall. Two Colorado River cotton rats were captured as well as four desert pocket mice (subspecies not determined).

The southern honey mesquite field was surveyed in April for MacNeill's sootywing skippers, and eggs and adults were present.

## FY19 Activities:

**Maintenance and Management:** In FY19, irrigation and management activities will continue on the same schedule as previous years until data become available that indicate adjustments are needed. The exception is the northern portion of the PVER where volunteer cottonwoods have become established within the planted honey mesquites. A reduced watering schedule will be implemented, and the response of the cottonwoods will be monitored.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. Data from the existing monitoring stations will be used to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat acoustic monitoring will be conducted during summer. Rodent monitoring will be conducted in fall and spring. Surveys will also be conducted for MacNeill's sootywing skippers.

## Proposed FY20 Activities:

**Maintenance and Management:** Irrigation and management of the PVER will continue on the same schedule as previous years until data become available that indicate adjustments are needed.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. The data collected from the salinity and soil moisture monitoring network will be used to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat monitoring will be conducted during summer. Rodent monitoring will be conducted in fall and spring. Surveys will also be conducted for MacNeill's sootywing skippers.

**Pertinent Reports:** The 2014-2017 annual reports are posted on the LCR MSCP website. The *2018 Palo Verde Ecological Reserve Annual Report* will also be posted upon completion.

## Work Task E5: Cibola Valley Conservation Area

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $850,000 | $839,589.33 | $13,240,974.03 | $850,000 | $600,000 | $350,000 | $350,000 |

**Contact:** Jessie Stegmeier, (702) 293-8121, jstegmeier@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BEVI1, CRCR2, ELOW1, GIFL1, GIWO1, MNSW2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

**Location:** Reach 4, River Miles 99–104, Arizona

**Purpose:** To create and manage a mosaic of native land cover types for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** Vegetation and species monitoring are being addressed under Work Tasks F1–F4 and F6.

**Project Description:** In 2007, 1,309 acres of land serviced by the Cibola Valley Irrigation and Drainage District (CVIDD) were secured by the LCR MSCP, and the Cibola Valley Conservation Area (CVCA) was established. The Arizona Game and Fish Department (AZGFD) acquired the CVCA in September 2007 through a multi-organizational agreement involving the AZGFD, the Bureau of Reclamation, the Mohave County Water Authority, The Conservation Fund, and the Hopi Tribe. Through these agreements, the AZGFD acquired the CVCA's fee title and water entitlements. The acreage for LCR MSCP covered species is managed by the LCR MSCP.

The CVCA is located in southwestern La Paz County, Arizona, about 15 miles south of Blythe, California. The valley encompasses the land inside an engineered bend of the lower Colorado River and a remnant oxbow on the west side of the river (Palo Verde Oxbow). The area is bordered to the south by the Cibola National Wildlife Refuge and on the east by unimproved land under the jurisdiction of the Bureau of Land Management. The river forms the north and west boundaries, except for the Palo Verde Oxbow, from River Miles 98.8 to 104.9.

**Annual Maintenance and Management:** Water is ordered through and provided by the CVIDD. A local farmer irrigates the various phases based on site conditions and species planted. This provides local knowledge of weather and farming practices, which are applied to the management of the CVCA. The farmer and his employees are an onsite presence and provide early recognition of issues or concerns. The farmer is also responsible for assessing the water needs of the trees and, in coordination with the CVIDD and the LCR MSCP, orders and delivers the water. Removal of vegetation along the roadside and ditches is typically performed quarterly to reduce the potential of wildfires and is done in conjunction with maintenance of the irrigation canals, gates, and roads.

The annual costs associated with operating the CVCA within the CVIDD, such as water taxes, water tolls, electrical power utility bills, and assessments for district operation, are included in the annual maintenance costs.

*Cottonwood-Willow*: Fields are divided into smaller areas to provide additional flexibility to create and maintain standing water or saturated soil areas for covered species. Irrigation typically occurs from February through October and is expected to continue throughout the 50-year term of the LCR MSCP.

*Honey Mesquite*: For honey mesquite, water is typically only used for establishment. Irrigation during establishment is done by creating deep furrows and planting only within the furrows. Typically, irrigation is concluded within 2 to 3 years, when the roots have reached the groundwater table.

**Previous Activities:** Through FY17, 966 acres of cottonwood-willow and honey mesquite have been established and are being managed for LCR MSCP covered species.

### FY18 Accomplishments:

**Maintenance and Management:** Management, maintenance, irrigation, and monitoring of the established habitat continued. Established cottonwood-willow habitat (Phase 1, 2, and 3) continued to be irrigated. Phases 8, 9, and 11 were irrigated using furrows in the honey mesquite planting and flood irrigation in the cottonwood-willow stands; however, the areas planted with honey mesquite trees within Phase 8 no longer receive water.

**Restoration:** Phase 11, consisting of 193 acres, was planted with honey mesquite, and mesquite trees for the FY19 planting of Phase 10 (123 acres) were purchased. Approximately 2,000 linear feet of irrigation canal was replaced in FY18.

**Monitoring:** Vegetation data were collected using light detection and ranging (lidar) remote sensing techniques. Monitoring stations as part of the salinity and soil moisture monitoring network were installed during FY18 to assess whether

adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health.

Riparian bird surveys were conducted at the CVCA between April 10 and June 5 using the LCR MSCP double sampling protocol. One territory of Arizona Bell's vireos was recorded. Southwestern willow flycatcher surveys were conducted between May 15 and July 17, and no resident or breeding individuals were detected. Yellow-billed cuckoo surveys were conducted between June 27 and August 10. There were 17 detections, including 2 confirmed and 2 possible breeding territories. Two nests were found in the southwestern fields of cottonwood-willow (planted in 2016 and 2017).

Surveys for MacNeill's sootywing skippers (sootywings) were conducted in the honey mesquite fields, and they were present in all areas sampled.

Two long-term acoustic bat stations were used to detect the presence of LCR MSCP bat species from June to August. Western red bats, western yellow bats, and California leaf-nosed bats were detected.

## FY19 Activities:

**Maintenance and Management:** Regular management, maintenance, irrigation, and monitoring will continue. The cottonwood-willow land cover type within Phases 1, 2, 3, 8, and 9 will be irrigated; however, the areas planted with honey mesquite trees within Phase 9 will no longer receive water starting in 2019. Phases 10 and 11 will be watered regularly for 2 years following planting.

**Restoration:** Phase 10 will be planted with honey mesquite in late March or early April 2019; this will conclude the scheduled development of the CVCA.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. Data from the existing monitoring stations will be used to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat acoustic monitoring will be conducted during summer. Rodent monitoring will be conducted in fall and spring. Surveys will also be conducted for sootywings.

## Proposed FY20 Activities:

**Maintenance and Management:** Regular management, maintenance, irrigation, and monitoring will continue. No additional planting is anticipated at the CVCA.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. The data collected from the salinity and soil moisture monitoring network will be used to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat monitoring will be conducted during summer. Rodent monitoring will be conducted in fall and spring. Surveys will also be conducted for sootywings.

**Pertinent Reports:** The 2014–17 annual reports are posted on the LCR MSCP website. The *2018 Cibola Valley Conservation Area Annual Report* will also be posted upon completion.

## Work Task E9: Hart Mine Marsh

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $250,000 | $116,905.59 | $7,424,821.59 | $250,000 | $250,000 | $150,000 | $150,000 |

**Contact:** Jessie Stegmeier, (702) 293-8121, jstegmeier@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BLRA1, CLRA1, CRCR2, and LEBI1

**Location:** Reach 4, Cibola National Wildlife Refuge, River Mile 92, Arizona

**Purpose:** To create and manage marsh habitat for Colorado River cotton rats, California black rails, western least bitterns, and Yuma clapper rails

**Connections with Other Work Tasks (Past and Future):** Vegetation and species monitoring are being addressed under Work Tasks F1–F4 and F7.

**Project Description:** Hart Mine Marsh was a decadent marsh located on the Cibola National Wildlife Refuge that was restored and expanded to create habitat for LCR MSCP covered species. This was accomplished by installing control structures to manage water levels, providing sources of higher-quality surface water flows, making physical changes to the site's topography, and by planting and supporting native marsh vegetation. The approach was to remove a substantial amount of existing saltcedar from the site, deepen areas of existing open water, contour areas adjacent to those deeper areas, and manage water at the higher elevations to promote and sustain marsh cover type vegetation and wetland functions. The creation of habitat included both the establishment of native plants and management of water levels to meet management guidelines for integrating emergent vegetation and open water at varying depths into a mosaic of marsh habitats.

**Annual Maintenance and Management of the Marsh:** The primary source of water for Hart Mine Marsh is drainage water from fields in Farm Unit #1 on the Cibola National Wildlife Refuge, which is delivered through Arnett Ditch into the marsh. However, Colorado River water can also be pumped and delivered either into Arnett Ditch or directly into the marsh. The increased

management flexibility of the two sources of water, along with a series of water control structures, allows for stable water level management as well as the ability to manage salinity. Water deliveries are used to maintain static water levels during marsh bird nesting season and for flushing of the marsh in winter to manage salinity.

Vegetation maintenance at the marsh employs an integrated pest management approach that uses both manual (hand pulling) and chemical (herbicide) treatment of invasive species, including saltcedar, phragmites, and five-hook bassia.

The annual costs associated with operating the marsh include operation and maintenance of the water control structures, maintenance of the pumping system and electrical costs, invasive and non-native vegetation control, and road maintenance.

**Previous Activities:** Construction activities occurred in FY09–FY10, resulting in the creation of a 255-acre marsh that is managed for LCR MSCP covered species.

### FY18 Accomplishments:

**Maintenance and Management:** Management, maintenance, and monitoring of the established marsh was conducted. No construction repairs or replacements were completed in FY18; this resulted in lower-than-estimated obligations.

*Pump Stand Replacement:* The pump stand is in a shallow section of the river, which has resulted in pump damage (sedimentation) and decreased pump efficiency (low suction head). To mitigate the negative impacts of shallow river conditions, a sediment transport and entrainment modeling study was completed to refine the new pump stand design. A conceptual design for the pump stand replacement was completed; however, the replacement is not scheduled until FY20. Partial funding for replacement of the pump stand was provided by the U.S. Fish and Wildlife Service.

**Monitoring:** Vegetation data were collected using light detection and ranging (lidar) remote sensing techniques.

The U.S. Fish and Wildlife Service conducted marsh bird surveys at Hart Mine Marsh in March and April as part of their annual monitoring program. They provide these data to the LCR MSCP: Western least bitterns and Yuma clapper rails were detected and are presumed to be breeding at the site. California black rails were not detected.

Rodent trapping was conducted, and Colorado River cotton rats were captured.

## FY19 Activities:

**Maintenance and Management:** Management and monitoring of Hart Mine Marsh will continue. Vegetation maintenance will be reduced to an as-needed basis and will likely result in lower obligations.

*Pump Stand Replacement:* The preliminary design, including addressing sediment intake at this site, are completed. Materials necessary for the pump replacement will be acquired, allowing for installation of the pumps and construction of the pump stand to be completed in FY20 during winter, when the river stage is low.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. Marsh bird surveys will be conducted March and April. Rodent monitoring will be conducted in fall and spring.

## Proposed FY20 Activities:

**Maintenance and Management:** Management and monitoring of Hart Mine Marsh will continue. No construction, restoration, or changes to marsh management are anticipated.

*Pump Stand Replacement:* Construction of the pump stand and installation of the pumps is expected to be completed. When funds provided by the U.S. Fish and Wildlife Service have been exhausted, the LCR MSCP will obligate funding to complete the project.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. Marsh bird surveys will be conducted in March and April. Rodent monitoring will be conducted in fall and spring.

**Pertinent Reports:** The 2013–17 annual reports are posted on the LCR MSCP website. The *2018 Hart Mine Marsh Conservation Area Annual Report* will also be posted upon completion.

## Work Task E13: McAllister Lake

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $400,000 | $28,776.19 | $180,822.70 | $400,000 | $400,000 | $50,000 | $40,000 |

**Contact:** John Swatzell, (702) 293-8165, jswatzell@usbr.gov

**Start Date:** FY05 (closed in FY07; reopened in FY17)

**Expected Duration:** FY55

**Long-Term Goal:** Habitat management

**Conservation Measures:** BONY2 and RASU2

**Location:** Reach 5, Imperial National Wildlife Refuge (Imperial NWR)

**Purpose:** To maintain a disconnected backwater for native fishes established under the 1997 Biological and Conference Opinion on Lower Colorado River Operations and Maintenance Activities (1997 BO)

**Connections with Other Work Tasks (Past and Future):** Monitoring of native fishes is being addressed under Work Task F5.

**Project Description:** McAllister Lake is a shallow, approximately 40-acre, isolated floodplain lake located on the Imperial NWR. Management of the lake is a continuation of the commitment to construct habitat for native fishes under the 1997 BO. Continued maintenance and management obligations of McAllister Lake, as well as research and development of the backwater as native fish habitat, were subsumed by the LCR MSCP in 2005.

McAllister Lake was identified under Reasonable and Prudent Alternative Number 3 in the 1997 BO as a backwater to be developed and managed for native fishes. The intent is to make improvements to the backwater, including the design and construction of a pumping system to exchange water within the lake to manage salinity and other water quality parameters at levels suitable for supporting native fishes.

A pumping station would be placed on a constructed berm between McAllister Lake proper and the western lobe of the lake. The creation of this earthen berm would protect the lake proper section of McAllister Lake from potential river flooding events. By using borrowed material from both McAllister Lake proper

and the western lobe, an additional benefit of the construction of this earthen berm would be localized deepening in these pump-out areas. These deeper areas may, in turn, provide a thermal refuge for native fishes. They could also potentially increase the subsurface hydraulic connection to the adjacent Colorado River, which could help to enhance water quality and water exchange efficiency. The excavation of these areas may also remove sediments with high biological oxygen demand, as identified by previous research, further improving water quality in both sections of the lake. The water exchange provided by the periodic operation of the pumping system may reduce accumulation rates of selenium within the lake. It is anticipated that operating a pumping system at this remote location will likely require installation of either a solar- or diesel-powered pumping system. If the proposed pumping system is installed, the backwater would continue to be managed for native fishes.

If the proposed development is not implemented and the pumping system is not installed due to incompatibilities with Imperial NWR missions, this work task would be closed consistent with the March 16, 2016, letter titled "Closure of the 1997 Biological and Conference Opinion (BO) on the lower Colorado River Operations and Maintenance (as amended on April 30, 2002) Reasonable and Prudent Alternative Number 3 (RPA 3)," and all commitments under the 1997 BO will have been satisfied.

**Previous Activities:** The Bureau of Reclamation initiated a series of experimental pump tests during FY03 and FY04, which included dewatering the lake to about one-fourth of its normal volume. Before, during, and after these tests, a variety of environmental data were collected to measure the lake's response to pumping and the consistency of the groundwater supply through the river aquifer. These pump tests were conducted from December 2002 through March 2004, during the fall and winter months only, to avoid potential impacts to Yuma clapper rails. The lake was left unmanaged during FY05. Monitoring was continued in order to assess how quickly the lake's water quality would degrade if pumping was stopped; the level of degradation would indicate the required pumping frequency needed to maintain sufficient water quality to support native fishes. After an approximately 18-month period with no pumping, salinity levels (measured as specific conductance) increased from approximately 4,000 to approximately 10,000 microsiemens per centimeter (μS/cm).

The results from these investigations suggested that salinity levels could be reduced through pumping and subsequent induced subsurface recharge but that regular water management (flushing) of the lake would be necessary to maintain desired salinity ranges. Some additional concerns were raised regarding managing McAllister Lake for native fishes, including the detection of heavy metals (arsenic and mercury) and seasonal low levels of dissolved oxygen. In FY07, all development and research activities at the lake were suspended in order to assess newly initiated research pertaining to water quality thresholds for native fishes and to decide the value of additional proposed limnologic research

investigations. The suspension of activity allowed time for developing a conceptual approach for the lake that would allow for potential mitigation of the challenges previously identified and to provide sustainable management options to benefit native fishes.

In FY15, sampling for arsenic, mercury, and selenium was conducted under Work Task C59. Samples of water, substrate, and biota were collected and analyzed to provide better resolution in suggesting the potential of bioaccumulation for native fishes stocked into McAllister Lake. The results were interpreted by the U.S. Fish and Wildlife Service's (USFWS) Environmental Contaminants Office. The levels of selenium were elevated in mosquitofish tissue and will likely require a plan for long-term selenium monitoring. Concentrations of arsenic, mercury, and selenium in water and substrate were well below the Arizona water quality standards threshold for concern. Concentrations of arsenic and mercury in tissue samples were also well below the Arizona water quality standards threshold for concern.

In FY17, the LCR MSCP and the USFWS Arizona Ecological Services Field Offices agreed that efforts to implement the proposed plan for restoration and management of McAllister Lake should move forward and that Work Task E13 should be reopened. Development will occur in a step-wise fashion in order to adequately consider the potential challenges of this site.

**FY18 Accomplishments:** The LCR MSCP met with the USFWS (Imperial NWR and Refuge Complex Managers as well as the USFWS Arizona Ecological Services Field Office) to discuss the viability of the low flow rate pumping system to be tested in FY18. The decision was made not to continue to evaluate this option but instead to proceed with the high flow rate pumping system. The decision was based on anticipated mobilization and demobilization as well as labor costs to install and maintain both systems. The high flow rate pumping system has been shown to be effective and a lower cost alternative. High flow rate pumping was conducted in February 2018 to manage salinity. Engineering design and shop drawings for the separation of the western lobe from the main body of McAllister Lake and the installation of the pumping system were completed.

Obligations were less than anticipated, as a slow drawdown was not conducted, and the engineering plan set was not ready in time to meet the construction window. Construction is scheduled to occur during low river stage, which occurs in the winter months.

**FY19 Activities:** Environmental compliance and permitting to allow for the separation of the western lobe from the main body of McAllister and installation of a permanent pumping system will be initiated. Obligations will be less than approved, as construction will not occur until FY20, allowing for permitting to be completed and construction to occur when the river stage is at its lowest.

**Proposed FY20 Activities:** Construction activities will begin during early FY20.

**Pertinent Reports:** Annual reports will be posted on the LCR MSCP website upon completion.

## Work Task E14: Imperial Ponds Conservation Area

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $1,450,000 | $515,675.14 | $10,808,015.81 | $350,000 | $350,000 | $350,000 | $350,000 |

**Contact:** John Swatzell, (702) 293-8165, jswatzell@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BEVI1, BLRA1, BONY2, CLRA1, ELOW1, GIFL1, GIWO1, LEBI1, RASU2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

**Location:** Reach 5, Imperial National Wildlife Refuge (Imperial NWR), River Mile 59, Arizona

**Purpose:** To create and manage a mosaic of native land cover types for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** Vegetation, species research, and monitoring is being conducted under Work Tasks C25 (closed), D9, and F1–F5.

**Project Description:** The Imperial Ponds Conservation Area is an integrated mosaic of native land cover types, including disconnected backwaters, cottonwood-willow, and marsh. It is situated within the Martinez Lake Management Unit (previously identified as an Intensive Management Area) of the Imperial NWR, an area of focused management for sensitive wildlife species, including native fishes, marsh birds, neotropical migratory birds, and migratory waterfowl. The marsh created within Field 18 and the cottonwood-willow to be created are Clean Water Act mitigation for dredging of the Laguna Reservoir, which is an action covered under the LCR MSCP.

**Previous Activities:**

**Disconnected Backwaters:** Six backwaters have been constructed to provide approximately 80 surface acres of habitat for razorback suckers and bonytail. Lower Colorado River water was supplied to the backwaters by a pump fitted

with a wedge-wire screen system. The screen had a slot size of 0.05 millimeter that was designed to prevent passage of fish eggs and larvae into the backwaters. An in situ evaluation of the screen was completed under Work Task G3. The results indicated that fish eggs and larvae of multiple species were passing through the screen. In response to the results, the pump was shut off in summer 2009, and water was supplied to all the backwaters using a single groundwater well. A water management study was initiated in May 2011 and was completed in 2015 to evaluate the water quality in Pond 1 (where regular water management was continued) and Ponds 2–6 (without a managed water supply). The water management study allowed us to determine average water surface elevations for Ponds 2–6. By operating the ponds at this elevation and tracking water quality, the amount of well water needed to be provided to maintain acceptable water quality was reduced. A second well was installed onsite to supply water to the ponds in FY14. The new well both allowed us to pump the volume of water needed to manage the ponds and provided redundancy in case one well became inoperable.

**Annual Maintenance and Management of the Disconnected Backwaters:** Two groundwater wells supply water to all six ponds. Each pond receives approximately 8.50 acre-feet per month, except during July through September, when the water volume increases to 17 acre-feet of water per month, for a total of 773 acre-feet for the year. Annual costs included those for electricity for the well, maintenance of the pumps and valves to direct water delivery, and boat ramp maintenance.

**Cottonwood-Willow:** Field leveling and irrigation system installation for the area were completed in FY08. Soil salinity is managed through irrigation of a cover crop.

**Marsh:** A 12-acre marsh unit was created at Field 18 in the southeast corner of the Imperial NWR. This field was cleared in winter 2007–08 and was converted into a common and Olney's three-square bulrush-dominated marsh managed for rail species. The irrigation cycle is based on an adjacent field, Field 16, which was created and is managed for California black rails and Yuma clapper rails. The marsh has been managed for LCR MSCP covered species since 2008, and both California black rails and Yuma clapper rails have been detected in Field 18.

**Annual Maintenance and Management of Marsh and Cottonwood-Willow:** Irrigation water for both the riparian area as well as the managed marsh complex is received from a pump platform, which is located in the Martinez Lake inlet channel. Annual costs associated with operation and maintenance of these areas include costs associated with the electrical power utility bill, pump maintenance, invasive and non-native weed control, road maintenance, and the labor to open and close the gates along the canal.

## FY18 Accomplishments:

**Maintenance and Management:** Annual maintenance and operation of the cottonwood-willow, marsh, and disconnected backwater were completed.

*Cottonwood-Willow*: Irrigation water was supplied from February through September to maintain a cover crop to manage salinity. No additional restoration or monitoring was performed on the 34 acres of the future cottonwood-willow field. Additional groundwater wells were installed around the fields to enhance the existing soil salinity and groundwater monitoring and to support decisions on future restoration of the area.

*Marsh*: The 12-acre marsh created in Field 18 continued to be managed for marsh covered species.

*Disconnected Backwater*: Approximately 760 acre-feet of water was delivered to the ponds in FY18.

**Restoration:**

*Cottonwood-Willow*: The final design for the irrigation system upgrade was approved by the refuge. A contract was awarded for the canal improvements, and funds were obligated in FY18. Construction is scheduled for FY19. Canal construction costs were less than anticipated; therefore, obligations were less than the approved estimate. The fields are currently being irrigated to manage salinity until restoration occurs.

**Monitoring:**

*Disconnected Backwaters*: Monitoring consisted of surveys for larval, juvenile, and adult native fishes. Razorback suckers stocked into Ponds 1, 3, and 4 in December 2016 averaged 64% survival through September 2018. A single razorback sucker recruit was captured in Pond 1. Bonytail stocked into Ponds 2, 5, and 6 in March 2017 averaged 22% survival. Recruits were captured in each of the bonytail ponds, and the low survival of adult bonytail may be a result of increased competition for food resources.

Water quality was monitored continuously throughout the year. Multi-parameter water quality probes were deployed to record temperature, pH, dissolved oxygen, and specific conductivity at 12-hour intervals. All water quality parameters remained within the ranges of acceptability for native fishes.

*Marsh*: Vegetation and marsh birds were monitored at the Imperial Ponds Conservation Area. Vegetation data were collected using light detection and ranging (lidar) remote sensing techniques.

The U.S. Fish and Wildlife Service (USFWS) conducted marsh bird surveys throughout the Imperial NWR, including Field 18 and the ponds, in March and April as part of their annual monitoring program. They provided these data to the LCR MSCP: Western least bitterns were detected in Field 18 on surveys in March and April. No Yuma clapper rails or California black rails were detected in Field 18 during these surveys. No covered marsh birds were detected at the ponds. During a separate research project conducted at the Imperial Ponds Conservation Area by the University of Idaho for the USFWS, Yuma clapper rails were captured in Field 18 from May to August in 2018.

## FY19 Activities:

**Maintenance and Management:** Onsite maintenance, utility payments, and water management for the site will continue. Construction of the canal system started in November 2018 and was finished in February 2019.

*Marsh*: The 12-acre marsh created in Field 18 will continue to be managed for marsh covered species.

*Disconnected Backwaters*: Water will be supplied to the ponds following the water management schedule. Post-development monitoring is being completed under Work Task F5.

**Restoration:**

*Cottonwood-Willow*: The fields will be irrigated to manage salinity in the soils. Currently, 34 acres are scheduled for riparian restoration by the LCR MSCP. Discussions with the USFWS have indicated a desire to evaluate planting an additional 69 acres of riparian vegetation on adjacent lands. Riparian restoration has been put on hold until options for the management of these fields are evaluated. Management options include (1) complete conversion with cottonwood-willow by the LCR MSCP, (2) conversion to fields managed by the USFWS for waterfowl and upland bird species, (3) creation of additional ponds by the LCR MSCP managed for native fishes, or (4) some combination of these options.

**Monitoring:** Monitoring will continue in FY19 similar to previous efforts for fishes and marsh birds. Vegetation data will be collected using lidar remote sensing techniques.

## Proposed FY20 Activities:

**Maintenance and Management:** Onsite maintenance, utility payments, and water management for the site will continue.

*Marsh*: The 12-acre marsh created in Field 18 will continue to be managed for marsh covered species. A survey of the existing topography within Field 18 will be conducted, and recommendations for future water management will be made. These recommendations may include ground-disturbance activities designed to improve water delivery and management.

*Disconnected Backwaters*: Boat ramps and riprap shorelines will be maintained. The automated watering schedule for all six ponds will continue to be used.

**Restoration:**

*Cottonwood-Willow*: An evaluation will be completed, and recommendations for future habitat creation activities will be discussed between the LCR MSCP and USFWS. These recommendations may include other habitat types, such as an additional backwater pond.

**Monitoring:** Monitoring will continue in FY20 similar to previous efforts for fishes and marsh birds. Vegetation data will be collected using lidar remote sensing techniques.

**Pertinent Reports:** The 2013–17 annual reports are posted on the LCR MSCP website. The 2009–11 and 2018 annual reports will also be posted upon completion.

## Work Task E16: Conservation Area Site Selection

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $700,000 | $1,077,161.04 | $7,264,268.50 | $200,000 | $150,000 | $100,000 | $100,000 |

**Contact:** Terry Murphy, (702) 293-8140, tmurphy@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY26

**Long-Term Goal:** Habitat creation

**Conservation Measures:** BEVI1, BLRA1, BONY2, CLNB2, CLRA1, CRCR2, ELOW1, FLSU1, GIFL1, GIWO1, LEBI1, MNSW2, PTBB2, RASU2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, YHCR2, and YWAR1

**Location:** Reaches 1–7, Arizona, California, and Nevada

**Purpose:** To identify, visit, evaluate, prioritize, and recommend potential conservation areas to the Steering Committee for development under the habitat creation requirements of the LCR MSCP

**Connections with Other Work Tasks (Past and Future):** The process developed under this work task will inform the selection of future conservation area sites to be developed under Conservation Area Development and Management (Section E) work tasks. In FY14, backwater site selection previously tracked under Work Task E15 (closed) was combined with this work task. This reflects the change in the process to select backwaters and allows for integration of multiple land cover types on a conservation area in which the primary purpose is the creation of a backwater.

**Project Description:** The Bureau of Reclamation (Reclamation) will work with landowners to secure an interest in land and water resources sufficient to create and maintain LCR MSCP habitats. It is anticipated that willing landowners will enter into a long-term commitment for the 50-year term of the program.

When developing a financial value for subject lands and water, Reclamation must administer a Federal appraisal using the U.S. Department of the Interior's designated Office of Valuation Services. The cost of appraisal services is captured under the budget of this work task.

After new sites are evaluated and prioritized, Reclamation will get concurrence from the Steering Committee to go forward with the new conservation areas either through the site selection process or, if acquisition is required, through a land and water resolution. This approval allows Reclamation to move forward with the new site and to prepare specific Restoration Development and Monitoring Plans that inform implementation of the conservation area.

**Previous Activities:** Guidelines have been developed to describe the process of working with interested parties to identify sites for screening and evaluation as potential conservation areas. Through FY17, 14 conservation areas have been established.

**FY18 Accomplishments:** Coordination with resource agencies and attendance at planning meetings was a similar effort to that of previous years. A Land Use Agreement was signed between the LCR MSCP and the U.S. Fish and Wildlife Service to create and manage a conservation area at Three Fingers Lake. A Memorandum of Understanding was signed between the LCR MSCP and Reclamation's Yuma Area Office to construct and manage the Yuma Meadows Conservation Area (YMCA).

The increase in obligations in FY18 was a result of the wetland delineations, Class III Cultural Surveys, and design of the YMCA. These tasks were funded through E16 to accelerate and evaluate potential conservation areas.

*Reach 3 Cadastral Surveys*: The draft report and maps provided by the cadastral team indicate the area within Township 8N, Range 23E, Section 26, San Bernardino Meridian within the State of California is on Reclamation withdrawn land, and the surrounding land is managed by the Bureau of Land Management (referred to as the Section 26 backwater). The parcels appear to be large enough to create a 20- 40 acre disconnected backwater, which would be located within the State of California.

*Wetland Delineations:* Surveys to delineate wetlands at the YMCA (433 acres), Beal Lake Expansion Area (1,000 acres), Cibola Unit #1 Expansion Area (1,200 acres), Three Fingers Lake (697 acres), and the Section 26 backwater (218 acres) were initiated and funded through Work Task E16. The delineations are typically funded through a specific work task; however, not all of these work tasks had either an approved budget or a signed Land Use Agreement. To facilitate the investigations, a small savings was achieved by funding all work through Work Task E16.

*Class III Cultural Pedestrian Surveys:* Surveys to identify culturally sensitive areas at the YMCA (433 acres), Beal Lake Expansion Area (1,000 acres), Cibola Unit #1 Expansion Area (1,200 acres), Three Fingers Lake (680 acres), Palo Verde Ecological Reserve-South (250 acres), and within the Section 26 backwater (218 acres) were also initiated and funded through Work Task E16. The cultural

surveys are typically funded through a specific work task; however, not all of these work tasks had either an approved budget or a signed Land Use Agreement. To facilitate the investigations, a small savings was achieved by funding all the work through Work Task E16.

*Yuma Meadows Conservation Area*: The YMCA is within the Laguna Division on Reclamation withdrawn lands. The property also contains an office and warehouse complex, known as the Laguna Field Office. The YMCA did not have an approved FY18 budget, as it was a new start in FY19; however, the opportunity for initiating the design was available, and Work Task E16 was used for this purpose. The design includes engineering drawings for twelve 1-acre rearing ponds and 111 acres of disconnected backwater. Final engineering plans are anticipated in FY19.

**FY19 Activities:** Coordination with resource agencies will continue. It is anticipated that both the proposed PVER-South and Dennis Underwood Conservation Areas will be formally established as conservation areas after the signing of an agreement with the California Department of Fish and Wildlife to use the PVER-South property and the signing of an easement for conservation purposes with the Metropolitan Water District of Southern California for the Dennis Underwood Conservation Area.

*Hydraulic Dredge Support Equipment*: A telehandler, used for movement of dredge pipe and materials, was acquired from Government excess and is used to support dredging operations. A D-6 high track dozer was also acquired; this obligation will exceed the approved budget but will result in lower overall operating costs.

*Reach 3 Cadastral Surveys*: Based on the cadastral work completed in FY18 to define Reclamation's withdrawn lands in Section 26, additional investigation, such as obtaining topographic data through light detection and ranging technology, soil sampling, installation of groundwater wells, and development of a restoration concept, is underway.

*Reach 4 Cadastral Surveys*: The Bureau of Land Management has initiated record searches for an area within Reach 4 that may be suitable for either a backwater or marsh complex. The task is to identify land status within Township 9S, Range 22E, Sections 5, 7, and 8, San Bernardino Meridian within the State of California. The final report and map are scheduled for delivery in FY19.

**FY20 Proposed Activities:** Coordination efforts with resource agencies will be reduced as lands become available to the program for restoration. Work Task E41 has been proposed to track the development of the lands identified for restoration in FY18. It is anticipated that all cadastral surveys will be completed,

and enough land will have been identified to meet the minimum land cover required by the end of FY20. However, this work task will remain open at a reduced funding level.

**Pertinent Reports:** Trip reports will be posted on the LCR MSCP website upon completion.

## Work Task E17: Topock Marsh Pumping

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $1,000 | $0 | $477,133.33 | $1,000 | $1,000 | $1,000 | $1,000 |

**Contact:** Jeremy Brooks, (702) 293-8257, jjbrooks@usbr.gov

**Start Date:** FY06

**Expected Duration:** FY25

**Long-Term Goal:** To avoid impacts from flow-related covered activities on covered species habitats at Topock Marsh

**Conservation Measures:** AMM2

**Location:** Reach 3, Havasu National Wildlife Refuge, River Miles 235–244, Arizona

**Purpose:** To avoid the impacts of flow-related covered actions on covered species habitats at Topock Marsh by constructing a reliable and manageable water control structure that ensures water delivery off the main stem of the Colorado River by gravitational diversion or pumping

**Connections with Other Work Tasks (Past and Future):** N/A

**Project Description:** Topock Marsh has been identified as habitat for southwestern willow flycatchers and Yuma clapper rails. At times, flow-related activities could lower the river stage and reduce gravity diversions of water from the Colorado River to the marsh. The U.S. Fish and Wildlife Service (USFWS) constructed a concrete-lined inlet canal (Fire Break Canal) that diverts water by gravity to Topock Marsh. Pumps are planned to be installed to supplement water delivery at river stages too low to provide gravity diversion. The combination of gravity diversion, supplemented by pumping, is necessary to maintain marsh elevations during the marsh bird nesting season.

**Previous Activities:** In early 2010, $1 million was provided by the LCR MSCP for the construction of Fire Break Canal, which improved the delivery of water to Topock Marsh by greatly reducing transmission losses that occurred when using the old, unlined inlet canal. In return for the monetary contribution, the USFWS concurred that the LCR MSCP had met its construction obligations under Avoidance and Minimization Measure 2 (AMM2).

At the Steering Committee meeting held on April 28, 2010, the decision was made to provide the USFWS with all the operation and maintenance funds, also required under AMM2, in a lump sum of $2.55 million during FY12. Lump sum funding was made to the USFWS in March 2012. The final USFWS letter stating that no further action was required by the LCR MSCP to meet the commitments stated in AMM2 was received on July 2, 2012. Additional funding from the Habitat Maintenance Fund (HMF) will be required to complete the infrastructure improvements.

The USFWS concurred with the use of HMF and AMM2 funds for this purpose, and an agreement to move forward was formalized. Key components of the agreement included: (1) all commitments under AMM2 will remain fulfilled, (2) all AMM2 funds will be expended prior to utilization of the HMF, and (3) prior to construction activities, the USFWS and the LCR MSCP will enter into an agreement to use the HMF that will detail the long-term roles and responsibilities of both agencies and marsh management objectives.

**FY18 Accomplishments:** The Bureau of Reclamation's Yuma Area Office built the original inlets and outlets to Topock Marsh and have some responsibilities for the continued operation in coordination with the USFWS. The Yuma Area Office presented the findings of an engineering and hydrological analysis to the USFWS in FY18. As a result of this analysis, multiple alternatives to maintain water levels in Topock Marsh were considered. The use of gravity diversion alone will not fill the marsh in time for the marsh bird breading season (March 15). To fill the marsh before March 15, the pumping system required is not technically feasible given the high flow rate necessary and the low river stage. One of the alternatives discussed included the use of a smaller flow rate pumping system and starting each calendar year with the marsh at a higher water surface elevation. This alternative incorporates a fixed pump stand to augment flows delivered by gravity through the existing concrete-lined Fire Break Canal into Topock Marsh. Therefore, less water is required between January 1 and March 15 to achieve the desired water surface elevation. This size pumping system is feasible and appears to satisfy the needs of all parties.

The USFWS and Bureau of Reclamation's Yuma Area Office developed a scope of work and funding agreement to support the preliminary design of this preferred alternative.

**FY19 Activities:** The Yuma Area Office will present the preliminary design and cost estimates to the USFWS Ecological Services Field Office and Regional Office in FY19 for review and approval. Upon approval, the design, permitting, and compliance activities will begin.

**Proposed FY20 Activities:** Engineering design, permitting, and environmental compliance are scheduled to be completed.

**Pertinent Reports:** N/A

## Work Task E18: Law Enforcement and Fire Suppression

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $200,000 | $402,885.33 | $2,115,485.48 | $250,000 | $250,000 | $250,000 | $250,000 |

**Contact:** Jeremy Brooks, (702) 293-8257, jjbrooks@usbr.gov

**Start Date:** FY06

**Expected Duration:** FY55

**Long-Term Goal:** Protect created habitat

**Conservation Measures:** CMM1

**Location:** Reaches 1–7

**Purpose:** To provide law enforcement and fire suppression in support of habitat created by the LCR MSCP

**Connections with Other Work Tasks (Past and Future):** Law enforcement and fire suppression are integral management components for all habitats created through Conservation Area Development and Management (Section E) work tasks.

**Project Description:** A law enforcement and fire protection effort for created habitat is funded under this work task. The Bureau of Land Management (BLM), U.S. Fish and Wildlife Service, Arizona Game and Fish Department, California Department of Fish and Wildlife, Nevada Department of Wildlife, Bureau of Indian Affairs, CAL-Fire, and other agencies conduct law enforcement and firefighting activities on the lower Colorado River. Law enforcement and fire suppression strategies have been developed at the programmatic level for each individual conservation area. As new conservation areas are incorporated into the LCR MSCP, site-specific law, fire, and access plans will be developed to help reduce fire and other risks.

**Previous Activities:** The BLM Colorado River District Office, based in Lake Havasu, Arizona, has been responsible for handling fire- and law-related activities for conservation areas on both State and Bureau of Reclamation lands. Conservation areas located on Federal refuges are managed for wildland fire and law enforcement by the U.S. Fish and Wildlife Service.

The BLM also conducts planning, coordination, monitoring, outreach, risk assessments, site mapping, and site inspection activities. Inspections are intended to proactively identify and address potential wildland fire management issues, and recommendations are discussed with the landowner and the LCR MSCP. These recommendations help identify high-risk areas, areas in need of fuel reduction, damage to infrastructure, and management of visitor use areas.

**FY18 Accomplishments:** Work with local fire and law agencies in support of the law and fire management activities continued in FY18. Activities included patrols, monitoring, planning, site visits, coordination meetings, and attendance at agency staff meetings.

In FY18, law enforcement activities included approximately 300 patrols of LCR MSCP conservation areas.

Fire suppression efforts related to LCR MSCP conservation areas included responding to the Fence Fire at Hunters Hole and the Prison Hill Fire at Yuma East Wetlands.

The Fence Fire occurred on February 6, 2018, and 2.7 acres were burned. Investigators determined that the fire was caused by a migrant using it as a diversion for an illegal border crossing. The irrigation pumps onsite were used to extinguish and prevent the spread of the fire. The fire burned the understory (leaf litter) of the cottonwood-willow stand but caused little irreparable damage. No replanting or additional restoration is required.

The Prison Hill Fire occurred on May 20, 2018, and while 60 acres were burned adjacent to the site, less than 1/10 of an acre was burned at Yuma East Wetlands. The irrigation pumps onsite were used to extinguish and prevent the spread of the fire. This fire was caused by migrants camping at the site. No replanting or additional restoration is required.

The LCR MSCP also entered into a 5-year Interagency Agreement with the National Park Service's (NPS) Exotic Plant Management Team to provide invasive plant species support and fuel load reduction at LCR MSCP conservation areas. The crews will respond as needed and have the flexibility to work at any conservation area. In FY18, this agreement was funded under this work task to allow the LCR MSCP to evaluate performance and track expenditures of the NPS at multiple conservation areas. The NPS provides these services to other agencies, but has not worked on the scale of the LCR MSCP, so a baseline was established from which budgets from future services could be made. Due to the size and complexity of each conservation area, multiple approaches for weed management and fuels reduction must be developed. In FY18, the crews worked at the Cibola National Wildlife Refuge Unit #1 Conservation Area, the Cibola Valley Conservation Area, the Mohave Valley Conservation Area, Parker Dam Camp, and the Laguna Division Conservation Area.

Obligations exceeded the approved estimate because treatments were conducted at multiple conservation areas and all were funded under Work Task E18. Work conducted in FY18 will help determine future treatment costs at each conservation area. In the future, a maximum of $50,000 for treatment costs will be funded through Work Task E18, and the remainder will be funded through conservation area management and maintenance funds.

**FY19 Activities:** In support of LCR MSCP conservation areas, coordination with law and fire agencies will continue through the Interagency Agreements with the BLM. Funding will continue to be allocated to the BLM for law enforcement and fire management activities, including patrols, fire prevention, activity reporting, site visits, coordination meetings, and other related activities. Work to renew the 5-year law and fire Interagency Agreements will begin in FY19.

The NPS's Exotic Plant Management Team will perform weed management and fuels reduction.

**Proposed FY20 Activities:** BLM law and fire personnel will continue with support activities similar to those performed in prior years.

The NPS's Exotic Plant Management Team will perform weed management and fuels reduction work.

**Pertinent Reports:** N/A

## Work Task E21: Planet Ranch

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $3,000,000 | $1,151,199.48 | $12,355,172.49 | $4,000,000 | $4,000,000 | $1,000,000 | $1,000,000 |

**Contact:** Jeremy Brooks, (702) 293-8257, jjbrooks@usbr.gov

**Start Date:** FY05 (closed in FY05; reopened in FY09)

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BEVI1, BONY2, CLRA1, CRCR2, ELOW1, GIFL1, GIWO1, LEB1, MNSW2, RASU2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, YBCU2, and YWAR1

**Location:** Reach 3, Bill Williams River, 11 miles east of River Mile 190, Arizona

**Purpose:** To create and manage disconnected backwaters within a mosaic of native land cover types for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** Costs associated with a Federal land and water appraisal conducted in FY08 were captured under Work Task E16.

**Project Description:** Planet Ranch, located on the Bill Williams River, was acquired to secure the river corridor and develop the property as a conservation area. Creditable acreage includes (1) active restoration of all four land cover types (cottonwood-willow and disconnected backwater) within the property boundary where feasible, (2) passive restoration within the active Bill Williams River channel on the property, and (3) downstream credit on the Bill Williams River National Wildlife Refuge (Bill Williams River NWR) (the site will be called the Middle Bill Williams River NWR). The current restoration concept for active restoration includes disconnected backwaters for native fishes. These areas will be integrated into a mosaic with cottonwood-willow and honey mesquite. An additional 396 acres of cottonwood-willow downstream at the Middle Bill Williams River NWR will also be afforded protection by securing the Planet Ranch property and are also creditable to the LCR MSCP.

The conservation area includes 3,418 acres of land; however, the ranch west of the main north/south access road (approximately 660 acres) and some acreage east of the main north/south access road, defined as reserved under the lease amendment, may be managed for LCR MSCP covered species. The ranch east of the main north/south access road (approximately 2,758 acres), except for lands reserved for LCR MSCP purposes in the lease amendment, would not be managed for LCR MSCP covered species. These lands would be managed by the Arizona Game and Fish Department.

**Previous Activities:** Planet Ranch encompassed approximately 8,400 acres, of which approximately 2,400 acres had previously been farmed for alfalfa. On October 22, 2008, the Steering Committee approved Motion 09-001(r), which authorized the Bureau of Reclamation (Reclamation) to enter into negotiations to secure approximately 3,418 acres of land and 5,549 acre-feet of water per year from the Freeport Minerals Corporation (FMC). Legislation directing the United States Secretary of the Interior to enter in an agreement for the acquisition of Planet Ranch was signed in December 2014. Program Decision Document 15-002, which allowed Reclamation to enter into a lease for the land and water, was approved by the Steering Committee on April 22, 2015. The sum of $8,300,000 to secure this land and water was determined through the Federal appraisal process.

The Arizona Game and Fish Commission received title for the land and water rights through a donation from the FMC in December 2015. The lease between Reclamation and the FMC was transferred as part of the donation agreement. FMC retained ownership of lands on Planet Ranch that were not acquired by the Arizona Game and Fish Commission.

Regulatory compliance activities required under the National Environmental Policy Act, the Endangered Species Act, and the National Historic Preservation Act were completed for the acquisition of Planet Ranch. Native American consultation and a Class I Cultural Survey as prescribed in Section 106 of the National Historic Preservation Act were completed in FY11.

The schedule of activities includes (1) farming approximately 1,100 acres to secure water rights in FY16 and FY17, (2) planning for restoration and ground stabilization, including a workshop to incorporate information from native fish experts in FY16, (3) drafting of a Restoration Development and Monitoring Plan, permitting, and design in FY17, and (4) infrastructure improvements, construction of ponds, ground stabilization on farmed areas, and restoration of cottonwood-willow between FY18 and FY21.

To ensure the viability of water rights associated with the property, approximately 1,000 acres of alfalfa was grown as pasture from December 15, 2015, through December 15, 2017.

**FY18 Accomplishments:** Irrigation of the alfalfa ceased on December 15, 2017, following the full utilization of the water right, which is now secured until 2022. No future farming efforts are planned. Power lines and infrastructure connected to the irrigation system were disconnected and removed. The LCR MSCP agreed to stabilize all of the farm fields in the Arizona Game and Fish managed areas. After irrigation stopped on the alfalfa in the fields irrigated using center pivots and wheel lines, native plants became established, and these areas are considered stabilized. The fields that were flood irrigated will be used for placement of fill from the excavated ponds to increase topographic diversity and stabilized with native vegetation.

The conceptual design for the site was finalized. The final design concept includes excavation of four ponds totaling 60 acres, installation of three groundwater wells to supply water to the ponds, and the construction of a sheet pile flood control structure for erosion control from both the Bill Williams River and from adjacent washes.

Several reports, studies, and analyses were conducted to inform design efforts, which included modeling the surface water flows on the Bill Williams River and adjacent drainages; conducting hydrologic, hydraulic, and geotechnical investigations to develop geologic design data for pond design and flood control; collecting infiltration data to assist in the design of the ponds, and identifying potential methods to reduce permeability. The analysis of water infiltration indicated synthetic lining of the ponds may not be necessary if existing in situ silty material is compacted and used to line the ponds.

An environmental assessment, supplemental environmental assessment, U.S. Army Corp of Engineers 404 Permit, State of Arizona 401 Permit, and Arizona Game and Fish environmental assessment were all completed. A right-of-way was also secured from the Bureau of Land Management, authorizing program use and enabling the expansion of the footprint of the ponds.

Improvements were made to existing houses onsite to lodge construction crews. Housing personnel overnight in these residences is in the best interest of the Government in that it enhances safety by avoiding unnecessary daily travel to and from the site, increases the number of hours worked onsite, reduces overall per-diem and travel costs, and provides an onsite presence, reducing the chance of vandalism and burglary. Improvements were also made to the maintenance shop.

In March 2018, the U.S. Army Corps of Engineers performed a maintenance release from Alamo Dam. During the release, the LCR MSCP monitored the flow of the river to determine potential impacts from high flow events. Within the area designated for construction of backwater habitat, the typical depth to groundwater is between 11 to 14 feet below ground surface, depending on location. Monitoring wells tracked the groundwater elevation in the pond area during the release, and the groundwater level rose to 4.5 to 5.5 feet below the

ground surface. The groundwater levels have returned to within 1 foot of pre-release levels. The release caused a 300- to 400-foot segment of Planet Ranch Road to wash away, which was subsequently repaired. The release provided important information related to the surface and subsurface hydrology of the site and demonstrated the need for planned flood control improvements included in the baseline design.

Obligations were less than anticipated to allow time for the development of additional infiltration testing to be completed. Infiltration modeling indicated native silt material could be compacted and used as a substitute for a synthetic liner, which would reduce the overall cost of construction; however, this led to a slight delay in construction, which affected obligations this fiscal year.

**Monitoring:** Planet Ranch has two distinct areas where monitoring occurred in FY18. Monitoring focused on vegetation composition and avian use in both Planet Ranch and the Middle Bill Williams River NWR.

*Planet Ranch*: Vegetation data were collected using light detection and ranging (lidar) remote sensing techniques. Southwestern willow flycatcher surveys were conducted between May 15 and July 17, 2018. No southwestern willow flycatchers were detected. Four surveys for yellow-billed cuckoos were conducted between June 20 and August 1, 2018. Two cuckoos were detected during the first survey period.

*Middle Bill Williams River NWR*: Vegetation data were collected using lidar remote sensing techniques. Riparian bird surveys were conducted from April 10 to June 5 using the LCR MSCP's double sampling protocol. Arizona Bell's vireos, Gila woodpeckers, Sonoran yellow warblers, and summer tanagers were detected breeding at the site. Southwestern willow flycatcher surveys were conducted between May 15 and July 17. Migrants were detected early, but no resident or breeding southwestern willow flycatchers were detected. Yellow-billed cuckoo surveys were conducted between June 19 and August 9. There were 10 yellow-billed cuckoo detections and 3 possible breeding territories.

**FY19 Activities:** Final improvements to the two residences will be made and furnishings added to prepare for the arrival of the construction crews.

The engineering design was completed, and a Value Engineering Study on the design was conducted. The study concurred with the design and provided several options to minimize seepage from the ponds after construction. Construction activities are anticipated to begin in 2019; work planned includes mobilization of heavy equipment; clearing of vegetation from the footprint of the ponds; the excavation of a test pond; the procurement, transportation, and installation of sheet pile for the flood control structure; and the drilling of new production and domestic wells.

A 3- to 5-acre test pond will be constructed and monitored to verify modeled water infiltration rates. A study plan has been developed to support this effort. Once the results from the test pond have been analyzed, excavation of the ponds will begin. To protect the site from future releases or floods, installation of the flood control structure will be prioritized over pond construction. This work will begin in 2019 and carry through into 2020.

**Monitoring**:

*Planet Ranch*: Vegetation data will be collected using lidar remote sensing techniques. Construction compliance monitoring will be conducted as needed to minimize impacts to listed and covered species. Post-development monitoring for southwestern willow flycatchers, yellow-billed cuckoos, and other riparian birds will be conducted in potential habitat outside the construction area. Post-development surveys for other covered species will begin after construction is completed and appropriate habitat is present.

*Middle Bill Williams River NWR*: Vegetation data will be collected using lidar remote sensing techniques. General bird surveys will be conducted from mid-April to June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons where appropriate habitat is available.

**Proposed FY20 Activities:** Construction activities, including installation of the sheet piling and excavation of the ponds, is scheduled to be completed in late FY20. Completion of the ponds is anticipated to create 60 acres of disconnected backwater for the program.

**Monitoring:**

*Planet Ranch*: Vegetation data will be collected using lidar remote sensing techniques. Construction compliance monitoring will be conducted as needed to minimize impacts to listed and covered species. Post-development monitoring for southwestern willow flycatchers, yellow-billed cuckoos, and other riparian birds will be conducted in potential habitat outside the construction area. Post-development surveys for other covered species will begin after construction is completed and appropriate habitat is present.

*Middle Bill Williams River NWR*: Vegetation data will be collected using lidar remote sensing techniques. General bird surveys will be conducted from mid-April to June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons where appropriate habitat is available.

**Pertinent Reports:** The Restoration, Development, and Monitoring Plan will be posted on the LCR MSCP website upon completion.

## Work Task E24: Cibola National Wildlife Refuge Unit #1 Conservation Area

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $750,000 | $1,131,907.15 | $7,106,550.91 | $900,000 | $1,000,000 | $2,500,000 | $3,000,000 |

**Contact:** Jessie Stegmeier, (702) 293-8121, jstegmeier@usbr.gov

**Start Date:** FY07

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BEVI1, CRCR2, ELOW1, GIFL1, GIWO1, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

**Location:** Reach 4, Cibola National Wildlife Refuge, 1/2 mile east of River Mile 97, Arizona

**Purpose:** To create and manage a mosaic of native land cover types for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** This work task incorporated lands under Work Tasks E6–E8 (closed), with additional adjacent acreage at the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1). Operation and maintenance of these work tasks will now be tracked under Work Task E24.

**Project Description:** A Land Use Agreement was signed with the U.S. Fish and Wildlife Service to create and maintain habitat on Cibola NWR Unit #1.

The Bureau of Reclamation had a number of restoration research and demonstration projects at Cibola NWR Unit #1 that began as a precursor to the LCR MSCP.

This work task incorporates the existing projects, active agricultural land, and undeveloped, adjacent acreage into a single conservation area. Cibola NWR

Unit #1 is targeted primarily for the cottonwood-willow land cover type but will also likely include a mosaic of native habitats, including wetland and riparian-upland interface areas.

The original 950 acres identified as the Cibola NWR Unit #1 Conservation Area has been divided into five areas:

- Area #1 (192 acres) includes active agricultural fields, existing (converted agriculture) cottonwood-willow land cover type, and LCR MSCP research and demonstration projects.

- Area #2 (Hippy Fire) includes 339 acres that were cleared as a result of the Hippy Fire and has been developed as cottonwood-willow land cover.

- Areas #3 (Baseline 90) includes 107 acres of undeveloped and fallowed agricultural land. Undeveloped areas will require clearing, leveling, installation of an irrigation infrastructure, and soil conditioning before development for native riparian species.

- Area #4 (North 160) includes 158 acres and is planted with alfalfa and cover crops until the area is conditioned to improve soil salinity. It is scheduled for cottonwood-willow land cover.

- Area #5 (Crane Roost) includes 154 acres that have been planted with cottonwood, willow, and honey mesquite.

In FY18, the U.S. Fish and Wildlife Service and LCR MSCP agreed to the expansion of Cibola NWR Unit #1. The habitat creation concept includes expanding the existing conservation area by establishing approximately 1,200 acres of additional cottonwood-willow, honey mesquite, and marsh land cover types on lands immediately south of the existing conservation area.

**Annual Maintenance and Management:** A local farmer diverts water to irrigate the conservation area based on site conditions and species planted. This provides local knowledge of weather and farming practices, which are applied to the management of the conservation area. The farmer and his employees are an onsite presence and provide early recognition of issues or concerns. The farmer is also responsible for assessing the water needs of the trees and, in coordination with the Cibola National Wildlife Refuge and LCR MSCP, orders and delivers the water. Removal of vegetation along the roadside and ditches is typically performed quarterly to reduce the potential of wildfires and is done in conjunction with maintenance of the irrigation canals, gates, and roads.

The annual costs associated with operating Cibola NWR Unit #1, such as electrical power utility bills, labor to open and close the irrigation gates, invasive and non-native vegetation control, and road maintenance, are included in the annual maintenance costs.

**Previous Activities:** Through FY17, 628 acres of cottonwood-willow have been established within the 950-acre site. Native trees have been irrigated and managed since 2007. Monitoring for birds, MacNeill's sootywing skippers, bats, and rodents was conducted.

## FY18 Accomplishments:

**Maintenance and Management:** Management, maintenance, flood irrigation, and monitoring of the established cottonwood-willow habitat continued.

**Restoration:**

*Cottonwood-Willow:* Approximately 158 acres were planted with a mix of cottonwood, willow, honey mesquite, and other riparian shrub and grass species in accordance with the Restoration Development and Monitoring Plan for the North 160 area. Plants were ordered for the Eastside and replanting of the Seed Feasibility areas (37 and 20 acres, respectively). Construction activities began in order to replace the pump stand at Cibola NWR Unit #1. Pilings required to secure the new pump stand were driven into the ground, and a new basin was excavated to allow the pumps to draw sediment-free water from the river. However, high groundwater conditions made the soil unstable, and a new design became necessary to ensure the platform would not be compromised. The acquisition of sheet piling to stabilize flowing sands delayed completion of the pump stand.

Obligations in FY18 were higher than approved, but necessary, due to the large acreage being managed, size of the plant orders, and the unforeseen pump replacement costs. Future budget annual operating estimates have been increased to reflect the actual costs of management of the increased acreage.

An exhibit to the Land Use Agreement for the expansion of the existing 950-acre Cibola NWR Unit #1 area to approximately 2,150 acres has been signed with the U.S. Fish and Wildlife Service. The habitat creation concept includes expanding the existing conservation area by establishing approximately 1,200 acres of cottonwood-willow, honey mesquite, and marsh land cover types on lands immediately south of the existing conservation area. The restored acreage would include areas that can be flooded and areas that would utilize the water table after establishment. Honey mesquite and low-density cottonwood-willow habitat may only be irrigated until their roots reach the water table. Cottonwood-willow areas planted in high density will be flood irrigated to create moist soil conditions for nesting birds.

**Monitoring:** Vegetation data were collected using light detection and ranging (lidar) remote sensing techniques. Monitoring stations, as part of the salinity and soil moisture monitoring network, were installed during FY18 to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health.

Southwestern willow flycatcher surveys were conducted from late June to early August, and no resident or breeding individuals were detected. Yellow-billed cuckoo surveys were conducted from late June to early August. Yellow-billed cuckoos were detected, and there were two confirmed, two probable, and five possible breeding pairs at the site. Riparian bird surveys were conducted at the Laguna Division Conservation Area between April 10 and June 5 using the LCR MSCP's double sampling protocol. There were no LCR MSCP covered species detected. Avian mist netting following the Monitoring Avian Productivity and Survivorship (MAPS) protocol was conducted from early May to early August. One Sonoran yellow warbler was captured and color banded. There were no recaptures or resightings of LCR MSCP covered species.

A long-term acoustic bat station detected the presence of LCR MSCP bat species from June to August. Western red bats, western yellow bats, and California leaf-nosed bats were detected.

Rodent trapping was conducted in fall and spring. No LCR MSCP species were detected at the site.

### FY19 Activities:

**Maintenance and Management:** Management, maintenance, flood irrigation, and monitoring of the established habitat created will continue.

**Restoration:**

*Cottonwood-Willow:* Approximately 57 acres within Area #1 will be planted with a mix of cottonwood, willow, honey mesquite, and other riparian shrub and grass species. Installation of the sheet piling, construction and installation of the pump platform, and installation of the pumps is scheduled.

A wetlands delineation, soil sampling, and groundwater well installation, to facilitate the restoration design, are scheduled to be completed for the additional 1,200 acres to be restored. A conceptual design for the expansion area will be drafted.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. Data from the existing monitoring stations will be used to assess whether adequate soil moisture is being maintained during the nesting season for

avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. Additional soil moisture monitoring stations will be installed in areas that were planted in FY18. General bird surveys will be conducted from mid-April to mid-June. A MAPS station will be operated from May until the end of July. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat acoustic monitoring will be conducted during summer. Rodent monitoring will be conducted in fall and/or spring. Surveys will be conducted for MacNeill's sootywing skippers.

### Proposed FY20 Activities:

**Maintenance and Management:** Management, maintenance, flood irrigation, and monitoring of the established habitat created will continue.

**Restoration:**

*Cottonwood-Willow:* The Restoration Development and Monitoring Plan, permitting, design, and compliance to restore the expansion area are expected to be completed. Control of saltcedar in portions of the expansion area may be conducted on an as-needed basis. Design and permitting of the expansion area are expected to be completed.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. The data collected from the salinity and soil moisture monitoring network will be used to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. Additional soil moisture monitoring stations will be installed in areas that were planted in FY19. General bird surveys will be conducted from mid-April to mid-June. A MAPS station will be operated from May until the end of July. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat acoustic monitoring will be conducted during summer. Rodent monitoring will be conducted in fall and/or spring. Surveys will be conducted for MacNeill's sootywing skippers.

**Pertinent Reports:** The 2014–16 annual reports are posted on the LCR MSCP website. The *Cibola National Wildlife Refuge Unit #1 Conservation Area, Fiscal Year 2018 Annual Report* will also be posted upon completion.

## Work Task E25: Big Bend Conservation Area

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $20,000 | ($6,534.23) | $1,224,828.92 | $20,000 | $60,000 | $320,000 | $520,000 |

**Contact:** Laken Anderson, (702) 293-8153, landerson@usbr.gov

**Start Date:** FY09

**Expected Duration:** FY55

**Long-Term Goal:** Habitat protection and management

**Conservation Measures:** BONY2, FLSU1, and RASU2

**Location:** Reach 3, Nevada, River Mile 266.5

**Purpose:** To protect and manage an existing connected backwater for native fishes

**Connections with Other Work Tasks (Past and Future):** Marsh bird surveys are conducted under Work Task D1, while fish surveys have been conducted under multiple work tasks under Species Research (Section C) and Work Task F5.

**Project Description:** The Boy Scout Camp purchased by the Southern Nevada Water Authority (SNWA), combined with the adjacent backwater managed by the State of Nevada, has collectively been identified as the Big Bend Conservation Area (BBCA). This conservation area includes approximately 15 acres of backwater within the Nevada portion of the Colorado River that will be protected and approximately 15 acres of upland area adjacent to the backwater. The dry upland area was enhanced for education and outreach purposes by the SNWA at minimal cost to the LCR MSCP and was completed in concert with protection of the backwater. The properties are adjacent to and buffered by Big Bend State Park.

Past native fish monitoring efforts have indicated the presence of native fishes in and adjacent to the existing backwater. Securing the site has resulted in 15 acres of a backwater habitat credit that benefits razorback suckers, bonytail, and flannelmouth suckers in Reach 3 of the LCR MSCP planning area. Reach 3 maintains the only self-sustaining population of flannelmouth suckers and has very few undeveloped backwaters, which made protection of the existing backwater a LCR MSCP priority. The Colorado River and Reach 3, in particular,

are experiencing extensive urban development. The BBCA maintains access to the river via the adjacent backwater and would have been a likely candidate for development. Securing the property for the LCR MSCP ensures the commitment of adjacent landowners and controls future development in the surrounding areas. Long-term security of the property provides protection to the backwater and allows for future restoration activities as warranted.

**Previous Activities:** Since 2010, the Nevada Department of Wildlife has managed the connected backwater as wakeless. Prior to FY13, all fisheries activities were restricted to February through May as part of ongoing flannelmouth sucker activities associated with Work Task C15 (closed). Since FY13, routine monitoring of the BBCA has been conducted monthly from February through May and has included electrofishing, trammel netting, remote passive integrated transponder (PIT) scanning, and larval light trapping in areas where there have been historical contacts of native fishes and adequate water levels to permit access for sampling. Water quality profiles were conducted during each monitoring trip and at least quarterly the remainder of the year. Through monitoring, low numbers of razorback and flannelmouth suckers continued to be contacted, including larvae of both species and an occasional flannelmouth sucker subadult. The backwater has a direct surface connection to the lower Colorado River; consequently, water quality parameters mirror that of the river. Marsh bird and small mammal surveys were conducted annually.

## FY18 Accomplishments:

**Maintenance and Management:** Minimal maintenance activities were conducted in 2018. A labor adjustment, which occurred at the end of FY17, resulted in a positive obligation in FY18.

**Monitoring:** Fisheries monitoring activities were conducted monthly throughout the year. Netting activities were completed in the winter and spring months, and remote PIT scanning was conducted continuously. Routine monitoring resulted in netting captures of 13 razorback suckers and 1 bonytail. The captured fishes came from three FY18 stockings: one on March 22 at Laughlin Lagoon and two on April 5 at Laughlin Lagoon and the Big Bend boat ramp. Remote PIT scanning resulted in the contact of 80 razorback suckers and 10 bonytail. All bonytail contacted via netting and scanning were from the March 22 stocking. Razorback sucker and flannelmouth sucker larvae were both present during spring surveys. Larval capture rates were lower than those in FY17 but similar to those of previous years. Water quality parameters remained within thresholds for all native fishes.

Marsh bird surveys were conducted on three occasions at the wetland portions of the BBCA in March and April. For the first time during formal surveys at BBCA, a California black rail was detected on March 15; breeding was not confirmed.

## FY19 Activities:

**Maintenance and Management:** Routine maintenance activities will be conducted. The bathymetric surveys conducted in past years indicate portions of the backwater have filled with sediment and are blocking access to the western portion of the backwater. The sediment plug appears to be caused by summer thunderstorms. A plan for removal of the sediment plug to increase surface water flow throughout the backwater is being discussed.

One bathymetric light detection and ranging (lidar) remote sensing survey is scheduled to be conducted in 2019 to continue BBCA backwater management monitoring. The purpose of these annual surveys is to provide elevation data, which will be used to monitor sediment deposition.

**Monitoring:** Due to sedimentation and reduced access in the BBCA backwater, trammel netting efforts will be discontinued until dredging activities are completed in FY22. To ensure adequate native fish monitoring is completed in the interim, additional remote PIT scanners will be deployed during each sampling trip to supplement the lack of netting. Larval trapping will be conducted as planned, and water quality will be monitored at a level similar to FY18. Vegetation data will be collected using lidar remote sensing techniques. Rodent trapping will be conducted in fall and/or spring.

## Proposed FY20 Activities:

**Maintenance and Management:** Annual bathymetric lidar surveys will continue at the BBCA. Permitting and compliance will be conducted to allow for maintenance dredging to remove sediment plugs and deepen the backwater. Dredging is scheduled to start in FY21. Routine maintenance activities will be conducted.

**Monitoring:** Fisheries monitoring will be conducted at a level and interval similar to that in previous years. Monitoring trips will include larval light trapping and remote PIT scanning. Water quality will be recorded during each monitoring event and quarterly outside of the monitoring period. Vegetation data will be collected using lidar remote sensing techniques. Rodent trapping will be conducted in fall and/or spring.

**Pertinent Reports:** The 2014–17 annual reports are posted on the LCR MSCP website. The *Big Bend Conservation Area, Fiscal Year 2018 Annual Report* will also be posted upon completion.

# Work Task E27: Laguna Division Conservation Area

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $150,000 | $156,319.43 | $27,670,351.23 | $120,000 | $120,000 | $100,000 | $100,000 |

**Contact:** Arien Chavez, (702) 293-8027, amchavez@usbr.gov

**Start Date:** FY10

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BEVI1, ELOW1, GIFL1, GIWO1, SUTA1, VEFL1, WIFL1, YBCU1, YHCR2, and YWAR1

**Location:** Reach 6, Federal lands, River Miles 43–49, California and Arizona

**Purpose:** To create and manage a mosaic of native land cover types for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** Vegetation and species monitoring are being addressed under Work Tasks F1–F4 and F7.

**Project Description:** The Laguna Division was identified as having the potential for large-scale riparian and marsh restoration and enhancement. In 2007, a Laguna Division Planning Group comprised of interested parties was formed to identify potential restoration projects within the division.

The undeveloped ground, which was shaped to become the Laguna Division Conservation Area (LDCA), was a relatively wide area with a series of low linear depressions that were remnants of former river meanders. The site was designed to create marsh and riparian land cover types that would be maintained with a maximum base flow of 100 cubic feet per second. Open water areas were created in the form of linear excavations aligned with historic river meanders, east of lands identified as future stockpiling areas for dredged material removed from the Colorado River (Laguna settling basin). To minimize earthwork, cuts and fills followed the existing topography where feasible. Adjacent terraces were graded to allow for flooding and to promote the establishment of native riparian species. Water control structures within the conservation area were designed to manage water levels by raising and lowering the water surface.

The LCR MSCP adjusts water levels at the LDCA based on habitat requirements. The conservation area can also be used to store excess flows through a

coordinated effort with the Bureau of Reclamation's Water Operations Group. When excess flows are anticipated, the water control structures at the LDCA can be adjusted to accommodate a portion of the excess flow.

**Annual Maintenance and Management:** The LDCA was designed and constructed to minimize annual operation and maintenance costs. The water delivery system does not require onsite personnel, and there are no pumps at the LDCA to maintain. Water is diverted from the desilting forebay of the Gila Gravity Main Canal (LDCA headworks) and delivered to the site via gravity. Inspection and maintenance of the LDCA headworks occurs annually and includes visual inspection of the cathodic protection system and pressure washing inside the structure. Every three years, to coincide with a planned outage on the Gila Gravity Main Canal, a more rigorous inspection of the LDCA headworks and cathodic protection is performed. Routine maintenance on the water control structures within the conservation area occurs twice a year. The annual cost for operation and maintenance of the LDCA includes road grading.

## Previous Activities:

**Maintenance and Management:** Inlet modifications to the point of diversion at the Gila Gravity Main Canal sluicing gates were made to allow for up to 100 cubic feet per second flow capacity. The diversion pipe system was engineered to allow for maximum management flexibility, including diverting the entire flow to the Mittry Lake Wildlife Area or the historic river channel. Approximately 4,000 feet of 48-inch high-density polyethylene pipe was installed between 2011 and 2012.

Clearing and contouring of the northern portion of the conservation area (over 500 acres) began in fall 2011 and was completed in 2012. Clearing and contouring activities in the southern portion of the conservation area (over 500 acres) began in summer 2012 and were completed in April 2014. In all, approximately 3,200,000 cubic yards of earthen material was excavated. Over 800,000 marsh plants and over 1 million trees and plants were planted.

## FY18 Accomplishments:

**Maintenance and Management:** Access, law enforcement, and fire suppression at the LDCA were regulated by the Bureau of Land Management. The water control infrastructure was maintained throughout the year via regular inspections and preventive maintenance. General site maintenance, which includes grading the roads, was also conducted.

**Monitoring:** Vegetation data were collected using light detection and ranging (lidar) remote sensing techniques.

Marsh bird surveys were conducted on three occasions at portions of the LCDA that currently contain marsh vegetation. Western least bitterns and Yuma clapper rails were detected and are presumed to be breeding at this conservation area.

Riparian bird surveys were conducted at the LDCA between April 10 and June 5 using the LCR MSCP's double sampling protocol. Arizona Bell's vireos, Gila woodpeckers, and Sonoran yellow warblers were detected breeding at the site. Southwestern willow flycatcher surveys were conducted between May 15 and July 17, 2018, and no resident or breeding individuals were detected. Yellow-billed cuckoo surveys were conducted between late June and early August, and there were 12 detections and 1 possible breeding territory, and 1 probable breeding territory.

Rodent trapping was conducted in fall and spring. No Yuma hispid cotton rats were captured.

## FY19 Activities:

**Maintenance and Management:** Access, law enforcement, and fire suppression at the LDCA is regulated by the Bureau of Land Management. Control of invasive plant species will occur on an as-needed basis by the National Park Service. The water control infrastructure is maintained via regular inspections and preventive maintenance. General site maintenance will include straw bale placement for soil stabilization and grading of the roads, as needed.

An inspection of the LDCA headworks structure was scheduled to occur in November 2018; however, upstream repairs on the Gila Gravity Main Canal are incomplete. Therefore, the inspection could not be completed under dry conditions. General maintenance and inspection of the LDCA headworks structure is scheduled for spring 2019.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. Monitoring for marsh birds will continue in suitable habitat. Riparian bird surveys will be conducted from mid-April to June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons where appropriate habitat is available. Surveys for rodents will be conducted in appropriate habitat.

## Proposed FY20 Activities:

**Maintenance and Management:** Access, law enforcement, and fire suppression at the LDCA will be regulated by the Bureau of Land Management. Control of invasive plant species will occur on an as-needed basis by the National Park Service. Water control infrastructure will be maintained throughout the year via regular inspections and preventive maintenance.

An inspection of the LDCA headworks is scheduled to coincide with the inspection of the Gila Gravity Main Canal once the repairs in the canal are complete. This comprehensive inspection will occur when the canal is drained in coordination with the operation of Imperial Dam and may increase obligations. General maintenance and inspection of the LDCA headworks structure will take place once a year.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. Monitoring for marsh birds will continue in suitable habitat. Riparian bird surveys will be conducted from mid-April to June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons where appropriate habitat is available. Surveys for rodents will be conducted in appropriate habitat.

**Pertinent Reports:** The 2016–18 annual reports will be posted on the LCR MSCP website upon completion.

## Work Task E28: Yuma East Wetlands

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $300,000 | $373,739.17 | $2,661,157.55 | $275,000 | $275,000 | $275,000 | $275,000 |

**Contact:** Jeremy Brooks, (702) 293-8157, jjbrooks@usbr.gov

**Start Date:** FY10

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BEVI1, BLRA1, CLRA1, ELOW1, GIFL1, GIWO1, LEBI1, NMGS1, SUTA1, VEFL1, WIFL1, YBCU1, YHCR2, and YWAR1

**Location:** Reach 6, Arizona, River Mile 31

**Purpose:** To maintain restored land cover types that benefit LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** Vegetation and species monitoring are being addressed under Work Tasks F1–F4.

**Project Description:** In 2000, the city of Yuma and the Quechan Indian Tribe collaborated to restore the local wetlands along the Colorado River by removing overgrown non-native species. Approximately 380 acres have been restored to create a mosaic of marsh, mesquite, and cottonwood-willow. The project is located in Yuma, Arizona, on city of Yuma, Quechan Indian Tribe, and Arizona Game and Fish Department lands. In coordination with these partners and the Yuma Crossing National Heritage Area Corporation (YCNHAC), a 501(c)3 non-profit organization responsible for managing day-to-day operations, 70% of the funding will be provided by the LCR MSCP to support the long-term operation and maintenance of created habitats and adaptive management actions that benefit species covered under the LCR MSCP Habitat Conservation Plan. Infrequent but substantial capital improvements may also occur and will be in addition to annual operating costs.

Yuma East Wetlands (YEW) is fully developed and has transitioned from development to maintenance and monitoring. The 380-acre conservation area, including the open water portions of the Colorado River, is classified as 183 acres of cottonwood-willow, 103 acres of honey mesquite, and 94 acres of marsh.

**Annual Maintenance and Management:** The work associated with the operation and maintenance of YEW is described in the Yuma East Wetlands Annual Management Plan. The plan is developed collaboratively among, and concurred to by, all partners prior to obligation of funding. The document describes the scope of work, budget, and responsibilities of all parties and is limited to recurring operation and maintenance activities. Funding for 70% of the annual operation and maintenance budget is provided by the LCR MSCP, and the remaining 30% is provided by the other partners.

Annual operation and maintenance activities anticipated throughout the 50-year term of the LCR MSCP include flood irrigation of the North Channel and AHA fields, pump maintenance and repair, minor repair of infrastructure, removal of invasive and non-native plant species, and general site maintenance such as road grading.

**Previous Activities:** In FY13, the Quechan Indian Tribe, Arizona Game and Fish Department, city of Yuma, the YCNHAC, and the Bureau of Reclamation agreed to the terms and conditions in the multi-party Land Use Agreement. The agreement was signed in late FY13 after review by the Steering Committee. Monitoring began in FY13.

## FY18 Accomplishments:

**Maintenance and Management:** YEW was operated and maintained in accordance with the work identified in the FY18 Yuma East Wetlands Annual Management Plan. LCR MSCP-supported activities included 22 flood irrigation cycles as well as other related site maintenance and management activities. In the spring of FY18, the FY19 Yuma East Wetlands Annual Management Plan was developed and approved.

In FY18, funding was provided to the YCNHAC to replace the North Channel vertical turbine pump with a trailer-mounted centrifugal pump. During the prior irrigation season, a Bureau of Reclamation owned trailer-mounted centrifugal pump was temporarily installed to evaluate performance. During this trial, the pump performed satisfactorily. Acquisition of the trailer-mounted pump resulted in exceeding the FY18 approved budget estimate.

On May 20, 2018, the Prison Hill Fire burned approximately 0.1 acre within the southern cottonwood stands and approximately 60 acres of undeveloped land north of the conservation area. Fire crews utilized the trailer-mounted centrifugal

pump to combat the fire and prevent further expansion. As a result, the fire caused negligible damage to the land cover at YEW. Investigators determined that the fire originated from a transient camp located on the site.

**Monitoring:** Vegetation data were collected using light detection and ranging (lidar) remote sensing techniques. Monitoring stations, as part of the salinity and soil moisture monitoring network, were installed during FY18 to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health.

Marsh bird surveys were conducted on three occasions at the wetland portions of YEW. Western least bitterns and Yuma clapper rails were detected and are presumed to be breeding at the site.

Riparian bird surveys were conducted at YEW between April 10 and June 5 using the LCR MSCP's double sampling protocol. Sonoran yellow warblers and Gila woodpeckers were detected breeding at the site. Southwestern willow flycatcher surveys were also conducted between late June and early August, and no resident or breeding individuals were detected. Yellow-billed cuckoo surveys were conducted between late June and early August, and there were eight detections. One confirmed breeding pair was detected for the first time at the conservation area. A nest was found, and at least one young was confirmed to have fledged.

A long-term acoustic bat station detected the presence of LCR MSCP bat species from June to August. Western red bats and western yellow bats were detected. Many of the acoustic station's components were replaced in May after they were damaged in the Prison Hill Fire on May 20.

Rodent trapping was conducted in fall and spring. Yuma hispid cotton rats continue to be detected at the site.

### FY19 Activities:

**Maintenance and Management:** YEW will be operated and maintained in accordance with the work identified in the FY19 Yuma East Wetlands Annual Management Plan. The FY20 Annual Management Plan will be developed with the partners in spring 2019.

The new trailer-mounted centrifugal pump, procured in FY18, will be installed in FY19.

Flow meters for the North Channel and AHA pumps, as well as staff gauges to track water levels within the north and south marsh complexes, will be installed.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. Data from the existing monitoring stations will be used to assess

whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. Marsh bird surveys will be conducted in March and April. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat acoustic monitoring will be conducted during summer. Surveys for rodents will be conducted in appropriate habitat.

### Proposed FY20 Activities:

**Maintenance and Management:** YEW is expected to be operated and maintained in accordance with the work identified in the FY20 Yuma East Wetlands Annual Management Plan. The FY21 Annual Management Plan will be developed with the partners in spring 2020. No significant changes to the operating plan or budget are anticipated.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. The data collected from the expanded salinity and soil moisture monitoring network will be used to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. Marsh bird surveys will be conducted in March and April. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat acoustic monitoring will be conducted during summer.

**Pertinent Reports:** The 2014–17 annual reports are posted on the LCR MSCP website. The Restoration, Development, and Monitoring Plan and the 2018 annual report will also be posted upon completion.

## Work Task E31: Hunters Hole

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $30,000 | $40,847.96 | $538,747.72 | $30,000 | $30,000 | $30,000 | $30,000 |

**Contact:** Arien Chavez, (702) 293-8027, amchavez@usbr.gov

**Start Date:** FY11

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BEVI1, GIFL1, GIWO1, SUTA1, VEFL1, WIFL1, YBCU1, YHCR2, and YWAR1

**Location:** Reach 7, Arizona, River Mile 2.5

**Purpose:** To create and maintain land cover types and support site improvements that benefit LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** Vegetation and species monitoring are being addressed under Work Tasks F1–F7.

**Project Description:** **Hunters Hole is located** in Arizona, within Reach 7 of the LCR MSCP planning area, approximately 3 miles north of the Southerly International Boundary with Mexico. The area historically consisted of interconnected ponds with adjacent marsh and stands of cottonwood-willow. Water levels in the ponds were maintained by groundwater, irrigation drainage flows, and by a channel connected to the river. Over time, the site degraded, and most of the habitat was lost due to declining water levels, establishment of invasive plant species, and wildfires. Officials from State, local, Tribal, and Federal agencies joined together in an effort to restore the area while increasing public safety and border security. The LCR MSCP assumed management of Hunters Hole as a LCR MSCP conservation area in FY12. Hunters Hole is comprised of 44 acres of cottonwood-willow habitat.

**Annual Maintenance and Management:** Irrigation is provided by a groundwater well through a series of automated valves. One irrigation cycle is approximately 89 hours long and occurs once every 3 weeks from February to November. The annual cost associated with managing Hunters Hole includes maintenance of the pumps and valves, the electrical power utility bills, and grading the road within the site.

**Previous Activities:** Hunters Hole has been managed by the LCR MSCP since 2012. Monitoring began in 2013.

## FY18 Accomplishments:

**Maintenance and Management:** The groundwater pump that supplies water to the site was serviced at the beginning of February. A small fire, the Fence Fire, occurred on February 6, 2018, affecting 2.7 acres of mainly understory vegetation. The City of San Luis Fire Department responded, and with the assistance of the Bureau of Land Management, the fire was quickly extinguished. Road wash-outs at the site led to a monthly road maintenance schedule from May until the end of September. No other significant management actions were taken.

**Monitoring:** Vegetation data were collected in using light detection and ranging (lidar) remote sensing techniques. Monitoring stations, as part of the salinity and soil moisture monitoring network, were installed during FY18 to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health.

Riparian bird surveys were conducted at Hunters Hole between April 15 and June 5 using the LCR MSCP's double sampling protocol. No LCR MSCP species were detected, but 10 other riparian bird species were found. Southwestern willow flycatcher surveys were conducted between May 15 and July 17. Migrant flycatchers were detected on the first survey in May, but no breeding or resident birds were detected. Yellow-billed cuckoo surveys were conducted between late June and early August. One bird was detected on two occasions and was considered a possible breeder and the first possible sign of yellow-billed cuckoos breeding at Hunters Hole.

A long-term acoustic bat station detected the presence of LCR MSCP bat species from June to August. Western red bats, western yellow bats, and California leaf-nosed bats were detected.

Rodent trapping was conducted in fall. Yuma hispid cotton rats were captured.

## FY19 Activities:

**Maintenance and Management:** Hunters Hole is irrigated via an automated irrigation system. No construction, restoration, or changes to management activities are anticipated. Irrigation cycles, water use, and costs are monitored in a continuing effort to manage the area as efficiently as possible.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. Data from the existing monitoring stations will be used to assess whether adequate soil moisture is being maintained during the nesting season for

avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat acoustic monitoring will be conducted during summer. Small mammal monitoring will be conducted in fall and spring.

### Proposed FY20 Activities:

**Maintenance and Management:** Hunters Hole will continue to be irrigated via the automated irrigation system. No construction, restoration, or changes to management activities are anticipated at this time.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. Data from the salinity and soil moisture monitoring network will be used to assess whether adequate soil moisture is being maintained during the nesting season for avian species and to assess whether soil moisture and salinity conditions are adequate for sustained vegetation health. General bird surveys will be conducted from mid-April to mid-June. Single species surveys for southwestern willow flycatchers and yellow-billed cuckoos will be conducted during their respective breeding seasons. Bat acoustic monitoring will be conducted during summer. Small mammal monitoring will be conducted in fall and spring.

**Pertinent Reports:** The 2013 and 2015 annual reports are posted on the LCR MSCP website. The Restoration, Development, and Monitoring Plan, the 2012, 2014, and 2016–18 annual reports will also be posted upon completion.

## Work Task E33: Pretty Water Conservation Area

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $40,000 | $24,647.30 | $1,793,801.56 | $30,000 | $20,000 | $20,000 | $20,000 |

**Contact:** Jessie Stegmeier, (702) 293-8121, jstegmeier@usbr.gov

**Start Date:** FY13

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BEVI1, ELOW1, VEFL1, WRBA2, and WYBA3

**Location:** Reach 4, Cibola National Wildlife Refuge, River Miles 95–97, California

**Purpose:** To create and manage a mosaic of native land cover types for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** This work task was identified under Work Task E16.

**Project Description:** The Pretty Water Conservation Area (PWCA) (previously referred to as the Shark's Tooth Conservation Area) consists of approximately 566 acres on the Cibola National Wildlife Refuge, located in California between River Miles 95 and 97.

The PWCA contains 566 acres of honey mesquite, which will be managed for LCR MSCP covered species throughout the 50-year term of the program.

**Annual Maintenance and Management:** The PWCA was fully developed in FY15 and provides the honey mesquite land cover type with minimal long-term operational and maintenance costs. Annual management activities are limited to visual inspections of the honey mesquite, coordination with the U.S. Fish and Wildlife Service, and minor road grading. Invasive plant species control may be periodically required.

**Previous Activities:** The Restoration Development and Monitoring Plan was approved by the California Department of Fish and Wildlife in 2012. A Land Use Agreement Exhibit between the LCR MSCP and U.S. Fish and Wildlife Service was signed in 2013. In FY14, compliance and pre-construction activities were completed, and honey mesquite were ordered. The site was cleared, and 22,500 honey mesquites were planted in FY15. After planting and watering was completed, public access was re-established along the main access roads; in addition, the parking area and primitive boat ramp were maintained. Non-native species control was implemented after planting to allow native vegetation to mature without competition.

## FY18 Accomplishments:

**Maintenance and Management:** Inspections were conducted to ensure that honey mesquite have successfully established. Minor road grading was completed. Invasive plant species control efforts were completed in December 2017.

**Monitoring:** Vegetation data were collected using light detection and ranging (lidar) remote sensing techniques.

Riparian bird surveys were conducted between April 10 and June 5 using the LCR MSCP's double sampling protocol. No LCR MSCP species were detected.

Surveys for MacNeill's sootywing skippers were conducted in the areas planted with mesquite, and they were detected in areas containing quailbush.

## FY19 Activities:

**Maintenance and Management:** Inspections were conducted to ensure that honey mesquite have successfully established, and invasive plant species control efforts will be implemented on an as-needed basis. As a result, annual operating costs have been reduced. Minor road grading was conducted.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. General bird surveys will be conducted from April to June. Surveys for MacNeill's sootywing skippers will be conducted.

## Proposed FY20 Activities:

**Maintenance and Management:** Inspections are planned to ensure that honey mesquite have successfully established, and invasive plant species control efforts will be implemented on an as-needed basis. Annual operating costs have been reduced again. Minor road grading was conducted.

**Monitoring:** Vegetation data will be collected using lidar remote sensing techniques. General bird surveys will be conducted from April to June. Surveys for MacNeill's sootywing skippers will be conducted.

**Pertinent Reports:** The 2015 and 2016 annual reports are posted on the LCR MSCP website. The 2017 and 2018 annual reports will also be posted upon completion.

## Work Task E35: Mohave Valley Conservation Area

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $3,500,000 | $4,240,523.35 | $8,957,749.40 | $1,750,000 | $160,000 | $100,000 | $100,000 |

**Contact:** Laken Anderson, (702) 293-8153, landerson@usbr.gov

**Start Date:** FY15

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BONY2, FLSU1, and RASU2

**Location:** Reach 3, River Miles 237–238, Park Moabi Regional Park, California

**Purpose:** To create and manage a mosaic of land cover types to provide habitat for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** This project was identified under Work Task E16, and the design of the conservation area will also be conducted under that work task. Vegetation and species monitoring will be conducted under Work Tasks F1–F7.

**Project Description:** The Mohave Valley Conservation Area is located 13 miles south of Needles, California, along the Colorado River. The 149-acre property resides within the boundary of Park Moabi Regional Park. A connected backwater was created that diverts water off the main stem of the Colorado River just below River Mile 237. Diverted flows run through an excavated channel, enter the existing Park Moabi backwater, and converge with the river 2 miles downstream from the new point of diversion. Approximately 60 acres of backwater habitat was created based on the as-built survey. The footprint of the Mohave Valley Conservation Area is 92 acres, with native land cover types lining the banks and upland slopes of the backwater accounting for the additional 32 acres.

**Previous Activities:** The land is owned by the California State Lands Commission (Commission) and was leased to San Bernardino County. Prior to approaching the Commission and county in 2012 about the backwater project, the 149-acre parcel was used as an off-highway vehicle recreational area. The Commission (landowner) and the county (lessee) agreed to allow the creation of

the conservation area, and the county was willing to divide the property to accommodate both uses. A lease was signed between the commission and Reclamation on November 2, 2016, for the 149-acre parcel for development of the conservation area. The Restoration Development and Monitoring Plan was approved by the California Department of Fish and Wildlife in November 2015.

A survey of the 149-acre parcel was conducted to establish control points and develop elevation contours. Additionally, a temporary gauging station was installed directly across the river from the proposed inlet location so the river stage could be monitored. These data, in conjunction with site elevation data, were used to determine the volume of material to be excavated to achieve the desired depth of the backwater. A geotechnical survey was conducted in June 2014.

The project's area of impact will involve the entire 149 acres (includes areas of fill) as well as lands at the top and bottom of the parcel to connect the backwater to the main stem of the Colorado River and the Park Moabi channel. Excavated material was used throughout the site to create the desired contour elevations, but the majority of the excavated material was used to create terrain within the county's off-highway vehicle area.

Riparian bird surveys were conducted in existing habitat in April and May 2015 to identify species that might be affected by construction; no LCR MSCP species were detected.

**FY18 Accomplishments:** Land-based construction activities finished in May 2018. Roughly 1.15 million cubic yards were moved, in total, by heavy equipment, not including the dredge. The northern inlet and southern outlet bridges were installed, creating an open connection to the river. The as-built survey of the open water created indicates that just over 60 acres of connected backwater have been created. The marsh plants, mesquites, and cottonwood and willows were planted in April 2018, after the northern inlet cofferdam was removed. The plants were irrigated using sprinklers and a water truck through September, allowing them to establish. Dredging operations began in May 2018 and will continue into late spring 2019. At the end of FY18, 1.2 million cubic yards of material was moved in total. Obligations in FY18 accounted for the labor, land-based equipment, some materials costs, and the operation of the dredge with its associated support equipment. Obligations were more than what were approved due to advance rental of equipment and supplies for the southern bridge. All land-based heavy equipment was obligated at the start of the contract (FY18), although the excavation continued into FY19. The acquisition of engineered fill and concrete for the southern bridge was obligated in FY18 instead of FY17.

**FY19 Activities:** May 2019 is the anticipated completion date for the project, including dredging activities. Planting may occur on the spoil material to curb

wind erosion. The removal of the southern outlet cofferdam took place in January 2019, opening the connection to the Park Moabi channel. The northern inlet was deepened in January, when river stage was low and access easier. Maintenance activities, including invasive plant species removal, will occur in winter 2019.

**Monitoring:** Compliance monitoring will be conducted as needed during construction. Native fish monitoring will initially be completed using remote passive integrated transponder (PIT) scanners, which were integrated into the northern inlet and southern outlet bridges. Scanning data will be used to confirm the presence of native fishes, and supplemental sampling will be completed as needed.

**Proposed FY20 Activities:** Management and monitoring of the conservation area will continue. Replanting, if necessary, will be conducted in the spring of FY20. Routine maintenance activities, including road maintenance and the removal of invasive plant species, may occur.

**Monitoring:** Native fish monitoring will continue via remote PIT scanning. If scanning data confirm the presence of native fishes, supplemental sampling, including trammel netting and larval fish surveys, will be completed. Data collected through these efforts will be used to direct future monitoring and sampling activities.

**Pertinent Reports:** The first annual report will be posted on the LCR MSCP website when the conservation area is fully developed.

## Work Task E36: Parker Dam Camp

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $50,000 | $1,167.13 | $17,591.82 | $40,000 | $5,000 | $5,000 | $5,000 |

**Contact:** John Swatzell (702) 293-8165, jswatzell@usbr.gov

**Start Date:** FY17

**Expected Duration:** FY55

**Long-Term Goal:** Habitat protection and management

**Conservation Measures:** BEVI1, CRCR2, ELOW1, VEFL1, WRBA2, and WYBA3

**Location:** Reach 4, Bureau of Reclamation (Reclamation) withdrawn lands, River Miles 191–192, California

**Purpose:** To create and manage a mosaic of native land cover types for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** This work task was identified and evaluated under Work Task E16.

**Project Description:** Parker Dam Camp is located south of Parker Dam on the California side of the Colorado River between River Miles 191 and 192. The site is located approximately 25 miles southeast of Lake Havasu City, Arizona, and 17 miles upstream of Parker, Arizona.

Parker Dam Camp was established by Reclamation to house workers during the construction of Parker Dam. The property consisted of numerous residences and other buildings, including a school. In the 1990s, Reclamation determined that the facility was no longer required for project activities and began the process of disposing of the houses and other buildings. Asphalt roads, concrete sidewalks, and sparse landscaping are all that remain of the Government town. Public access was restricted by fencing on the north and east sides and by the Whipple Mountains to the south and west.

After the structures were removed, Reclamation evaluated potential options for use of this property. The LCR MSCP entered into an agreement with the Lower Colorado Dams Office (LDCO) to transfer management responsibly to the LCR MSCP so Parker Dam Camp could be managed as a conservation area to

promote the natural establishment of honey mesquite. Exotic vegetation is being selectively removed to promote the growth and expansion of honey mesquite within the camp. Additional land cover types may be created at a later date.

**Previous Activities:** In FY16, an agreement was signed by the LCR MSCP and the LCDO to transfer management responsibility of Parker Dam Camp from the LCDO to the LCR MSCP. Invasive vegetation maintenance has been completed as needed.

### FY18 Accomplishments:

**Operations and Management:** The disposal of the town left debris within the conservation area. Cleanup of the debris piles was planned for FY18; however, it was delayed until FY19, which resulted in reduced obligations.

**Monitoring:** Riparian bird surveys were conducted between April 10 and June 5 using the LCR MSCP's double sampling protocol. Gila woodpeckers were documented breeding.

### FY19 Activities:

**Operations and Management:** Site maintenance activities, removal of the debris piles, and general cleanup are scheduled. A plan to replace invasive plants with native vegetation along a small stream located on the northern portion of Parker Dam Camp will be developed.

**Monitoring:** Riparian bird surveys will be conducted from May to early August. Reconnaissance surveys will be conducted to determine if gilded flicker breeding habitat may be present.

### Proposed FY20 Activities:

**Operations and Management:** Site maintenance and general cleanup will continue as needed.

**Monitoring:** Riparian bird surveys will be conducted from May to early August. Surveys for gilded flickers may be conducted if habitat is found in FY19.

**Pertinent Reports:** The 2017 and 2018 annual reports will be posted on the LCR MSCP website upon completion.

# Work Task E37: Palo Verde Ecological Reserve-South

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $500,000 | $0 | $10,027.29 | $100,000 | $500,000 | $500,000 | $300,000 |

**Contact:** Andrea Finnegan, (702) 293-8203, afinnegan@usbr.gov

**Start Date:** FY17

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BEVI1, ELOW1, GIFL1, GIWO1, MNSW2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

**Location:** Reach 4, River Miles 123–125, California

**Purpose:** To create and manage a mosaic of native land cover types for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** Vegetation monitoring is conducted under Work Task F1, and wildlife monitoring is conducted under Work Tasks F2–F4 and F7.

**Project Description:** Palo Verde Ecological Reserve-South (PVER-South), located within the Palo Verde Irrigation District (PVID), is approximately 350 acres with a mix of active agricultural fields, undeveloped ground, and portions of an old river meander. The California Department of Fish and Wildlife has made this property available for LCR MSCP habitat restoration activities. Development of the project is intended to satisfy both the LCR MSCP requirements and a portion of California Endangered Species Act Incidental Take Permit No. 2081-2005-008-06.

The eastern boundary of the property is adjacent to the Colorado River, and the western boundary is adjacent to active agricultural fields and a main irrigation canal for the PVID. Existing infrastructure, which includes lined canals, can deliver water to approximately 200 acres of active agricultural lands.

The intent of this project is to develop the property in a mosaic of land cover types using the active agricultural lands, undeveloped lands, and the former river meander.

**Previous Activities:** Identification of the property and evaluation for inclusion into the LCR MSCP were completed under Work Task E16.

**FY18 Accomplishments:** Restoration of PVER-South was postponed while other priority sites were being developed; therefore, obligations were less than approved.

**Maintenance/Restoration/Management:** No habitat creation or management activities occurred in FY18.

**Monitoring:** No monitoring activities were conducted in FY18.

## FY19 Activities:

**Restoration:**

*Maintenance and Management:* The *Restoration Development and Monitoring Plan for Palo Verde Ecological Reserve-South* was submitted and approved by the California Department of Fish and Wildlife. The LCR MSCP will assume management responsibilities of the property, provide irrigation to the site, evaluate and repair the canal system as necessary, and provide any other maintenance needed.

*Monitoring:* Pre-development monitoring may be conducted if additional data are needed for compliance documentation. This work will be funded under post-development monitoring work tasks (Section F).

## Proposed FY20 Activities:

**Restoration:**

*Maintenance and Management*: The LCR MSCP will plant approximately 111 acres of honey mesquite in accordance with the approved development plan. The PVID will provide water to PVER-South and will send a record of diversionary amounts to the LCR MSCP. The LCR MSCP will begin incurring annual costs, such as water tax and coalition fees, from the PVID.

*Monitoring:* Pre-development monitoring may be conducted if additional data are needed for compliance documentation. This work will be funded under post-development monitoring work tasks (Section F).

**Pertinent Reports:** The Restoration Development and Monitoring Plan will be posted on the LCR MSCP website upon completion.

## Work Task E38: Three Fingers Lake

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $200,000 | $173,347.70 | $289,090.33 | $100,000 | $10,000 | $10,000 | $10,000 |

**Contact:** John Swatzell, (702) 293-8165, jswatzell@usbr.gov

**Start Date:** FY17

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BLRA1, CLRA1, CRCR2, and LEBI1

**Location:** Reach 4, Cibola National Wildlife Refuge, California, River Mile 90

**Purpose:** To create and manage a mosaic of native land cover types for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** Vegetation monitoring is conducted under Work Task F1, wildlife monitoring is conducted under Work Tasks F2–F4 and F7, and fisheries monitoring is conducted under Work Task F5.

**Project Description:** Three Fingers Lake, located within the Cibola National Wildlife Refuge, is a 680-acre conservation area being restored to create a 241-acre marsh complex within the State of California. Honey mesquite and cottonwood- willow will be included on the fringe to add to the mosaic and for soil stabilization. Development of the project is intended to satisfy both the LCR MSCP Habitat Conservation Plan requirements and a portion of California Endangered Species Act Incidental Take Permit No. 2081-2005-008-06.

Three Fingers Lake was dredged in the late 1990s, which established 24 acres of open water with a small fringe of cattails. The surrounding landscape is dominated with invasive saltcedar. The backwater is bounded by the old river channel to the east and Milpitas Wash to the west. It is disconnected from the old river channel by earthen and sheet pile structures.

Discussions with the U.S. Fish and Wildlife Service (USFWS) have resulted in a restoration concept that would create a large marsh complex similar in size to Hart Mine Marsh (E9). A decision was made to construct a marsh complex, as it

is more cost effective to construct and more manageable than a backwater/marsh mosaic design. The restoration concept includes reshaping and contouring of the ground surrounding the dredged channel to allow for managed flooding. Using a combination of river stage and pumped surface water, water levels would be maintained in the marsh throughout the year and could be held static during the marsh bird breeding season.

The existing earthen and sheet pile structures will be modified to ensure their long-term viability and to reduce the permeability of the structures. The existing pump stand and pumps will be used to divert water into the dredged channels to increase circulation. Culverts or weirs could also be constructed to ensure the maximum marsh elevations would not be exceeded.

Shaping and contouring of the ground adjacent to the dredged channels would target a depth of 0–2 feet and would be sloped from the edge of the channels out to the perimeter of the marsh. Smaller, deeper channels may also be excavated to increase depth diversity and facilitate circulation of water. Approximately 1,000,000 cubic yards of dirt are anticipated to be moved.

**Previous Activities:** Identification of Three Fingers Lake and evaluation for inclusion into the LCR MSCP were conducted under Work Task E16.

**FY18 Accomplishments:**

**Restoration:** A design concept to create a marsh complex was developed with the USFWS. A Land Use Agreement for restoration activities was signed by the USFWS. River gauge information was used in conjunction with water surface elevation data from data loggers installed within Three Fingers Lake to complete the design. Final land cover type acres will be determined after the design has been finalized. Creditable acres will be based on an as-built survey conducted after the construction is completed.

**Monitoring:** The USFWS conducted marsh bird surveys at Three Fingers Lake in March and April as part of their annual monitoring program. Western least bitterns and Yuma clapper rails were detected within the lake. The LCR MSCP will coordinate with the Cibola National Wildlife Refuge to ensure these surveys continue up to and after construction. The USFWS completed one electrofishing survey in FY18. No native fish (razorback suckers) were captured or observed.

**Proposed FY19 Activities:** Site-specific compliance activities, such as a wetlands delineation, have been initiated. However, higher priority sites will be developed first, and construction at Three Fingers Lake has not been scheduled yet.

**Restoration:** Restoration design, quantity and cost estimates, compliance, and permitting are expected to be completed for a 30% design. The development schedule will be integrated with construction activities already scheduled at other conservation areas.

**Monitoring:** Three groundwater monitoring wells were installed to track groundwater elevations. Water surface levels are also being monitored.

Pre-development monitoring may be conducted if additional data are needed for compliance documentation. This work will be funded under post-development monitoring work tasks (Section F).

### Proposed FY20 Activities:

**Restoration:** Coordination and discussions concerning development of the site will continue and will include periodic site visits to collect and store data gathered by groundwater and surface water data loggers.

**Monitoring:** Pre-development monitoring may be conducted if additional data are needed for compliance documentation. This work will be funded under post-development monitoring work tasks (Section F).

### Pertinent Reports: N/A

# Work Task E39: Dennis Underwood Conservation Area

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $6,000,000 | $213,860.00 | $122,675.06 | $10,230,000[1] | $1,500,000 | $1,500,000 | $350,000 |

[1] Resolution 19-002 was approved by the Steering Committee on April 24, 2019.

**Contact:** Andrea Finnegan, (702) 293-8203, afinnegan@usbr.gov

**Start Date:** FY18

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BEVI1, ELOW1, GIFL1, GIWO1, MNSW2, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, and YWAR1

**Location:** Reach 4, River Miles 96–99, California

**Purpose:** To create and manage a mosaic of native land cover types for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** Vegetation monitoring is conducted under Work Task F1, and wildlife monitoring is conducted under Work Tasks F2–F4 and F7.

**Project Description:** The Dennis Underwood Conservation Area is located adjacent to the north border of the Pretty Water Conservation Area. The property is located within the Palo Verde Irrigation District (PVID) and is owned by the Metropolitan Water District of Southern California (Metropolitan). The Metropolitan has made 635 acres of active agricultural ground available for inclusion in the LCR MSCP. The development of this project will satisfy both the LCR MSCP Habitat Conservation Plan requirements and a portion of California Endangered Species Act Incidental Take Permit No. 2081-2005-008-06. Restoration of the site includes planting both the honey mesquite and cotton-wood willow land cover types.

**Previous Activities:** This is a new start FY18.

## FY18 Accomplishments:

**Restoration:** Obligations were less than approved due to a delay in obtaining the Federal appraisal, which resulted in a delay in presenting the project to the Steering Committee for land and water approval.

## FY19 Activities:

**Restoration:** On October 24, 2018, the Steering Committee approved Program Decision Document 19-001, *Land and Water Approval*, which authorized the Bureau of Reclamation to enter into a permanent easement for conservation purposes with Metropolitan. The LCR MSCP secured the easement at a cost of $9,730,000 for 635 acres of land, including 575 water toll acres. Compensation for the use of the land and water was made based on the Federal appraisal. The approved FY19 estimate will be exceeded due to the delay in completing the easement. The full cost of the appraised value of $9,730,000 will be reflected in FY19 obligations.

The *Restoration Development and Monitoring Plan for the Dennis Underwood Conservation Area* was submitted to the California Department of Fish and Wildlife. The LCR MSCP will begin incurring annual costs, such as water tax and coalition fees, from the PVID. The LCR MSCP assumed management responsibilities on the property, provided irrigation to the site, evaluated and repaired the canal system as necessary, and provided any other maintenance needed. Honey mesquite habitat was planted in accordance with the development plan. Construction activities to excavate swales within the remaining acres scheduled for cottonwood-willow establishment was completed and a cover crop planted.

**Monitoring:** Compliance monitoring will be conducted as needed during construction and funded under post-development monitoring work tasks (Section F). Post-development monitoring will begin after restoration is complete and trees are mature enough to provide habitat.

## Proposed FY20 Activities:

**Maintenance and Management:** The established honey mesquite habitat will be maintained and irrigated.

**Restoration:** The cottonwood-willow habitat will be planted on 231 acres.

**Monitoring:** Compliance monitoring will be conducted as needed during construction. Post-development monitoring will begin after restoration is complete and trees are mature enough to provide habitat.

## Pertinent Reports: N/A

# Work Task E40: Yuma Meadows Conservation Area

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $0 | $26,478.64 | $11,625.60 | $4,000,000 | $2,000,000 | $3,000,000 | $300,000 |

**Contact:** Arien Chavez, (702) 293-8027, amchavez@usbr.gov

**Start Date:** FY19

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BONY2, BONY4, RASU2, and RASU4

**Location:** Reach 6, Federal lands, River Miles 45–47, California

**Purpose:** To create and manage disconnected backwaters for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** This is a new conservation area for the LCR MSCP in FY19. Vegetation monitoring is conducted under Work Task F1, and wildlife monitoring is conducted under Work Tasks F2, F3, F7, F9, and F10.

**Project Description:** Located within Reach 6 of the LCR MSCP planning area, the Yuma Meadows Conservation Area (YMCA) is in the State of California on Bureau of Reclamation (Reclamation) withdrawn lands, approximately 13 miles northeast of Yuma. Dense saltcedar stands dominate much of the landscape with small areas of marsh and riparian vegetation, which is an indication of a high water table.

The YMCA will include the development of 123 acres of disconnected backwaters that will be managed for razorback suckers and bonytail. The conservation area will consist of several large disconnected backwaters ranging in size from 10 to 30 acres each. The total size of these refugia ponds will be approximately 111 acres. Twelve smaller disconnected backwaters (referred to as grow-out ponds) will be approximately 1 acre each in size. The conservation area will include the Laguna Field Office, which is owned and operated by the Bureau of Reclamation's Yuma Area Office. These existing facilities will be used for the management of the YMCA.

## Previous Activities:

**Maintenance/Restoration/Management:** This is a new start in FY19. Preliminary site suitability investigations, environmental compliance, and permitting activities for development of the area were completed using funding from Work Task E16 until FY19. An agreement between the LCR MSCP and Reclamation's Yuma Area Office was signed to allow the property to be developed and managed as a conservation area in perpetuity.

**FY18 Accomplishments:** This project was not expected to begin until FY19. However, the opportunity arose to begin management of the area and to accelerate the design of the project; therefore, project costs were incurred.

**Maintenance and Management:** An evaluation of the existing structures and office complex at the YMCA was conducted to define the share relationship between Reclamation's Yuma Area Office and the LCR MSCP. The evaluation determined which buildings would be used by whom and who was responsible for their upgrade.

**Restoration:** A Restoration Development and Monitoring Plan was drafted, which included the design of multiple disconnected backwaters and 12 acres of grow-out ponds. The plan was submitted to the California Department of Fish and Wildlife for approval. Nine groundwater observation wells were installed around the perimeter of the YMCA to monitor the hydrology of the area and to ascertain if a hydraulic gradient is present; funds from Work Task F1were used. The contract to produce engineering design drawings of the site was awarded using funds from Work Task E16. Environmental compliance activities, such as a wetland delineation and a Class III Cultural Pedestrian Survey, were also initiated. A Value Planning Study of the conservation area conceptual design took place in Provo, Utah, and included subject matter experts from different Reclamation regions. The study is intended to identify areas of concern that need to be addressed early in the design process.

## FY19 Activities:

**Maintenance and Management:** New entrance gates and perimeter fencing will be installed. Upgrades to existing offices and warehouses will begin. These improvements will occur over the next 3–4 years, and all buildings will be fully functional by FY23, when construction of the grow-out ponds is anticipated to be complete. A security review of the site will be conducted, and any security recommendations will be scheduled and implemented.

**Restoration:** Cultural surveys and wetland delineation, to assist in permitting and obtaining National Environmental Policy Act compliance, are scheduled to be completed in FY19. Clearing of transects, to allow access for geotechnical investigations, was conducted. Samples were taken from four borings and six test

pits along the transects to assist in the design. The engineering design drawings are expected to be complete in FY19. It was anticipated that construction of the grow-out ponds would begin in FY19. However, this activity will be delayed; therefore, obligations are expected to be less than approved.

### Proposed FY20 Activities:

**Maintenance and Management:** Upgrades to existing offices and warehouses started in FY18 are expected to continue.

**Restoration:** Clearing and grubbing of existing non-native vegetation may occur when possible and would be conducted outside of the migratory bird nesting season. Procurement of materials for the construction of the grow-out ponds is anticipated in FY20.

**Monitoring:** Compliance monitoring will be conducted as needed prior to and during construction and funded under post-development monitoring work tasks (Section F). Post-development monitoring will begin after restoration is complete.

### Pertinent Reports: N/A

## Work Task E41: Section 26 Conservation Area

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $0 | $0 | $0 | $0 | $400,000 | $100,000 | $100,000 |

**Contact:** Laken Anderson, (702) 293-8153, landerson@usbr.gov

**Start Date:** FY20

**Expected Duration:** FY55

**Long-Term Goal:** Habitat creation and management

**Conservation Measures:** BONY2, FLSU1, and RASU2

**Location:** Reach 3, River Miles 238–239, California

**Purpose:** To create and manage a connected backwater to provide habitat for LCR MSCP covered fish species

**Connections with Other Work Tasks (Past and Future):** This project was identified under Work Task E16, and the design of the conservation area will also be conducted under that work task. Vegetation and species monitoring will be conducted under Work Tasks F1–F7.

**Project Description:** The Section 26 Conservation Area (Section 26) is roughly 218 acres of Bureau of Reclamation withdrawn land adjacent to the lower Colorado River between River Miles 238–239, just north of Beal Slough. Section 26 is located within Township 8N, Range 23E, Section 26, San Bernardino Meridian within the State of California. Section 26 is within the historic Colorado River floodplain, bounded by the Colorado River on the east and railroad tracks to the west. The landscape is dominated with invasive saltcedar, but also contains arrowweed and mesquites. The project proposes a minimum of 21 acres of connected backwater habitat to be created and managed for razorback suckers, bonytail, and flannelmouth suckers. Connected backwaters typically involve the removal of overburden to a depth slightly below the water table and dredging to reach the targeted water depths.

**Previous Activities:** A cadastral survey was conducted in FY17 to confirm the property is Reclamation withdrawn land. Aerial photos, including the collection of light detection and ranging (lidar) to determine topography, were taken of the

site for pre-construction purposes in April 2018. A wetlands delineation to assist in the design process was initiated in FY19. Obligations incurred prior to an approved budget are tracked under Work Task E16.

**FY18 Accomplishments:** This is a new start in FY20.

**FY19 Activities:** This is a new start in FY20.

**Proposed FY20 Activities:** The design phases (30%, 60%, and 90%) are scheduled to be initiated. The environmental compliance and permitting process is expected to be completed.

**Monitoring:** Compliance monitoring will be conducted before, during, and after construction as necessary. Native fish monitoring will continue on the main stem of the river, but will not be conducted on the conservation area, as there is no open water on the conservation area.

**Pertinent Reports:** The first annual report will be posted on the LCR MSCP website when the conservation area is fully developed.

# WORK TASKS – SECTION F

Post-Development Monitoring

## Work Task F1: Habitat Monitoring at Conservation Areas

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $850,000 | $966,385.23 | $6,139,012.89 | $700,000 | $700,000 | $700,000 | $700,000 |

**Contact:** Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Pre- and post-development monitoring

**Conservation Measures:** BEVI1, BLRA1, CLRA1, CRCR2, ELOW1, GIFL1, GIWO1, LEBI1, MNSW2, MRM2 (BEVI, BLRA, CLRA, CRCR, ELOW, GIFL, GIWO, LEBI, MNSW, SUTA, VEFL, WIFL, WRBA, WYBA, YBCU, YHCR, and YWAR), SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, YHCR2, YWAR1

**Location:** All LCR MSCP conservation areas

**Purpose:** The purpose of this work task is to provide post-development monitoring to assess the effectiveness of each conservation area. Monitoring will include biotic and abiotic components and will be used to make informed management decisions throughout the 50-year term of the LCR MSCP.

**Connections with Other Work Tasks (Past and Future):** Post-development habitat monitoring will be conducted at conservation areas detailed in the Conservation Area Development and Management (Section E) work tasks. Soil moisture data collected under Work Task E34 (closed) were used for analyses performed under this work task. All salinity and soil moisture monitoring previously performed under Work Task E34 (closed) is now performed under this work task (since FY17). Data collected under this work task are also used under Work Task C60.

**Project Description:** Species habitat characteristics will be evaluated. Monitoring data will be used to document progress toward achieving LCR MSCP goals and to provide habitat data for covered species to make informed management decisions.

**Previous Activities:** During FY10 to FY14, ground-based vegetation monitoring was conducted at most established conservation areas. Monitoring protocols focused on the following variables: density, species richness, vegetation structure, ground cover, canopy closure, distance to nearest standing water, distance to nearest open space, temperature, and relative humidity. In FY14, after an external review, adaptive management recommendations for vegetation monitoring were implemented, which included selecting plots in an improved, spatially randomized approach and targeting areas where the vegetation structure and soils were more consistent with southwestern willow flycatcher and yellow-billed cuckoo habitat characteristics.

In FY14, long-term vegetation monitoring began the transition to using remote sensing techniques. This decision was based on improvements in light detection and ranging (lidar) technology. Lidar has been proven to provide more accurate representations of vegetation in forests; it can be collected quickly during the breeding season without disturbing the covered species, and it is expected to provide higher-quality data at a reduced cost compared to ground-based monitoring.

A tool was developed in FY16 to automate vegetation classification using lidar data according to the Anderson and Ohmart classification system. The tool is used to assign the Anderson-Ohmart structure type to cottonwood-willow and honey mesquite vegetation at all conservation areas. The results from this tool are used to determine habitat creation accomplishment in accordance with the established process. Results from ground-based vegetation surveys are used to validate the accuracy of the remote sensing-based vegetation classification.

Salinity and soil moisture monitoring began to be managed under this work task in FY17, and data will be used to (1) further identify the range of habitat characteristics (vegetation and soil moisture) present at areas occupied by breeding southwestern willow flycatchers, (2) assess whether adequate soil moisture is being maintained during the nesting season at conservation areas being managed for southwestern willow flycatchers, and (3) assess whether soil moisture and salinity conditions are adequate for sustained vegetation health.

**FY18 Accomplishments:** The LCR MSCP began acquisition of lidar data for the entire LCR MSCP planning area during FY18 in cooperation with other Bureau of Reclamation offices and the U.S. Geological Survey. Lidar data and multispectral satellite data will be used to perform a vegetation classification across this area of interest. This vegetation classification will be used for several purposes: (1) identify areas for system-wide monitoring of suitable habitat for several covered species, (2) create a stratified random sampling design for the system-wide riparian bird monitoring project, and (3) identify areas for future conservation areas. The vegetation classification will utilize a procedure used previously by the Bureau of Reclamation for classifying riparian vegetation. Ground-based vegetation surveys will be conducted and used to validate the

accuracy of the remote sensing-based vegetation classification. Lidar data collected in FY18 were not available yet to perform the habitat creation accomplishment analysis.

The salinity and soil moisture monitoring network was expanded to include monitoring at six conservation areas: the Beal Lake Conservation Area, the Palo Verde Ecological Reserve, the Cibola Valley Conservation Area, the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1), Yuma East Wetlands, and Hunters Hole. Instrumentation includes shallow groundwater monitoring stations to monitor groundwater levels and groundwater salinity, and soil monitoring stations that will monitor soil moisture and soil salinity.

Obligations were more than approved due to the unforeseen costs of installing monitoring wells at Cibola NWR Unit#1, the Beal Lake Conservation Area, and the Imperial Ponds Conservation Area.

**FY19 Activities:** Long-term habitat monitoring is continuing. Lidar data will be acquired to assess vegetation characteristics and will be analyzed using the tools developed under Work Task C60.

Vegetation monitoring techniques being analyzed under Work Task C60 may be used under this work task. This involves the use of unmanned aerial systems (UASs) to collect marsh vegetation data at Hart Mine Marsh using multispectral and photographic sensors. Depending on the results of the work being performed under Work Task C60, UAS-based monitoring may be incorporated into the long-term marsh vegetation monitoring performed under this work task.

The salinity and soil moisture monitoring network was expanded to include monitoring at newly planted phases of existing conservation areas (Cibola NWR Unit #1), at expansion areas of existing conservation areas (Beal Lake Conservation Area, Cibola NWR Unit #1, and the Imperial Ponds Conservation Area), and at new conservation areas (Three Fingers Lake).

**Proposed FY20 Activities:** Long-term habitat monitoring will continue using the previously developed techniques. Using the lidar data collected from FY14 to FY18, a data collection schedule will be developed based on the needs of each conservation area. It is likely that lidar data will be collected at a higher frequency for new conservation areas, while more mature conservation areas will require less frequent data collection. Based on the results of the marsh vegetation monitoring using UAS techniques (C60), UAS-based data collection will be evaluated as a tool for habitat monitoring under this work task. If it is concluded that UAS techniques provide valuable marsh vegetation monitoring data, marsh vegetation monitoring will transition to UAS-based techniques. Due

to the rapid deployment time possible using UASs, it is likely that this technique could also be used when data are required soon after a disturbance occurs (e.g., fire or flash flood).

The salinity and soil moisture monitoring network will continue to operate at established locations and will be expanded as needed to include all conservation areas where these parameters are of concern for evaluating species' habitat requirements and for maintaining vegetation health.

Additional remote sensing techniques and products will be evaluated based on vegetation mapping needs at LCR MSCP conservation areas. The techniques and products evaluated may also be used for system-wide monitoring purposes.

**Pertinent Reports:** During the development of remote sensing vegetation monitoring techniques, an annual report for FY18 will not be prepared. Once remote sensing monitoring techniques are finalized, the reports will then be prepared annually and posted on the LCR MSCP website upon completion.

## Work Task F2: Avian Monitoring at Conservation Areas

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $350,000 | $360,204.59 | $2,747,081.22 | $450,000 | $450,000 | $450,000 | $450,000 |

**Contact:** Beth Sabin, (702) 293-8435, lsabin@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Conduct pre- and post-development monitoring for avian species at conservation areas

**Conservation Measures:** MRM1 and MRM2 (BEVI, ELOW, GIFL, GIWO, SUTA, VEFL, and YWAR)

**Location:** Beal Lake Conservation Area (BLCA), Havasu National Wildlife Refuge, Arizona; Middle Bill Williams River National Wildlife Refuge (Middle Bill Williams NWR), Bill Williams National Wildlife Refuge, Arizona; Planet Ranch Conservation Area, Arizona; Cibola Valley Conservation Area (CVCA), Arizona; the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1) and Hart Mine Marsh, Cibola National Wildlife Refuge, Arizona; Imperial Ponds Conservation Area, Arizona; Laguna Division Conservation Area (LDCA), Arizona; Yuma East Wetlands (YEW), Arizona; Hunters Hole, Arizona; Mohave Valley Conservation Area, California; Parker Dam Camp, California; Palo Verde Ecological Reserve (PVER), California; Palo Verde Ecological Reserve-South (PVER-South), California; Pretty Water Conservation Area (PWCA) California; and Three Fingers Lake, California

**Purpose:** To monitor Arizona Bell's vireo, elf owl, Gila woodpecker, gilded flicker, Sonoran yellow warbler, summer tanager, and vermillion flycatcher use of conservation areas

**Connections with Other Work Tasks (Past and Future):** Pre- and post-development avian monitoring will be conducted at conservation areas listed in "Conservation Area Development and Management (Section E)." In addition, information obtained from this work task may be used to provide data for avian system monitoring by using the same protocols established in system monitoring

(D6). Work Tasks C24, C36 (closed), and C52 (closed) provided information for developing a protocol to monitor elf owls and gilded flickers on the conservation areas.

**Project Description:** The creation of riparian habitat will benefit LCR MSCP covered avian species (Arizona Bell's vireos, elf owls, Gila woodpeckers, gilded flickers, Sonoran yellow warblers, summer tanagers, and vermillion flycatchers). Conservation areas will be monitored for bird activity using the double sampling area search method, which involves intensive and rapid area search surveys. Data gathered will be used to document the presence of covered species at the conservation areas to inform habitat management and creation of future conservation areas.

**Previous Activities:** Pre- and post-development monitoring for avian covered species has been conducted at conservation areas since FY05. Avian pre-development monitoring was conducted at the CVCA, Cibola NWR Unit #1, the Imperial Ponds Conservation Area, Hart Mine Marsh, the PVER, the PWCA, the Mohave Valley Conservation Area, PVER-South, Planet Ranch, Three Fingers Lake, and the LDCA. Post-development monitoring for avian covered species was conducted at the BLCA, the Middle Bill Williams River NWR, Parker Dam Camp, Cibola NWR Unit #1, the CVCA, the PVER, the LDCA, YEW, and Hunters Hole. The double sampling rapid and intensive area search survey protocol has been used since 2008 for pre- and post-development monitoring. From FY08 to FY10, all area search plots were surveyed using intensive area search surveys due to the small acreage of habitat in the conservation areas. In FY11 and FY12, all area search plots were surveyed with rapid area search protocols, and a subset of those area search plots was surveyed using intensive area search protocols. In FY13, three additional area search plots were established at YEW and were surveyed with intensive area search surveys. Beginning in FY14, area search plots were selected with a stratified random approach because existing habitat at the conservation areas exceeded the amount of habitat that could be covered within 80-area search plots. Each year, avian use was evaluated at each conservation area and compared among conservation areas. Arizona Bell's vireos, Sonoran yellow warblers, and summer tanagers were the covered species that had the largest populations breeding at the conservation areas. An evaluation of the monitoring protocol for conservation area monitoring (F2) and system-wide monitoring (D6) was initiated to clarify the monitoring questions the data will inform and to improve the accuracy of monitoring methods.

**FY18 Accomplishments:** Avian post-development monitoring was conducted at existing conservation areas. The following conservation areas were surveyed: the BLCA, the Middle Bill Williams River NWR, Parker Dam Camp, the PVER, the CVCA, Cibola NWR Unit #1, the PWCA, the LDCA, YEW, and Hunters Hole. Eighty area search plots on the conservation areas were surveyed using the

double sampling protocol. Rapid area search surveys were conducted on all area search plots, and intensive area search surveys were conducted on a stratified random subsample of eight of those area search plots.

LCR MSCP covered bird species and other territorial breeding birds were documented at each conservation area:

- BLCA – Two area search plots were surveyed at this conservation area. There were 31 pairs of territorial breeding birds detected comprising 18 species. Three pairs of Arizona Bell's vireos and four pairs of Sonoran yellow warblers were confirmed breeding.

- Middle Bill Williams River NWR – Fourteen area search plots were surveyed at this creditable area. There were 450 pairs of birds detected comprising 35 species. Twelve pairs of Arizona Bell's vireos, 12 pairs of Gila woodpeckers, 35 pairs of Sonoran yellow warblers, and 5 pairs of summer tanagers were confirmed breeding.

- Parker Dam Camp – Two area search plots were surveyed at this conservation area. There were 49 pairs of birds detected comprising 22 species. Two pairs of Gila woodpeckers were confirmed breeding.

- PVER – Fifteen area search plots were surveyed at this conservation area. There were 178 pairs of territorial breeding birds detected comprising 29 species. Three pairs of Sonoran yellow warblers and four pairs of summer tanagers were confirmed breeding. Bell's vireos were detected; however, no pairs were confirmed breeding.

- CVCA – Thirteen area search plots were surveyed at this conservation area. There were 216 pairs of territorial breeding birds detected comprising 27 species. One Arizona Bell's vireo pair was confirmed breeding. Yellow warblers and summer tanagers were detected; however, no pairs were confirmed breeding.

- Cibola NWR Unit #1 – Nine area search plots were surveyed at this conservation area. There were 98 pairs of territorial breeding birds detected comprising 28 species. Gila woodpeckers and yellow warblers were detected; however, no pairs were confirmed breeding.

- PWCA – Nine area search plots were surveyed at this conservation area. There 64 pairs of territorial birds detected comprising 26 species. Bell's vireos, Gila woodpeckers, and yellow warblers were detected; however, no pairs were confirmed breeding.

- LDCA – Twelve area search plots were surveyed at this conservation area. There were 286 pairs of territorial birds detected comprising 30 species. Seven pairs of Arizona Bell's vireos, two pairs of Gila woodpeckers, and four pairs of Sonoran yellow warblers were confirmed breeding.

- YEW – Four area search plots were surveyed at this conservation area. There were 104 pairs of territorial breeding birds detected comprising 28 species. One pair of Gila woodpeckers and one pair of Sonoran yellow warblers were confirmed breeding. Bell's vireos were detected; however, no pairs were confirmed breeding.

- Hunters Hole – One area search plot was surveyed at this conservation area. There were 10 pairs of territorial breeding birds comprising 18 species detected. No LCR MSCP covered species were detected.

All conservation areas had numerous pairs of non-territorial breeders as well. Many species of migrants and non-breeders were detected at all conservation areas.

Refinement of the riparian bird monitoring mobile electronic field form continued. A script was created in the statistical program R to calculate population estimates from the double sampling areas search surveys; program R will replace the DS program, which is no longer updated. Data and record management activities continued, and the 2017 and 2018 reports were finalized.

The monitoring protocol evaluation continued, which included verifying goals and objectives, updating the vegetation map and the associated survey plots, evaluating other analysis and survey methods to determine what methods are the most cost efficient, and analyzing existing data to verify the number of samples to survey and how often they need to be surveyed in order to detect presence of territorial nesting riparian birds and measure their trends. A code in program R was created and tested to analyze the double sampling data. This evaluation of the monitoring protocol for Work Tasks D6 and F2 will ensure that monitoring methods and statistical analyses are meeting the LCR MSCP objectives and budgetary targets for the next 15 years.

**FY19 Activities:** Avian post-development monitoring will be conducted at existing conservation areas, including the BLCA, the Middle Bill Williams River NWR, Parker Dam Camp, the PVER, the CVCA, Cibola NWR Unit #1, the PWCA, the LDCA, YEW, and Hunters Hole. Surveys will be conducted using the double sampling method. Eighty area search plots will be selected from all possible plots within the conservation areas using a stratified random approach. All plots will be surveyed with rapid surveys, and a subset of eight area search plots will be selected to be surveyed with intensive surveys using a stratified

random approach. Pre-construction and compliance activities related to the Migratory Bird Treaty Act will be conducted as needed on existing and proposed conservation areas.

Data and records management activities will continue. The monitoring protocol evaluation will continue. Once complete, a long-term monitoring plan will be prepared as well as updated survey protocols and training materials. Refinement of the mobile electronic field form platform will continue so that all data are collected and summarized in ArcGIS Online.

**Proposed FY20 Activities:** Avian post-development monitoring for LCR MSCP covered species will be conducted at conservation areas supporting riparian vegetation, including the BLCA, the Middle Bill Williams River NWR, Parker Dam Camp, the PVER, the CVCA, Cibola NWR Unit #1, the PWCA, the LDCA, YEW, and Hunters Hole. Pre-construction and compliance activities related to the Migratory Bird Treaty Act will be conducted as needed on existing and proposed conservation areas.

**Pertinent Reports:** The 2017 and 2018 annual reports are posted on the LCR MSCP website.

## Work Task F3: Rodent Monitoring at Conservation Areas

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $65,000 | $64,748.87 | $596,139.98 | $65,000 | $65,000 | $65,000 | $65,000 |

**Contact:** Jeff Hill, (702) 293-8163, jhill@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** Conduct pre- and post-development monitoring for small mammal species

**Conservation Measures:** CRCR1, DPMO1, MRM1 (CRCR, DPMO, and YHCR), MRM2 (DPMO), and YHCR1

**Location:** Reaches 3–7

**Purpose:** To monitor small mammal presence within conservation areas

**Connections with Other Work Tasks (Past and Future):** Post-development small mammal monitoring will be conducted at conservation areas listed in "Conservation Area Development and Management (Section E)." In addition, presence information obtained from this work task was used under Work Task C27 (closed) to document habitat characteristics and improve small mammal monitoring methods. Protocol improvements developed under Work Task C27 (closed) were incorporated under this work task.

**Project Description:** Small mammal live trapping will be conducted in conservation areas to document the presence of Colorado River cotton rats, Yuma hispid cotton rats, and desert pocket mice.

**Previous Activities:** Presence live trapping surveys were conducted at conservation areas from FY06 to FY17. Trapping occurred for 1–2 nights at the sites sampled each year and was conducted in vegetation anticipated to provide the best habitat to obtain detections of Colorado River and Yuma hispid cotton rats. Colorado River cotton rats were captured at the Palo Verde Ecological Reserve (PVER) and Hart Mine Marsh (HMM). Yuma hispid cotton rats were captured at Yuma East Wetlands (YEW) and Hunters Hole.

**FY18 Accomplishments:** Presence live trapping surveys were conducted at the Beal Lake Conservation Area (BLCA), the PVER, the Cibola Valley Conservation Area (CVCA), the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1), HMM, YEW, the Laguna Division Conservation Area (LDCA), and Hunters Hole. Colorado River cotton rats were captured at the PVER and HMM; none were captured at the BLCA, the CVCA, or Cibola NWR Unit #1. Yuma hispid cotton rats were captured at YEW and Hunters Hole; none were captured at the LDCA.

**FY19 Activities:** Small mammal live trapping surveys will continue as part of the post-development monitoring efforts at the Big Bend Conservation Area, the BLCA, Cibola NWR Unit #1, the CVCA, YEW, the LDCA, and Hunters Hole to detect the presence of cotton rats.

**Proposed FY20 Activities:** Small mammal live trapping surveys will continue as part of the post-development monitoring efforts at the BLCA, Cibola NWR Unit #1, the CVCA, Hunters Hole, the LDCA, the PVER, Parker Dam Camp, and YEW.

**Pertinent Reports:** The FY16 and FY17 annual reports are posted on the LCR MSCP website. The FY18 annual report will also be posted upon completion.

## Work Task F4: Bat Species Monitoring at Conservation Areas

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $80,000 | $88,410.11 | $1,227,132.74 | $140,000 | $140,000 | $140,000 | $140,000 |

**Contact:** Jeff Hill, (702) 293-8163, jhill@usbr.gov

**Start Date:** FY07

**Expected Duration:** FY55

**Long-Term Goal:** Pre- and post-development monitoring of covered bat species

**Conservation Measures:** MRM1, MRM2 (CLNB, PTBB, WRBA, and WYBA), WRBA1, and WYBA1

**Location:** Reaches 3–5; Beal Lake Conservation Area (BLCA), Havasu National Wildlife Refuge; Palo Verde Ecological Reserve (PVER), California; Cibola Valley Conservation Area (CVCA), the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1), Cibola, Arizona; and the Imperial Ponds Conservation Area, Imperial National Wildlife Refuge, Arizona. Additional conservation areas will be surveyed to document presence as needed.

**Purpose:** The purpose of this work task is to assess the use of conservation areas by the two LCR MSCP covered bat species (the western red bat and western yellow bat) and the two evaluation species (the pale Townsend's big-eared bat and California leaf-nosed bat).

**Connections with Other Work Tasks (Past and Future):** Pre- and post-development monitoring will be conducted at conservation areas listed in "Conservation Area Development and Management (Section E)." Information obtained through this work task, in conjunction with Work Task D9, will help determine the distribution of these species.

**Project Description:** Post-development monitoring for the two covered bat species (the western red bat and western yellow bat) and the two evaluation species (the pale Townsend's big-eared bat and California leaf-nosed bat) will be conducted at conservation areas. Acoustic monitoring will record bat echolocation calls in order to determine species presence. Bats may be captured with mist nets at these sites to determine the age, sex, and reproductive status of the covered and evaluation bat species.

**Previous Activities:** Conservation areas were monitored from FY07 to FY17 using acoustic and/or capture techniques. Western red bats have been detected at the BLCA, Cibola NWR Unit #1, the CVCA, Hunters Hole, Planet Ranch, the PVER, and Yuma East Wetlands (YEW). Western yellow bats have been detected at the BLCA, Cibola NWR Unit #1, the CVCA, Hunters Hole, Planet Ranch, the PVER, and YEW. California leaf-nosed bats have been detected at the BLCA, Cibola NWR Unit #1, the CVCA, Hunters Hole, the PVER, Planet Ranch, and YEW. Pale Townsend's big-eared bats have been detected at the BLCA, Cibola NWR Unit #1, the CVCA, Planet Ranch, and the PVER. Surveys for covered and evaluation bat species were also conducted at the 'Ahakhav Tribal Preserve under Work Task F4 (acoustic monitoring FY08–17 and bat captures FY07–15). The 'Ahakhav Tribal Preserve was included to increase the number of restoration areas being monitored early in the program in case bat species were detected infrequently and additional cottonwood-willow riparian forest would be needed to identify bat roosting and foraging habitat characteristics.

**FY18 Accomplishments:** Acoustic monitoring consisted of using long-term bat detector stations to record echolocation calls of bats every night from June to August. The stations used to collect data were at the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, YEW, and Hunters Hole. At the PVER and CVCA, two stations were used to cover these large conservation areas. An additional station was also operated at the 'Ahakhav Tribal Preserve.

Western red bats and western yellow bats were detected at the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, YEW, and Hunters Hole. None were detected at the 'Ahakhav Tribal Preserve. California leaf-nosed bats were detected at the BLCA, the PVER, the CVCA, Cibola NWR Unit #1, Hunters Hole, and the 'Ahakhav Tribal Preserve. None were detected at YEW. A new method for identifying pale Townsend's big-eared bats was adopted in FY18. This method, called the Analook Verification Method, is more conservative than prior methods and, when combined with the whispering calls emitted by the pale Townsend's big-eared bat, resulted in no verified detections at any location.

**FY19 Activities:** Bat presence will continue to be monitored in Reaches 3–5 at BLCA, the PVER, the CVCA, and Cibola NWR Unit #1 using eight acoustic monitoring stations. The stations will continue to operate, and data will be analyzed, presence documented, and activity level rates calculated. The acoustic monitoring stations at YEW and Hunters Hole will be moved to the system-wide monitoring network (D9) in FY19, as they are located in Reaches 6–7. Conservation Measures WRBA2 and WYBA3 state that habitat that will be created and managed for these species must be located within Reaches 3–5. The acoustic station at the 'Ahakhav Tribal Preserve will also move to the system-wide monitoring network (D9) in FY19, as it is not on an LCR MSCP conservation area.

**Proposed FY20 Activities:** Bat presence at the conservation areas in Reaches 3–5 will continue to be monitored. Data will be analyzed, presence documented, and activity level rates calculated.

**Pertinent Reports:** The reports titled *Post-Development Acoustic Monitoring of LCR MSCP Bat Species, 2015 – 2016 Annual Report* and *Post-Development Bat Monitoring of Conservation Areas and the 'Ahakhav Tribal Preserve Along the Lower Colorado River – 2016 and 2017 Capture Surveys* are posted on the LCR MSCP website. The FY17 and FY18 annual reports will also be posted upon completion.

## Work Task F5: Post-Development Monitoring of Fishes at Conservation Areas

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $500,000 | $381,622.26 | $2,472,419.44 | $450,000 | $400,000 | $400,000 | $400,000 |

**Contact:** Jeff Lantow, (702) 293-8557, jlantow@usbr.gov

**Start Date:** FY07

**Expected Duration:** FY55

**Long-Term Goal:** Post-development monitoring

**Conservation Measures:** BONY5 and RASU6

**Location:** Backwater habitats (Reaches 3–6)

**Purpose:** To monitor fish use of conservation areas in order to provide data for the adaptive management process and to develop management guidelines for created backwater habitats

**Connections with Other Work Tasks (Past and Future):** Post-development monitoring will be conducted at all backwaters created under Conservation Area Development and Management (Section E) work tasks. Other related work tasks have included Work Tasks C23 (closed), C31 (closed), C33 (closed), C34 (closed), C40, and C41 (closed).

**Project Description:** Fishes and created backwater habitat will be monitored at conservation areas. It is anticipated that these areas will play various roles in the conservation of target fish species throughout the 50-year term of the LCR MSCP. Some habitats will be able to develop self-sustaining populations; others may become overpopulated, requiring harvest or thinning, and some will require continuous population augmentation. Most isolated fish habitats will require some stock rotation to maintain genetic diversity through time. Basic surveys of the fish population and the physical and chemical components in developed or restored habitats will be required. Fish monitoring will include trapping (hoop, fyke, and minnow traps), trammel netting, electrofishing, larval collections, and ocular surveys (including scuba and snorkeling where necessary and practical). Water quality assessments will require annual measurements of temperature, oxygen, pH, and conductivity (salinity) as well as periodic monitoring of chemical makeup and selenium.

**Previous Activities:** Between 2006 and 2012, Beal Lake was stocked with more than 6,000 razorback suckers, 2,000 large bonytail, and 27,000 young-of-the-year bonytail; a limited portion of these stockings was marked with passive integrated transponder (PIT) tags. Subsets of native fishes stocked were contacted through annual surveys, but long-term survival was low. Populations of stocked razorback suckers declined rapidly within the first several months post-release and eventually leveled off near 100 individuals. In 2012, stockings were discontinued at Beal Lake, and fisheries surveys were reduced to relative abundance and biomass estimates for all species within the backwater. Non-native fishes were the dominant species in the lake, accounting for almost 90% of the total fishes. A large fishkill was observed in February 2013, and water samples confirmed a golden algae bloom. The backwater was isolated from Topock Marsh following the detection of golden algae; however, this closure resulted in a rapid increase in specific conductivity, which approached 11,000 microsiemens per centimeter (µS/cm) in FY14. Improvements to the water delivery system were completed following this event, and specific conductivity decreased to approximately 2,200 µS/cm in FY16. The non-native fish community has rebounded since the fishkill. Water quality has been monitored continuously, and all parameters have remained within the known ranges of acceptability for native fishes. Golden algae monitoring continued through FY17 but was discontinued when no golden algae were detected over a 4-year sampling period (FY14–17).

Routine monitoring of the Big Bend Conservation Area (BBCA) has been conducted monthly from February through May each year since FY11 and has included electrofishing, trammel netting, remote PIT scanning, and larval light trapping in areas where there have been historical contacts of native fishes. Sonic- and radio-tagged flannelmouth suckers released locally as part of Work Task C53 have been found within the dense California or softstem bulrush stands at the BBCA backwater for extended periods. Water quality was recorded during each monitoring trip and at least quarterly for the remainder of the year. Low numbers of razorback and flannelmouth suckers continued to be contacted through monitoring, including larvae of both species and an occasional flannelmouth sucker subadult. The backwater has a direct surface connection to the lower Colorado River; consequently, water quality parameters mirror that of the river.

**FY18 Accomplishments:** Routine monitoring at the BBCA resulted in netting captures of 13 razorback suckers and 1 bonytail. The captured fishes came from three stockings: one on March 22 at Laughlin Lagoon and two on April 5 at Laughlin Lagoon and the Big Bend boat ramp. Remote PIT scanning resulted in the contact of 80 razorback suckers and 10 bonytail. All bonytail contacted via netting and scanning were from the March 22 stocking. Larval razorback and flannelmouth sucker capture rates were lower than those in FY17 but similar to those in previous years. Water quality parameters remained within thresholds for all native fishes.

Monitoring of the Imperial ponds was previously completed under Work Task C25 (closed) and was moved to Work Task F5 in FY18. Monitoring consisted of surveys for larval, juvenile, and adult native fishes. Razorback suckers stocked into Ponds 1, 3, and 4 in December 2016 averaged 64% survival through September 2018. Bonytail stocked into Ponds 2, 5, and 6 in March 2017 averaged 22% survival. Recruits were captured in each of the bonytail ponds, and the low survival of adult bonytail may be a result of increased competition for food resources. A single razorback sucker recruit was captured in Pond 1.

Obligations were less than expected, as monitoring activities at Beal Lake were postponed until dredging activities are completed in FY21.

**FY19 Activities:** Due to sedimentation and reduced access in the BBCA backwater, trammel netting efforts will be discontinued until dredging activities are completed in FY21. To ensure adequate native fish monitoring is completed in the interim, additional remote PIT scanners will be deployed during each sampling trip to supplement the lack of netting. Larval trapping will be conducted as planned, and water quality will be monitored at a level similar to that in FY18.

Construction of the 60-acre Mohave Valley Conservation Area backwater is expected to be completed in April 2019. Native fish monitoring will initially be completed using remote PIT scanners that were integrated into the northern and southern backwater inlets. Scanning data will be used to confirm the presence of native fishes, and supplemental sampling will be completed as needed. As this site matures, it will be evaluated as a potential future stocking location.

Monitoring of the Imperial ponds will continue to focus on population monitoring and documenting recruitment. Activities will include monitoring via remote PIT scanners, annual winter surveys using a variety of capture gear, larval/young-of-year monitoring through spring and summer, and continuous water quality monitoring. Annual surveys of the Imperial ponds were completed in December 2018. Adults were contacted in each of the ponds, and all fishes exhibited good growth and appeared healthy. Subadult bonytail were contacted in Ponds 2, 5, and 6, indicating another successful spawn in each of the bonytail ponds. The spawning event in Pond 2 appeared to be greater than the other ponds but less than it was in 2017. With a similar level of effort, the total catch decreased from 1,430 bonytail in 2017 to 331 bonytail in 2018; however, the pond continues to support a robust population of multiple year classes. Razorback sucker recruitment was documented in Pond 1 (35 recruits) and Pond 3 (1 recruit). The young fish in Pond 1 are the first evidence of a substantial razorback sucker recruitment event in the ponds.

Monitoring at Beal Lake has been postponed until dredging activities are completed in FY21.

**Proposed FY20 Activities:** Monitoring activities will be similar to those at the BBCA and Mohave Valley Conservation Area and will include remote PIT scanning, larval surveys, and water quality monitoring.

Activities at the Imperial ponds will include population monitoring via remote PIT scanners, annual winter surveys using a variety of capture gear, larval/young-of-year monitoring through spring and summer, and continuous water quality monitoring.

**Pertinent Reports:** Project reports will be posted on the LCR MSCP website upon completion.

## Work Task F6: Post-Development Monitoring of MacNeill's Sootywing Skippers at Conservation Areas

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $40,000 | $41,121.18 | $565,676.33 | $20,000 | $20,000 | $20,000 | $20,000 |

**Contact:** Carrie Ronning, (702) 293-8106, cronning@usbr.gov

**Start Date:** FY09

**Expected Duration:** FY55

**Long-Term Goal:** Post-development monitoring of MacNeill's sootywing skippers (sootywings)

**Conservation Measures:** MNSW1 and MRM2 (MNSW)

**Location:** Habitat conservation areas, Reaches 1–4

**Purpose:** To monitor sootywings in habitat created for this species

**Connections with Other Work Tasks (Past and Future):** Habitat requirements were studied under Work Task C7 (closed). System-wide monitoring of sootywings in cottonwood-willow habitat containing quailbush along the lower Colorado River will be conducted under Work Task D14 starting in FY19 to inform management of creditable habitat.

**Project Description:** To monitor the presence and habitat use of sootywings in conservation areas that have the appropriate land cover type available.

**Previous Activities:** Habitat created for sootywings at the Cibola Valley Conservation Area (CVCA) and Palo Verde Ecological Reserve (PVER) was surveyed for adults from FY09 to FY13. Sootywings were detected, though the number detected varied greatly from year to year. Vegetation was monitored in FY13 to document the characteristics of host and nectar plants, including species, plant height, and width. Survey methods were updated further in FY14 to refine measurements of potential habitat and the length of time surveys should be conducted to effectively detect sootywing presence. Habitat measurements included those of quailbush, nectar plant metrics, soil moisture, air temperature, and relative humidity. Data indicated that 1 hour of survey time at the appropriate time of day could be used to detect adult sootywings in 90% of sampled intervals.

Sootywings have been detected at the Beal Lake Conservation Area, the CVCA, the PVER, the Cibola National Wildlife Refuge Unit #1 Conservation Area, and Hart Mine Marsh in Reaches 3–5, and at Hunters Hole in Reach 7. Sootywings have not yet been detected at the Big Bend Conservation Area; the site has few, small quailbush, which may explain the lack of sootywing detections.

**FY18 Accomplishments:** The PVER, the CVCA, and the Pretty Water Conservation Area were surveyed for sootywing presence in April. Sootywings were detected at all three conservation areas. Survey intensity was reduced from monthly surveys at all sites from March through June, to continuing surveys after March only at sites where sootywings were not detected. As sootywings were recorded at all sites during April 2018, no further surveys were completed in May or June.

**FY19 Activities:** Presence surveys for sootywings will be conducted in March, April, May, and June in potential habitat within the CVCA, the PVER, and the Pretty Water Conservation Area. Once sootywings are detected, surveys in the remaining months will not be conducted.

**Proposed FY20 Activities:** The honey mesquite land cover type at conservation areas in Reaches 3 and 4 will be surveyed to monitor for continued presence of sootywings. Presence surveys for sootywings will be conducted in potential habitat during March, April, May, and June. Once sootywings are detected, surveys in the remaining months will not be conducted.

**Pertinent Reports:** The *Monitoring of the MacNeill's Sootywing and its Habitats, 2016 Annual Report* and *Monitoring of the MacNeill's Sootywing and its Habitats, 2017 Annual Report* are posted on the LCR MSCP website. The FY18 annual report will also be posted upon completion.

## Work Task F7: Marsh Bird Monitoring at Conservation Areas

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $40,000 | $38,104.37 | $170,329.54 | $40,000 | $10,000 | $10,000 | $10,000 |

**Contact:** Joe Kahl, Jr. (702) 293-8568, jkahl@usbr.gov

**Start Date:** FY11

**Expected Duration:** FY55

**Long-Term Goal:** Post-development monitoring of California black rails, western least bitterns, and Yuma clapper rails

**Conservation Measures:** MRM1 and MRM2 (BLRA, CLRA, and LEBI)

**Location:** Presence surveys will be conducted at conservation areas where marsh habitat was created, including Hart Mine Marsh (HMM) on the Cibola National Wildlife Refuge; the Imperial Ponds Conservation Area (IPCA) on the Imperial National Wildlife Refuge; and Yuma East Wetlands (YEW), Arizona

**Purpose:** To monitor the use of created marsh habitat by covered marsh bird species

**Connections with Other Work Tasks (Past and Future):** System-wide marsh bird surveys have been conducted by the Bureau of Reclamation on existing marsh habitat since 1996 and under Work Task D1 since FY05.

**Project Description:** Marsh bird surveys will be conducted at LCR MSCP conservation areas. The National Marsh Bird Monitoring Program protocol will be used, which involves surveying for several species, including the LCR MSCP covered marsh species, using recordings of the species' calls.

**Previous Activities:** HMM and the IPCA were surveyed for marsh birds prior to development. Marsh bird surveys were conducted at HMM and IPCA Field 18 after restoration was completed and at YEW after its inclusion into the LCR MSCP. In addition, marsh bird surveys were conducted at the Big Bend Conservation Area (BBCA), the Beal Lake Conservation Area, the ponds at the IPCA, and the Laguna Division Conservation Area to determine if areas containing marsh vegetation at these conservation areas were also utilized by

LCR MSCP covered marsh bird species. From FY12 to FY17, the Bureau of Reclamation partnered with the U.S. Fish and Wildlife (USFWS) to share the costs and labor needed to conduct the surveys at HMM and the IPCA.

**FY18 Accomplishments:** Marsh bird surveys were conducted once during March and twice in April at all the sites:

**Western Least Bittern Detections**

| Conservation Area | Survey 1 (March) | Survey 2 (April) | Survey 3 (late April) |
|---|---|---|---|
| Hart Mine Marsh | 4 | 11 | 13 |
| Imperial Ponds Conservation Area Field 18 | 0 | 0 | 0 |
| Yuma East Wetlands | 0 | 2 | 1 |
| | | | |
| Beal Lake Conservation Area | 2 | 4 | 12 |
| Big Bend Conservation Area | 0 | 0 | 0 |
| Imperial Ponds Conservation Area ponds | 1 | 1 | 0 |
| Laguna Division Conservation Area | 2 | 2 | 3 |

**Yuma Clapper Rail Detections**

| Conservation Area | Survey 1 (March) | Survey 2 (April) | Survey 3 (late April |
|---|---|---|---|
| Hart Mine Marsh | 5 | 18 | 25 |
| Imperial Ponds Conservation Area Field 18 | 0 | 0 | 0 |
| Yuma East Wetlands | 2 | 5 | 5 |
| | | | |
| Beal Lake Conservation Area | 0 | 3 | 9 |
| Big Bend Conservation Area | 0 | 0 | 0 |
| Imperial Ponds Conservation Area ponds | 0 | 0 | 0 |
| Laguna Division Conservation Area | 2 | 4 | 1 |

One California black rail was detected at the BBCA during the March survey. This was the only detection of a California black rail at a conservation area in FY18 and the first time the species has been detected at the BBCA.

**FY19 Activities:** Marsh bird surveys will be conducted on conservation areas with creditable marsh land cover: HMM, IPCA Field 18, and YEW. In addition, surveys will be conducted at Beal Lake to detect possible presence of Yuma clapper rails prior to dredging activities. Data will be entered into the LCR MSCP and Avian Knowledge Network (AKN) databases and analyzed.

Obligations in FY19 are expected to be lower than budgeted, as surveys funded from this work task will only be conducted at YEW and Beal Lake. The USFWS is planning to fund and conduct the surveys at HMM and IPCA Field 18.

**Proposed FY20 Activities:** Marsh bird surveys will be conducted on conservation areas with creditable marsh land cover: HMM, IPCA Field 18, and YEW. Data will be entered into the LCR MSCP and AKN databases and analyzed. The USFWS is planning to fund and conduct the surveys at HMM and IPCA Field 18; therefore, funds for those surveys will not be needed under this work task in FY20.

**Pertinent Reports:** The *Marsh Bird Surveys at Conservation Areas, 2017 Annual Report* and the *Marsh Bird Surveys at Conservation Areas, 2018 Annual Report* are posted on the LCR MSCP website.

## Work Task F8: Reptile and Amphibian Monitoring at Conservation Areas

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $25,000 | $9,699.58 | $9,699.58 | $25,000 | $25,000 | $25,000 | $25,000 |

**Contact:** Carrie Ronning, (702) 293-8106, cronning@usbr.gov

**Start Date:** FY18

**Expected Duration:** FY55

**Long-Term Goal:** Post-development monitoring for Colorado River toads, lowland leopard frogs, and northern Mexican gartersnakes

**Conservation Measures:** CRTO1, LLFR1, and MRM2 (NMGS)

**Location:** Presence surveys will be conducted at conservation areas where marsh habitat was created, including adjacent cottonwood-willow habitat where northern Mexican gartersnakes may be present, such as the Beal Lake Conservation Area, the Havasu National Wildlife Refuge, and Planet Ranch, Arizona.

**Purpose:** To monitor the use of created marsh habitat and associated cottonwood-willow habitat by covered reptile and evaluation amphibian species

**Connections with Other Work Tasks (Past and Future):** Monitoring will be conducted to support conservation area development work tasks where northern Mexican gartersnakes may be present, including Work Tasks E1 and E21.

**Project Description:** Presence surveys for northern Mexican gartersnakes and their prey (including Colorado River toads and lowland leopard frogs) will be conducted at conservation areas where marsh habitat was created, and nearby cottonwood-willow habitat, where northern Mexican gartersnakes may be present.

**Previous Activities:** This is a new start in FY18.

**FY18 Accomplishments:** No construction occurred in potential habitat in FY18, so northern Mexican gartersnake surveys and avoidance monitoring were not required. Site visits were conducted at the Bubbling Ponds Fish Hatchery, Santa Maria River, and the Big Sandy River in February to view created fish

backwaters that are being used by northern Mexican gartersnakes and natural riparian habitat. The U.S. Fish and Wildlife Service and Arizona Game and Fish Department shared lessons learned regarding facility management challenges, habitat characteristics, and species activity periods. The LCR MSCP participated in the annual Northern Mexican Gartersnake Coordination Meeting.

**FY19 Activities:** The LCR MSCP will participate in the annual Northern Mexican Gartersnake Coordination Meeting.

**Proposed FY20 Activities:** Pre-construction presence surveys and monitoring for northern Mexican gartersnakes may be conducted at proposed or current conservation areas in marsh habitat, nearby cottonwood-willow habitat, and rocky areas where northern Mexican gartersnakes may be present.

**Pertinent Reports:** N/A

## Work Task F9: Southwestern Willow Flycatcher Monitoring at Conservation Areas

| FY18 Estimates | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $100,000 | $53,502.65 | $52,502.65 | $500,000 | $360,000 | $360,000 | $360,000 |

**Contact:** Chris Dodge, (702) 293-8115, cdodge@usbr.gov

**Start Date:** FY18

**Expected Duration:** FY55

**Long-Term Goal:** Post-development monitoring of southwestern willow flycatchers

**Conservation Measures:** MRM1, MRM2, and MRM4 (WIFL)

**Location:** Conservation areas in Reaches 1–7 along the lower Colorado River (LCR), and lower Bill Williams River

**Purpose:** To monitor southwestern willow flycatcher populations at LCR MSCP conservation areas

**Connections with Other Work Tasks (Past and Future):** Work Task D2 included post-development and system-wide monitoring of southwestern willow flycatcher population numbers and demographics along the LCR from FY05 to FY17. Monitoring of southwestern willow flycatchers was split into separate work tasks beginning in FY18, with system-wide monitoring continuing under Work Task D2 and post-development monitoring conducted under Work Task F9.

**Project Description:** Presence surveys are conducted at LCR MSCP conservation areas.

**Previous Activities:** Presence surveys and life history studies of southwestern willow flycatchers have been conducted along the LCR since 1996 and since FY05 under Work Task D2.

**FY18 Accomplishments:** Presence surveys for southwestern willow flycatchers were conducted at 34 sites on LCR MSCP conservation areas and the Middle Bill Williams River National Wildlife Refuge (Middle Bill Williams River NWR) (E21) containing the cottonwood-willow land cover type. This included the Beal Lake Conservation Area, the Palo Verde Ecological Reserve,

the Cibola Valley Conservation Area, the Cibola Valley National Wildlife Refuge Unit #1 Conservation Area, the Middle Bill Williams River NWR, Planet Ranch, the Laguna Division Conservation Area, Yuma East Wetlands, and Hunters Hole. Migratory willow flycatchers were detected at all conservation areas, but no resident southwestern willow flycatchers were detected at any conservation area. Nest monitoring and color banding activities were not conducted.

FY18 obligations were lower than the approved budget, as the majority of field surveys and project oversight were tied to contract obligations under Work Task D2 instead of Work Task F9.

**FY19 Activities:** Presence surveys for southwestern willow flycatchers will be conducted at LCR MSCP conservation areas and the Middle Bill Williams River NWR (E21) containing the cottonwood-willow land cover type. Nest monitoring and color banding may occur if potentially breeding southwestern willow flycatchers are detected at LCR MSCP conservation areas.

**Proposed FY20 Activities:** Presence surveys for southwestern willow flycatchers will be conducted at LCR MSCP conservation areas and the Middle Bill Williams River NWR (E21) containing the cottonwood-willow land cover type. Nest monitoring and color banding may occur if potentially breeding southwestern willow flycatchers are detected at LCR MSCP conservation areas.

**Pertinent Reports:** The 2018 annual report will be posted on the LCR MSCP website upon completion.

## Work Task F10: Yellow-billed Cuckoo Monitoring at Conservation Areas

| FY18 Estimates | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $600,000 | $618,393.95 | $424,700.22 | $650,000 | $650,000 | $650,000 | $650,000 |

**Contact:** Barbara Raulston, (702) 293-8396, braulston@usbr.gov

**Start Date:** FY18

**Expected Duration:** FY55

**Long-Term Goal:** Post-development monitoring of yellow-billed cuckoos

**Conservation Measures:** MRM1 and MRM2 (YBCU)

**Location:** Protocol-level surveys are conducted in suitable habitat at LCR MSCP conservation areas

**Purpose:** To conduct surveys to monitor existing yellow-billed cuckoo populations at LCR MSCP conservation areas

**Connections with Other Work Tasks (Past and Future):** Yellow-billed cuckoo monitoring on LCR MSCP conservation areas was previously conducted under Work Task D7. Monitoring was split into separate work tasks beginning in FY18, with system-wide monitoring continuing under Work Task D7 and post-development monitoring conducted under this work task.

**Project Description:** Yellow-billed cuckoos use cottonwood-willow habitat and may act as an umbrella species for other covered avian species that use these habitats. A standardized survey protocol (issued by the U.S. Fish and Wildlife Service on April 22, 2015) will be used to determine the presence of yellow-billed cuckoos at conservation areas consisting of cottonwood-willow habitat at least 2 years old.

**Previous Activities:** This is a new start in FY18.

**FY18 Accomplishments:** Surveys were conducted at all LCR MSCP conservation areas with suitable cottonwood-willow habitat, including the Beal Lake Conservation Area (BLCA), the Palo Verde Ecological Reserve (PVER), CVCA, the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR Unit #1), Yuma East Wetlands (YEW), the Laguna Division Conservation

Area (LDCA), the Middle Bill Williams River NWR, Planet Ranch, and Hunters Hole. Birds banded in previous years were resighted, and nests were found incidental to these activities. Followup visits to find cuckoos tagged with geolocator devices in previous years were conducted at the PVER. Followup visits to determine breeding status were conducted at conservation areas where breeding has yet to be documented, or has not been document recently, including the LDCA, YEW, CVCA, and Hippy Fire.

There were 255 detections of cuckoos throughout the LCR MSCP's conservation areas. Cuckoos were detected at the BLCA, the Middle Bill Williams River NWR, the PVER, the CVCA, Cibola NWR Unit #1, YEW, the LDCA, Planet Ranch, and Hunters Hole. Thirty-five confirmed breeding territories, 24 nests, and an additional 11 probable and 26 possible breeding territories were detected in FY18. One breeding territory was confirmed at the BLCA. There were 26 confirmed breeding territories and 19 nests at the PVER (Phases 2, 5, 6, and 7). The majority of the nests found were in Phase 6. At Cibola NWR Unit #1, there were five confirmed territories and three nests at Crane Roost and Hippy Fire. Two nests were found at the CVCA and one nest at YEW, documenting nesting there for the first time.

Design of the second-generation mobile electronic field forms that will be used for future yellow-billed cuckoo surveys was initiated.

**FY19 Activities:** Call-playback surveys will be conducted at conservation areas planted with cottonwood-willow habitat at least 2 years old. Followup surveys to detect breeding will be conducted at conservation areas where breeding has yet to be documented. Birds banded in previous years may be resighted, and nests may be found incidentally to these activities.

Obligations are expected to increase in FY19 due to the additional acreage of cottonwood-willow land cover type on conservation areas that is potential habitat for yellow-billed cuckoos.

**Proposed FY20 Activities:** Surveys will continue at all conservation areas, and the work will be similar to what will be conducted in FY19.

**Pertinent Reports:** The *Yellow-billed Cuckoo Surveys on the Lower Colorado River 2017 Annual Report* is posted on the LCR MSCP website. The *Yellow-billed Cuckoo Surveys on the Lower Colorado River and Tributaries, 2014–2018 Summary Report* will also be posted upon completion.

# WORK TASKS – SECTION G

Adaptive Management Program

## Work Task G1: Data Management

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $1,000,000 | $1,081,315.25 | $7,647,277.31 | $1,250,000 | $1,000,000 | $850,000 | $750,000 |

**Contact:** Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

**Start Date:** FY07

**Expected Duration:** FY55

**Long-Term Goal:** Data management will be an ongoing task for species research, system monitoring, habitat creation, post-development monitoring, and habitat maintenance programs.

**Conservation Measures:** All

**Location:** Program-wide

**Purpose:** To develop and maintain an accessible, multi-disciplinary, spatially referenced, relational database and associated tools to consolidate, organize, document, store, and distribute scientific information related to the LCR MSCP

**Connections with Other Work Tasks (Past and Future):** Data management is integral for the successful completion of the work tasks undertaken: Fish Augmentation (Section B), Species Research (Section C), System Monitoring (Section D), Conservation Area Development and Management (Section E), Post-Development Monitoring (Section F), Adaptive Management Program (Section G), and Funding Accounts (Section H).

**Project Description:** Under this work task, the LCR MSCP manages the database, data collection, applications development, and software management. To fully implement the program, a database management system is being developed to handle the data collected through the species research, system monitoring, habitat creation, post-development monitoring, adaptive management, and habitat maintenance programs. Database design, initial implementation, field data collection systems, and maintenance are funded under this work task.

**Previous Activities:** The Database Management System Requirements Analysis was completed in FY06, which outlined several options and recommendations for implementing a database management system. Some recommendations from this analysis were implemented.

Support for the LCR Native Fish Database has been provided since FY04. The primary purpose of the database is to support periodic population estimates of native fishes.

Mobile data loggers and software for collection of data in the field were acquired. These units standardize data collection across LCR MSCP projects. Mobile electronic field forms (MEFFs)/data dictionaries for data collection were developed and are now used for most field data collection. The data from these first-generation MEFFs were transferred from single-year, single-project databases to a single enterprise database system. This allowed for cross-project data management and analysis.

A new platform was selected in FY17 for field data collection. The platform was selected based on its ability to (1) integrate with current LCR MSCP systems, (2) provide almost immediate access to data using cloud-based storage systems, and (3) be used on a wide variety of devices due to its cross-platform support. MEFFs developed using this platform are considered second-generation MEFFs.

**FY18 Accomplishments:** Maintenance and updates to the LCR MSCP website continued, including posting of all published reports, Steering Committee information, and status updates for ongoing projects. The agreement for redesign of the LCR MSCP website was finalized and will accommodate a complete redesign and migration to a content management system to take place during FY19.

The native fish databases continued to be maintained in their current formats. The two databases are (1) the native fish augmentation database, which includes initial stocking/tagging information as well as recontacts via netting or electrofishing, and (2) the remote scanning database, which includes recontacts via remote sensing.

Several projects were transferred to second-generation MEFFs during FY18. Field data collection devices compatible with this new platform and software tools to assist with the transition were also acquired during FY18.

The LCR MSCP databases continued to be maintained and upgraded for location, species, project-related reference tables, and utility procedures to centralize processing of project data.

In FY16, the Bureau of Reclamation (Reclamation) decided to transfer server administration for the collaboration portal that the LCR MSCP utilizes to Denver, Colorado. This centralization effort also involved a major version upgrade. This migration took place during FY18. Prior to migration, the LCR MSCP organized the content contained in the collaboration portal and performed maintenance tasks involved with the migration and upgrade. Workflows were developed using this

platform to make internal work processes more efficient, transparent, and trackable. Content contained in the portal were catalogued and indexed so that all project information is easier to find and is more accessible.

The LCR MSCP participated in the Reclamation Information Sharing Environment (RISE) (https://water.usbr.gov/docs/RISE.pdf). RISE is an open data initiative sponsored by Reclamation, with the goal of sharing Reclamation's data in consistent, open, machine-readable formats via a centralized, sustainable public data portal. This will help provide reasonable access to data to members of the Steering Committee for monitoring the progress and performance of the LCR MSCP. The LCR MSCP also participated in planning for a U.S. Fish and Wildlife Service (USFWS) initiative to allow for cloud-based electronic delivery of southwestern willow flycatcher data instead of older, less-efficient methods. These data will be submitted using the Avian Knowledge Network infrastructure.

**FY19 Activities:** Maintenance and updates to the LCR MSCP website continue, including posting of all published reports, Steering Committee information, and status updates for ongoing projects. Work on the website redesign has begun involving development of a new sitemap, content strategy, and design directions. It is anticipated that the new website will launch in FY19.

The native fish databases continue to be maintained in their current formats. Several improvements are being made to the remote scanning database, which will provide for easier upload of data and advanced querying capabilities. Work continues in order to incorporate these data into the LCR MSCP database.

The field data collection processes continue to be updated and/or maintained. Additional projects are being transitioned to the second-generation MEFF platform. Improvements are being made to data collection protocols, quality assurance and quality control procedures, and post-processing techniques using the new platform.

The LCR MSCP continues to participate in the Reclamation RISE effort and the USFWS Avian Knowledge Network initiatives.

**Proposed FY20 Activities:** Once the new website is launched, updates and additional content will be incorporated into the new content management system.

The native fish databases will continue to be maintained in their current format. Incorporation of these data into the LCR MSCP database is scheduled to take place. It is also anticipated that native fish stocking data in legacy formats will be incorporated into the LCR MSCP database. Field collection of native fish stocking data and other fisheries related data will be updated to use second-generation MEFFs.

Any wildlife or restoration field data collection project not using MEFFs will be updated to second-generation MEFFs. Implementation of the enterprise system will continue. Automation of field data, post-processing, and publishing of data for internal use and external sharing will also continue.

Participation in the RISE project and the USFWS Avian Knowledge Network initiative will continue.

**Pertinent Reports:** N/A

## Work Task G3: Adaptive Management Research Projects

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $300,000 | $5,386.62 | $2,818,200.69 | $300,000 | $100,000 | $100,000 | $100,000 |

**Contact:** Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

**Start Date:** FY06

**Expected Duration:** FY55

**Long-Term Goal:** Effective conservation of native species and their habitats

**Conservation Measures:** BONY2, BONY5, RASU2, and RASU6

**Location:** System-wide

**Purpose:** To develop tools to effectively evaluate conservation actions

**Connections with Other Work Tasks (Past and Future):** Research projects initiated under this work task may be continued as Species Research (Section C). Information obtained may be used for Fish Augmentation (Section B), System Monitoring (Section D), Conservation Area Development and Management (Section E), Post-Development Monitoring (Section F), or Funding Accounts (Section H) work tasks.

**Project Description:** The adaptive management process is an assurance that the conservation actions presented in the Habitat Conservation Plan are effectively accomplished. Tools will be developed and evaluated that can measure the effectiveness of conservation actions, and data will be provided to improve the efficacy of techniques for creating habitat.

Funding will be provided to initiate high priority research projects identified during the year that were not identified as work tasks in the work plan. For example, opportunistic research proposals (e.g., time sensitive, such as spawning or breeding-season dependent) can be considered and initiated during the funding year and then be elevated to full research or monitoring status (Section C, D, or F work tasks) the following year. Also, experimental techniques can be evaluated through research to assess their utility, and if found to be useful, they would be incorporated into monitoring activities.

**Previous Activities:** All previous activities were moved to other work tasks after the initial year of funding.

**FY18 Accomplishments:** Minor administrative closeout activities were performed for past research projects.

**FY19 Activities:** Research questions identified during fish augmentation, species research, system-wide monitoring, habitat creation, and post-development monitoring will be evaluated for development into adaptive management research projects under this work task.

**Proposed FY20 Activities:** Research questions identified during fish augmentation, species research, system-wide monitoring, habitat creation, and post-development monitoring will be evaluated for development into adaptive management research projects under this work task. Due to an expected decrease in the need for adaptive management research projects, proposed budget estimates have been reduced for FY20 and later.

**Pertinent Reports:** Reports will be posted on the LCR MSCP website upon completion.

## Work Task G4: Science/Adaptive Management Strategy

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $400,000 | $654,991.70 | $2,358,791.87 | $400,000 | $400,000 | $400,000 | $400,000 |

**Contact:** Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

**Start Date:** FY06

**Expected Duration:** FY55

**Long-Term Goal:** To ensure successful and efficient implementation of the LCR MSCP conservation measures

**Conservation Measures:** All conservation measures related to habitat creation and management, species research, system monitoring, and fish augmentation

**Location:** LCR MSCP planning area

**Purpose:** To define the procedure for implementing the LCR MSCP using the best available science and adaptive management processes

**Connections with Other Work Tasks (Past and Future):** All science-based work tasks

**Project Description:** The Habitat Conservation Plan (HCP) conservation measures were designed to meet the biological needs of 27 covered species and to benefit 5 evaluation species. A science strategy, developed in FY06, defined the processes for ensuring implementation of the LCR MSCP using the best available science, and it described a two-tier planning process to ensure effective implementation of research and monitoring actions: a 5-year planning cycle and annual work plans covering a 3-year cycle.

Every 5 years, a plan will be developed that describes the current knowledge of covered species, establishes the monitoring and research priorities for that 5-year period, and describes potential challenges that may inhibit successful implementation of the conservation measures. During each 5-year cycle, the accumulated data from ongoing research and monitoring will be reviewed along with existing species accounts and/or conceptual ecological models.

Additional work may be generated from the evaluation of research conducted under Work Task G3.

The LCR MSCP participates in interagency meetings and workshops held to discuss natural resource conservation along the lower Colorado River. These meetings bring together scientists, managers, and resource users interested in the lower Colorado River ecosystem. Additional special topic workshops will be held for covered species or their habitats as needed to revisit the status of one or more of these species within the LCR MSCP planning area.

Recently completed, ongoing, and proposed research and monitoring activities will be reviewed to ensure they meet the goals and objectives of the HCP. This includes internal and external peer reviews of all reports and data products. The peer review process ensures that all research and monitoring complies with the LCR MSCP science strategy and the U.S. Department of the Interior Code of Scientific and Scholarly Conduct. This process also ensures that research and monitoring meets the needs of the LCR MSCP as outlined in the HCP and other program documents.

**Previous Activities:** The science strategy was developed in August 2006 and finalized in October 2007. The LCR MSCP hosted Colorado River Terrestrial and Riparian meetings and attended the Colorado River Aquatic Biologists meetings. The Habitat Creation Conservation Measure Accomplishment Tracking Process was developed for tracking conservation measure accomplishment pertaining to the habitat creation conservation measures and approved by the Steering Committee in FY12. The report titled *LCR MSCP Five-Year Monitoring and Research Priorities*: *2013–2017* was completed in FY13.

On October 27, 2011, the Steering Committee approved minor modifications to five conservation measures (BONY3, BLRA1, RASU3, STBU1, and THMI1) reported in the FY11 accomplishments report. Reported in FY14, three minor modifications to conservation measures were approved by the Steering Committee on April 23. Research and monitoring activities provided habitat information to adjust conservation measures BEVI1, CRCR2, and WRBA1.

Independent program reviews were completed on the bat and vegetation monitoring projects.

**FY18 Accomplishments:** Scientific peer reviews were conducted on approximately 35 reports, which are posted on the LCR MSCP website. These reviews were accomplished through the established internal and external peer review process.

Feedback and input were provided on internal study plan designs, statistical analyses of results, and technical and scientific writing standards. When appropriate, this information was shared with external partners to assist in their research, monitoring, and report writing activities.

The review of the system-wide avian monitoring project (D6) continued. The analytical methods and survey intensity were reviewed, and initial steps on the vegetation classification update for avian survey plots was completed.

Based on the results from the initial, independent review of genetic research (completed in FY16) for razorback suckers, an additional review was completed by an independent panel of five genetic experts. This additional effort included reviewing all genetic data collected to date, examining the current methods in the context of the goals/needs/objectives of the LCR MSCP, and reviewing the current available technology. The purpose of this expanded, more detailed review was to identify the level of effort and long-term needs for monitoring fish genetics and to address any additional questions that resulted from the initial review. Next steps include developing plans for implementing the recommended genetics monitoring plan. The panel of experts will be available to review proposals to accomplish the provided recommendations.

The development of adaptive management plans for each research and monitoring effort began in FY18. Components of these plans will include a research or monitoring question, a summary of data to be collected to answer the research or monitoring question, how the data will be used to answer the question, adaptive management triggers/thresholds for monitoring efforts, and potential adaptive management actions. These plans will feed into the development of the conservation area management plans for each conservation area. Obligations were more than approved due to funds being obligated in FY18 for this work that will be completed in FY19. The level of effort needed to develop these plans was greater than initially estimated, also resulting in obligations being greater than approved.

A draft of the LCR MSCP *Five-Year Monitoring and Research Priorities Report 2018–22* was completed in FY18 and distributed to the Steering Committee for their review. This report describes the current knowledge of covered species, establishes the monitoring and research priorities for the next 5-year period (2018–22), and describes potential challenges that may inhibit successful implementation of the conservation measures. The final version of this report was published in early FY19.

The LCR MSCP attended the Colorado River Aquatic Biologists meeting and the Priorities in Riparian Restoration Workshop (hosted by Utah State University).

The habitat creation accomplishment analysis was not conducted during FY18 due to the light detection and ranging (lidar) vegetation data not being available.

Lidar acquisition for FY18 included the entire LCR MSCP planning area, and due to the volume of data being collected, processed data will not be available until late FY19.

**FY19 Activities:** Research and monitoring activities continue to be reviewed and evaluated internally as well as through independent, external reviewers.

The review of the system-wide avian monitoring project (D6) will be finalized. The findings from the review will be evaluated, and plans for implementation will be formulated. The review will provide recommendations on field survey protocol, frequency of monitoring, selection of survey plots, and analysis of data. The review will also provide recommendations for the avian monitoring at conservation areas (F2) project.

The recommendations from the fish genetics panel will be reviewed, and a plan to implement recommendations will be developed.

Development of adaptive management plans for each research and monitoring effort continue. Development of decision support tools has been postponed until completion of the adaptive management plans.

**Proposed FY20 Activities:** Research and monitoring activities will be reviewed and evaluated internally as well as through independent reviewers. Specific programs may include avian, small mammal, insect, fisheries, and habitat monitoring programs.

Information from the conceptual ecological models will continue to be used for analyses of current and proposed management actions. Further development of decision support tools will also continue. Adaptive management plans will continue to be developed and refined for each monitoring and research effort. Information from these analyses and tools will be used to develop additional conservation area management plans and to refine existing plans. At each conservation area, proposed management guidelines must be agreed upon by the LCR MSCP and the landowner. After concurrence, each conservation area management plan will be developed and implemented accordingly.

The monitoring and research priorities report will be reviewed to ensure that the priorities in the report are still priorities for the program and that efforts are in line with the priorities.

**Pertinent Reports:** N/A

## Work Task G6: Conceptual Ecological Models

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $40,000 | $15,162.76 | $92,681.58 | $40,000 | $40,000 | $40,000 | $40,000 |

**Contact:** Jimmy Knowles, (702) 293-8172, jknowles@usbr.gov

**Start Date:** FY16

**Expected Duration:** FY55

**Long-Term Goal:** To ensure successful and efficient implementation of the LCR MSCP conservation measures

**Conservation Measures:** BEVI1, BLRA1, BLRA2, BONY2, BONY5, CLNB1, CLNB2, CLRA1, CLRA2, CRCR1, CRCR2, CRTO1, CRTO2, CRTO3, DPMO1, ELOW1, FLSU1, GIFL1, GIWO1, LEBI1, LLFR1, LLFR2, LLFR3, MNSW1, MNSW2, MRM1, MRM2, MRM3, PTBB1, PTBB2, RASU2, RASU6, SUTA1, VEFL1, WIFL1, WIFL2, WRBA1, WRBA2, WYBA1, WYBA3, YBCU1, YBCU2, YHCR1, YHCR2, and YWAR1

**Location:** System-wide, Arizona, California, Nevada

**Purpose:** To assess and organize existing knowledge on each LCR MSCP covered and evaluation species to determine research, monitoring, and habitat requirements for current and future research, monitoring, habitat creation, and fish augmentation projects

**Connections with Other Work Tasks (Past and Future):** Previous work was done through Work Tasks C3 (closed), G3, and G4. Information collected under this work task is currently being used to develop future work tasks and research projects, design monitoring programs and habitat creation projects, and to implement the adaptive management process. Information from this work task will be used under Fish Augmentation (Section B), Species Research (Section C), System Monitoring (Section D), Conservation Area Development and Management (Section E), and Post-Development Monitoring (Section F).

**Project Description:** To successfully create and manage habitats for LCR MSCP covered species, conceptual ecological models (CEMs) are being developed to better direct research and monitoring efforts as well as management.

CEMs are widely recognized and utilized in natural resource management and structured decisionmaking, as they provide a clear framework for informing management actions.

CEMs integrate and organize existing knowledge concerning (1) what is known about an ecological resource, with what certainty, and the sources of this information, (2) critical areas of uncertain or conflicting science that demand resolution to better inform management planning and action, (3) crucial attributes to use while monitoring system conditions and predicting the effects of experiments, management actions, and other potential agents of change, and (4) how the characteristics of the resource are expected to change as a result of altering its shaping/controlling factors, including those resulting from management actions.

**Previous Activities:** First editions of CEMs for most covered species were finalized in FY16. The species accounts updated in FY14 under Work Task C3 (closed) were finalized and published during FY16. Information from these species accounts were incorporated into the CEMs for covered species during FY16.

The CEM developed in FY14 for the razorback sucker was updated in FY17 to reflect new information about the species.

**FY18 Accomplishments:** Updates to all existing CEMs began (except for the razorback sucker, which was updated in FY17). The literature was reviewed for new information, and subject matter experts were consulted. These updates will be included as addendums. When more substantial updates are performed, new versions of the CEMs will be generated.

CEMs for the five LCR MSCP evaluation species (Colorado River toad, lowland leopard frog, California leaf-nosed bat, pale Townsend's big-eared bat, and the desert pocket mouse) began being developed.

The LCR MSCP participated in a workshop on how to use the species-specific CEMs to better understand the impacts of management actions on habitat created under the LCR MSCP and the relationship between these actions and their effect on covered species.

The CEMs were used to identify knowledge gaps. These knowledge gaps were addressed in the 5-year monitoring and research priorities report that was developed under Work Task G4.

Obligations were less than approved due to work being accomplished with funds that were obligated during FY17.

**FY19 Activities:** Work on updates to all existing CEMs continues. Work on development of new CEMs for the five evaluation species also continues.

**Proposed FY20 Activities:** Updates to CEMs will be made as new information is received, with literature searches being performed at least once per year. Initial steps to develop decision support tools will be completed. These decision support tools will help model the impacts that management actions have on created habitat and LCR MSCP covered species.

**Pertinent Reports:** CEMs are posted on the LCR MSCP website.

# WORK TASKS – SECTION H

Funding Accounts

## Work Task H1: Habitat Maintenance Fund

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18* | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $0 | $0 | $32,466,770.00 | $0 | $0 | $0 | $0 |

* Cumulative expenditures reflect total required contributions to develop the fund.

**Contact:** Jeremy Brooks, (702) 293-8157, jjbrooks@usbr.gov

**Start Date:** FY06

**Expected Duration:** FY55

**Long-Term Goal:** Maintenance of existing habitat

**Conservation Measures:** BLRA2, CLRA2, WIFL2, and YBCU2

**Location:** Lower Colorado River (Reaches 1–7)

**Purpose:** To maintain existing habitat areas, excluding newly created habitat within conservation areas, by implementing actions that will prevent the further degradation or loss of habitat for LCR MSCP covered species

**Connections with Other Work Tasks (Past and Future):** This is a stand-alone requirement as described in the LCR MSCP Habitat Conservation Plan.

**Project Description:** The development of a $25 million interest-bearing fund, called the Habitat Maintenance Fund (HMF), was completed over a 10-year period. The HMF will be used for maintaining habitats, which existed at the time of the signing of the Record of Decision (2005) and were suitable for LCR MSCP covered species, and which have since degraded after the LCR MSCP was initiated.

The HMF was established during the first 10 years of the LCR MSCP by the States of California, Arizona, and Nevada. Funding contributions during the initial 5 years were established at $500,000 per year, with funding contributions in years 6–10 established at $5,000,000 per year. Values are indexed to 2003 dollars and adjusted annually for inflation. All required contributions to the HMF are retained in interest-bearing accounts managed by the States of California, Arizona, and Nevada until required for use by the LCR MSCP. Current fund balances and project expenditures are detailed in attachment D-3a.

For HMF projects, the LCR MSCP serves as the funding source but will not directly implement specific projects. The lead agencies and planning participants are expected to use their own funds in the development of proposals and for participation in planning teams. Funds required to administer the HMF under the LCR MSCP will be tracked under Work Task A1.

The Habitat Conservation Plan specifies a priority for habitat and species types benefiting from projects funded through the HMF. The highest priority is the protection of marsh, specifically marsh complexes occupied by LCR MSCP covered rail species that serve as key source populations. The four key source population areas are Topock Marsh and Topock Gorge within the Havasu National Wildlife Refuge (Reach 3), Reach 5 primarily within the Imperial National Wildlife Refuge, and Mittry Lake (Reach 6), which is located on Bureau of Reclamation withdrawn lands. The focus of the first 10 years of expenditures from the HMF (FY16–25) is to (1) improve the infrastructure to manage water levels for rail species at Topock Marsh and Mittry Lake and (2) enhance degraded rail habitat in Topock Gorge and Reach 5.

**Previous Activities:** Required annual funding contributions have been completed. In coordination with the U.S. Fish and Wildlife Service (USFWS) Arizona Ecological Services Field Office, planning teams comprised of representatives of appropriate resource agencies and landowners were assembled to investigate the use of the HMF to maintain Yuma clapper rail and California black rail key population centers at Topock Marsh and Mittry Lake.

Discussions between the LCR MSCP, the USFWS Arizona Ecological Services Field Office, and the USFWS Region 2 Regional Office resulted in an agreement to leverage remaining Avoidance and Minimization Measure 2 (AMM2) funds (E17) of approximately $2.1 million and contributions from the HMF to complete infrastructure improvements at Topock Marsh. Funding from the HMF will not be used or budgeted until AMM2 funding is exhausted.

**FY18 Accomplishments:** No funds were expended from the HMF for project purposes. The total dollar value of the HMF at the end of FY18, with interest, was $34,285,574.82.

The USFWS developed a 10-year plan to manage marshes that were suitable habitat for marsh birds covered under the LCR MSCP at the time of the signing of the Record of Decision (2005). Preliminary discussions were held with the USFWS regarding the use of the HMF to fund a coordinated, long-term, controlled burn program at the Havasu and Imperial National Wildlife Refuges.

**FY19 Activities:**

*Existing Marsh Maintenance on National Wildlife Refuges:* The LCR MSCP is providing general support and guidance to the USFWS to develop a proposal to manage marshes for the next 10 years. Implementation of this 10-year plan may begin in FY19. Obligations may occur to fund these marsh projects as well as the procurement of equipment to support those management actions.

*Topock Marsh*: No activities will be conducted under the HMF until all AMM2 funding is spent and the USFWS submits a proposal to make infrastructure improvements to benefit marsh birds covered under the LCR MSCP.

*Mittry Lake*: No activities are anticipated in FY19 unless the Bureau of Reclamation's Yuma Area Office submits a qualified proposal to make infrastructure improvements to benefit marsh birds covered under the LCR MSCP.

**Proposed FY20 Activities:** No activities will be conducted until proposals are received by LCR MSCP.

**Pertinent Reports:** N/A

## Work Task H2: Remedial Measures Fund

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18[1] | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $1,122,360 | $1,122,360.00 | $7,329,835.38 | $1,147,832 | $1,194,796 | $1,194,796 | $1,194,796 |

[1] Cumulative expenditures reflect total required contributions to develop the fund.

**Contact:** John Swett, (702) 293-8555, jswett@usbr.gov

**Start Date:** FY13

**Expected Duration:** FY55

**Long-Term Goal:** Remedial measures for changed circumstances

**Conservation Measures:** BEVI1, BLRA1, BONY2, BONY3, CLRA1, CRCR2, ELOW1, FLSU1, GIFL1, GIWO1, LEBI1, MNSW2, RASU2, RASU3, SUTA1, VEFL1, WIFL1, WRBA2, WYBA3, YBCU1, YHCR2, and YWAR1

**Location:** Lower Colorado River (Reaches 1–7)

**Purpose:** To implement remedial measures to respond to changed circumstances as necessary

**Connections with Other Work Tasks (Past and Future):** Any Fish Augmentation (Section B) and Conservation Area Development and Management (Section E) work tasks that may be affected by changed circumstances

**Project Description:** To address the potential for changed circumstances, a contingency fund was established to implement remedial measures identified in the Habitat Conservation Plan. On April 25, 2012, the Steering Committee passed Program Decision Document 12-001 to establish interest-bearing Remedial Measure Funds managed by each State. The total funds allocated to remedial measures was $13,270,000 (in 2003 dollars and indexed to inflation). Current fund balances are detailed in attachment D-3b.

In the event that changed circumstances occur, the Program Manager will implement remedial measures identified in the Habitat Conservation Plan. The measures will be implemented within the available LCR MSCP budget, including contingency funds allocated through this work task.

**Previous Activities:** A Remedial Measures Fund process was established and approved by the Steering Committee in FY12.

**FY18 Accomplishments:** A total of $1,122,360 was deposited into three non-Federal interest-bearing accounts among Arizona, California, and Nevada. They consisted of $280,590 of funding from Arizona, $280,590 from Nevada, and $561,180 from California. The total dollar value of the Remedial Measures Fund at the end of FY18, with interest, was $7,542,121.16. No funds have been withdrawn from the Remedial Measures Fund to date.

**FY19 Activities:** A total of $1,147,832 will be deposited into three non-Federal interest-bearing accounts among Arizona, California, and Nevada.

**Proposed FY20 Activities:** A total of $1,194,796 is expected to be deposited into three non-Federal interest-bearing accounts among Arizona, California, and Nevada.

**Pertinent Reports:** N/A

# WORK TASKS – SECTION I

Public Outreach

## Work Task I1: Public Outreach

| FY18 Estimate | FY18 Actual Obligations | Cumulative Expenditures Through FY18 | FY19 Approved Estimate | FY20 Proposed Estimate | FY21 Proposed Estimate | FY22 Proposed Estimate |
|---|---|---|---|---|---|---|
| $125,000 | $141,757.83 | $890,818.82 | $125,000 | $125,000 | $125,000 | $125,000 |

**Contact:** Nathan Lenon, (702) 293-8015, nlenon@usbr.gov

**Start Date:** FY05

**Expected Duration:** FY55

**Long-Term Goal:** To provide information about LCR MSCP goals and implementation activities and increase support for the LCR MSCP

**Conservation Measures:** N/A

**Location:** N/A

**Purpose:** To communicate with, coordinate, and educate Steering Committee members, internal and external stakeholders, and the general public about LCR MSCP implementation activities

**Connections with Other Work Tasks (Past and Future):** All LCR MSCP work tasks

**Project Description:** An outreach program for the LCR MSCP will be implemented. Activities are widely varied and include the creation of educational materials, participation at conferences and other public events, interaction with school groups, and coordination with youth conservation corps groups. Outreach may be specific to a project but more typically addresses the overall focus of the LCR MSCP and general conservation issues.

**Previous Activities:** The LCR MSCP has hosted the Colorado River Terrestrial and Riparian annual meeting since FY06 and participated in the Colorado River Aquatic Biologists annual meeting since FY05. These meetings provide centralized forums for scientists and resource managers to discuss current research and monitoring projects taking place on the lower Colorado River. Information from these annual meetings is available on the LCR MSCP website.

A wide range of printed materials, videos, and reports has been created to explain various program features in both summary (factsheet) format as well as detailed

reports. Several banner displays have been created; these materials have been used extensively to promote the LCR MSCP at conferences, conservation area dedications, and other events.

**FY18 Accomplishments:** LCR MSCP information was exhibited at numerous science education events, including the eighth annual Las Vegas Science and Technology Festival, the Colorado River Water Users Association annual conference (CRWUA), and the Arizona Game and Fish Department (AZGFD) Outdoor Expo, as well as numerous smaller events. The AZGFD Outdoor Expo was the largest event, drawing more than 43,000 attendees during the two main days that the LCR MSCP participated.

The LCR MSCP provided tours of conservation areas for the Water Education Foundation and other stakeholder groups. The LCR MSCP presented programs at two continuing education workshops for Project WET (Water Education for Teachers). Participation in this project is through a partnership between the National Park Service and Bureau of Reclamation. These workshops focus on explaining Colorado River water, science, and other related issues to Nevada teachers and provided information to be used in classrooms. The LCR MSCP participated in the Colorado River Aquatic Biologists (CRAB) meeting, but the Colorado River Terrestrial and Riparian (CRTR) meeting was not held due to a lapse in Federal appropriations. The LCR MSCP also visited several elementary schools in southern Nevada, contacting approximately 470 students.

The LCR MSCP received 37 hours of volunteer labor during the year. Volunteers participated in wildlife monitoring at several locations and razorback sucker monitoring on Lake Havasu. These volunteers assisted the LCR MSCP, engaged the public and youth in conservation work, and fostered relationships between the community and the program.

A collection of three-dimensional models of covered wildlife species was created to enhance the program's outreach exhibits and educational activities.

**FY19 Activities:** Costs for renting exhibit space at CRWUA, the Las Vegas Science and Technology Festival, and the AZGFD Outdoor Expo will be funded from this work task. Neither the CRAB nor CRTR meetings were held due to a lapse in Federal appropriations.

The LCR MSCP will participate in educational events, science and conservation-themed community events, and several conferences, including the AZGFD Outdoor Expo, CRWUA, the Las Vegas Science and Technology Festival, and Project WET workshops.

**Proposed FY20 Activities:** Emphasis for outreach will continue to focus on LCR MSCP stakeholder education, with interaction in local communities. The LCR MSCP will continue to support one to three large events per year, such as

the annual CRWUA conference and the Las Vegas Science and Technology Festival. These activities provide opportunities to expand stakeholder and public knowledge of the LCR MSCP. Outreach to local community schools and colleges will continue, with a focus on providing volunteer opportunities when appropriate.

The LCR MSCP plans to participate in Project WET workshops and will expand outreach as additional conservation areas are completed. This increased public awareness will help resolve potential issues over conflicting use of conservation areas.

**Pertinent Reports:** The 2017 and 2018 annual reports will be posted on the LCR MSCP website upon completion.

# ATTACHMENTS


**A** Letter from Central Arizona Water Conservation District

**B** Description of Take

B-1: Federal Flow-Related Covered Actions and Accomplishments, Calendar Year 2018

B-2: Federal Non-Flow-Related Covered Actions and Incidental Take Summary, Fiscal Year 2018

B-3: LCR MSCP Non-Federal Covered Activities and Incidental Take Summary, Fiscal Year 2018

**C** Recommendations from Resource Agencies

**D** Financial Statement

D-1: Required Contributions

D-2: Funding Credits

D-2a: San Diego County Water Authority
D-2b: The Metropolitan Water District of Southern California
D-2c: Nevada
D-2d: Arizona
D-2e: Bureau of Reclamation

D-3: Funding Accounts
D-3a: Habitat Maintenance Fund
D-3b: Remedial Measures Fund
D-3c: Land and Water Fund

D-4: Cumulative Program Accomplishment, FY04 – FY18

E Reports Published in Fiscal Year 2018

# Attachment A – Letter from Central Arizona Water Conservation District

CAP
CENTRAL ARIZONA PROJECT

June 19, 2019

Joseph A. Vanderhorst
Deputy General Counsel
Metropolitan Water District of Southern California
P.O. Box 54153
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Christopher S. Harris
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The Multi-Species Conservation Program (MSCP) Non-Federal share for the Federal Fiscal Year 2020, both annually and quarterly, are shown by state below. The inflation index used is 1.501.

FY20 is year 15 of the program and the fifth year of Arizona's 20 year payback period.

| | |
|---|---|
| FY 2020 Non-Federal Share (2003 $) | $11,082,000 |
| FY 2020 Inflation Index | 1.501 |
| FY 2020 Non-Federal Share (Escalated $) | $16,634,082 |

| FY 2020 Non-Fed | Arizona Payback | Other Work Tasks | Remedial Measures | Total Non-Fed Payment Due |
|---|---|---|---|---|
| Arizona | $ 790,242.73 | $3,859,821.50 | $ 298,699.00 | $ 4,948,763.23 |
| Nevada | (395,121.36) | 3,859,821.50 | 298,699.00 | 3,763,399.14 |
| California | (395,121.37) | 7,719,643.00 | 597,398.00 | 7,921,919.63 |
| Totals | $ 0.0 | $15,439,286.00 | $1,194,796.00 | $16,634,082.00 |

P.O. Box 43020 – Phoenix, AZ 85080-3020 • 23636 North Seventh Street – Phoenix, AZ 85024 • 623-869-2333 • www.cap-az.com

| FY 2020 Quarterly Payments | | Arizona Payback | Other Work Tasks | Remedial Measures | Total Non-Fed Payment Due |
|---|---|---|---|---|---|
| Arizona | Q1 | $ 197,560.68 | $ 964,955.38 | $ 74,674.75 | $1,237,190.81 |
| | Q2 | 197,560.68 | 964,955.38 | 74,674.75 | 1,237,190.81 |
| | Q3 | 197,560.68 | 964,955.38 | 74,674.75 | 1,237,190.81 |
| | Q4 | 197,560.69 | 964,955.36 | 74,674.75 | 1,237,190.80 |
| | FY Totals | $ 790,242.73 | $3,859,821.50 | $298,699.00 | $4,948,763.23 |
| Nevada | Q1 | $ (98,780.34) | $ 964,955.38 | $ 74,674.75 | $ 940,849.79 |
| | Q2 | (98,780.34) | 964,955.38 | 74,674.75 | 940,849.79 |
| | Q3 | (98,780.34) | 964,955.38 | 74,674.75 | 940,849.79 |
| | Q4 | (98,780.34) | 964,955.36 | 74,674.75 | 940,849.77 |
| | FY Totals | $ (395,121.36) | $3,859,821.50 | $298,699.00 | $3,763,399.14 |
| California | Q1 | $ (98,780.34) | $1,929,910.75 | $149,349.50 | $1,980,479.91 |
| | Q2 | (98,780.34) | 1,929,910.75 | 149,349.50 | 1,980,479.91 |
| | Q3 | (98,780.34) | 1,929,910.75 | 149,349.50 | 1,980,479.91 |
| | Q4 | (98,780.35) | 1,929,910.75 | 149,349.50 | 1,980,479.90 |
| | FY Totals | $ (395,121.37) | $7,719,643.00 | $597,398.00 | $7,921,919.63 |

If you have any questions, please call or e-mail either Dana Sedig, 623-869-2148 (dsedig@cap-az.com) or myself, 623-869-2167 (tcooke@cap-az.com).

Sincerely,

Theodore Cooke
General Manager
Central Arizona Project

Attachments

Cc John Swett, MSCP Program Manager, Bureau of Reclamation
Laura Vecerina, MSCP Program Deputy Manager, Bureau of Reclamation
Douglas Dunlap, Manager-Finance and Accounting, CAP
Dana Sedig, Supervisor-Financial Operations, CAP

# Attachment B – Acronyms and Abbreviations

| | |
|---|---|
| AOP | Annual Operating Plan |
| BCPA | Boulder Canyon Project Act |
| CAP | Central Arizona Project |
| CAWCD | Central Arizona Water Conservation District |
| CFR | Code of Federal Regulations |
| CVWD | Coachella Valley Water District |
| Decree | Supreme Court Consolidated Decree of 2006 in *Arizona* v. *California*, 547 U.S. 150 |
| DPOC | Drain Pump Outlet Channel |
| Freeport | Freeport Minerals Corporation |
| FY | fiscal year |
| IBWC | International Boundary and Water Commission |
| ICS | Intentionally Created Surplus |
| IID | Imperial Irrigation District |
| Interim Guidelines | Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead |
| kWh | kilowatt hour(s) |
| LCWSP | Lower Colorado Water Supply Project |
| Lower Division States | Arizona, California, and Nevada |
| LROC | Long-Range Operation of Colorado River Reservoirs |
| maf | million acre-feet |
| mi | mile(s) |
| MODE | Main Outlet Drain Extension |
| MWD | Metropolitan Water District of Southern California |
| NIB | Northerly International Boundary |
| PPR | Present Perfected Right |
| Reclamation | Bureau of Reclamation |
| RRA | Reclamation Reform Act |
| SCAT | San Carlos Apache Tribe |
| SDCWA | San Diego County Water Authority |
| Secretary | United States Secretary of the Interior |
| SIB | Southerly International Boundary |
| SIRA | Storage and Interstate Release Agreement |
| SLR | San Luis Rey |
| U.S. | United States |
| YMC | Yuma Mesa conduit |

# Attachment B – Description of Take

## B-1: Federal Flow-Related Covered Actions and Accomplishments, Calendar Year 2018

| Federal Covered Actions *Biological Assessment* Chapter 2 | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions[1] | 2018 Accomplishments[2, 3] |
|---|---|---|---|---|
| **2.2 BUREAU OF RECLAMATION** | | | | |
| **2.2.1 Ongoing Flow-Related Actions** | | | | |
| **2.2.1.1 Flood Control (page 2-3; Table 2-1, page 2-5)** | • Prescribed flood control releases per Field Working Agreement and Water Control Manual for Lake Mead/Hoover Dam | • Timing of required releases may be varied within the month<br><br>• Anticipatory flood control releases<br><br>• Available flood control space in Lake Mead can be reduced to 1.5 million acre-feet (maf) August 1 to January 1 if prescribed space is available in upstream reservoirs<br><br>• Management of target elevations for Lake Mohave (Davis Dam) and Lake Havasu (Parker Dam) | — | No flood control releases were made from Lake Mead.<br><br>The hourly elevation of Lake Mead provided for flood control space, which was well above the space required. In 2018, the Lake Mead elevation varied between 1,076.38 and 1,088.35 feet above mean sea level.<br><br>Elevations at Lake Mohave and Lake Havasu were managed to target elevations. |
| **2.2.1.2 State Apportionment and Water Contracts (page 2-5; Table 2-2, page 2-6)** | • Delivery of water to water users in the United States pursuant to applicable Federal law, including the Boulder Canyon Project Act (BCPA) and the Supreme Court Consolidated Decree of 2006 in *Arizona* v. *California*, 547 U.S. 150 (Decree)<br><br>• Delivery of a State's unused entitlement to a junior entitlement holder within that State on an annual basis | • Determinations and delivery of post-2016 unused apportionment water from one State to another within the Lower Basin on an annual basis | • Delivery of water to water users in the United States pursuant to applicable Federal law, including the BCPA and the Decree | In 2018, water deliveries were made to users in Arizona, California, and Nevada (Lower Division States) to satisfy the States' basic apportionments for delivery of Colorado River water. Arizona consumptively used 2,632,260 acre-feet, California consumptively used 4,265,525 acre-feet, and Nevada consumptively used 244,103 acre-feet.<br><br>In 2018, unused entitlement within the Lower Division States was made available to the junior priority entitlement holders; however, 108,734 acre-feet of Arizona's unused apportionment was left in Lake Mead to benefit system storage.<br><br>Pursuant to Article II(B)(6) of the Decree and the Storage and Interstate Release Agreement (SIRA) dated December 18, 2002, 13,500 acre-feet of Nevada's unused apportionment was delivered to Arizona. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions[1] | 2018 Accomplishments[2, 3] |
|---|---|---|---|---|
| **2.2.1.3 Annual Operations Normal, Surplus, Shortage, and Unused Apportionment (page 2-6; Table 2-3, page 2-9)** | • Issuance of an annual operating plan for Colorado River reservoirs (AOP) pursuant to the Colorado River Basin Project Act<br><br>• Delivery of water to water users in the United States pursuant to applicable Federal law, including the BCPA and the Decree<br><br>• Delivery of water to Mexico pursuant to the 1944 Water Treaty<br><br>• Determination of shortage conditions based on the *Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead* (Interim Guidelines)<br><br>• Determination of surplus conditions based on the Interim Guidelines | • Revision of annual operations through the AOP, pursuant to the Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs (LROC) within the year to reflect current hydrologic conditions<br><br>• Determinations and delivery of post-2016 unused apportionment water from one State to another within the Lower Basin on an annual basis<br><br>• Execution of agreements and the delivery of surplus water pursuant to the Reclamation Reform Act (RRA) and the Reclamation States Emergency Drought Relief Act<br><br>• Periodic review of the LROC | • Delivery of water to water users in the United States pursuant to applicable Federal law, including the BCPA and the Decree | The AOP for 2018, which documented the operating tier for Lake Mead under the Interim Guidelines, was issued on December 29, 2017.<br><br>Annual operations were revised through the AOP pursuant to the LROC and the Interim Guidelines to reflect current hydrologic conditions.<br><br>An Intentionally Created Surplus (ICS) condition was determined for 2018. The ICS was created in 2018.<br><br>Water was delivered to water users in the United States pursuant to applicable Federal law, including the BCPA and the Decree.<br><br>Water was delivered to Mexico pursuant to the 1944 Water Treaty.<br><br>No review of the LROC was conducted in 2018.<br><br>Pursuant to Article II(B)(6) of the Decree and the SIRA dated December 18, 2002, 13,500 acre-feet of Nevada's unused apportionment was delivered to Arizona. |
| **2.2.1.4 Daily Hoover Dam Operations (Table 2-4, page 2-10)** | • Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States, to deliver 1944 Water Treaty water to Mexico, and to generate hydropower with these water releases | • Monthly energy targets are set prior to each month based on the best information available with respect to downstream water demands and lake elevation targets at Lake Mohave and Lake Havasu; energy targets may be revised during the month to meet changing water demands and other constraints (e.g., to benefit native fishes in Lake Mohave) | • Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States and to generate hydropower with these water releases | Water releases from Hoover Dam were made to satisfy beneficial use requirements of entitlement holders in the United States, to deliver 1944 Water Treaty water to Mexico, and to generate hydropower with these water releases. Energy targets were set monthly based on the best information available with respect to downstream water demands and lake elevation targets at Lake Mohave and Lake Havasu. Energy targets were revised during the month (if needed) to meet changing water demands and other operational constraints. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions[1] | 2018 Accomplishments[2, 3] |
|---|---|---|---|---|
| **2.2.1.4 Daily Davis Dam Operations (Table 2-5, page 2-11)** | • Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States, deliver 1944 Water Treaty water to Mexico, and generate hydropower with these water releases | • Timing of releases, to a limited degree, may be varied by a few days based on available downstream storage, Lake Mohave and Lake Havasu operational constraints, downstream water requirements, and hydropower needs | • Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States and to generate hydropower with these water releases | Water releases from Davis Dam were made to satisfy beneficial use requirements of entitlement holders in the United States, to deliver 1944 Water Treaty water to Mexico, and to generate hydropower with these water releases.<br><br>The timing of releases was varied based on available downstream storage, operational constraints for Lake Mohave and Lake Havasu, downstream water requirements, and hydropower needs. |
| **2.2.1.4 Daily Parker Dam Operations (Table 2-6, page 2-11)** | • Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States, to deliver 1944 Water Treaty water to Mexico, and to generate hydropower with these water releases | • Timing of releases, to a limited degree, may be varied by the hour based on hydropower needs, water requirements, or other operational constraints immediately downstream from the dam | • Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States and to generate hydropower with these water releases | Water releases from Parker Dam were made to satisfy beneficial use requirements of entitlement holders in the United States, to deliver 1944 Water Treaty water to Mexico, and to generate hydropower with these water releases.<br><br>The timing of releases was varied based on available downstream water requirements, hydropower needs, and other operational constraints immediately downstream from Parker Dam. |
| **2.2.1.4 Daily Senator Wash, Imperial Dam, Laguna Dam, and Warren H. Brock Reservoir Operations (Table 2-7, page 2-11)** | • Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States, to deliver 1944 Water Treaty water to Mexico, and to generate hydropower with water releases for Senator Wash | • Senator Wash, Imperial Dam, and Laguna Dam operations to prevent over-deliveries, to release water to entitlement holders, for sluicing operations, to deliver a portion of the 1944 Water Treaty deliveries to Mexico, and for flood control purposes | • Water releases are made to satisfy beneficial use requirements of entitlement holders in the United States | Water release operations from Senator Wash, Imperial and Laguna Dams, and Brock Reservoir were made to satisfy beneficial use requirements of entitlement holders in the United States and/or deliver 1944 Water Treaty water to Mexico.<br><br>Water releases from Senator Wash, Imperial and Laguna Dams, and Brock Reservoir were made to prevent water passing to Mexico in excess of treaty requirements, to release water to entitlement holders, for sluicing operations, and/or to deliver a portion of the 1944 Water Treaty water deliveries to Mexico. |
| **2.2.1.5 Electric Power Generation (page 2-11)**<br><br>**43 CFR Part 431 (page 2-14)** | • Operational requirements to satisfy 43 Code of Federal Regulations (CFR) Part 431 requirements | — | — | Hydroelectric power generated:<br><br>• Hoover Dam: – 3,614,275,413 kilowatt hours (kWh)<br>• Davis Dam: – 1,126,310,000 kWh<br>• Parker Dam: – 451,707,000 kWh<br><br>Operations met the requirements to satisfy 43 CFR Part 431. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions[1] | 2018 Accomplishments[2, 3] |
|---|---|---|---|---|
| **2.2.1.6 Lower Colorado Water Supply Project – California (page 2-15; Table 2-8, page 2-16)** | • Delivery of water under executed Lower Colorado Water Supply Project (LCWSP) contracts | • The Bureau of Reclamation's (Reclamation) execution and administration of individual LCWSP contracts | • Participate in the development of, and consult on the execution of, individual contracts under the LCWSP | In 2018, 10,001 acre-feet of water was pumped by the LCWSP well field. In accordance with its contractual obligations, the Imperial Irrigation District (IID) reduced its consumptive use of Colorado River water by 10,000 acre-feet, which were made available for use by the LCWSP contractors, including The Metropolitan Water District of Southern California (MWD), pursuant to LCWSP Contract No. 06-XX-30-W0452, as amended, dated March 26, 2007. |
| **2.2.1.7 1944 Water Treaty Deliveries (page 2-17; Table 2-9, page 2-20)** | • Delivery of Mexico allotment (1.5 maf) pursuant to the 1944 Water Treaty and related Minutes<br><br>• Delivery of Mexico allotment (up to 1.7 maf) when the Secretary of the Interior (Secretary) determines that sufficient mainstream water is available to satisfy in excess of 7,500,000 acre-feet of consumptive use in the Lower Division States of Arizona, California, and Nevada<br><br>• Delivery of Mexico allotment pursuant to the 1944 Water Treaty and related Minutes under extraordinary drought conditions<br><br>• Compliance with the salinity requirements of Minute No. 242 of the 1944 Water Treaty | • Routing of water through the Yuma Division for delivery to the Northerly International Boundary (NIB)<br><br>• Determination of quantity of water delivered at the Southerly International Boundary (SIB), up to 140,000 acre-feet per year<br><br>• Drainage pumping and delivery of drainage return flows at the NIB and SIB<br><br>• Operation of variable-speed pumps and diversion canal at the SIB to reduce salinity<br><br>• Routing of water through the Yuma Division during flood control conditions | — | Water delivery met the Mexico allotment (1.5 maf) pursuant to the 1944 Water Treaty and related Minutes. Deliveries to Mexico were made pursuant to the 1944 Water Treaty and related Minutes as follows:<br><br>Delivery at the Limitrophe – 4,012 acre-feet<br><br>Diversion for delivery at Tijuana – 316 acre-feet<br><br>Delivery at the SIB – 124,204 acre-feet<br><br>Diversion channel discharge – 1,888 acre-feet<br><br>Delivery at the NIB – 1,362,907 acre-feet<br><br>Pursuant to Minute No. 323, Mexico deferred delivery of 6,673 acre-feet in 2018 for the creation of Mexico's water reserve.<br><br>A total of 7,416 acre-feet of water passed to Mexico in excess of treaty requirements.<br><br>Reclamation complied with the salinity requirements of International Boundary and Water Commission (IBWC) Minute No. 242. A total of 122,569 acre-feet of agricultural drainage return flow was bypassed pursuant to IBWC Minute No. 242.<br><br>Drainage pumping and delivery of drainage return flows were made to Mexico at the NIB and SIB. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions[1] | 2018 Accomplishments[2, 3] |
|---|---|---|---|---|
| **2.2.1.8 Decree Accounting (page 2-21; Table 2-10, page 2-22)** | • Annual preparation of official records of the diversion, return flow, and consumptive use of Colorado River water pursuant to Article V of the Decree | • None | • Report data for Decree accounting records | The *Colorado River Accounting and Water Use Report, Arizona, California, Nevada for Calendar Year 2018*, was published on May 21, 2019. A summary of diversions, return flows, and consumptive use is provided below. The final report is available at http://www.usbr.gov/lc/region/g4000/wtracct.html<br><br>**Arizona**:<br>Diversions = 3,472,265 acre-feet<br>Measured returns = 663,743 acre-feet<br>Unmeasured returns = 176,262 acre-feet<br>Consumptive use = 2,632,260 acre-feet<br><br>**California**:<br>Diversions = 4,639,003 acre-feet<br>Measured returns = 454,361 acre-feet<br>Unmeasured returns = 81,778 acre-feet<br>Consumptive use = 4,265,525 acre-feet*<br>*Includes 162,661 acre-feet delivered from William H. Brock Reservoir<br><br>**Nevada**:<br>Diversions = 479,279 acre-feet<br>Measured returns = 233,493 acre-feet<br>Unmeasured returns = 1,683 acre-feet<br>Consumptive use = 244,103 acre-feet |
| **2.2.2 Future Flow-Related Covered Actions** | | | | |
| **2.2.2.1 Specific Surplus and Shortage Guidelines (page 2-22; Table 2-11, page 2-24)** | • Delivery of surplus water pursuant to Article II(B)(2) of the Decree<br><br>• Delivery of water pursuant to the Article II(B)(3) of the Decree (shortage)<br><br>• Determination of shortage conditions based on criteria developed in the Interim Guidelines<br><br>• Determination of surplus conditions based on criteria listed in the Interim Guidelines | • Adoption of specific post-2026 surplus guidelines<br><br>• Adoption of specific post-2026 shortage guidelines | • Consult with States on development of specific post-2026 surplus guidelines or specific post-2026 shortage guidelines<br><br>• Delivery of water to water users in the United States pursuant to applicable Federal law, including the BCPA and the Decree | No surplus water was delivered pursuant to Article II(B)(2) of the Decree.<br><br>No reductions in deliveries pursuant to Article II(B)(3) of the Decree occurred. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions[1] | 2018 Accomplishments[2, 3] |
|---|---|---|---|---|
| **2.2.2.2 Flood Release Contracts (page 2-24; Table 2-12, page 2-25)** | • Delivery of water under executed flood release contracts | • Execution of contracts for water released during flood control operations | • Participate in the development of, and consult in the execution of, flood release contracts | No water deliveries were made under flood release contracts. |
| **2.2.2.3 Changes in the Storage and Delivery of State Entitlement Waters through Various Administrative Actions (page 2-25; Table 2-13, page 2-26)** | — | — | — | No administrative actions were taken to reduce the water deliveries as listed in Table 2-13 of the biological assessment. |
| **Flow Changes Below Hoover Dam to Davis Dam (Table 2-14, after page 2-26)** | — | — | — | **Pilot System Conservation Program Conservation:**<br>• Tohono O'odham Nation –11,050 acre-feet<br>• Colorado River Indian Tribes (Arizona) – 8,859 acre-feet<br>• Bullhead City – 542 acre-feet<br>• Central Arizona Water Conservation District (CAWCD) – 5,042 acre-feet<br>• Coachella Valley Water District (CVWD) – 196 acre-feet<br>• City of Needles –156 acre-feet<br>• Bard Water District – 1,747 acre-feet<br>**Arizona Unused Apportionment Voluntarily Left in Lake Mead** – 108,734 acre-feet<br>**ICS:**<br>• Creation of Extraordinary Conservation ICS by CAWCD – 47,013 acre-feet<br>• Creation of Extraordinary Conservation ICS by MWD – 130,946 acre-feet*****<br>• Creation of Extraordinary Conservation ICS by IID – 1,579 acre-feet*****<br>* ICS creation amounts are provisional until verified by Reclamation.<br>**Interstate Water Banking**<br>• Pursuant to Article II(B)(6) of the Decree and the SIRA dated December 18, 2002, 13,500 acre-feet of Nevada's unused apportionment was delivered to Arizona.<br>**Reclamation Yuma Desalting Plant** – 211 acre-feet<br>Collectively, these actions contributed to a net reduction in flow below Hoover Dam of 302,575 acre-feet. Values are provided on a consumptive use basis. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions[1] | 2018 Accomplishments[2, 3] |
|---|---|---|---|---|
| **Flow Changes Below Davis Dam to Parker Dam (Table 2-15, after page 2-26)** | — | — | — | **Pilot System Conservation Program Conservation:**<br>• Tohono O'odham Nation – 11,050 acre-feet<br>• Colorado River Indian Tribes (Arizona) – 8,859 acre-feet<br>• CAWCD – 5,042 acre-feet<br>• CVWD – 196 acre-feet<br>• City of Needles – 156 acre-feet<br>• Bard Water District – 1,747 acre-feet<br>**Arizona Unused Apportionment Voluntarily Left in Lake Mead** – 108,734 acre-feet<br>**ICS:**<br>• Creation of Extraordinary Conservation ICS by CAWCD – 47,013 acre-feet<br>• Creation of Extraordinary Conservation ICS by MWD – 130,946 acre-feet*****<br>• Creation of Extraordinary Conservation ICS by IID – 1,579 acre-feet*****<br>* ICS creation amounts are provisional until verified by Reclamation.<br>**Interstate Water Banking**<br>Pursuant to Article II(B)(6) of the Decree and the SIRA dated December 18, 2002, 13,500 acre-feet of Nevada's unused apportionment was delivered to Arizona<br>**Reclamation Yuma Desalting Plant** – 211 acre-feet<br>Collectively, these actions contributed to a net reduction in flow below Davis Dam of 302,033 acre-feet. Values are provided on a consumptive use basis. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions[1] | 2018 Accomplishments[2, 3] |
|---|---|---|---|---|
| **Flow Changes Below Parker Dam to Imperial Dam (Table 2-16, after page 2-26)** | — | — | — | **Pilot System Conservation Program:**<br>• Colorado River Indian Tribes (Arizona) – 8,859 acre-feet<br>• CVWD – 196 acre-feet<br>• Bard Water District – 1,747 acre-feet<br>**ICS*:**<br>• Creation of Extraordinary Conservation ICS by MWD – 95,752 acre-feet**<br>• Creation of Extraordinary Conservation ICS by IID – 1,579 acre-feet<br>* ICS creation amounts are provisional until verified by Reclamation.<br>** For the Parker Dam – Imperial Dam reach, MWD's ICS creation amount includes only conservation from the Palo Verde Irrigation District/MWD Forbearance and Fallowing Program (95,752 acre-feet).<br>**Additional Conservation:**<br>• IID Excess Extraordinary Conservation diverted by MWD – 87,594 acre-feet<br>**Colorado River Water Delivery Agreement Conservation:**<br>• IID Transfer to San Diego County Water Authority (SDCWA) – 130,000 acre-feet<br>• IID All-American Canal Lining Conservation ─ 67,700 acre-feet<br>– IID transfer to SDCWA – 56,200 acre-feet<br>– IID transfer to SLR Settlement Parties – 11,500 acre-feet<br>• CVWD Coachella Canal Lining Project Conservation –26,046 acre-feet<br>– CVWD Transferred to SDCWA – 21,546 acre-feet<br>– CVWD Transferred to MWD/SLR Settlement Parties – 4,500 acre-feet<br>• IID Reduction for Miscellaneous Present Perfected Rights (PPRs) – 9,705 acre-feet<br>• CVWD Reduction for Miscellaneous PPRs – 2,402 acre-feet<br>**Water Transfers** – 3,078 acre-feet<br>**Reclamation Yuma Desalting Plant** – 211acre-feet<br>Collectively, these actions contributed to a net reduction in flow below Parker Dam of 434,869 acre-feet. Values are provided on a consumptive use basis. |
| **Water Conservation Field Services Program (page 2-27; Table 2-17, page 2-28)** | • Develop water conservation program pursuant to RRA Section 210(a) | Implementation of the Field Services Program | • Consult in the development of conservation plans pursuant to RRA Section 210(a) | All water conservation plans for the Lower Colorado Region are complete. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions[1] | 2018 Accomplishments[2, 3] |
|---|---|---|---|---|
| **Unlawful Use (page 2-28; Table 2-18, page 2-30)** | • BCPA requires all Colorado River water users to have a contract with the Secretary | • Implementation of appropriate policy or rule to address unlawful use of Colorado River water<br><br>• Execution of water delivery contracts with entities or individuals identified as unlawful users | • Consult with States in the development of policies or rules to address unlawful use of Colorado River water<br><br>• Consult with States on the execution of water delivery contracts with entities or individuals identified as unlawful users | The well inventory is being performed for Reclamation by the U.S. Geological Survey to identify wells that draw water directly from the lower Colorado River or pump water that would be replaced by water drawn from the lower Colorado River.<br><br>A proposed guidance document is currently under development. |
| **Unallocated Colorado River Water in Arizona, Exclusive of Central Arizona Project (CAP) (page 2-30; Table 2-19, page 2-31)**<br><br>**Note: Changed title from "Unallocated or Noncontract Water in Arizona, Exclusive of CAP"** | • Delivery of water pursuant to executed contracts for unallocated water in Arizona (non-CAP) | • Execution of water delivery contracts for unallocated water in Arizona (non-CAP) | • Review of water delivery contracts and consultation with Arizona on contract recommendations | Unallocated non-CAP Arizona water was delivered to the CAWCD for the CAP and 5th priority Arizona water contractors as allowed under the CAWCD's contract with the United States and the 5th priority Arizona water delivery contracts. This water is unallocated because it has not yet been placed under permanent contract. The Arizona Department of Water Resources will recommend the entities with which the Secretary should contract with for the unallocated Arizona water upon completion of the well inventory. |
| **Central Arizona Project (CAP) Contract Actions (page 2-31; Table 2-20, page 2-31)** | • Delivery of water pursuant to executed contracts | • Completion of allocation and execution of contracts for delivery of CAP water subject to congressional direction | • Review of contracts and consultation on proposed allocation | Water was delivered to the CAP.<br><br>On February 5, 2018, the San Carlos Apache Tribe (SCAT) and the Pascua Yaqui Tribe (PYT) entered into a lease for the delivery of up to 500 acre-feet of SCAT CAP water to the PYT during calendar year 2018.<br><br>On February 5, 2018, SCAT and the Town of Gilbert entered into a lease for the delivery of 20,000 acre-feet of SCAT CAP water to the town of Gilbert during calendar year 2018.<br><br>On January 8, 2018, the Fort McDowell Yavapai Nation (FMYN) and the town of Gilbert entered into a lease for the delivery of 13,933 acre-feet of the FMYN's CAP water to the town during calendar year 2018.<br><br>On June 13, 2018, SCAT and Freeport Minerals Corporation (Freeport) entered into a lease for the delivery of up to 17,010 acre-feet of SCAT CAP water to Freeport during calendar year 2018. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions[1] | 2018 Accomplishments[2, 3] |
|---|---|---|---|---|
| **Changes in Delivery Related to Water Transfers (page 2-32; Table 2-21, page 2-32)** | • Delivery of water pursuant to contracts that recognize temporary or permanent transfers of water entitlements | • Approval of new contracts or contract changes to recognize temporary or permanent transfers of water entitlements | • Review of contracts and consultation on new or amended contracts that recognize transfers of water entitlements | **IID Excess Extraordinary Conservation Diverted by MWD** – 87,594 acre-feet<br>**Water Transfers** – 3,078 acre-feet<br>The following conservation and transfers were made pursuant to the Colorado River Water Delivery Agreement. The actions represent changes in delivery amounts and points of diversion required to implement the Quantification Settlement Agreement.<br>**1988 IID/MWD Water Conservation Agreement:**<br>• Transfer to MWD – 105,000 acre-feet<br>**IID Transfer to SDCWA** – 130,000 acre-feet<br>**IID All-American Canal Lining Conservation** – 67,700 acre-feet<br>• IID transfer to SDCWA – 56,200 acre-feet<br>• IID Transfer to SLR Settlement Parties – 11,500 acre-feet<br>**Coachella Canal Lining Project Conservation** – 26,046 acre-feet<br>• CVWD Transferred to SDCWA – 21,546 acre-feet<br>• CVWD Transferred to MWD/SLR Settlement Parties – 4,500 acre-feet<br>**IID Intra-Priority 3 Transfer to CVWD** – 63,000 acre-feet<br>**IID Reduction for Miscellaneous PPRs** – 9,705 acre-feet<br>**CVWD Reduction for Miscellaneous PPRs** – 2,402 acre-feet |
| **Changes in Delivery Related to Off-Stream Storage (page 2-32; Table 2-22, page 2-33)** | • Delivery of water under executed off-stream storage agreements pursuant to 43 CFR Part 414 | • Execution of a Storage and Interstate Release Agreements pursuant to 43 CFR Part 414 | • Delivery of water under executed off-stream storage agreements pursuant to 43 CFR Part 414 | Pursuant to Article II(B)(6) of the Decree and the SIRA dated December 18, 2002, 13,500 acre-feet of Nevada's unused apportionment was delivered to Arizona. |
| **Changes in Amount of Delivery (page 2-33; Table 2-23, page 2-34)** | • Delivery of water pursuant to executed contracts or amendments to recognize changes in amounts of delivery or changes in points of diversion | • Execution of contract amendments or amendments to recognize changes in amounts of delivery or changes in points of diversion | • Review of contracts and consultation on new or amended contracts | No changes. |
| **Changes in Type of Water Use (page 2-34; Table 2-24, page 2-34)** | • Delivery of water pursuant to executed contracts or contract amendments that recognize changed water use types | • Execution of contracts or contract amendments that recognize changed water use types | • Review of contracts and consultation with Reclamation on new or amended contracts | No changes. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions[1] | 2018 Accomplishments[2, 3] |
|---|---|---|---|---|
| **Inclusions and Exclusions to Service Areas (page 2-34; Table 2-25, page 2-35)** | • Delivery of water pursuant to executed contract amendments or new contracts that include or exclude lands in service areas | • Execution of contract amendments or new contracts that include or exclude lands in service areas | • Review of contracts and consultation on new or amended contracts | On August 23, 2018, Reclamation approved an inclusion of approximately 80 acres of land from the Yuma Irrigation District service area. |
| **Contract Terminations (page 2-35; Table 2-26, page 2-36)** | • None | • Termination of water contract due to abandonment<br><br>• Execution of contract amendments when entitlement holder has relinquished water | • Consultation on the disposition of any water allocated for use, but not consumptively used within, a State | No contracts were terminated in calendar year 2018. |
| **2.3 WESTERN AREA POWER ADMINISTRATION** | — | — | — | See section 2.2.1.5 accomplishments in this table. |
| **2.4 NATIONAL PARK SERVICE** | — | — | • Water entitlement holder | See section 2.2.1.8 accomplishments in this table. |
| **2.5 BUREAU OF INDIAN AFFAIRS** | | | | |
| **2.5.2.2 Ongoing Water Conservation Practices (page 2-77)** | — | • Conduct conservation measures for efficient water use | — | Existing practices were continued. |
| **2.5.2.6 Flow-Related Actions (page 2-82)** | — | — | • Water entitlement holder | See section 2.2.1.8 accomplishments in this table. |
| **2.5.3.2 Future Water Conservation Practices (page 2-77)** | — | • Institute new conservation measures for efficient water use | — | No implementation in 2018. |
| **2.5.3.5 Headgate Rock Dam Operation and Maintenance (page 2-88)** | — | • Water releases and generation of hydropower with these water releases | — | Existing practices were continued. |
| **2.6 U.S. FISH AND WILDLIFE SERVICE** | — | — | • Water entitlement holder | See section 2.2.1.8 accomplishments in this table. |
| **2.7 BUREAU OF LAND MANAGEMENT** | — | — | • Water entitlement holder | See section 2.2.1.8 accomplishments in this table. |

[1] See the *Lower Colorado River Multi-Species Conservation Program Final Habitat Conservation Plan*, *Volume II*, "Section 2.1.1, Relationship of Non-Federal Covered Activities to Federal Nondiscretionary Actins." This can be accessed at http://www.lcrmscp.gov/publications/hcp_volii_dec04.pdf.

[2] Reporting for the non-Federal flow-related covered activities (attachment B, table B-3) is included in the Federal flow-related covered actions and accomplishments.

[3] Flow-related Federal covered actions and flow-related non-Federal covered activities are reported for calendar year 2018.

# Attachment B – Description of Take

## B-2: Federal Non-Flow-Related Covered Actions and Incidental Take Summary, Fiscal Year 2018

| Federal Covered Actions *Biological Assessment* Chapter 2 | Covered Actions Summary | | | Covered Actions Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.2 BUREAU OF RECLAMATION** | | | | | | | | | | |
| **2.2.3 Ongoing Non-Flow-Related (Facilities and Channel Activities) (page 2-36; Table 2-27, page 2-37)** | • Operate, maintain, and control river in Arizona, California, and Nevada<br>•Construct, maintain, and improve drainage works for water projects<br>• Maintain floodway to accommodate floodflows for 100-year event or 40,000 cubic feet per second, whichever is greater<br>• Measure diversions and return flows to and from the main stem of the Colorado River | — | • Administration of contracts for water district operation and maintenance of federally owned facilities | | | | | | | See line items in this table. |
| **2.2.3.1 Channel Maintenance (page 2-38)** | — | — | — | | | | | | | |
| **Wash Fans (page 2-40; Table 2-30, page 2-42)** | — | • Wash fan removal | — | | | | | | | No implementation in fiscal year (FY) 2018. |
| **Protected Bankline Maintenance and Care of Unprotected Banklines (page 2-43)** | — | • Protected bankline location and maintenance | — | | | | | | | No implementation in FY18. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Covered Actions Summary | | | Covered Actions Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **Levee Maintenance (page 2-44)** | — | • Levee location and maintenance | — | 7 | Yuma Levee | | None | 0 | 1, 3, and 6 | Yuma Levee road maintenance performed. |
| | | | | 4 | A-10 levee road | | None | 0 | 1, 3, and 6 | Levee road near the A-10 backwater was rebuilt. |
| **Desilting Basins (page 2-46; Table 2-32, page 2-46)** | — | • Sediment dredging upstream of principal canal diversions and disposal sites<br>• Maintenance of settling basins to remove sediment and maintain flows; four principal basins | — | | | | | | | No implementation in FY18. |
| **Jetties and Training Structures (page 2-47; Tables 2-33 – 2-34, page 2-48)** | — | • Jetty and training structure location and maintenance | — | | | | | | | No implementation in FY18. |
| **Stockpiles (page 2-49; Table 2-37, page 2-49)** | — | • Location of three future stockpiles | — | 4 | Cibola | A105 | None | 0 | 1, 3, and 6 | Material hauled from stockpile site near River Mile 105 was hauled to rebuild levee road near the A-10 backwater. |
| **Riprap Placement and Haul Roads (page 2-50)** | — | • Haul roads and riprap storage location and maintenance | — | 7 | Limitrophe | 0 to 24 | None | 0 | 1, 3, and 6 | Limitrophe: 59.2 miles (mi) |
| | | | | 6 | Yuma | 24 to 43 | None | 0 | 1, 3, and 6 | Yuma: 158.1 mi |
| | | | | 6 | Laguna | 43 to 49 | None | 0 | 1, 3, and 6 | Laguna: 3 mi |
| | | | | 6 | Gila River Area | 49 to 87 | None | 0 | 1, 3, and 6 | Gila River Area: 19.4 mi |
| | | | | 4 | Cibola | 87 to 107 | None | 0 | 1, 3, and 6 | Cibola: 67.6 mi |
| | | | | 4 | Palo Verde | 107 to 134 | None | 0 | 1, 3, and 6 | Palo Verde: 10 mi |
| | | | | 3 | Mohave Valley | 234 to 276 | None | 0 | 1, 3, and 6 | Mohave Valley: 38.1 mi |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Covered Actions Summary | | | Covered Actions Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.2.3.2 Major Federal Facilities and Miscellaneous Operation, Maintenance, and Replacement (page 2-50; Table 2-36, after page 2-50)** | — | • Maintenance of Yuma area drainage wells and conveyance facilities, including maintenance and access roads | — | 7 | Yuma Valley Well Field | A0 to A29 | None | 0 | 1, 3, and 6 | Maintenance work on YV-7, YV-8, YV-9, YV-12, YV-13, and YV-23. |
| | | | | 7 | South Gila Wells | A34 to A36 | None | 0 | 1, 3, and 6 | Maintenance work on SG-2, SG-7, SG-10, SG-713, SG-714, and SG-721. |
| | | | | 7 | Yuma Mesa Wells | A5 to A19 | None | 0 | 1, 3, and 6 | Maintenance work on YM-6, YM-8, YM-9, YM-11, YM-12, YM-13, and YM-14. |
| | | • Maintenance of open channel drains and outfall channels | | 7 | Yuma Mesa Conduit (YMC) | A27 | None | 0 | 1, 3, and 6 | YMC removed from YM-11 to Co. 19th. YMC extension planned for future work. |
| | | | | 7 | DPOCs | A34 to A36 | None | 0 | 1, 3, and 6 | Drain Pump Outlet Channels (DPOCs) were cleaned. Salinity probe installed at DPOC 3. |
| | | | | 7 | MODE | 26 | None | 0 | 1, 3, and 6 | Sediment removed from intake near the Yuma Desalting Plant. The Main Outlet Drain Extension (MODE) was also cleaned. |
| | | • Senator Wash penstock repairs | | 5 | Senator Wash | C51.2 | None | 0 | 1, 3, and 6 | |
| | | • Maintenance and replacement of gauging stations, survey line markers, and boat ramps | | 3 | Needles Gaging Station | 243.6 | None | 0 | 1, 3, and 6 | Work on retaining wall performed. Culvert pipe, pilings, and weir installed at middle pond.<br><br>Gate installed at Needles Gauge site. |
| **Maintenance Activities at the Southerly International Boundary (page 2-52)** | — | | | 7 | 242 Well Field and Conveyance System | 0–5 | None | 5 | 1, 3, and 6 | Maintenance work performed on various wells in the 242 well field. Work to improve/develop the conveyance system and road maintenance were also performed. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Covered Actions Summary | | | Covered Actions Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.2.3.3 Backwater Maintenance (page 2-53; Table 2-37, page 2-54)** | — | • Backwater maintenance | — | | | | | | | See lines below for each division. |
| **Mohave Division (page 2-55; Table 2-38, page 2-56)** | — | • Backwater maintenance | — | 3<br><br><br><br><br>3 | Park Moabi Backwater<br><br><br><br><br>Laughlin Lagoon | C234.9 to C236.1<br><br><br><br><br>N268.9 to N267.65 | Saltcedar Arrowweed<br><br><br><br><br>None | 1<br>0.5<br><br><br><br>0 | 1, 3, and 6<br><br><br><br><br>1, 3, and 6 | Three existing culverts were replaced with two 48-inch culverts under the crossing at the Park Moabi backwater.<br><br>Dredging work began at Laughlin Lagoon and will continue into 2019. |
| **Parker Division (page 2-57; Table 2-39, page 2-57)** | — | • Backwater maintenance | — | | | | | | | No implementation in FY18. |
| **Palo Verde Division (page 2-58; Table 2-40, page 2-58)** | — | • Backwater maintenance | — | 4 | A-10 Backwater | A1113.7 to A115.1 | Arrowweed Phragmites | 0.25<br>0.25 | 1, 3, and 6 | Boat ramp repaired and sediment removed from the A-10 backwater. |
| **Cibola Division (page 2-58; Table 2-41, page 2-59)** | — | • Backwater maintenance | — | | | | | | | No implementation in FY18. |
| **Imperial Division (page 2-59; Table 2-42, page 2-59)** | — | • Backwater maintenance | — | | | | | | | No implementation in FY18. |
| **Laguna Division (page 2-60; Table 2-43, page 2-60)** | — | • Backwater maintenance | — | | | | | | | No implementation in FY18. |
| **Yuma Division (page 2-60; Table 2-44, page 2-61)** | — | • Backwater maintenance | — | | | | | | | No implementation in FY18. |
| **Limitrophe Division Mitigation Obligations (page 2-61; Table 2-45, page 2-62)** | — | — | — | 7<br><br><br>7 | Hunters Hole<br><br><br>Fortuna Pond | A2.5<br><br><br>Gila | None<br><br><br>Cattails | 0<br><br><br>5 | 1, 3, and 6<br><br><br>1, 3, and 6 | Pump repaired at Hunters Hole.<br><br>Pest management activities at Fortuna Pond. |
| **2.2.3.4 Limitrophe Division Maintenance (page 2-62)** | — | — | — | | | | | | | No implementation in FY18. |
| **2.2.4 Future Non-Flow-Related Actions (page 2-63)** | — | — | — | | | | | | | |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Covered Actions Summary | | | Covered Actions Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.2.4.1 Topock Marsh (page 2-63)** | — | — | — | 3 | Topock Marsh | A234 | Saltcedar<br>Arrowweed | 0.5<br>0.5 | 1, 3, and 6 | Dredge ramp constructed. Topock Marsh outlet was dredged. Additional ingress route for trucks was constructed. |
| **2.2.4.2 Laguna Reservoir (page 2-63)** | — | — | — | 6 | Laguna Dam | 49.0 | None | 0 | 1, 3, and 6 | Laguna Reservoir Restoration Project. Ongoing dredging activities above Laguna Dam. Seven acres of wetland vegetation were initially impacted when project commenced. |
| **2.2.4.3 Bankline Maintenance – Unprotected Banklines (page 2-65; Table 2-46, page 2-66)** | — | — | — | | | | | | | No implementation in FY18. |
| **2.2.4.4 Proposed Jetties (page 2-67; Table 2-48, page 2-67)** | — | — | — | | | | | | | No implementation in FY18. |
| **2.3 WESTERN AREA POWER ADMINISTRATION** | | | | | | | | | | No implementation in FY18. |
| **2.4 NATIONAL PARK SERVICE** | | | | | | | | | | |
| **2.4.2 Riparian Habitat Restoration (page 2-70)** | | • Riparian habitat restoration on Lake Mead and Lake Mohave | | | Lake Mead<br><br>Lake Mohave | | Sahara mustard<br>Sahara mustard<br>California fan palm<br>Fountain grass | 3 acres<br>1<br>Small infestations | | Habitat restoration through removal of exotic plants (gross infested acres). |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Covered Actions Summary | | | Covered Actions Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.4.3 Fishery Management (page 2-71)** | | • Habitat modifications on Lake Mead and Lake Mohave, including development and enhance-ment of grow-out ponds, construction of docks, and creation of angler enhancement structures | | | Lake Mohave | | | 975 square feet | | Enhancement of fish habitat, through submersion of brush or polyvinyl chloride structures, to create structural diversity. Seven structures were submerged at Princess Cove, four at Box Cove, and two at Shoshone Cove. All were done in partnership with the Nevada Division of Wildlife. |
| **2.4.4 Boating Access (page 2-72)** | | • Maintenance and enhance-ment of boating access on Lake Mead and Lake Mohave | | | | | | | | No implementation in FY18. |
| **2.5 BUREAU OF INDIAN AFFAIRS** | | | | | | | | | | |
| **2.5.2.1 Ongoing Irrigation System Operation and Maintenance (page 2-74)** | | • Irrigation system operation and maintenance for existing irrigation projects | | 3 | Fort Mohave | — | None | 0 | 1 and 3 | Continued existing practices. |
| | | | | 3 | Chemehuevi | — | None | 0 | 1 and 3 | Continued existing practices. |
| | | | | 4 | Colorado River Indian Tribe | — | None | 0 | 1 and 3 | Continued existing practices. |
| | | | | 6 | Fort Yuma | — | None | 0 | 1 and 3 | Continued existing practices. |
| | | | | 7 | Cocopah | — | None | 0 | 1 and 3 | Continued existing practices. |
| **2.5.2.2 Ongoing Water Conservation Practices (page 2-77)** | | • Operation and maintenance of existing equipment | | | | | | | | Continued existing practices. |

| Federal Covered Actions *Biological Assessment* Chapter 2 | Covered Actions Summary | | | Covered Actions Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | Nondiscretionary Actions | Discretionary Actions | Nondiscretionary Actions Related to Non-Federal Actions | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.5.2.4 Ongoing Wildland Fire Management (page 2-88)** | | • Implementation of fuel management projects | | | | | | | | No implementation in FY18. |
| **2.5.2.5 Ongoing Woodland and Shoreline Maintenance (page 2-82)** | | • Maintenance on Chemehuevi Woodlands Project | | | | | | | | Continued existing practices. |
| **2.5.3.1 Future Canal Lining (page 2-84)** | | • Repair, reline, and line irrigation canals | | | | | | | | No implementation in FY18. |
| **2.5.3.2 Future Water Conservation Practices (page 2-85)** | | • Installation, operation, and maintenance of new equipment | | | | | | | | No implementation in FY18. |
| **2.5.3.3 Future Farmland Development (page 2-85)** | | • Develop additional agricultural acreage, including construction of irrigation systems | | | | | | | | No Implementation in FY18. |
| **2.5.3.6 Future Wildland Fire Management (page 2-88)** | | • Implementation of new fuel management projects | | | | | | | | No implementation in FY18. |
| **2.6 U.S. FISH AND WILDLIFE SERVICE** | | | | | | | | | | No non-flow-related actions are covered under the Lower Colorado River Multi-Species Conservation Program. |
| **2.7 BUREAU OF LAND MANAGEMENT** | | | | | | | | | | No non-flow-related actions are covered under the Lower Colorado River Multi-Species Conservation Program. |

## B-3: Lower Colorado River Multi-Species Conservation Program MSCP Non-Federal Covered Activities and Incidental Take Summary, Fiscal Year 2018

| Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2 | Covered Activities Summary | Covered Activities Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|
| | | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.2 ARIZONA** | | | | | | | | |
| **2.2.1 Ongoing Flow-Related Covered Activities[1] (page 2-4)** | • Diversion of up to 2.8 million acre-feet (maf) of Arizona's full annual entitlement, plus surplus, plus Arizona's share of any unused apportionment, plus the volume of return flow, as applicable<br>• Generation and transmission of hydroelectric power<br>• Power contracting | | | | | | | Non-Federal flow-related covered activities are included in the Federal flow-related covered actions and accomplishments (see attachment B, table B-1). |
| **2.2.2 Future Flow-Related Covered Activities[1] (page 2-6)** | Future Arizona water contract holder activities may include:<br>• Diversions, discharges, and return flows through existing facilities<br>• Changes to points of diversion<br>• New points of diversion<br>• Interstate water banking<br>• Water marketing<br>• Water transfers<br>• Any other actions as made possible from any future agreements and/or measures taken by the Arizona Department of Water Resources or contract holder(s)<br>Future Arizona hydroelectric power contract holder activities may include:<br>• Execution, administration, and operation of extended, renewed, new, or additional contracts for hydroelectric power from hydroelectric facilities at Hoover Dam, Davis Dam, Parker Dam, Headgate Rock Dam, Siphon Drop Power Plant, and Pilot Knob Power Plant | | | | | | | Non-Federal flow-related covered activities are included in the Federal flow-related covered actions and accomplishments (see attachment B, table B-1). |

| Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2 | Covered Activities Summary | Covered Activities Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|
| | | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.2.3 Ongoing Non-Flow-Related Covered Activities(page 2-7)** | Operation, maintenance, and replacement of:<br>• The facilities and equipment through which water is diverted and conveyed<br>• The facilities through which return flows are returned to the river<br>• Drainage wells in the Yuma area<br>• The facilities and equipment through which electric power is generated and transmitted<br>• The appurtenant works that support these facilities, including access and service roads, electric power and communication transmission lines, and substations, docks, boat ramps, and bankline protection | 6 | Yuma Valley | — | — | — | 1 and 3 | 195 miles of canal maintenance and 60 miles of open drain maintenance. |
| **2.2.3.1 Arizona Game and Fish Department Programs and Activities** | | | | | | | | |
| **Vegetation and Habitat Management Programs (page 2-8)** | • Aquatic, wetland, and riparian habitat maintenance and restoration activities | | | | | | | No implementation in FY18. |
| **Fish Surveys (page 2-8)** | • Surveys for non-native fish species | | | | | | | Surveys for sport fish are covered under separate compliance. |
| **Fish Stocking (page 2-9)** | • Stocking of trout | | | | | | | Fish stocking is covered under separate compliance. |

| Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2 | Covered Activities Summary | Covered Activities Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|
| | | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **Maintenance of Aids to Navigation and Boating Access (page 2-9)** | • Place and maintain aids to navigation | | | | | | | Maintained approximately 120 buoys. Boat dock and ramp maintenance is covered under separate environmental compliance. |
| **Law Enforcement Patrol Activities (page 2-9)** | • Administer law enforcement and boating safety program using watercraft patrols | | | | | | | An estimated 4,903 hours of watercraft law enforcement. Includes all Arizona Game and Fish Department Regions III and IV watercraft law enforcement patrols within the Lower Colorado River Multi-Species Conservation Program action area. |
| **2.3 CALIFORNIA** | | | | | | | | |
| **2.3.1 Ongoing Flow-Related Covered Activities[1] (page 2-11)** | • Diversion of up to 4.4 maf of California's full annual entitlement (consistent with the Quantification Settlement Agreement), plus California's share of any unused apportionment and designated surpluses, plus volume of return flows, as applicable<br>• Generation and transmission of hydroelectric power<br>• Power contracting | | | | | | | Non-Federal flow-related covered activities are included in the Federal flow-related covered actions and accomplishments (see attachment B, table B-1). |

| Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2 | Covered Activities Summary | Covered Activities Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|
| | | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.3.2 Future Flow-Related Covered Activities[1] (page 2-13)** | Future California water contract holder activities may include:<br><br>• Diversions, discharges, and return flows through existing facilities<br><br>• Changes to points of diversion<br><br>• New points of diversion<br><br>• Interstate water banking<br><br>• Water marketing<br><br>• Water transfers<br><br>• Any other actions as made possible from any future agreements and/or measures taken by the Colorado River Board of California or contract holder(s)<br><br>Future California hydroelectric power contract holder activities may include:<br><br>• Execution, administration, and operation of extended, renewed, new, or additional contracts for hydroelectric power from hydroelectric facilities at Hoover Dam, Davis Dam, Parker Dam, Headgate Rock Dam, Siphon Drop Power Plant, and Pilot Knob Power Plant | | | | | | | Non-Federal flow-related covered activities are included in the Federal flow-related covered actions and accomplishments (see attachment B, table B-1). |

| Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2 | Covered Activities Summary | Covered Activities Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|
| | | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.3.3 Ongoing Non-Flow-Related Activities** | Operation, maintenance, and replacement of:<br>• The facilities and equipment through which water is diverted and conveyed<br>• The facilities through which return flows are returned to the river<br>• The facilities and equipment through which electric power is generated and transmitted<br>• The appurtenant works that support these facilities, including access and service roads, electric power and communication transmission lines, and substations, docks, boat ramps, and bankline protection | 4<br>6 | Palo Verde Irrigation District<br>Bard Water District | — | — | — | 1 and 3<br>1 and 3 | 7.15 acres<br>4.8 acres<br>Only emergency work during marsh bird breeding season, March 15 – July 31. |
| **2.4 NEVADA** | | | | | | | | |
| **2.4.1 Ongoing Flow-Related Covered Activities[1] (page 2-15)** | • Diversion of up to 0.3 maf of Nevada's full annual entitlement, plus surplus flows, plus Nevada's share of any unused apportionment, plus volume of return flows, as applicable<br>• Generation and transmission of hydroelectric power<br>•Power contracting | | | | | | | Non-Federal flow-related covered activities are included in the Federal flow-related covered actions and accomplishments (see attachment B, table B-1). |

| Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2 | Covered Activities Summary | Covered Activities Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|
| | | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.4.2 Future Flow-Related Covered Activities (page 2-17)** | Future Nevada water contract holder activities may include:<br><br>• Diversions, discharges, and return flows through existing facilities<br><br>• Changes to points of diversion<br><br>• New points of diversion<br><br>• Interstate water banking<br><br>• Water marketing<br><br>• Water transfers<br><br>• Any other actions as made possible from any future agreements and/or measures taken by the Colorado River Commission of Nevada or contract holder(s)<br><br>Future Nevada hydroelectric power contract holder activities may include:<br><br>• Execution, administration, and operation of extended, renewed, new, or additional contracts for hydroelectric power from hydroelectric facilities at Hoover Dam, Davis Dam, Parker Dam, and Headgate Rock Dam | | | | | | | Non-Federal flow-related covered activities are included in the Federal flow-related covered actions and accomplishments (see attachment B, table B-1). |

| Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2 | Covered Activities Summary | Covered Activities Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|
| | | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.4.3 Ongoing Non-Flow-Related Activities (page 2-18)** | Operation, maintenance, and replacement of:<br>• The facilities and equipment through which water is diverted and conveyed<br>• The facilities through which return flows are returned to the river<br>• The facilities and equipment through which electric power is generated and transmitted<br>• The appurtenant works that support these facilities, including access and service roads, electric power and communication transmission lines, and substations, docks, boat ramps, and bankline protection | | | | | | | No implementation in FY18. |

| Non-Federal Covered Activities *Habitat Conservation Plan* Chapter 2 | Covered Activities Summary | Covered Activities Implemented | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|
| | | Reach | Location | River Miles | Habitat Type Impacted | Number of Acres Impacted | Complied with Avoidance and Minimization Measures | |
| **2.4.3.1 Nevada Department of Wildlife Programs and Activities (page 2-18)** | Implementation of select federally funded: | | | | | | | |
| | • Aquatic, wetland, and riparian habitat maintenance and restoration activities | — | -— | — | — | — | — | A total of 13 habitat modules were placed on approximately 0.1 acre at Princess Cove, Solicitor Cove, and Box Cove on Lake Mohave as part of a cooperative project with the National Park Service and the Arizona Game and Fish Department. |
| | • Aquatic, wetland, and riparian revegetation enhancement activities | — | — | — | — | — | — | No implementation in FY18. |
| | • Place and maintain aids to navigation and boating access | 3 | Clark County, downstream from Davis Dam | 257.5–275.0 | None | 0 | 1 and 3 | Performed routine maintenance and inspection of aids to navigation. |
| | • Administer law enforcement and boating safety program using watercraft patrols | 1 and 2 | — | Lake Mead – 275.0 | None | 0 | 1 and 3 | Conducted routine law enforce-ment patrols on Lake Mead, Lake Mohave, the main stem of the lower Colorado River below Davis Dam, and limited patrol activities in Laughlin Lagoon. |

[1] See the *Lower Colorado River Multi-Species Conservation Program Final Habitat Conservation Plan*, *Volume II*, "Section 2.1.1, Relationship of Non-Federal Covered Activities to Federal Nondiscretionary Actions." This can be accessed at http://www.lcrmscp.gov/publications/hcp_volii_dec04.pdf

# Attachment C – Recommendations from Resource Agencies

**United States Department of the Interior**
**Fish and Wildlife Service**
**Arizona Ecological Services Office**
9828 North 31st Avenue, C3
Phoenix, Arizona 85051
Telephone: (602) 242-0210 Fax: (602) 242-2513

In Reply Refer to:
AESO/SE
AESO/SE/22410-2004-F-0161

July 16, 2018

Memorandum

To: Program Manager, Lower Colorado River Multi-Species Conservation Plan, Bureau of Reclamation, Boulder City, Nevada (Attn: John Swett)

From: Acting Field Supervisor, Arizona Ecological Service Field Office

Subject: Approval of Minor Modification to Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Habitat Conservation Plan: Implementation Agreement and Funding and Management Agreement

This memorandum responds to your request dated July 5, and received by this office July 6, 2018, for U.S. Fish and Wildlife Service to approve a minor modification to the Bureau of Reclamation's Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Habitat Conservation Plan. On April 27, 2018, the LCR MSCP Steering Committee approved, by consensus, minor modification to be implemented to the Funding and Management Agreement and the By-Laws in accordance with Section 4.1 of the Implementation Agreement. The purpose of these minor modifications is to change language in agreements to reference Table 1-2 of the Habitat Conservation Plan (HCP) and Biological Assessment as amended and modified, in place of listing each species. The proposed minor modifications in Table 1-2 of the HCP and Biological Assessment are to reference species listed in the Biological Opinion and section 10(a)1(B) permit and allow an updated list of covered species to be in place in the Funding and Management Agreement and Implementation Agreement Program Decision Document 18-001 that summarizes the minor modification. We approve the minor modifications outlined in Program Decision Document 18-001.

The LCR MSCP has accomplished significant conservation benefits in the ten years since it was signed in 2005, and we recently amended the HCP and reinitiated consultation to include an additional species under the program. We look forward to our continuing involvement with this important program.

If there are other questions, or we may assist in any way, please contact Jessica Gwinn, or me at 602/242-0210.

BRENDA SMITH Digitally signed by BRENDA SMITH Date: 2018.07.13 12:52:42 -07'00'

Laurel Barnhill

cc (electronic):
Chief, Nongame Branch, Arizona Game and Fish Department, Phoenix, AZ
Marty Tuegel, Environmental Review Supervisor, Ecological Services, Fish and Wildlife Service, Albuquerque, NM

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**United States Department of the Interior**
**Fish and Wildlife Service**
**Arizona Ecological Services Office**
9828 North 31st Avenue, C3
Phoenix, Arizona 85051
Telephone: (602) 242-0210 Fax: (602) 242-2513

In Reply Refer to:
AESO/SE
22410-2004-F-0161

November 02, 2018

Memorandum

To: John Swett, Program Manager, Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation, Boulder City, Nevada (LC-8000)

From: Acting Field Supervisor, Arizona Ecological Service Field Office

Subject: Acceptance of Lower Colorado River Multi-Species Conservation Program *Consistency Review for Final Implementation Report, Fiscal Year 2019 Work Plan and Budget, Fiscal Year 2017 Accomplishment Report*

This responds to your memorandum dated July 5, 2018, requesting consistency review by the Fish and Wildlife Service (Service) of the combined document containing the Fiscal Year 2019 Work Plan and Budget, Fiscal Year 2017 Accomplishment Report for the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). This combined document encompasses the reporting requirements of the LCR MSCP section 10(a)(1)(B) permit dated April 4, 2005, (TE-086834-0) and the biological and conference opinion dated March 4, 2005, as amended March 5, 2018; and requirements of the Funding and Management Agreement sections 7.4.2. and 7.4.3.

The Fiscal Year 2017 Accomplishment Report details the activities undertaken by the Bureau of Reclamation (Reclamation) to implement the LCR MSCP in accordance with the section 10 permit and biological opinion. The report also lists the Federal actions and non-Federal activities included in the LCR MSCP as covered actions that were implemented during Fiscal Year 2017 covered by the LCR MSCP (October 1, 2016-September 31, 2017), including the reporting of incidental take that occurred during this period. The LCR MSCP Steering Committee voted to approve the report and submission to the Service on June 27, 2018.

We have reviewed the information provided and conclude that the document meets the requirements for the annual report for the LCR MSCP under the section 10(a)(1)(B) permit and the reporting requirements of the terms and conditions of the biological and conference opinion. All covered actions and activities and implementation of the Conservation Plan are suitably described and documented.

The Fiscal Year 2019 Work Plan and Budget contains the work tasks and estimated costs for LCR MSCP implementation during Fiscal Year 2019 beginning on October 1, 2018. We have reviewed the Work Plan and determined that its implementation is directly applicable to meet the conservation requirements and is consistent with the LCR MSCP section 10(a)(1)(B) permit and biological opinion.

We appreciate the positive working relationship between the Service and Reclamation on the implementation of the LCR MSCP. The opportunity to review and contribute to the development of the Accomplishment Report and Work Plan is greatly appreciated. Thank you for your significant efforts to conserve listed and special-status species through the LCR MSCP.

If there are any questions or concerns about this response, please contact Jessica Gwinn, or me at (602) 242-0210.

cc (electronic):
Regional Director, Fish and Wildlife Service, Albuquerque, NM (ARD-ES, Marty Tuegel)

LCR MSCP 17-19 workplan Budget concurrence docx

# Attachment D – Financial Statement

## D-1: Required Contributions

| | Subtotal FY06 – FY10 | Subtotal FY11 – FY15 | FY16 | FY17 | FY18 | Total FY06 – FY18 |
|---|---|---|---|---|---|---|
| **Reclamation** | | | | | | |
| *Cash* | 33,058,872.00 | 86,558,220.00 | 15,370,734.00 | 15,437,226.00 | 15,625,620.00 | **166,050,672.00** |
| *Funding Credit*[1] | 0 | 3,800,520.00 | 0 | 0 | 0 | **3,800,520** |
| ***Reclamation Total*** | **33,058,872.00** | **90,358,740.00** | **15,370,734.00** | **15,437,226.00** | **15,625,620.00** | **169,851,192.00** |
| **Arizona** | | | | | | |
| *Cash* | 3,270,883.60 | 5,506,147.38 | 4,296,894.80 | 4,315,482.66 | 4,362,836.17 | **21,752,244.61** |
| *Funding Credit* | 0 | 165.12 | 0 | 0 | 0 | **165.12** |
| *Cash Tribal Contractors* | *n/a* | *n/a* | *n/a* | *n/a* | 5,312.11 | **5,312.11** |
| *Habitat Maintenance Fund* | 737,000.00 | 7,379,692.50 | 0 | 0 | 0 | **8,116,692.50** |
| *Remedial Measures Fund* | *n/a* | 667,806.00 | 276,013.00 | 277,207.00 | 280,590.00 | **1,501,616.00** |
| ***Arizona Total*** | **4,007,883.60** | **13,553,811.00** | **4,572,907.80** | **4,592,689.66** | **4,648,738.28** | **31,376,030.34** |
| **Nevada** | | | | | | |
| *Cash* | 9,220,135.20 | 18,053,715.27 | 3,201,558.35 | 3,215,407.92 | 3,254,018.48 | **36,944,835.22** |
| *Funding Credit* | 0 | 330.23 | 0 | 0 | 0 | **330.23** |
| *Cash Tribal Contractors* | *n/a* | *n/a* | *n/a* | *n/a* | 629.88 | **629.88** |
| *Habitat Maintenance Fund* | 737,000.00 | 7,379,692.50 | 0 | 0 | 0 | **8,116,692.50** |
| *Remedial Measures Fund* | *n/a* | 1,237,884.00 | 276,013.00 | 277,207.00 | 280,590.00 | **2,071,694.00** |
| *In-Kind Credit* | 436,000.00 | 436,000.00 | 0 | 0 | 0 | **872,000.00** |
| ***Nevada Total*** | **10,393,135.20** | **27,107,622.00** | **3,477,571.35** | **3,492,614.92** | **3,535,238.36** | **48,006,181.83** |
| **California** | | | | | | |
| ***Cash*** | **16,846,894.93** | **28,693,127.34** | **6,399,331.23** | **6,427,014.00** | **6,505,448.48** | **64,871,815.98** |
| *Metropolitan Water District of Southern California* | 9,924,055.91 | 12,095,549.69 | 3,545,435.31 | 3,560,772.46 | 3,582,429.90 | **32,708,243.27** |
| *Imperial Irrigation District* | 2,727,356.94 | 7,454,596.05 | 1,268,085.56 | 1,273,571.15 | 1,289,113.65 | **14,012,723.35** |
| *Coachella Valley Water District* | 1,487,649.26 | 4,066,143.30 | 691,683.03 | 694,675.17 | 703,152.90 | **7,643,303.66** |
| *Los Angeles Department of Water and Power* | 843,001.25 | 2,304,147.87 | 391,953.72 | 393,649.26 | 388,545.22 | **4,321,297.32** |
| *San Diego County Water Authority* | 456,454.63 | 0 | 0 | 0 | 0 | **456,454.63** |
| *Palo Verde Irrigation District* | 664,552.28 | 739,618.77 | 156,332.10 | 157,008.37 | 158,924.48 | **1,876,436.00** |
| *Southern California Public Power Authority* | 347,118.16 | 948,766.78 | 161,392.71 | 162,090.87 | 160,105.78 | **1,779,474.30** |
| *Southern California Edison Company* | 297,529.86 | 813,228.66 | 138,336.61 | 138,935.03 | 136,667.35 | **1,524,697.51** |
| *Bard* | 33,058.88 | 90,358.74 | 15,370.73 | 15,437.23 | 15,625.62 | **169,851.20** |
| *Colorado River Board of California* | 33,058.88 | 90,358.74 | 15,370.73 | 15,437.23 | 15,625.62 | **169,851.20** |
| *Needles* | 33,058.88 | 90,358.74 | 15,370.73 | 15,437.23 | 15,625.62 | **169,851.20** |
| *Cash Schedule D Contractors* | *n/a* | *n/a* | *n/a* | *n/a* | 39,632.34 | **39,632.34** |
| ***Funding Credit*** | | | | | | |
| *San Diego County Water Authority* | 336,958.27 | 2,168,609.76 | 368,897.62 | 370,493.42 | 375,014.88 | **3,619,973.95** |
| *Metropolitan Water District of Southern California* | 0 | 1,987,279,52 | **0** | **0** | **0** | **1,987,279.52** |
| ***Habitat Maintenance Fund*** | **1,474,000.00** | **14,759,385.00** | **0** | **0** | **0** | **16,233,385.00** |
| ***Remedial Measures Fund*** | ***n/a*** | **2,088,905.38** | **552,026.00** | **554,414.00** | **561,180.00** | **3,756,525.38** |
| ***California Total*** | **18,657,853.20** | **49,697,307.00** | **7,320,254.85** | **7,351,921.42** | **7,441,643.36** | **90,468,979.83** |
| **TOTAL** | **66,117,744.00** | **180,717,480.00** | **30,741,468.00** | **30,874,452.00** | **31,251,240.00** | **339,702,384.00** |

[1] Additional Reclamation credits/debits are shown in table D-2e.

## D-2: Funding Credits

*D-2a*: *San Diego County Water Authority*

**Credits Earned**

| FY | Credits Earned | Composite i | 2003 Dollars | Total 2003 Dollars |
|---|---|---|---|---|
| 2005 | 145,737.14 | 1.019 | 143,019.76 | 143,019.76 |
| 2006 | 500,000 | 1.083 | 461,680.51 | 604,700.27 |
| 2007 | 250,000 | 1.122 | 222,816.39 | 827,516.66 |
| 2008 | 3,298,069.94 | 1.187 | 2,778,491.95 | 3,606,008.61 |

**Credits Used – Revised Inflation Rate**

| FY | Total 2003 Credits Available | 2003 Credits Used | Composite i | Current Year Credits |
|---|---|---|---|---|
| 2009 | 3,606,008.61 | 134,568.00 | 1.210 | 162,827.28 |
| 2010 | 3,471,440.61 | 134,568.00 | 1.294 | 174,130.99 |
| 2011 | 3,336,872.61 | 330,480.00 | 1.258[1] | 415,743.84 |
| 2012 | 3,006,392.61 | 330,480.00 | 1.278[1] | 422,353.44 |
| 2013 | 2,675,912.61 | 330,480.00 | 1.321[1] | 436,564.08 |
| 2014 | 2,345,432.61 | 330,480.00 | 1.347[1] | 445,156.56 |
| 2015 | 2,014,952.61 | 330,480.00 | 1.358 | 448,791.84 |
| 2016 | 1,684,472.61 | 265,968.00 | 1.387 | 368,897.62 |
| 2017 | 1,418,504.61 | 265,968.00 | 1.393 | 370,493.42 |
| 2018 | 1,152,536.61 | 265,968.00 | 1.410 | 375,014.88 |
| 2019 | 886,568.61 | 265,968.00 | 1.442 | 383,525.86 |
| 2020 | 620,600.61 | 265,968.00 | | |
| 2021 | 354,632.61 | 265,968.00 | | |
| 2022 | 88,664.61 | 88,664.61 | | |

[1] Revised inflation index.

## *D-2b*: *The Metropolitan Water District of Southern California*

**Credits Earned**

| FY | Credits Earned | Composite i | 2003 Dollars | Total 2003 Dollars |
|---|---|---|---|---|
| 2008 | 1,834,768.57 | 1.187 | 1,545,719.10 | 1,545,719.10 |

**Credits Used – Revised Inflation Rate**

| FY | Total 2003 Credits Available | 2003 Credits Used | Composite i | Current Year Credits |
|---|---|---|---|---|
| 2011 | 1,545,719.10 | 515,239.70 | 1.258[1] | 648,171.54 |
| 2012 | 1,030,479.40 | 515,239.70 | 1.278[1] | 658,476.34 |
| 2013 | 515,239.70 | 515,239.70 | 1.321[1] | 680,631.64 |
| 2014 | 0 | | | |

[1] Revised inflation index.

## *D-2c*: *Nevada*

**Credits Earned**

| FY | Credits Earned | Composite i | 2003 Dollars | Total 2003 Dollars |
|---|---|---|---|---|
| 2014 | 40,438.72 | 1.347 | 30,021.32 | 30,021.32 |

**Credits Used**

| FY | Total 2003 Credits Available | 2003 Credits Used | Composite i | Current Year Credits |
|---|---|---|---|---|
| 2015 | 30,021.32 | 30,021.32 | 1.358 | 40,768.95 |
| 2016 | 0 | | | |

## *D-2d*: *Arizona*

**Credits Earned**

| FY | Credits Earned | Composite i | 2003 Dollars | Total 2003 Dollars |
|---|---|---|---|---|
| 2014 | 20,219.36 | 1.347 | 15,010.66 | 15,010.66 |

**Credits Used**

| FY | Total 2003 Credits Available | 2003 Credits Used | Composite i | Current Year Credits |
|---|---|---|---|---|
| 2015 | 15,010.66 | 15,010.66 | 1.358 | 20,384.48 |
| 2016 | 0 | | | |

## *D-2e*: *Bureau of Reclamation*

**Credits/Debits – Revised Inflation Rate**

| FY | Credits/Debits Earned[1] | Composite i | 2003 Dollars | Total 2003 Dollars |
|---|---|---|---|---|
| 2004 | 1,559,739.07 | 1.000 | 1,559,739.07 | 1,559,739.07 |
| 2005 | 4,112,477.11 | 1.019 | 4,035,796.97 | 5,595,536.04 |
| 2006 | (2,863,394.87) | 1.083 | (2,643,947.25) | 2,951,588.79 |
| 2007 | 2,314,455.02 | 1.122 | 2,062,794.14 | 5,014,382.93 |
| 2008 | (495,025.15) | 1.187 | (417,038.88) | 4,597,344.05 |
| 2009 | 1,833,416.80 | 1.210 | 1,515,257.69 | 6,112,601.73 |
| 2010 | 7,099,834.71 | 1.294 | 5,486,734.71 | 11,599,336.44 |
| 2011 | 796,149.37 | 1.258[2] | 632,869.13 | 12,232,205.57 |
| 2012 | (3,105,120.42) | 1.278[2] | (2,429,671.69) | 9,802,533.88 |
| 2013 | (2,260,293.50) | 1.321[2] | (1,711,047.31) | 8,091,486.57 |
| Underfunding 2014 | (3,800,520.00) | 1.347[2] | (2,821,469.93) | 5,270,016.64 |
| 2014 | (1,054,326.44) | 1.347[2] | (782,721.93) | 4,487,294.71 |
| 2015 | 1,502,469.24 | 1.358 | 1,106,383.83 | 5,593,678.54 |
| 2016 | (666,351.00) | 1.387 | (480,426.10) | 5,113,252.44 |
| 2017 | (724,589.65) | 1.393 | (520,164.86) | 4,593,087.58 |
| 2018 | 1,295,823.63 | 1.410 | 919,023.85 | 5,512,111.43 |

[1] Based on expenditures.

[2] Revised inflation index.

## D-3: Funding Accounts

*D-3a*: *Habitat Maintenance Fund*

| FY | HCP Table 7-1 2003 Dollars | Required 2003 Dollars | Additional 2003 Dollars | Total 2003 Dollars | i | Required Current Year Dollars | Additional Current Year Dollars | Total Current Year Dollars | Cumulative Current Year Dollars | Cumulative With Interest Current Year Dollars |
|---|---|---|---|---|---|---|---|---|---|---|
| 2006 | $500,000 | $500,000 | | $500,000 | 1.083 | $541,500 | | $541,500.00 | $541,500.00 | $552,705.68 |
| 2007 | $500,000 | $500,000 | | $500,000 | 1.122 | $561,000 | | $561,000.00 | $1,102,500.00 | $1,154,574.04 |
| 2008 | $500,000 | $500,000 | | $500,000 | 1.187 | $593,500 | | $593,500.00 | $1,696,000.00 | $1,812,275.61 |
| 2009 | $500,000 | $500,000 | | $500,000 | 1.210 | $605,000 | | $605,000.00 | $2,301,000.00 | $2,467,094.21 |
| 2010 | $500,000 | $500,000 | | $500,000 | 1.294 | $647,000 | | $647,000.00 | $2,948,000.00 | $3,154,714.70 |
| 2011 | $4,500,000 | $4,500,000 | | $4,500,000 | 1.191[1] | $5,359,500 | | $5,359,500.00 | $8,307,500.00 | $8,579,502.74 |
| 2012 | $4,500,000 | $4,500,000 | | $4,500,000 | 1.210[1] | $5,445,000 | | $5,445,000.00 | $13,752,500.00 | $14,164,435.13 |
| 2013 | $4,500,000 | $4,500,000 | | $4,500,000 | 1.251[1] | $5,629,500 | | $5,629,500.00 | $19,382,000.00 | $19,884,284.86 |
| 2014 | $4,500,000 | $4,500,000 | $930,000 | $5,430,000 | 1.276[1] | $5,742,000 | $1,186,680.00 | $6,928,680.00 | $26,310,680.00 | |
| 2014 Underfunding Makeup | | | | | | $654,015 | | $654,015.00 | $26,964,695.00 | |
| 2014 Underfunding Overpay | | | | | | | $22,025.64 | $22,025.64 | $26,986,720.64 | $27,619,568.11 |
| 2015 Underfunding Makeup | | | | | | | $654,015.00 | $654,015.00 | $27,640,735.64 | |
| 2015 | $4,500,000 | $3,570,000 | | $3,570,000 | 1.358 | $4,848,060 | ($22,025.64) | $4,826,034.36 | $32,446,770.00 | $33,051,595.90 |
| 2016 | | | | | | | | | | $33,464,227.50 |
| 2017 | | | | | | | | | | $33,771,897.09 |
| 2018 | | | | | | | | | | $34,285,574.82 |
| **Total** | **$25,000,000** | **$24,070,000** | **$930,000** | **$25,000,000** | | | | | | |
| **Program Total** | **$25,000,000** | | | **$25,000,000** | | | | | | |

[1] Original inflation index. The difference between the original inflation index and the revised inflation index is shown as “Underfunding Makeup.”

**Arizona Habitat Maintenance Fund**

| FY | HCP Table 7-1 2003 Dollars | Required 2003 Dollars | Additional 2003 Dollars | Total 2003 Dollars | i | Required Current Year Dollars | Additional Current Year Dollars | Total Current Year Dollars | Cumulative Current Year Dollars | Cumulative With Interest Current Year Dollars |
|---|---|---|---|---|---|---|---|---|---|---|
| 2006 | $125,000 | $125,000 | | $125,000 | 1.083 | $135,375.00 | | $135,375.00 | $135,375.00 | $138,251 |
| 2007 | $125,000 | $125,000 | | $125,000 | 1.122 | $140,250.00 | | $140,250.00 | $275,625.00 | $287,860 |
| 2008 | $125,000 | $125,000 | | $125,000 | 1.187 | $148,375.00 | | $148,375.00 | $424,000.00 | $444,052.83 |
| 2009 | $125,000 | $125,000 | | $125,000 | 1.210 | $151,250.00 | | $151,250.00 | $575,250.00 | $596,037.45 |
| 2010 | $125,000 | $125,000 | | $125,000 | 1.294 | $161,750.00 | | $161,750.00 | $737,000.00 | $757,787.45 |
| 2011 | $1,125,000 | $1,125,000 | | $1,125,000 | 1.191[1] | $1,339,875.00 | | $1,339,875.00 | $2,076,875.00 | $2,097,622.45 |
| 2012 | $1,125,000 | $1,125,000 | | $1,125,000 | 1.210[1] | $1,361,250.00 | | $1,361,250.00 | $3,438,125.00 | $3,458,912.45 |
| 2013 | $1,125,000 | $1,125,000 | | $1,125,000 | 1.251[1] | $1,407,375.00 | | $1,407,375.00 | $4,845,500.00 | $4,866,287.45 |
| 2014 | $1,125,000 | $1,125,000 | $232,500 | $1,357,500 | 1.276[1] | $1,435,500.00 | $296,670 | $1,732,170.00 | $6,577,670.00 | |
| 2014 Underfunding Makeup | | | | | | $327,007.50 | | $327,007.50 | $6,904,677.50 | |
| 2014 Underfunding Overpay | | | | | | | $11,012.82 | $11,012.82 | $6,915,690.32 | $6,936,580.16 |
| 2015 | $1,125,000 | $892,500 | | $892,500 | 1.358 | $1,212,015.00 | ($11,012.82) | $1,201,002.18 | $8,116,692.50 | $8,137,521.39 |
| 2016 | | | | | | | | | | $8,146,823.02 |
| 2017 | | | | | | | | | | $8,186,051.73 |
| 2018 | | | | | | | | | | $8,294,910.30 |
| **Total** | **$6,250,000** | **$6,017,500** | **$232,500** | **$6,250,000** | | | | | | |
| **Program Total** | **$6,250,000** | | | **$6,250,000** | | | | | | |

[1] Original inflation index. The difference between the original inflation index and the revised inflation index is shown as “Underfunding Makeup.”

**Nevada Habitat Maintenance Fund**

| FY | HCP Table 7-1 2003 Dollars | Required 2003 Dollars | Additional 2003 Dollars | Total 2003 Dollars | i | Required Current Year Dollars | Additional Current Year Dollars | Total Current Year Dollars | Cumulative Current Year Dollars | Cumulative With Interest Current Year Dollars |
|---|---|---|---|---|---|---|---|---|---|---|
| 2006 | $125,000 | $125,000 | | $125,000 | 1.083 | $135,375.00 | | $135,375.00 | $135,375.00 | $137,378.85 |
| 2007 | $125,000 | $125,000 | | $125,000 | 1.122 | $140,250.00 | | $140,250.00 | $275,625.00 | $286,813.26 |
| 2008 | $125,000 | $125,000 | | $125,000 | 1.187 | $148,375.00 | | $148,375.00 | $424,000.00 | $453,778.83 |
| 2009 | $125,000 | $125,000 | | $125,000 | 1.210 | $151,250.00 | | $151,250.00 | $575,250.00 | $619,413.59 |
| 2010 | $125,000 | $125,000 | | $125,000 | 1.294 | $161,750.00 | | $161,750.00 | $737,000.00 | $789,731.22 |
| 2011 | $1,125,000 | $1,125,000 | | $1,125,000 | 1.191[1] | $1,339,875.00 | | $1,339,875.00 | $2,076,875.00 | $2,133,479.56 |
| 2012 | $1,125,000 | $1,125,000 | | $1,125,000 | 1.210[1] | $1,361,250.00 | | $1,361,250.00 | $3,438,125.00 | $3,500,534.71 |
| 2013 | $1,125,000 | $1,125,000 | | $1,125,000 | 1.251[1] | $1,407,375.00 | | $1,407,375.00 | $4,845,500.00 | $4,920,897.14 |
| 2014 | $1,125,000 | $1,125,000 | $232,500 | $1,357,500 | 1.276[1] | $1,435,500.00 | $296,670.00 | $1,732,170.00 | $6,577,670.00 | |
| 2014 Underfunding Makeup | | | | | | $327,007.50 | | $327,007.50 | $6,904,677.50 | |
| 2014 Underfunding Overpay | | | | | | | $11,012.82 | $11,012.82 | $6,915,690.32 | $7,005,875.48 |
| 2015 | $1,125,000 | $892,500 | | $892,500 | 1.358 | $1,212,015.00 | ($11,012.82) | $1,201,002.18 | $8,116,692.50 | $8,236,569.18 |
| 2016 | | | | | | | | | | $8,274,230.08 |
| 2017 | | | | | | | | | | $8,335,230.87 |
| 2018 | | | | | | | | | | $8,440,801.13 |
| **Total** | **$6,250,000** | **$6,017,500** | **$232,500** | **$6,250,000** | | | | | | |
| **Program Total** | **$6,250,000** | | | **$6,250,000** | | | | | | |

[1] Original inflation index. The difference between the original inflation index and the revised inflation index is shown as “Underfunding Makeup.”

**California Habitat Maintenance Fund**

| FY | HCP Table 7-1 2003 Dollars | Required 2003 Dollars | Additional 2003 Dollars | Total 2003 Dollars | i | Required Current Year Dollars | Additional Current Year Dollars | Total Current Year Dollars | Cumulative Current Year Dollars | Cumulative With Interest Current Year Dollars |
|---|---|---|---|---|---|---|---|---|---|---|
| 2006 | $250,000 | $250,000 | | $250,000 | 1.083 | $270,750.00 | | $270,750.00 | $270,750.00 | $277,075.83 |
| 2007 | $250,000 | $250,000 | | $250,000 | 1.122 | $280,500.00 | | $280,500.00 | $551,250.00 | $579,900.78 |
| 2008 | $250,000 | $250,000 | | $250,000 | 1.187 | $296,750.00 | | $296,750.00 | $848,000.00 | $914,443.95 |
| 2009 | $250,000 | $250,000 | | $250,000 | 1.210 | $302,500.00 | | $302,500.00 | $1,150,500.00 | $1,251,643.17 |
| 2010 | $250,000 | $250,000 | | $250,000 | 1.294 | $323,500.00 | | $323,500.00 | $1,474,000.00 | $1,607,196.03 |
| 2011 | $2,250,000 | $2,250,000 | | $2,250,000 | 1.191[1] | $2,679,750.00 | | $2,679,750.00 | $4,153,750.00 | $4,348,400.73 |
| 2012 | $2,250,000 | $2,250,000 | | $2,250,000 | 1.210[1] | $2,722,500.00 | | $2,722,500.00 | $6,876,250.00 | $7,204,987.97 |
| 2013 | $2,250,000 | $2,250,000 | | $2,250,000 | 1.251[1] | $2,814,750.00 | | $2,814,750.00 | $9,691,000.00 | $10,097,100.27 |
| 2014 | $2,250,000 | $2,250,000 | $465,000 | $2,715,000 | 1.276[1] | $2,871,000.00 | $593,340.00 | $3,464,340.00 | $13,155,340.00 | $13,677,112.47 |
| 2015 Underfunding Makeup | | | | | | | $654,015.00 | $654,015.00 | $13,809,355.00 | |
| 2015 | $2,250,000 | $1,785,000 | | $1,785,000 | 1.358 | $2,424,030.00 | | $2,424,030.00 | $16,233,385.00 | $16,677,505.33 |
| 2016 | | | | | | | | | | $17,043,174.40 |
| 2017 | | | | | | | | | | $17,250,614.49 |
| 2018 | | | | | | | | | | $17,549,863.39 |
| **Total** | **$12,500,000** | **$12,035,000** | **$465,000** | **$12,500,000** | | | | | | |
| **Program Total** | **$12,500,000** | | | **$12,500,000** | | | | | | |

[1] Original inflation index. The difference between the original inflation index and the revised inflation index is shown as “Underfunding Makeup.”

*D-3b*: *Remedial Measures Fund*

| FY | HCP Table 7-1 2003 Dollars | Required 2003 Dollars | Additional 2003 Dollars | Total 2003 Dollars | i | Required Current Year Dollars | Additional Current Year Dollars | Total Current Year Dollars | Cumulative Current Year Dollars | Cumulative With Interest Current Year Dollars |
|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | $266,000 | | | | | | | | | |
| 2012 | $266,000 | | | | | | | | | |
| 2013 | $266,000 | $798,000 | $0 | $798,000 | 1.251[1] | $998,298.00 | $0 | $998,298.00 | $998,298.00 | $1,001,102.71 |
| 2014 | $266,000 | $266,000 | $0 | $266,000 | 1.276[1] | $339,416.00 | $0 | $339,416.00 | $1,337,714.00 | |
| 2014 Underfunding Makeup | | | | | | $37,373.00 | | $37,373.00 | $1,375,087.00 | |
| 2014 Underfunding Makeup Additional | | | $756,381.59 | $756,381.59 | 1.347 | | $1,018,846.00 | $1,018,846.00 | $2,393,933.00 | |
| 2014 Underfunding Overpay | | | | | | | $38,632.44 | $38,632.44 | $2,432,565.44 | $2,441,713.88 |
| 2015 Underfunding Makeup | | | | | | $37,373.00 | | $37,373.00 | $2,469,938.44 | |
| 2015 Underfunding Makeup Additional | | | $892,398.95 | $892,398.95 | 1.347 | | $1,202,061.38 | $1,202,061.38 | $3,671,999.82 | |
| 2015 | $266,000 | $266,000 | | $266,000 | 1.358 | $361,228.00 | ($38,632.44) | $322,595.56 | $3,994,595.38 | $4,019,296.52 |
| 2016 | $796,000 | $796,000 | $0 | $796,000 | 1.387 | $1,104,052.00 | $0 | $1,104,052.00 | $5,098,647.38 | $5,154,340.85 |
| 2017 | $796,000 | $796,000 | $0 | $796,000 | 1.393 | $1,108,828.00 | $0 | $1,108,828.00 | $6,207,475.38 | $6,315,323.07 |
| 2018 | $796,000 | $796,000 | $0 | $796,000 | 1.410 | $1,122,360.00 | $0 | $1,122,360.00 | $7,329,835.38 | $7,542,121.16 |
| 2019 | $796,000 | $796,000 | $0 | $796,000 | 1.442 | $1,147,832.00 | $0 | $1,147,832.00 | | |
| 2020 | $796,000 | $796,000 | $0 | $796,000 | 1.501 | $1,194,796.00 | $0 | $1,194,796.00 | | |
| **Total** | $4,514,000 | $4,514,000 | $1,648,780.54 | $6,162,780.54 | | | | | | |
| **Program Total** | **$13,270,000** | | | **$13,270,000.00** | | | | | | |

[1] Original inflation index. The difference between the original inflation index and the revised inflation index is shown as "Underfunding Makeup."

**Arizona Remedial Measures Fund**

| FY | HCP Table 7-1 2003 Dollars | Required 2003 Dollars | Additional 2003 Dollars | Total 2003 Dollars | i | Required Current Year Dollars | Additional Current Year Dollars | Total Current Year Dollars | Cumulative Current Year Dollars | Cumulative With Interest Current Year Dollars |
|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | $66,500 | | | | | | | | | |
| 2012 | $66,500 | | | | | | | | | |
| 2013 | $66,500 | $199,500.00 | $0 | $199,500.00 | 1.251[1] | $249,574.50 | $0 | $249,574.50 | $249,574.50 | $249,574.50 |
| 2014 | $66,500 | $66,500.00 | $0 | $66,500.00 | 1.276[1] | $84,854.00 | $0 | $84,854.00 | $334,428.50 | |
| 2014 Underfunding Makeup | | | | | | $18,686.50 | | $18,686.50 | $353,115.00 | |
| 2014 Underfunding Makeup Additional | | | $166,580.55 | $166,580.55 | 1.347 | | $224,384.00 | $224,384.00 | $577,495.00 | |
| 2014 Underfunding Overpay | | | | | | | $9,206.54 | $9,206.54 | $586,705.54 | $586,705.54 |
| 2015 | $66,500 | $66,500.00 | | $66,500.00 | 1.358 | $90,307.00 | ($9,206.54) | $81,100.46 | $667,806.00 | $667,806.00 |
| 2016 | $199,000 | $199,000 | $0 | $199,000 | 1.387 | $276,013.00 | $0 | $276,013.00 | $943,819.00 | $944,722.67 |
| 2017 | $199,000 | $199,000 | $0 | $199,000 | 1.393 | $277,207.00 | $0 | $277,207.00 | $1,221,026.00 | $1,227,167.99 |
| 2018 | $199,000 | $199,000 | $0 | $199,000 | 1.410 | $280,590.00 | $0 | $280,590.00 | $1,501,616.00 | $1,526,352.71 |
| 2019 | $199,000 | $199,000 | $0 | $199,000 | 1.442 | $286,958.00 | $0 | $286,958.00 | | |
| 2020 | $199,000 | $199,000 | $0 | $199,000 | 1.501 | $298,699.00 | $0 | $298,699.00 | | |
| **Total** | **$1,128,500** | **$1,128,500** | **$166,580.55** | **$1,295,080.55** | | | | | | |
| **Program Total** | **$3,317,500** | | | **$3,317,500.00** | | | | | | |

[1] Original inflation index. The difference between the original inflation index and the revised inflation index is shown as “Underfunding Makeup.”

**Nevada Remedial Measures Fund**

| FY | HCP Table 7-1 2003 Dollars | Required 2003 Dollars | Additional 2003 Dollars | Total 2003 Dollars | i | Required Current Year Dollars | Additional Current Year Dollars | Total Current Year Dollars | Cumulative Current Year Dollars | Cumulative With Interest Current Year Dollars |
|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | $66,500 | | | | | | | | | |
| 2012 | $66,500 | | | | | | | | | |
| 2013 | $66,500 | $199,500.00 | $0 | $199,500.00 | 1.251[1] | $249,574.50 | $0 | $249,574.50 | $249,574.50 | $249,601.70 |
| 2014 | $66,500 | $66,500.00 | $0 | $66,500.00 | 1.276[1] | $84,854.00 | $0 | $84,854.00 | $334,428.50 | |
| 2014 Underfunding Makeup | | | | | | $18,686.50 | | $18,686.50 | $353,115.00 | |
| 2014 Underfunding Makeup Additional | | | $589,801.04 | $589,801.04 | 1.347 | | $794,462.00 | $794,462.00 | $1,147,577.00 | |
| 2014 Underfunding Overpay | | | | | | | $29,425.90 | $29,425.90 | $1,177,002.90 | $1,177,637.60 |
| 2015 | $66,500 | $66,500.00 | | $66,500.00 | 1.358 | $90,307.00 | ($29,425.90) | $60,881.10 | $1,237,884.00 | $1,242,877.63 |
| 2016 | $199,000 | $199,000 | $0 | $199,000 | 1.387 | $276,013.00 | $0 | $276,013.00 | $1,513,897.00 | $1,524,135.35 |
| 2017 | $199,000 | $199,000 | $0 | $199,000 | 1.393 | $277,207.00 | $0 | $277,207.00 | $1,791,104.00 | $1,811,095.89 |
| 2018 | $199,000 | $199,000 | $0 | $199,000 | 1.410 | $280,590.00 | $0 | $280,590.00 | $2,071,694.00 | $2,114,338.50 |
| 2019 | $199,000 | $199,000 | $0 | $199,000 | 1.442 | $286,958.00 | $0 | $286,958.00 | | |
| 2020 | $199,000 | $199,000 | $0 | $199,000 | 1.501 | $298,699.00 | $0 | $298,699.00 | | |
| **Total** | **$1,128,500** | **$1,128,500** | **$589,801.04** | **$1,718,301.04** | | | | | | |
| **Program Total** | **$3,317,500** | | | **$3,317,500.00** | | | | | | |

[1] Original inflation index. The difference between the original inflation index and the revised inflation index is shown as "Underfunding Makeup."

**California Remedial Measures Fund**

| FY | HCP Table 7-1 2003 Dollars | Required 2003 Dollars | Additional 2003 Dollars | Total 2003 Dollars | i | Required Current Year Dollars | Additional Current Year Dollars | Total Current Year Dollars | Cumulative Current Year Dollars | Cumulative With Interest Current Year Dollars |
|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | $133,000 | | | | | | | | | |
| 2012 | $133,000 | | | | | | | | | |
| 2013 | $133,000 | $399,000 | $0 | $399,000 | 1.251[1] | $499,149.00 | $0 | $499,149.00 | $499,149.00 | $501,926.51 |
| 2014 | $133,000 | $133,000 | $0 | $133,000.00 | 1.276[1] | $169,708.00 | $0 | $169,708.00 | $668,857.00 | $677,370.74 |
| 2015 Underfunding Makeup | | | | | | $37,373.00 | | $37,373.00 | $706,230.00 | |
| 2015 Underfunding Makeup Additional | | | $892,398.95 | $892,398.95 | 1.347 | | $1,202,061.38 | $1,202,061.38 | $1,908,291.38 | |
| 2015 | $133,000 | $133,000 | | $133,500.00 | 1.358 | $180,614.00 | | $180,614.00 | $2,088,905.38 | $2,108,612.89 |
| | | | | | | | | | | |
| 2016 | $398,000 | $398,000 | $0 | $398,000 | 1.387 | $552,026.00 | $0 | $552,026.00 | $2,640,931.38 | $2,685,482.83 |
| 2017 | $398,000 | $398,000 | $0 | $398,000 | 1.393 | $554,414.00 | $0 | $554,414.00 | $3,195,345.38 | $3,277,059.19 |
| 2018 | $398,000 | $398,000 | $0 | $398,000 | 1.410 | $561,180.00 | $0 | $561,180.00 | $3,756,525.38 | $3,901,429.95 |
| 2019 | $398,000 | $398,000 | $0 | $398,000 | 1.442 | $573,916.00 | $0 | $573,916.00 | | |
| 2020 | $398,000 | $398,000 | $0 | $398,000 | 1.501 | $597,398.00 | $0 | $597,398.00 | | |
| **Total** | **$2,257,000** | **$2,257,000** | **$892,398.95** | **$3,149,398.95** | | | | | | |
| **Program Total** | **$6,635,000** | | | **$6,635,000.00** | | | | | | |

[1] Original inflation index. The difference between the original inflation index and the revised inflation index is shown as “Underfunding Makeup.”

*D-3c*: *Land and Water Fund*

| FY | Current Year Contributions | Current Year Withdrawals | Cumulative Contributions |
|---|---|---|---|
| 2011 | $8,900,000 | $0 | $8,900,000 |
| 2012 | $4,600,000 | $0 | $13,500,000 |
| 2013 | $0 | $0 | $13,500,000 |
| 2014 | $0 | $0 | $13,500,000 |
| 2015 | $6,100,000 | $0 | $19,600,000 |
| 2016 | $4,100,000 | $8,300,000 | $15,400,000 |
| 2017 | $0 | $0 | $15,400,000 |
| 2018 | $0 | $0 | $15,400,000 |
| 2019 | $0[1] | $9,730,000[2] | $5,670,000 |
| 2020 | $0 | $0 | $5,670,000 |

**[1] Resolution 19-003 (Increase FY2019 Work Plan and Budget, FY2017 Accomplishment Report) approved amount.**
**[2] PDD 19-001 (Dennis Underwood Conservation Area Land and Water Approval).**

## D-4: Cumulative Program Accomplishment, FY04 – FY18

| Work Task | 2004–2005 Expenditures | 2006–2010 Expenditures | 2011–2015 Expenditures | 2016 Obligations | 2016 Expenditures | 2017 Obligations | 2017 Expenditures | 2018 Obligations | 2018 Expenditures | 2004–2018 Expenditures |
|---|---|---|---|---|---|---|---|---|---|---|
| **A1** | $403,953.57 | $5,449,608.25 | $5,141,558.77 | $1,188,765.48 | $1,140,032.88 | $1,196,839.51 | $1,169,900.60 | $1,288,045.42 | $1,262,277.18 | $14,567,331.25 |
| **G2** | $0.00 | $130,535.22 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $130,535.22 |
| **Total A** | **$403,953.57** | **$5,580,143.47** | **$5,141,558.77** | **$1,188,765.48** | **$1,140,032.88** | **$1,196,839.51** | **$1,169,900.60** | **$1,288,045.42** | **$1,262,277.18** | **$14,697,866.47** |
| **B1** | $170,868.72 | $1,066,391.84 | $921,401.81 | $216,932.74 | $195,408.34 | $137,699.21 | $207,830.04 | $211,549.45 | $196,391.51 | $2,758,292.26 |
| **B2** | $145,568.04 | $1,659,561.45 | $1,605,411.67 | $309,156.64 | $221,205.32 | $299,717.05 | $254,893.46 | $324,870.50 | $398,475.00 | $4,285,114.94 |
| **B3** | $14,527.30 | $417,611.27 | $812,275.52 | $269,149.88 | $152,729.68 | $19,643.79 | $130,928.66 | $166,345.03 | $190,503.35 | $1,718,575.78 |
| **B4** | $9,857.95 | $845,339.56 | $1,287,567.57 | $253,146.40 | $156,044.68 | $236,605.59 | $243,054.67 | $259,697.43 | $454,126.36 | $2,995,990.79 |
| **B5** | $40,720.81 | $1,115,649.42 | $1,583,166.66 | $731,953.63 | $335,097.81 | $162,031.14 | $441,157.56 | $541,538.62 | $520,027.96 | $4,035,820.22 |
| **B6** | $25,878.76 | $234,358.80 | $390,860.55 | $241,051.09 | $256,919.15 | $280,966.59 | $408,840.78 | $324,717.13 | $264,823.02 | $1,581,681.06 |
| **B7** | $186,003.61 | $862,848.38 | $1,001,518.88 | $149,862.21 | $162,654.16 | $174,790.62 | $175,104.04 | $183,822.20 | $174,313.63 | $2,562,442.70 |
| **B8** | $124,792.00 | $316,603.38 | $437,409.68 | $140,133.31 | $165,503.33 | $130,604.88 | $51,591.78 | $137,535.12 | $137,957.22 | $1,233,857.39 |
| **B9** | $3,073.11 | $534.14 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $3,607.25 |
| **B10** | $0.00 | $537,148.73 | $17,672.96 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $554,821.69 |
| **B11** | $0.00 | $250,664.96 | $178,289.49 | $62.19 | $62.19 | $0.00 | $0.00 | $0.00 | $0.00 | $429,016.64 |
| **B12** | $0.00 | $0.00 | $0.00 | $70,499.86 | $30,123.36 | $76,778.77 | $114,158.57 | $65,881.81 | $50,871.00 | $195,152.93 |
| **Total B** | **$721,290.30** | **$7,306,711.93** | **$8,235,574.79** | **$2,381,947.95** | **$1,675,748.02** | **$1,518,837.64** | **$2,027,559.56** | **$2,215,957.29** | **$2,387,489.05** | **$22,354,373.65** |
| **C1** | $45,276.00 | $101,382.15 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $146,658.15 |
| **C2** | $0.00 | $50,000.00 | $65,851.18 | $11,311.51 | $9,416.92 | $10,844.47 | $2,739.06 | $11,101.09 | $21,101.09 | $149,108.25 |
| **C3** | $0.00 | $225,763.98 | $52,899.88 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $278,663.86 |
| **C4** | $0.00 | $64,782.41 | $50,050.43 | $0.00 | $4,898.43 | $0.00 | $0.00 | $0.00 | $0.00 | $119,731.27 |
| **C5** | $0.00 | $319,598.56 | $234,278.88 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $553,877.44 |
| **C6** | $0.00 | $101,441.68 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $101,441.68 |
| **C7** | $0.00 | $546,964.77 | -$2,315.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $544,649.77 |
| **C8** | $136,060.00 | $444,257.78 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $580,317.78 |
| **C9** | $43,816.00 | $69,039.62 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $112,855.62 |
| **C10** | $0.00 | $576,061.87 | $488,660.39 | $0.00 | $31,450.75 | $0.00 | $0.00 | $0.00 | $0.00 | $1,096,173.01 |
| **C11** | $0.00 | $548,492.74 | $578,795.96 | $0.00 | $27,562.06 | $0.00 | $0.00 | $0.00 | $0.00 | $1,154,850.76 |
| **C12** | $0.00 | $813,567.37 | $222,699.50 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $1,036,266.87 |
| **C13** | $99,996.80 | $1,131,690.20 | $463,921.41 | $184.39 | $232,180.41 | $0.00 | $0.00 | $0.00 | $0.00 | $1,927,788.82 |
| **C14** | $0.00 | $85,336.94 | $202,650.17 | $0.00 | $0.00 | $229.50 | $229.50 | $0.00 | $0.00 | $288,216.61 |
| **C15** | $22,255.00 | $450,245.67 | $23,239.78 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $495,740.45 |
| **C16** | $0.00 | $55,332.60 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $55,332.60 |

| Work Task | 2004–2005 Expenditures | 2006–2010 Expenditures | 2011–2015 Expenditures | 2016 Obligations | 2016 Expenditures | 2017 Obligations | 2017 Expenditures | 2018 Obligations | 2018 Expenditures | 2004–2018 Expenditures |
|---|---|---|---|---|---|---|---|---|---|---|
| **C17** | $9,750.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $9,750.00 |
| **C18** | $41,981.82 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $41,981.82 |
| **C19** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| **C20** | $53,779.96 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $53,779.96 |
| **C21** | $70,000.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $70,000.00 |
| **C22** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| **C23** | $0.00 | $356,826.42 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $356,826.42 |
| **C24** | $0.00 | $618,939.19 | $1,088,443.70 | $302,717.48 | $328,007.72 | $349,373.16 | $282,033.90 | $124,254.93 | $240,573.87 | $2,557,998.38 |
| **C25** | $0.00 | $592,084.80 | $1,052,356.76 | $197,068.70 | $156,562.06 | $186,861.08 | $216,239.86 | $537.58 | $17,429.47 | $2,034,672.95 |
| **C26** | $0.00 | $50,111.40 | $78,699.67 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $128,811.07 |
| **C27** | $0.00 | $258,044.64 | $180,660.54 | $801.21 | $13,260.91 | $0.00 | $5,887.09 | $0.00 | $0.00 | $457,853.18 |
| **C28** | $0.00 | $121,555.67 | $31,527.07 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $153,082.74 |
| **C29** | $0.00 | $106,526.28 | $100,000.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $206,526.28 |
| **C30** | $0.00 | $153,121.71 | $186,897.58 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $340,019.29 |
| **C31** | $0.00 | $140,518.71 | $509,512.62 | $148,968.92 | $109,157.90 | $145,010.65 | $118,591.23 | $149,136.13 | $124,008.07 | $1,001,788.53 |
| **C32** | $0.00 | $173,121.81 | $517,835.16 | $99,638.94 | $99,638.94 | $117,484.11 | $117,484.11 | ($7,531.34) | ($7,531.34) | $900,548.68 |
| **C33** | $0.00 | $81,186.05 | $450,438.52 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $531,624.57 |
| **C34** | $0.00 | $111,714.31 | $12,304.81 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $124,019.12 |
| **C35** | $0.00 | $10,688.46 | $510,228.60 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $520,917.06 |
| **C36** | $0.00 | $93,004.96 | $158,863.99 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $251,868.95 |
| **C37** | $0.00 | $113,822.56 | $177,340.58 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $291,163.14 |
| **C38** | $0.00 | $6,250.70 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $6,250.70 |
| **C39** | $0.00 | $170,403.17 | $1,000,552.97 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $1,170,956.14 |
| **C40** | $0.00 | $2,106.76 | $758,341.60 | $274,332.93 | $168,168.67 | $399,170.09 | $171,772.56 | $413,755.84 | $274,527.11 | $1,374,916.70 |
| **C41** | $0.00 | $5,885.67 | $180,615.94 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $186,501.61 |
| **C42** | $0.00 | $49,236.73 | $410,961.44 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $460,198.17 |
| **C43** | $0.00 | $0.00 | $110,099.63 | $39,374.35 | $47,121.13 | $4,473.02 | $10,459.89 | $0.00 | $0.00 | $167,680.65 |
| **C44** | $0.00 | $0.00 | $242,133.66 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $242,133.66 |
| **C45** | $0.00 | $0.00 | $717,366.60 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $717,366.60 |
| **C46** | $0.00 | $0.00 | $296,058.13 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $296,058.13 |
| **C47** | $0.00 | $0.00 | $717,535.15 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $717,535.15 |
| **C48** | $0.00 | $0.00 | $101,084.94 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $101,084.94 |
| **C49** | $0.00 | $0.00 | $249,235.78 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $249,235.78 |
| **C50** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| **C51** | $0.00 | $0.00 | $42,560.10 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $42,560.10 |

| Work Task | 2004–2005 Expenditures | 2006–2010 Expenditures | 2011–2015 Expenditures | 2016 Obligations | 2016 Expenditures | 2017 Obligations | 2017 Expenditures | 2018 Obligations | 2018 Expenditures | 2004–2018 Expenditures |
|---|---|---|---|---|---|---|---|---|---|---|
| **C52** | $0.00 | $0.00 | $513,269.60 | $151,012.21 | $119,347.25 | $169,883.43 | $193,058.85 | $254.54 | $6,317.50 | $831,993.20 |
| **C53** | $0.00 | $0.00 | $410,889.16 | $112,896.35 | $122,886.58 | $81,661.52 | $103,342.63 | $42,475.54 | $37,590.71 | $674,709.08 |
| **C54** | $0.00 | $0.00 | $9,110.44 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $9,110.44 |
| **C55** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| **C56** | $0.00 | $0.00 | $22,208.29 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $22,208.29 |
| **C57** | $0.00 | $0.00 | $541,878.93 | $3,227.48 | $150,244.17 | $4,210.82 | $4,210.82 | $0.00 | $0.00 | $696,333.92 |
| **C58** | $0.00 | $0.00 | $30,179.14 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $30,179.14 |
| **C59** | $0.00 | $0.00 | $110,385.45 | $167,129.76 | $31,396.71 | $169,998.97 | $65,937.84 | $153,470.62 | $130,206.20 | $337,926.20 |
| **C60** | $0.00 | $0.00 | $120,067.55 | $11.05 | $77,329.28 | $230,860.93 | $42,373.65 | $156,839.19 | $102,018.29 | $341,788.77 |
| **C61** | $0.00 | $0.00 | $209,893.35 | $175,395.05 | $163,661.99 | $38,271.69 | $123,566.67 | $288,857.26 | $111,718.12 | $608,840.13 |
| **C62** | $0.00 | $0.00 | $251,387.83 | $147,788.13 | $165,922.17 | $12,554.37 | $70,977.85 | ($43.31) | $40,147.65 | $528,435.50 |
| **C63** | $0.00 | $0.00 | $102,751.51 | $90,290.50 | $90,290.50 | $141,661.66 | $60,524.10 | $98,270.13 | $75,725.19 | $329,291.30 |
| **C64** | $0.00 | $0.00 | $502,874.59 | $656,351.17 | $540,791.98 | $452,557.00 | $334,261.50 | $451,416.35 | $446,430.08 | $1,824,358.15 |
| **C65** | $0.00 | $0.00 | $20,738.26 | $99,329.26 | $84,318.17 | $135,135.12 | $74,131.08 | $44,359.14 | $74,827.43 | $254,014.94 |
| **C66** | $0.00 | $0.00 | $0.00 | $83,717.80 | $83,717.80 | $43,378.83 | $43,378.83 | $25,505.31 | $25,505.31 | $152,601.94 |
| **Total C** | **$522,915.58** | **$8,799,108.34** | **$15,108,022.22** | **$2,761,547.19** | **$2,857,332.50** | **$2,693,620.42** | **$2,041,201.02** | **$1,952,659.00** | **$1,720,594.75** | **$31,049,174.41** |
| **D1** | $29,367.09 | $130,308.25 | $130,797.53 | $36,470.97 | $36,470.97 | $37,432.99 | $37,432.99 | $40,504.44 | $40,504.44 | $404,881.27 |
| **D2** | $370,174.62 | $3,602,160.66 | $3,649,573.42 | $748,047.05 | $760,095.13 | $812,409.57 | $985,972.16 | $706,478.94 | $617,477.07 | $9,985,453.06 |
| **D3** | $0.00 | $427,612.12 | $310,908.17 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $738,520.29 |
| **D4** | $60,520.00 | $200,571.38 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $261,091.38 |
| **D5** | $247,118.33 | $1,245,689.80 | $1,358,964.39 | $234,559.10 | $234,559.10 | $233,591.60 | $233,591.60 | $269,757.00 | $269,757.00 | $3,589,680.22 |
| **D6** | $0.00 | $761,484.19 | $1,555,281.71 | $152,057.03 | $297,303.10 | $21,818.80 | $21,818.80 | $94,088.91 | $94,088.91 | $2,729,976.71 |
| **D7** | $0.00 | $2,309,256.14 | $3,019,380.04 | $688,770.88 | $860,371.04 | $621,507.82 | $588,971.56 | $62,281.40 | $206,807.56 | $6,984,786.34 |
| **D8** | $134,246.08 | $2,089,212.74 | $3,500,095.26 | $943,608.61 | $775,008.88 | $940,176.70 | $964,561.65 | $1,043,344.18 | $1,006,230.02 | $8,469,354.63 |
| **D9** | $0.00 | $477,001.13 | $1,193,232.34 | $379,451.91 | $470,531.02 | $125,396.79 | $196,587.81 | $129,056.63 | $129,265.87 | $2,466,618.17 |
| **D10** | $0.00 | $51,830.67 | $160,396.07 | $44,452.69 | $44,452.69 | $32,248.98 | $32,248.98 | $31,374.56 | $31,374.56 | $320,302.97 |
| **D11** | $269,097.12 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $269,097.12 |
| **D12** | $0.00 | $7,730.12 | $429,684.25 | $31,285.23 | $31,006.41 | $17,835.26 | $17,835.26 | $7,468.38 | $7,468.38 | $493,724.42 |
| **D13** | $0.00 | $0.00 | $29,381.98 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $29,381.98 |
| **D14** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| **Total D** | **$1,110,523.24** | **$11,302,857.20** | **$15,337,695.16** | **$3,258,703.47** | **$3,509,798.34** | **$2,842,418.51** | **$3,079,020.81** | **$2,384,354.44** | **$2,402,973.81** | **$36,742,868.56** |
| **E1** | $1,223,657.72 | $948,680.39 | $1,815,137.41 | $209,035.87 | $208,513.89 | $205,584.41 | $163,333.70 | $220,524.14 | $268,287.99 | $4,627,611.10 |
| **E2** | $147,333.85 | $508,005.30 | $140,060.18 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $795,399.33 |
| **E3** | $484,011.77 | $325,862.80 | $61,353.62 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $871,228.19 |
| **E4** | $17,278.54 | $3,952,533.88 | $5,351,078.84 | $449,393.91 | $424,660.32 | $488,325.18 | $484,508.12 | $644,951.71 | $482,078.16 | $10,712,137.86 |

| Work Task | 2004–2005 Expenditures | 2006–2010 Expenditures | 2011–2015 Expenditures | 2016 Obligations | 2016 Expenditures | 2017 Obligations | 2017 Expenditures | 2018 Obligations | 2018 Expenditures | 2004–2018 Expenditures |
|---|---|---|---|---|---|---|---|---|---|---|
| **E5** | $100,548.43 | $8,981,972.21 | $2,269,193.14 | $661,721.39 | $627,510.72 | $436,085.32 | $478,696.89 | $839,589.33 | $783,052.64 | $13,240,974.03 |
| **E6** | $79,586.39 | $39,474.36 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $119,060.75 |
| **E7** | $312,199.68 | $18,421.87 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $330,621.55 |
| **E8** | $1,035.50 | $837,004.58 | $22,143.98 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $860,184.06 |
| **E9** | $53,320.19 | $4,226,506.44 | $2,543,130.10 | $293,218.97 | $354,396.15 | $131,649.13 | $135,626.92 | $116,905.59 | $111,841.79 | $7,424,821.59 |
| **E10** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| **E11** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| **E12** | $32,427.43 | $43,784.10 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $76,211.53 |
| **E13** | $25,912.33 | $101,424.49 | $0.00 | $0.00 | $0.00 | $24,709.69 | $24,709.69 | $28,776.19 | $28,776.19 | $180,822.70 |
| **E14** | $84,309.07 | $7,171,901.60 | $2,413,003.65 | $403,637.91 | $339,732.72 | $496,526.61 | $503,105.02 | $515,675.14 | $295,963.75 | $10,808,015.81 |
| **E15** | $0.00 | $1,265,224.57 | $428,756.47 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $1,693,981.04 |
| **E16** | $5,392.59 | $993,317.46 | $1,955,608.78 | $785,451.33 | $771,277.61 | $2,966,489.85 | $1,678,250.45 | $1,077,161.04 | $1,860,421.61 | $7,264,268.50 |
| **E17** | $0.00 | $37,724.66 | $1,102,894.00 | $0.00 | $104,457.79 | $0.00 | ($769,251.82) | $0.00 | $1,308.70 | $477,133.33 |
| **E18** | $0.00 | $372,729.14 | $1,236,035.62 | $179,921.81 | $96,635.50 | $212,393.13 | $171,340.52 | $402,885.33 | $238,744.70 | $2,115,485.48 |
| **E19** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| **E20** | $35,000.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $35,000.00 |
| **E21** | $19,739.97 | $109,196.40 | $215,275.85 | $10,548,669.63 | $9,372,466.23 | $689,679.10 | $1,309,830.18 | $1,151,199.48 | $1,328,663.86 | $12,355,172.49 |
| **E22** | $4,028.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $4,028.00 |
| **E23** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| **E24** | $0.00 | $2,020,229.12 | $2,458,779.14 | $843,168.99 | $685,408.82 | $900,063.09 | $753,973.54 | $1,131,907.15 | $1,188,160.29 | $7,106,550.91 |
| **E25** | $0.00 | $201,394.44 | $115,873.76 | $12,101.05 | $12,101.05 | $29,993.90 | $29,993.90 | ($6,534.23) | ($6,534.23) | $352,828.92 |
| **E25 In-Kind** | $0.00 | $436,000.00 | $436,000.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $872,000.00 |
| **E26** | $0.00 | $147.62 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $147.62 |
| **E27** | $0.00 | $295,869.31 | $25,958,686.14 | $846,914.71 | $992,624.60 | $179,098.65 | $267,944.75 | $156,319.43 | $155,226.43 | $27,670,351.23 |
| **E28** | $0.00 | $156,905.74 | $1,538,805.52 | $318,447.52 | $410,664.22 | $269,402.54 | $266,187.67 | $373,739.17 | $288,594.40 | $2,661,157.55 |
| **E29** | $0.00 | $173,512.57 | $59,683.31 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $233,195.88 |
| **E30** | $0.00 | $0.00 | $255,733.98 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $255,733.98 |
| **E31** | $0.00 | $0.00 | $440,441.26 | $42,096.23 | $17,811.23 | $41,975.85 | $39,439.69 | $40,847.96 | $41,055.54 | $538,747.72 |
| **E32** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| **E33** | $0.00 | $0.00 | $1,268,018.44 | $322,214.66 | $250,882.25 | $173,882.03 | $205,985.55 | $24,647.30 | $68,915.32 | $1,793,801.56 |
| **E34** | $0.00 | $0.00 | $133,159.02 | $123,672.64 | $123,672.64 | $11.83 | $11.83 | $0.00 | $0.00 | $256,843.49 |
| **E35** | $0.00 | $0.00 | $324,968.99 | $158,178.28 | $236,841.95 | $4,765,001.75 | $2,970,491.64 | $4,240,523.35 | $5,425,446.82 | $8,957,749.40 |
| **E36** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $16,424.69 | $16,424.69 | $1,167.13 | $1,167.13 | $17,591.82 |
| **E37** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $10,027.29 | $10,027.29 | $0.00 | $0.00 | $10,027.29 |
| **E38** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $115,742.63 | $115,742.63 | $173,347.70 | $173,347.70 | $289,090.33 |

| Work Task | 2004–2005 Expenditures | 2006–2010 Expenditures | 2011–2015 Expenditures | 2016 Obligations | 2016 Expenditures | 2017 Obligations | 2017 Expenditures | 2018 Obligations | 2018 Expenditures | 2004–2018 Expenditures |
|---|---|---|---|---|---|---|---|---|---|---|
| **E39** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $213,860.00 | $122,675.06 | $122,675.06 |
| **E40** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $26,478.64 | $11,625.60 | $11,625.60 |
| **Total E** | **$2,625,781.46** | **$33,217,823.05** | **$52,543,821.20** | **$16,197,844.90** | **$15,029,657.69** | **$12,153,066.67** | **$8,856,372.85** | **$11,373,971.55** | **$12,868,819.45** | **$125,142,275.70** |
| **F1** | $199,492.67 | $1,338,304.56 | $2,741,582.10 | $471,224.34 | $541,133.66 | $839,620.04 | $509,888.32 | $966,385.23 | $808,611.58 | $6,139,012.89 |
| **F2** | $65,235.81 | $558,948.29 | $1,023,786.96 | $273,682.73 | $273,966.32 | $487,309.71 | $330,715.45 | $360,204.59 | $494,428.39 | $2,747,081.22 |
| **F3** | $23,023.55 | $178,096.37 | $224,767.11 | $63,377.64 | $63,377.64 | $42,126.44 | $42,126.44 | $64,748.87 | $64,748.87 | $596,139.98 |
| **F4** | $0.00 | $370,759.30 | $683,041.46 | $36,810.41 | $36,810.41 | $123,507.75 | $62,102.16 | $88,410.11 | $74,419.41 | $1,227,132.74 |
| **F5** | $0.00 | $508,229.54 | $1,013,665.04 | $241,313.96 | $238,890.68 | $362,211.47 | $268,516.37 | $381,622.26 | $443,117.81 | $2,472,419.44 |
| **F6** | $0.00 | $58,283.91 | $389,433.51 | $49,043.49 | $54,639.37 | $22,198.36 | $22,198.36 | $41,121.18 | $41,121.18 | $565,676.33 |
| **F7** | $0.00 | $0.00 | $78,366.68 | $23,225.44 | $23,225.44 | $30,633.05 | $30,633.05 | $38,104.37 | $38,104.37 | $170,329.54 |
| **F8** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $9,699.58 | $9,699.58 | $9,699.58 |
| **F9** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $53,502.65 | $53,502.65 | $53,502.65 |
| **F10** | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $618,393.95 | $424,700.22 | $424,700.22 |
| **Total F** | **$287,752.03** | **$3,012,621.97** | **$6,154,642.86** | **$1,158,678.01** | **$1,232,043.52** | **$1,907,606.82** | **$1,266,180.15** | **$2,622,192.79** | **$2,452,454.06** | **$14,405,694.59** |
| **G1** | $0.00 | $1,124,098.20 | $3,436,647.91 | $919,025.71 | $840,662.37 | $1,277,295.14 | $1,107,997.12 | $1,081,315.25 | $1,137,871.71 | $7,647,277.31 |
| **G3** | $0.00 | $1,478,396.05 | $991,137.22 | $190,240.44 | $183,255.64 | $4,493.69 | $99,375.32 | $5,386.62 | $66,036.46 | $2,818,200.69 |
| **G4** | $0.00 | $217,908.07 | $919,478.57 | $420,190.00 | $311,930.98 | $692,311.87 | $347,011.93 | $654,991.70 | $562,462.32 | $2,358,791.87 |
| **G6** | $0.00 | $0.00 | $0.00 | $27,482.43 | $3,359.07 | $97,582.09 | $21,032.38 | $15,162.76 | $68,290.13 | $92,681.58 |
| **Total G** | **$0.00** | **$2,820,402.32** | **$5,347,263.70** | **$1,556,938.58** | **$1,339,208.06** | **$2,071,682.79** | **$1,575,416.75** | **$1,756,856.33** | **$1,834,660.62** | **$12,916,951.45** |
| **H1** | $0.00 | $2,948,000.00 | $29,518,770.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $32,466,770.00 |
| **H2** | $0.00 | $0.00 | $3,994,595.38 | $1,104,052.00 | $1,104,052.00 | $1,108,828.00 | $1,108,828.00 | $1,122,360.00 | $1,122,360.00 | $7,329,835.38 |
| **Total H** | **$0.00** | **$2,948,000.00** | **$33,513,365.38** | **$1,104,052.00** | **$1,104,052.00** | **$1,108,828.00** | **$1,108,828.00** | **$1,122,360.00** | **$1,122,360.00** | **$39,796,605.38** |
| **I1** | $0.00 | $35,376.14 | $473,628.79 | $106,930.04 | $96,930.04 | $133,126.02 | $143,126.02 | $141,757.83 | $141,757.83 | $890,818.82 |
| **G5** | $0.00 | $61,059.68 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $61,059.68 |
| **Total I** | **$0.00** | **$96,435.82** | **$473,628.79** | **$106,930.04** | **$96,930.04** | **$133,126.02** | **$143,126.02** | **$141,757.83** | **$141,757.83** | **$951,878.50** |
| **GRAND Totals** | **$5,672,216.18** | **$75,084,104.10** | **$141,855,572.87** | **$29,715,407.62** | **$27,984,803.05** | **$25,626,026.38** | **$21,267,605.76** | **$24,858,154.65** | **$26,193,386.75** | **$298,057,688.71** |

# Attachment E – Reports Published in Fiscal Year 2018

Except where otherwise noted for journal articles, these reports are available on the Lower Colorado River Multi-Species Conservation Program website at: http://www.lcrmscp.gov/steer_committee/technical_reports.html

| Work Task | Report Title |
|---|---|
| C2 | Surveys of Threecorner Milkvetch and Sticky Buckwheat in Fiscal Year 2017 |
| C24 | Elf Owl, 2015 Annual Report |
| C40 | Genetic and Demographic Studies to Guide Conservation Management of Razorback Sucker and Bonytail in Off-Channel Habitats, 2010–2015 |
| C52 | Techniques for Locating, Capturing, and Monitoring Gilded Flickers, 2015 Annual Report |
| C66 | Marsh Bird Water Depth Analysis, 2016 Progress Report |
| D1 | Marsh Bird Surveys in Topock Gorge, 2015–2017 |
| D2 | Southwestern Willow Flycatcher Presence/Absence Surveys, 2017 Annual Report |
| D6/F2 | Lower Colorado River Riparian Bird Surveys, 2011–2015 Summary Report |
| D7 | Yellow-billed Cuckoo Project, 2006–2007 |
| D7 | Yellow-billed Cuckoo Surveys on the Lower Colorado River, 2017 Annual Report |
| D9 | California Leaf-nosed and Townsend's Big-eared Bat Foraging Distance Survey, 2017 |
| D10/F3 | Post-Development and System-Wide Monitoring of Rodent Populations – Spring 2016 |
| D10/F3 | Post-Development and System-Wide Monitoring of Rodent Populations, Fiscal Year 2017 |
| D12 | Lowland Leopard Frog and Colorado River Toad Surveys, 2017 Final Report |
| E1 | Beal Lake Conservation Area, 2014 Annual Report |
| E1 | Beal Lake Conservation Area, 2015 Annual Report |
| E1 | Beal Lake Conservation Area, 2016 Annual Report |
| E1 | Beal Lake Conservation Area, 2017 Annual Report |
| E4 | Palo Verde Ecological Reserve, 2014 Annual Report |

| Work Task | Report Title |
|---|---|
| E4 | Palo Verde Ecological Reserve, 2015 Annual Report |
| E4 | Palo Verde Ecological Reserve, 2016 Annual Report |
| E4 | Palo Verde Ecological Reserve, 2017 Annual Report |
| E5 | Cibola Valley Conservation Area, 2014 Annual Report |
| E5 | Cibola Valley Conservation Area, 2015 Annual Report |
| E5 | Cibola Valley Conservation Area Restoration Development and Monitoring Plan: Phase 7 |
| E5 | Cibola Valley Conservation Area Restoration Development and Monitoring Plan: Phases 8–9 |
| E5 | Cibola Valley Conservation Area Restoration Development and Monitoring Plan: Phases 10–11 |
| E9 | Hart Mine Marsh, 2013 Annual Report |
| E9 | Hart Mine Marsh, 2014 Annual Report |
| E9 | Hart Mine Marsh, 2015 Annual Report |
| E14 | Imperial Ponds Conservation Area, 2013 Annual Report |
| E14 | Imperial Ponds Conservation Area, 2014 Annual Report |
| E14 | Imperial Ponds Conservation Area, 2015 Annual Report |
| E14 | Imperial Ponds Conservation Area, 2016 Annual Report |
| E24 | Cibola NWR Unit #1, 2014 Annual Report |
| E24 | Cibola NWR Unit #1, 2015 Annual Report |
| E25 | Big Bend Conservation Area, 2014 Annual Report |
| E25 | Big Bend Conservation Area, 2015 Annual Report |
| E28 | Yuma East Wetlands, 2013 Annual Report |
| E31 | Hunters Hole, 2013 Annual Report |
| E31 | Hunters Hole, 2015 Annual Report |
| E33 | Pretty Water Conservation Area, 2015 Annual Report |
| E34 | Soil and Groundwater Salinity Conditions for Lower Colorado River Multi-Species Conservation Program Habitat Conservation Sites – 2014 |
| F2 | Lower Colorado River Riparian Bird Surveys, 2016 Annual Report |
| F2 | Riparian Bird Surveys at Conservation Areas in the Lower Colorado Region, 2017 |

| Work Task | Report Title |
|---|---|
| F2 | Riparian Bird Surveys at Pre-Development Conservation Areas in the Lower Colorado Region, 2017 |
| F4 | Post-Development Bat Monitoring of Conservation Areas and the ‘Ahakhav Tribal Preserve Along the Lower Colorado River – 2016 and 2017 Capture Surveys |
| F6 | Monitoring of the MacNeill’s Sootywing Skipper and its Habitats, 2016 Annual Report |
| F6 | Monitoring of the MacNeill’s Sootywing Skipper and its Habitats, 2017 Annual Report |
| F7 | Marsh Bird Surveys, Conservation Areas, 2014–2016 Annual Report |
| F7 | Marsh Bird Surveys, Conservation Areas, 2017 Annual Reports |
| G6 | Razorback Sucker (*Xyrauchen texanus*) (RASU) Basic Conceptual Ecological Model for the Lower Colorado River |
| I1 | Fiscal Year 2016 Outreach Activities |