

Lower Colorado River Multi-Species Conservation Program



Balancing Resource Use and Conservation

Hart Mine Marsh: Annual Report 2010



August 2012

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National Park Service
Bureau of Land Management
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Lower Colorado River Multi-Species Conservation Program

Hart Mine Marsh: Annual Report 2010

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

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Contents

| | |
|--|----|
| Executive Summary | 1 |
| Background | 2 |
| 1.0 General Site Information..... | 3 |
| 1.1 Purpose..... | 3 |
| 1.2 Location/Description..... | 4 |
| 1.3 Land Ownership..... | 8 |
| 1.4 Water Right Information..... | 8 |
| 1.5 Land Use Agreements..... | 8 |
| 2.0 Habitat Development and Management..... | 8 |
| 2.1 Design and Construction..... | 8 |
| 2.1.1 Construction, Phase 1..... | 9 |
| 2.1.2 Construction, Phase 2..... | 13 |
| 2.1.3 Construction, Phase 3..... | 15 |
| 2.2 Habitat Development | 15 |
| 2.2.1 Planting, Phase 1 | 16 |
| 2.2.2 Planting, Phase 2..... | 16 |
| 2.2.3 Planting, Phase 3..... | 20 |
| 2.3 Operation and Management..... | 20 |
| 2.4 General Site Maintenance | 21 |
| 2.5 Wildland Fire Management | 22 |
| 2.10 Law Enforcement..... | 22 |
| 2.11 Public Use | 22 |
| 3.0 Monitoring | 22 |
| 3.1 Abiotic Monitoring | 22 |
| 3.2 Microclimate Monitoring..... | ? |
| 3.3 Vegetation | ? |
| 3.4 Bat Surveys | ? |
| 3.5 System-wide Avian Monitoring..... | ? |
| 3.6 Southwestern Willow Flycatcher Surveys | ? |
| 3.7 Yellow-billed Cuckoo Surveys | ? |
| 4.0 Established Land Cover and Habitat Credit..... | ? |
| 5.0 Adaptive Management Recommendations | ? |
| 5.1 Operations and Maintenance..... | ? |
| 5.2 Soil Management | ? |
| 5.3 Water Management..... | ? |
| 5.4 Structural Management..... | ? |
| Literature Cited | ? |

Executive Summary

The purpose of this annual report is to summarize all activities, including planning, design, construction, and management that have occurred at the Hart Mine Marsh from October 1, 2004 through September 30, 2010. The first annual report for this conservation area was originally planned for September 30, 2011 to summarize all of the construction phases of Hart Mine Marsh (completion date of construction March 1, 2011). However, rapid growth and colonization of planted and existing vegetation and subsequent development of marsh habitats has prompted the creation of this report. Without the initiation of this report and the included habitat monitoring plans, data may not be collected and important information pertaining to habitat development and species use might be missed.

This document contains sections describing the general background of the site, land and water ownership, current agreements, and constructed habitat areas, as well as the past management of established land cover types. In addition, projected activities for Fiscal Year 2011, in terms of future development, management, and monitoring, will also be identified in this report. Adaptive Management is expected to be a larger part of subsequent annual reports for this conservation area as more data regarding the effectiveness of management techniques and performance of the habitat becomes available.

Background

Hart Mine Marsh was a decadent wetland on the U.S. Fish and Wildlife Service's (USFWS) Cibola National Wildlife Refuge (CNWR). The channelization of the lower Colorado River near Hart Mine Marsh caused a drop in the water table and the marsh became disconnected from the former floodplain. The river's hydrograph has been altered so that it no longer has large, dynamic overbank flow events that would have likely created and maintained Hart Mine Marsh. Subsequently, Hart Mine Marsh was reduced to a much smaller area of open water and emergent vegetation (approximately 20 acres). The surrounding areas were colonized primarily by saltcedar, an invasive, nonnative species. For years, the remaining marsh was characterized by poor water quality, marginal wetland/marsh habitat, and saline soils, which included some areas completely devoid of vegetation. In addition, the design of the marsh's infrastructure and the way it was managed may have contributed to the decadent state of the marsh by increasing concentrations of salinity and nitrogen. Surface water inputs to Hart Mine Marsh after the channelization of the lower Colorado River were supplied from three main sources: the Arnett (drainage) Ditch, the refuge's Unit 2 irrigation ditch, and tributary inflows from adjacent alluvial fans. During this period of management, the surface water hydrology of the marsh was highly dependent upon irrigation practices in adjacent farming areas and episodic precipitation events in the uplands. Additionally, all three surface water sources terminated in the marsh, with only limited surface water outflows (Hautzinger et al. 2007). Prior to restoration activities, there was little existing marsh cover type (open water and emergent vegetation) occupying this site. The majority of the site (80%) was dominated by various classes of saltcedar associations. A portion of the 646 acres defined as the Hart Mine Marsh Management Unit was selected for establishment as an LCR MSCP conservation area. This area now comprises approximately 255 acres designated as the Hart Mine Marsh Conservation area, referred to hereafter as Hart Mine Marsh (HMM).

Hart Mine Marsh was previously identified as a site with potential for marsh habitat restoration by the USFWS and Reclamation before the implementation of the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). The USFWS's Lower Colorado River Refuges Comprehensive Management Plan and Ecological Assessment had also targeted Hart Mine Marsh as a restoration priority (USFWS 1993). In the mid-90s, a number of improvements were made; these included the extension of the Arnett Ditch past the Hart Mine Marsh Management Unit with the installation of a controlled outflow through the tie-back levee and a series of control structures along this ditch extension. These control structures were designed to allow for drain water from the Arnett Ditch to be diverted into the Hart Mine Marsh Management Unit (pers. comm. Russ Phelps, Reclamation).

With the authorization of the LCR MSCP and the mutual desire for the USFWS and Reclamation to restore HMM, a partnership between the two agencies was formed. As part of the planning effort for the restoration partnership at HMM, the USFWS hosted a Wetland Review at the CNWR. It comprised an interdisciplinary gathering of approximately 20 scientists and resource managers representing a range of federal, state,

non-governmental organizations, and private agencies. The intent of the review was to generate the integral components of a restoration plan that functioned within the abiotic and physical process constraints of the HMM, as well as within the administrative and political discretions that exist for the LCR MSCP and for the CNWR. This process produced a number of desired features and approaches for the restoration of the site. These are discussed in more detail in the *Hart Mine Marsh Conservation Area Restoration Development and Monitoring Plan* (2009) located on the LCR MSCP website. Reclamation determined that many of these approaches and practices could be incorporated into a restoration design and would ultimately improve habitat for the program's covered species. Using baseline information gathered and compiled by the USFWS in the *Hart Mine Marsh - Existing Conditions Report* (Hautzinger et al. 2007) and guided in part by the wetland review process, Reclamation developed an appropriate engineering design and approach that was intended to fulfill both the needs of the CNWR and those of the LCR MSCP.

1.0 General Site Information

Cibola National Wildlife Refuge (CNWR) consists of about 16,600 acres of land located along approximately twelve miles of the lower Colorado River in Arizona and California. It was established in 1964 as a refuge and breeding ground for migratory birds and other wildlife. The Refuge is divided into six management units: Unit 1, Unit 2, Unit 3, Unit 4, Unit 5, and Unit 6. The Hart Mine Marsh Management Unit is part of Unit 2 (Figure 1). The Hart Mine Marsh Management Unit is a sub-unit of Unit 2, located on the southern end of the CNWR in Arizona. The management unit encompasses approximately 646 acres, with approximately 523 acres that have wetland development potential and classify as "wetlands" according on the U.S. Army Corps of Engineers guidelines for wetland delineation with the Arid West supplement. Approximately 255 acres within this area now make up the HMM conservation area.

1.1 Purpose

The purpose of this project is to restore portions of the Hart Mine Marsh to functional habitats that support species covered under the LCR MSCP, specifically Yuma clapper rail (*Rallus longirostris yumanensis*), western least bittern (*Ixobrychus exilis hesperis*), and Colorado River cotton rat (*Sigmodon arizonae plenus*). It is likely that the creation of a mosaic of marsh habitat will also benefit a host of other species, including the California black rail (*Laterallus jamaicensis coturniculus*), as well as other wading birds and migratory waterfowl. This will be 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 wetland and marsh vegetation. The basic approach of this project is to remove a substantial amount of existing saltcedar from the site, deepen areas of existing open water and contour areas adjacent to these deeper areas, and manage water on the site at higher elevations to promote and sustain marsh cover-type vegetation and wetland functions. The creation of habitat includes both the establishment of native plants and the

management of water levels to meet performance standards for integrating emergent vegetation and open water at varying depths into a mosaic of marsh habitats.

1.2 Location/Description

The HMM consists of approximately 255 acres on CNWR located in Arizona between river miles 90 and 93 (figures 2 and 3). The initial partnership for HMM includes Reclamation and the USFWS.

The legal description of this area is Gila and Salt River Base and Meridian, La Paz County, Arizona; Township 1 South, Range 23 West, Section 31, Township 2 South, Range 23 West, Sections 6 and 5, and Township 2 South, Range 23 West Sections 7 and 8. The land and water resources will be provided by the USFWS.

Figure 1. Cibola National Wildlife Refuge's six management units.

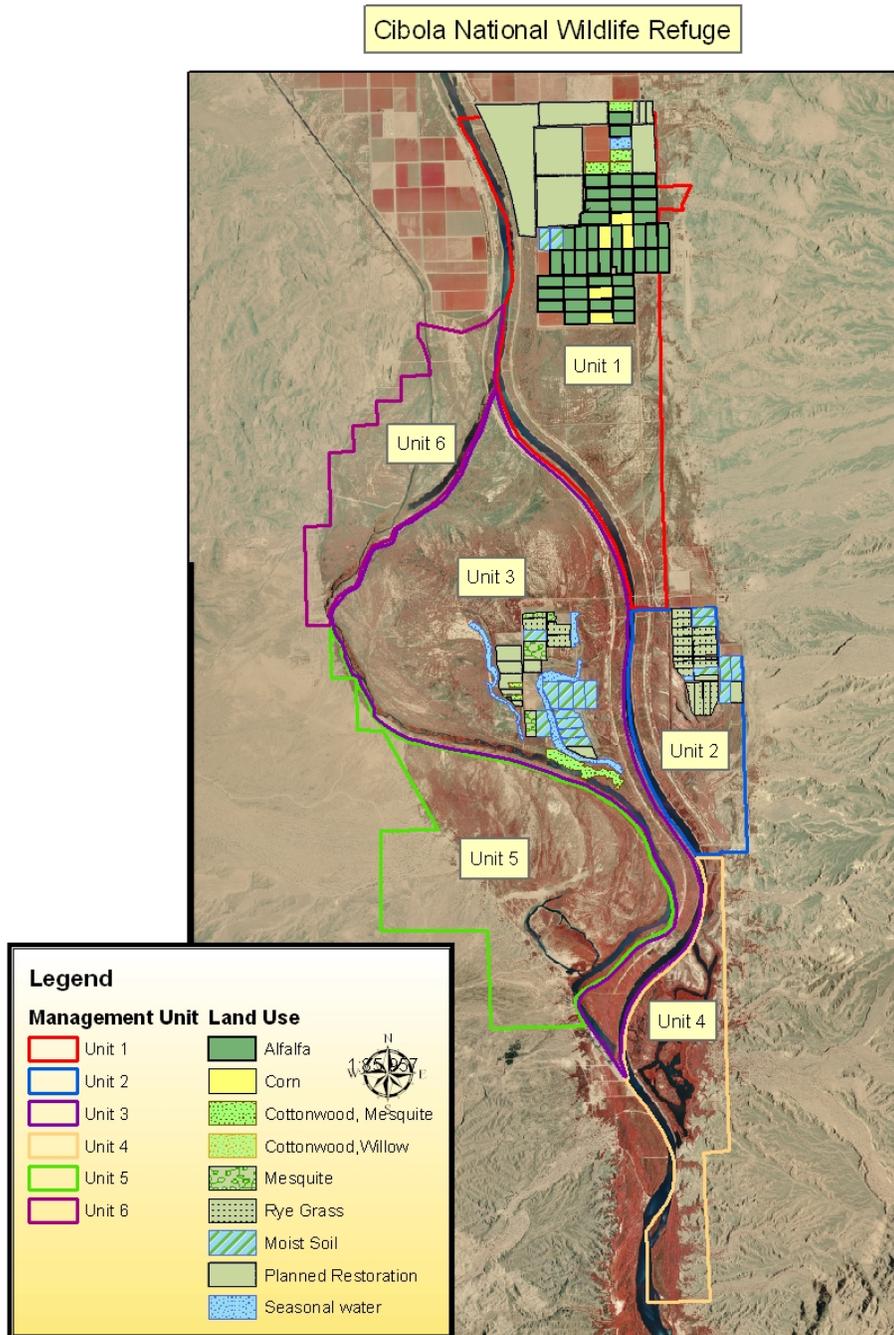


Figure 2. General location of the Hart Mine Marsh Conservation Area.

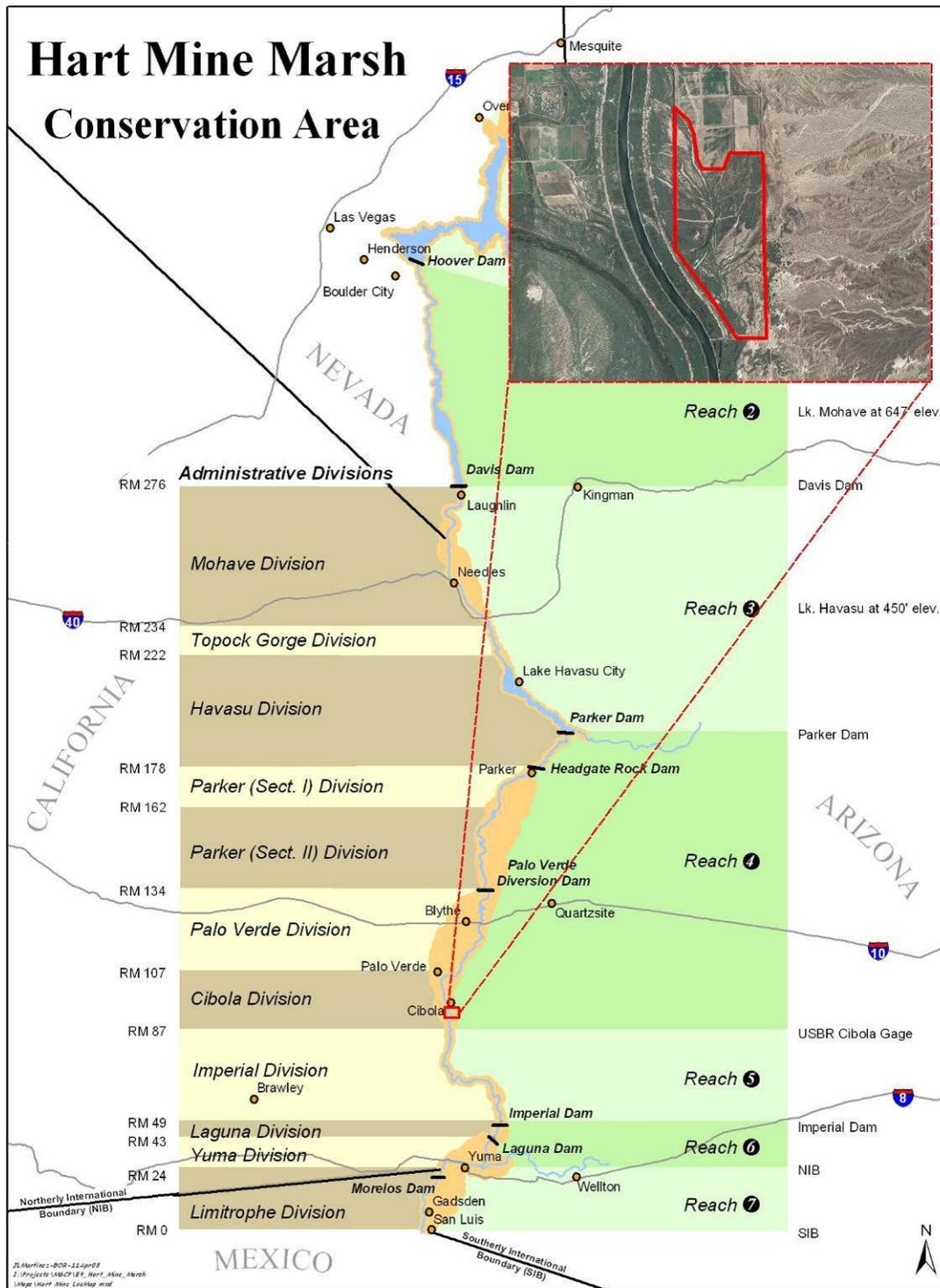
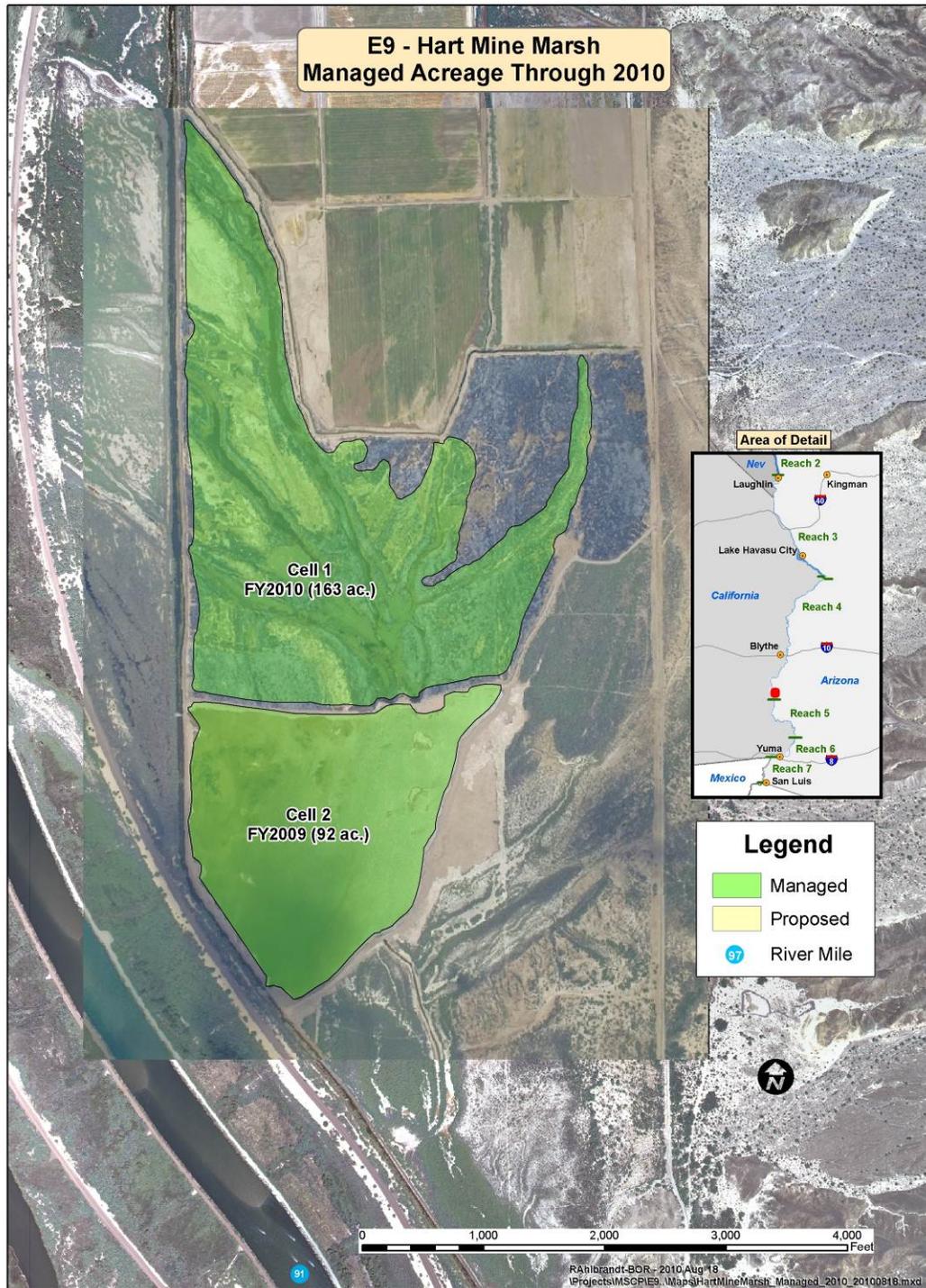


Figure 3. Managed acres of Hart Mine Marsh through 2010.



1.3 Land Ownership

The property is owned by the USFWS, who will dedicate land and water to Reclamation to develop and maintain native land cover types for the LCR MSCP. The property will be owned and managed by the USFWS.

1.4 Water Right Information

Cibola National Wildlife Refuge has second priority water rights. These include a diversionary entitlement of 27,000 acre-feet per year and a consumptive use entitlement (diversion minus return flow) of 16,793 acre-feet per year. In addition, the refuge has a circulatory (circulation water with minimum consumptive use) water right of 7,500 acre-feet per year. The 174-acre HMM will have an average of 1,258 acre-feet per year (7.23 acre-feet per acre, per year) available when the conservation area has been fully developed.

1.5 Land Use Agreement

A Land Use Agreement for general restoration activities on CNWR has been executed and is on file. An attachment (2) to Exhibit B of the aforementioned Land Use Agreement, which specifies the activities at the HMM, has been finalized, and secured the land and water resources at the HMM for the 50-year term of the program.

2.0 Habitat Development and Management

2.1 Design and Construction

Hart Mine Marsh was created using a design-build approach, which offers benefits in capital savings. It accomplishes this by reducing the effort needed to conduct detailed surveys to produce high resolution contour maps and eliminates the need for developing and formalizing strict design specifications. It allows for a generalized design to be used to guide construction, but also allows for appropriate on-the-ground changes to be made without revising designs and delaying construction activities. A potential result of the design-build approach is the relatively low resolution contour map that is developed from the survey data; this was the case at HMM, since most of the site was covered in saltcedar (some very dense). This limitation can make it difficult to accurately predict cut and fill quantities and in the case of HMM, can make it difficult to estimate the amount of flooded acreage of the completed site. The original projected marsh area for cells 1 and 2 combined, based on the survey data, was 174 acres. Since many of the areas over the entire cleared footprint were consistently low, the marsh area after construction and contouring of cells 1 and 2 resulted in approximately 255 acres. This result was not perceived as a detriment impact for the restoration of HMM.

Cells in the design of HMM were labeled from North to South: cell 1 and cell 2, respectively. However, construction was performed from South to North, to better control water on the site during construction and for more efficient utilization of time and resources. Construction of HMM was completed in phases where each cell was cleared and contoured within a construction season. Each phase was performed within a Fiscal Year (FY) and these construction intervals were confined from October 1 through March 1 to comply with avoidance practices for the Yuma Clapper Rail breeding season.

The main goal for the design and construction of HMM in terms of function was to have good control and flexibility of water over the site. HMM has a weak subsurface hydraulic connection to the Colorado River and the supply of water available to fill and maintain the marsh has to be diverted from the Arnett Ditch (drain) or supplied from an irrigation pump (lifted). These limitations combined with very low fall across the site, necessitated the use of multiple control structures to check-up water and to allow flexibility in the use of multiple water sources and paths for inlet and outlets to and from the marsh cells.

2.1.1 Construction, Phase 1

Phase 1 included the clearing and contouring of cell 2 and the installation of a number of water control structures. Saltcedar and other woody vegetation were removed from the design footprint of the phase approximately (130 acres). Initially, a disposal area was cleared as part of this footprint so that the slash could be piled and burned at a later date; however, the slash piles were too wet and full of soil from the grubbed root balls for effective burning. Instead, the slash was piled temporarily and then buried directly on site to reduce the costs of loading and transport to another location.

While the clearing activities were ongoing in cell 2, a series of seven control structures were installed at the outlet of the marsh, within cell 2, and along the Arnett Ditch (figures 4 and 5). These included two structures to route the discharge water from the marsh, three structures located along the Arnett Ditch to provide inlets/outlets for cells 2 and 3, and two structures placed between cells to allow water to pass from cell 1 (not constructed until FY10) into cell 2 and from cell 2 into cell 3. Cell 3 was incorporated into the marsh complex, but was not cleared or contoured and will be managed by the USFWS. Cell 3 is not part of the LCR MSCP HMM conservation area.

After the areas in cell 2 were cleared, channels were excavated following the existing geomorphology of the site to connect the inlet and outlet structures. These channels were also intended to maintain areas of permanent open water and to provide deeper water continuity for better management of water quality. Channel depths ranged from 213 feet (NGVD27) to 210 feet (Figure 6). The excavated material from the channels was used to create the dikes confining cell 2 or was incorporated in the contouring of the cell as dictated in the grading plan. Cell 2, approximately 92 acres, was filled in mid-March 2009 and held at approximately 216.5 feet through August, 2009 (Figure 7).

Figure 4. Installation of HMM Colorado River outlet control structure.



Figure 5. One of the controls structures on the Arnett Ditch used to divert water into HMM, cell 2.



Figure 6. HMM cell 2 asbuilt.

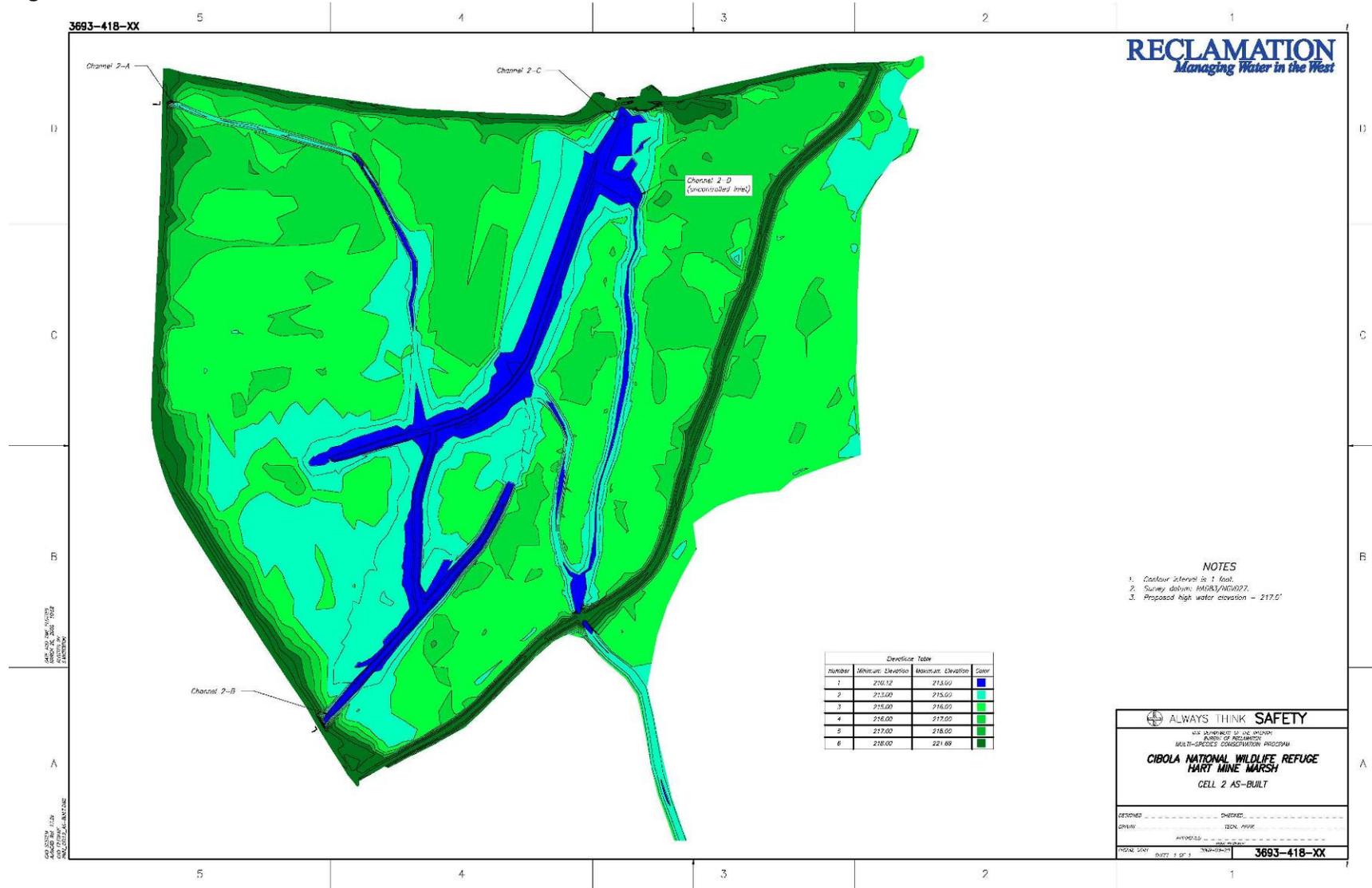


Figure 7. Cell 2 in June 2009 filled to elevation 216.5' after completion of construction. New cattail growth is pictured in the foreground.



In June 2009, the USFWS performed a controlled burn on the area north of cell 2 at HMM (Figure 8). The intent was to facilitate clearing for the next phase of construction at HMM by decreasing the volume of woody debris that would have to be grubbed and buried on site. The burn was successful and also improved visibility in areas for heavy equipment operators.

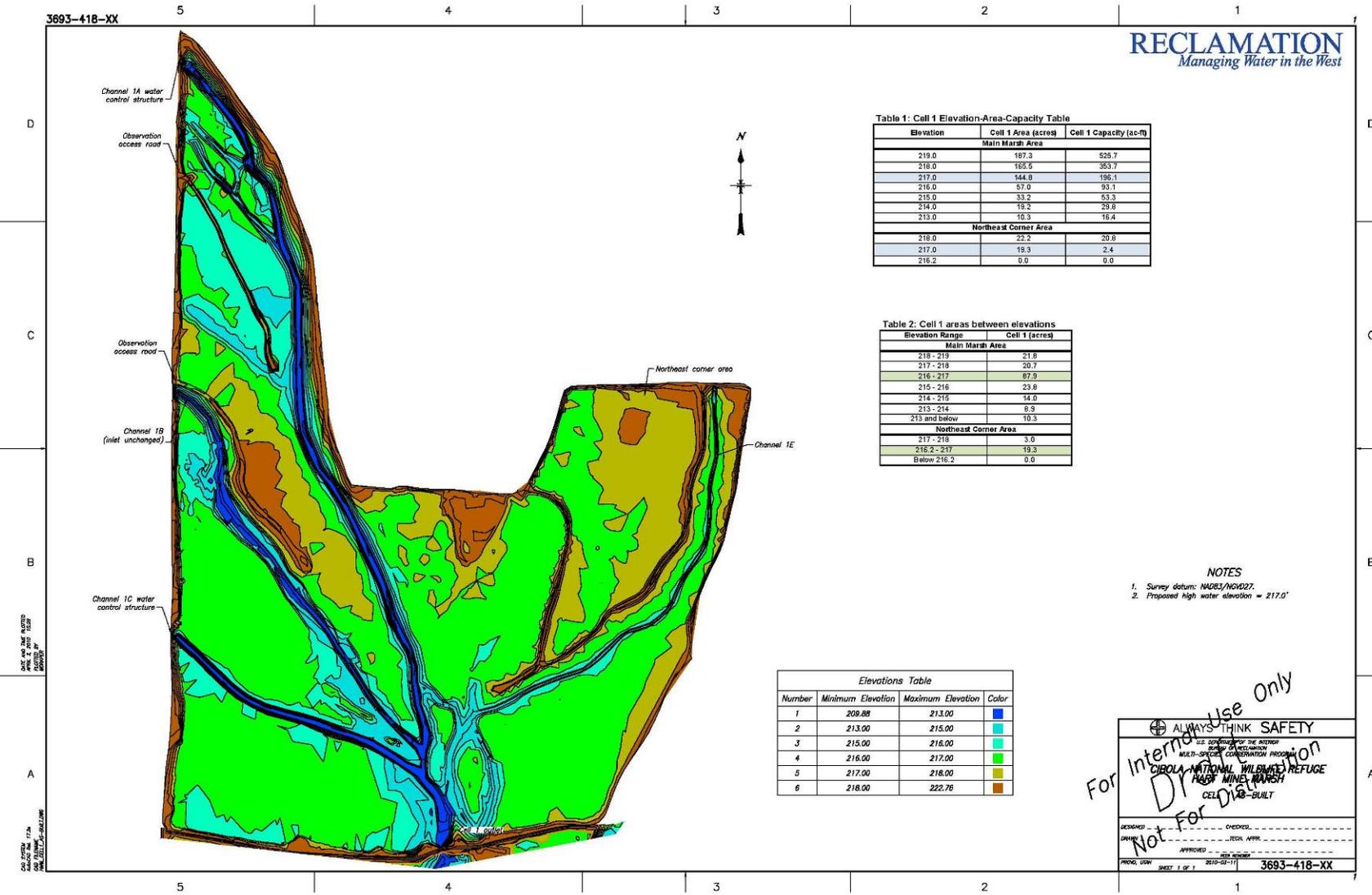
Figure 8. Part of cell 1 after the recent controlled burn at HMM in June 2009.



2.1.2 Construction, Phase 2

Cell 1 was constructed from October 1, 2009 through March 1, 2010. This included the removal of primarily saltcedar and other vegetation from the design footprint of the phase. The controlled burn that was conducted in the summer by USFWS prior to this construction phase facilitated grubbing and clearing. Construction crews were able to clear over 200 acres. During this clearing effort, the construction crews were able to leave a number of standing dead trees to serve as roosting sites for birds. Similar to the procedures in the construction of cell 2, channels were excavated and cleared areas were contoured. Excavated materials were used to construct the confining dikes/perimeter roads for the cell or balanced on site during contouring (Figure 9). Two additional control structures were installed on the Arnett Ditch adjacent to cell 1 to provide an inlet and outlet for the cell. The supply culvert that directs pumped water into the Arnett Ditch was also upgraded to a concrete box culvert to increase its capacity. Cell 1, approximately 163 acres, was filled in early March 2010 (Figure 10). An additional cell of approximately 23 acres, located adjacent to the NE corner of cell 1, was created to be managed by the USFWS and is not part of the HMM conservation area.

Figure 9. HMM cell 1 asbuilt.



RECLAMATION
Managing Water in the West

Table 1: Cell 1 Elevation-Area-Capacity Table

| Elevation | Cell 1 Area (acres) | Cell 1 Capacity (ac-ft) |
|------------------------------|---------------------|-------------------------|
| Main Marsh Area | | |
| 219.0 | 187.3 | 525.7 |
| 218.0 | 185.5 | 353.7 |
| 217.0 | 144.9 | 196.1 |
| 216.0 | 67.0 | 93.1 |
| 215.0 | 33.2 | 63.3 |
| 214.0 | 19.2 | 29.8 |
| 213.0 | 10.3 | 16.4 |
| Northeast Corner Area | | |
| 218.0 | 22.2 | 20.8 |
| 217.0 | 19.3 | 2.4 |
| 216.2 | 0.0 | 0.0 |

Table 2: Cell 1 areas between elevations

| Elevation Range | Cell 1 (acres) |
|------------------------------|----------------|
| Main Marsh Area | |
| 218 - 219 | 21.8 |
| 217 - 218 | 20.7 |
| 216 - 217 | 87.9 |
| 215 - 216 | 23.8 |
| 214 - 215 | 14.9 |
| 213 - 214 | 8.9 |
| 213 and below | 10.3 |
| Northeast Corner Area | |
| 217 - 218 | 3.0 |
| 216.2 - 217 | 19.3 |
| Below 216.2 | 0.0 |

Elevations Table

| Number | Minimum Elevation | Maximum Elevation | Color |
|--------|-------------------|-------------------|--------------|
| 1 | 209.88 | 213.00 | Blue |
| 2 | 213.00 | 215.00 | Cyan |
| 3 | 215.00 | 216.00 | Light Green |
| 4 | 216.00 | 217.00 | Green |
| 5 | 217.00 | 218.00 | Yellow-Green |
| 6 | 218.00 | 222.76 | Brown |

NOTES
1. Survey datum: NAD83/NGVD22.
2. Proposed high water elevation = 217.0'

Use Only
ALWAYS THINK SAFETY
For Internal Use Only
Not For Distribution
DESIGNED: _____ CHECKED: _____
DRAWN: _____ FIELD APPR: _____
APPROVED: _____
3693-418-XX
SHEET 1 OF 1

DATE AND TIME OF SURVEY: APRIL 2, 2010 10:00 AM
PROJECT: HMM CELL 1 AS-BUILT
DRAWN BY: J. J. [unreadable]
CHECKED BY: [unreadable]
APPROVED BY: [unreadable]

Figure 10. Construction of a control structure along the Arnett Ditch for cell 1 at HMM, January, 2010.



2.1.3 Construction, Phase 3

The third construction phase is currently ongoing and is expected to be completed by March 2011. This final construction phase at HMM will include the installation of a “fresh” water inlet (Colorado River water that passes directly into cell 1 of HMM), as well as additional controls structures and control structure upgrades, perimeter access road construction, supplemental marsh planting, and additional clearing of saltcedar from adjacent areas.

Two areas were designated as potential sites for the installation of the fresh water inlet: in the NE corner of cell 1 or in the NW corner of cell 1. One of these locations will be chosen based on topography, projected effectiveness, and overall logistical ease for installation and operation. Control structures for the operation of the new inlet will be installed to connect the irrigation canal from the Unit 2 farming area to cell 1 of HMM. In addition, the control structures between cell 1 and cell 2 and cell 2 and cell 3 will be upgraded with stop log structures. These upgrades will allow greater flexibility in water management by permitting the use of Colorado River water alone, Arnett Ditch water alone, or a combination of these water sources, as necessary. They will also make managing static water levels on site more efficient and effective by providing a set elevation with no gates to operate.

2.2 Habitat Development

Marsh habitat for LCR MSCP covered species can be achieved by providing the appropriate combination of emergent vegetation and water depths. At HMM, the design and construction of cells 1 and 2 sought to meet these requirements by providing a variety of water depths without substantially altering the existing natural geomorphic features. In most cases these features, such as historic river meander scrolls, were incorporated into the design and construction of HMM. The vegetation aspect of this habitat requirement is being achieved through the establishment of native emergent vegetation. This establishment occurs in two ways: through planting desired vegetation species, and by natural occupation and colonization of native emergent plant species. Both of these methods are being employed at HMM. Additional transitional and upland plant species are also being used within the boundaries of HMM to stabilize the ground surrounding the marsh cells, inhibit establishment of other invasive species, and to provide a more diverse habitat mosaic to the conservation area.

2.2.1 Planting, Phase 1

No marsh species were planted in cell 2 as part of phase 1. Difficulties with the procurement of native emergent species delayed the acquisition of these plant materials. During this delay, natural establishment and spread of cattails was observed in the northwest corner of cell 2. Marsh planting was postponed in cell 2 to assess the amount of colonization of cattails to better quantify the need and extent of supplemental planting for cell 2 in subsequent years. Marsh transitional and upland planting did, however, occur on cell 2 in May 2009. Approximately 150 honey mesquite (*Prosopis glandulosa*) trees were planted in the upland areas on the slopes of the dikes surrounding cell 2 and approximately 249,500 saltgrass (*Distichlis spicata*) plugs were planted along the wetted edge of cell 2 at the approximate elevation of 216.5 feet. In addition, a native seed mix of salt-tolerant upland plants was spread along the slope of the dikes surrounding cell 2.

Survival of the honey mesquite trees was poor; only four survived through the first summer. This high mortality was attributed to highly saline soils and an inadequate watering regime. The saltgrass survival was considerably better; however, there was observed mortality in a number of areas. This variability in survival was again attributed to localized high soil salinity. Of the variety of species in the salt-tolerant seed mix, only quail bush (*Atriplex lentiformis*) became established. Establishment was patchy across the areas where it was spread. Drought conditions and high soils salinities may have influenced species-specific establishment and may also explain the patchy distributions of the quail bush.

2.2.2 Planting, Phase 2

After the completion of cell 1 construction, emergent and marsh transitional vegetation species were planted. Table 1 contains the species and number of individual containers that were planted in March 2010. The species were chosen based on their USDA native plant status, for their relatively high tolerance to saline conditions, for their diversity in structure, and for their adaptation to different water depths.

Table 1. Species, common name, and number of containers of plants ordered for cell 1 of HMM for planting in March 2010.

| <i>Species</i> | <i>Common Name</i> | <i>Number of Plants</i> |
|------------------------------------|----------------------|-------------------------|
| <i>Schoenoplectus californicus</i> | California bulrush | 35,200 |
| <i>Scirpus tabernaemontani</i> | Great bulrush | 4,800 |
| <i>Scirpus olneyi</i> | Three-square bulrush | 65,000 |
| <i>Eleocharis palustris</i> | Common spikerush | 20,000 |
| <i>Distichlis spicata</i> | Inland saltgrass | 575,000 |
| <i>Atriplex lentiformis</i> | Quail bush | 1,500 |
| <i>Prosopis glandulosa</i> | Honey mesquite | 200 |
| Total | | 701,700 |

Cell 1 was drawn down approximately 2 feet, 10 days prior to planting to enable crews to access areas that would have the proper range of water depths for the selected marsh plants. The emergent marsh species were planted on the eastern side of cell 1 (Figure 11).

This area was selected due to the relative ease of access for planting, because natural cattail establishment was relatively sparse, and to provide proper water depths available for each of the marsh species: shallow water for short emergent species verses deeper water areas for tall emergent species. Saltgrass plugs were planted along the high water mark (217 feet) in dense clumps along the margin of the marsh, until the supply was exhausted (figure 12). Immediately after planting was completed water in cell 1 was returned to approximately elevation 217 feet.

Overall, the establishment of marsh plants and saltgrass was successful. Mortality estimates were not attempted due to the rapid growth and expansion (localized vegetative reproduction) of these species (figures 13 and 14). The emergent marsh species appeared to exhibit excellent growth and vigor except for the common spikerush. Common spikerush exhibited signs of decline almost immediately and none of the plants were observed by the end of summer. We assumed 100% mortality, which we attributed to incompatible local environmental conditions for this species: high salinity levels, high water temperatures, improper water depths, or some combination of these factors. Saltgrass establishment and survival overall was improved from what was observed from planting in cell 2; however, there were still some discreet areas of poor survival. Although changes were made to the watering regime from the previous year, quail bush and honey mesquite had relatively poor survival.

Figure 11. Hart Mine Marsh Planting asbuilt showing the location, species, and number planted at HMM in 2010.

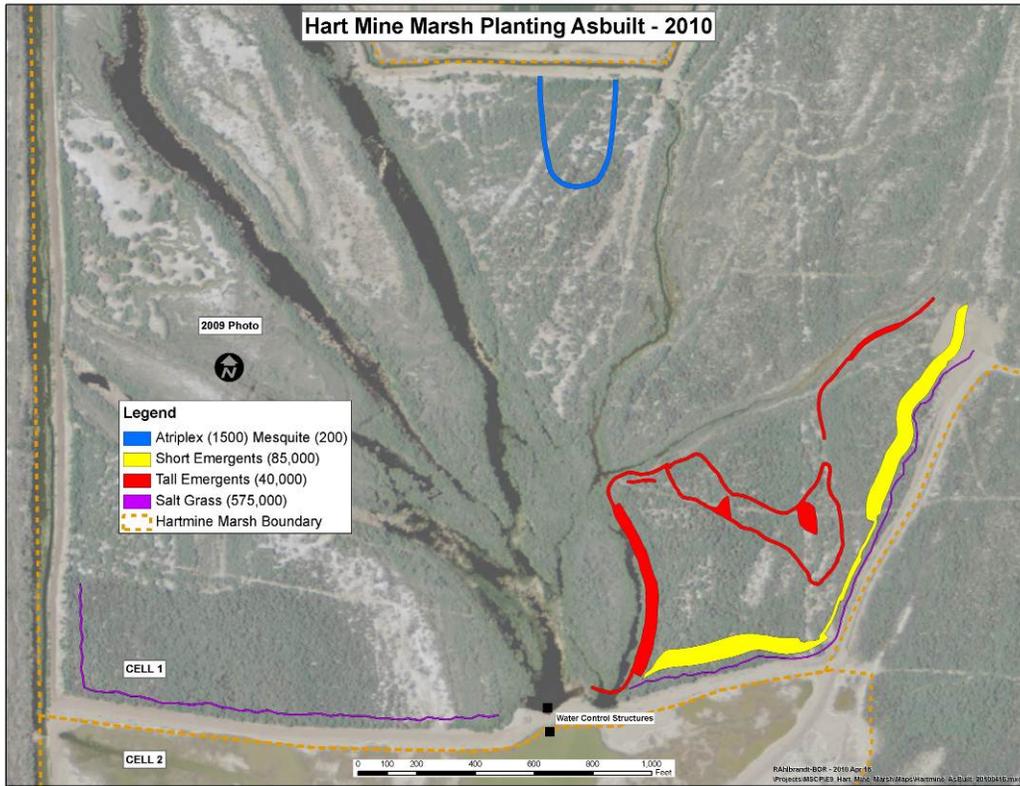


Figure 12. Saltgrass being hand planted around cell 1 at HMM in March 2010. Recent planted marsh species are also present in the background.



Figure 13. Photo point 9: planted saltgrass (foreground) and marsh species (background), June 2010.



Figure 14. Photo point 9: planted saltgrass (foreground) and marsh species (background), September 2010.



2.2.3 Planting Phase 3

As part of an effort to increase vegetation species diversity at HMM, supplemental planting is planned for Phase 3 in FY11. This will include additional three-square bulrush planting in shallow areas on the north side of cell 1. Saltgrass plugs will be planted along the north side of cell 1 at elevation 217 feet in an attempt to vegetate the margin of the marsh cell. Additionally, three-square bulrush, great bulrush, and California bulrush will be planted on the eastern side of cell 2 (Table 2).

Table 2. Species, common name, and number of containers of plants ordered for cells 1 and 2 of HMM for planting in February 2011.

| <i>Species</i> | <i>Common Name</i> | <i>Number of Plants</i> |
|------------------------------------|----------------------|-------------------------|
| <i>Schoenoplectus californicus</i> | California bulrush | 10,000 |
| <i>Scirpus tabernaemontani</i> | Great bulrush | 10,000 |
| <i>Scirpus olneyi</i> | Three-square bulrush | 30,000 |
| <i>Distichlis spicata</i> | Inland saltgrass | 70,000 |
| Total | | 120,000 |

In addition, alkali sacaton (*Sporobolus airoides*) seed will be spread in some of the adjacent upland areas around the marsh for ground stabilization and to add to the native vegetation mosaic of the site. In subsequent years, additional marsh and upland plant species may be established within and adjacent to both cells 1 and 2 to fill in non-vegetated areas, stabilize ground, inhibit invasion of nonnative species, and to promote vegetation diversity, as necessary.

2.3 Operation and Management

Operation and management of the conservation area primarily relates to the control, manipulation, and management of water on the site. Cells 1 and 2 can be operated independently in terms of surface elevations and inlets and outlets. This is accomplished through a series of gated and/or stop log-type control structures located on the Arnett Ditch and between the cells. HMM can be supplied with water from the Arnett Ditch by checking up water at a series of control structures and routing this water source through the marsh cells using gravity flow. Currently, this source of water in the Arnett Ditch can also be supplemented with Colorado River water by using the Unit 2 pumps and infrastructure. After the completion of Phase 3, Colorado River water, unmixed with drain water from the Arnett Ditch, will be supplied to HMM using the Unit 2 delivery canals. The outlet works for the HMM conservation areas also allows flexibility in where the water exiting the marsh and Arnett Ditch can be discharged. Water draining from the marsh and Arnett Ditch can be routed through Cibola Lake or directly back to the Colorado River through a pair of gated control structures located along the Arnett Ditch south of the HMM conservation area.

Because one of the targeted species for the conservation area is the Yuma Clapper Rail (YCLR), water elevations will be strictly controlled in cells 1 and 2. Elevations will be managed in a static condition prior to and during the breeding season for this species. These water surface elevations will be held relatively constant from about March 1 through August 31. The projected managed elevations are 217 feet and 216.5 feet (NGVD27) for cells 1 and 2, respectively.

During the construction of phases 1 and 2, and presumably though Phase 3, water levels in the cells had to be manipulated to allow for construction and planting activities. Typically, this meant completely dewatering the cell being worked on (lowered to approximately 213 feet) or lowering the cell approximately two feet temporarily to allow equipment and crews to plant native vegetation. These actions may be needed in the future for additional planting or maintenance activities, but would occur outside the YCLR breeding season.

Other water management may include the dewatering and flushing (refilling with Colorado River water) of cells 1 and 2. This would also occur outside of the breeding season for YCLR. This would likely be conducted for one cell at a time, to allow some flooded habitats to remain for YCLR and other species during this management activity. Long-term management activities may also include the removal of decadent emergent vegetation to improve habitats for YCLR. This is also expected to be conducted one cell

at a time, with a longer interval between vegetation removal at each cell to maintain usable emergent marsh habitats. Vegetation removal may be accomplished through controlled burning or by mechanical means. This management action is expected to be driven and supported by data from monitoring activities and prescribed using the adaptive management process of the LCR MSCP.

2.4 General Site Maintenance

The majority of maintenance on the site is expected to be controlling invasive and nonnative species invasion. Currently, the majority of this work is being performed through contracted services. This has been accomplished by frequent site visits to assess the occupation and spread of weedy species followed by control actions, if necessary. Control is performed using crews that employ hand pulling of weeds, using mechanical removal techniques, and through limited herbicide treatments, when appropriate. The area that this contract covers includes the perimeter of the entire marsh complex from wetted edge of the marsh to the tops of the perimeter road surrounding the marsh. The refuge is responsible for the adjacent areas outside the HMM conservation area and for the islands present within the marsh.

Other site maintenance includes the upkeep of access roads and the water delivery infrastructure. Access roads specific to the HMM conservation area will be maintained by the LCR MSCP. To provide water for HMM using a source other than the Arnett Ditch (drain water), the conservation area relies on the water conveyance infrastructure associated with the refuge's Unit 2 management area. This infrastructure includes two electric pumps and a series of buried pipe and concrete-lined supply canals. It is shared by the refuge, contract farmers, adjacent private landowners, and now HMM. Currently, the LCR MSCP shares the electrical costs from pumping water through this infrastructure and would also share in the cost of maintenance and repair to the system as is provided for in the existing Land Use Agreement.

2.5 Fire Management

The Fish and Wildlife Service (who is the cooperating land management agency) will provide an appropriate management response on all wildfires that occur within the Cibola NWR. The full range of suppression strategies is available to managers provided that selected options do not compromise firefighter and public safety, cost-effectiveness, benefits, and values to be protected. The USFWS is developing a fire management plan for all the refuges located on the Lower Colorado River. The plan is expected to be released in 2009. The plan will contain detailed information about all elements of wildland fire management within each refuge.

Federal and state agencies in Arizona have entered into Wildland Fire Management Joint Powers Master Agreements, whereby they agreed to work cooperatively to improve efficiency by facilitating the coordination and exchange of personnel, equipment, supplies, services, and funds among the agencies for management of wildland fires, presidential declared emergencies and disasters, or other emergencies under the Federal

Emergency Management Agency's authority. The state of Arizona also has agreements in place with the federal agencies.

2.6 Law Enforcement

Law enforcement regulations are administered on Cibola National Wildlife Refuge through the USFWS. USFWS special agents and refuge officers have existing authority to enforce federal and state regulations on refuge lands. Refuge officers have proprietary jurisdiction on refuges in Arizona. In addition, local law enforcement agreements are in place with BLM, NPS, and Reclamation.

2.7 Public Use

Public use on HMM will be administered by the CNWR, but will be compatible with the goals of the LCR MSCP as defined in the LUA. For 2010, duck hunting is permitted at HMM from 10 am to 3 pm during the Arizona state waterfowl season. Other low-impact public use such as wildlife watching, sport fishing, and education/outreach is expected at HMM. However, these uses may be regulated depending on future occupation of listed species.

3.0 Monitoring

3.1 Abiotic Monitoring

Extensive preconstruction abiotic baseline site conditions were recorded by the USFWS and presented in the *Hart Mine Marsh - Existing Conditions Report* (Hautzinger et. al 2007). The USFWS will continue to be responsible for monitoring and reporting on many abiotic parameters of the site. This work is covered by an interagency agreement with Reclamation and is effective through FY13. Water quality parameters including water temperature, pH, dissolved oxygen, and specific conductivity (as a measurement of total salinity) will be measured beginning in spring 2011. Accumulation of selenium in HMM and soil data will also be tracked by the USFWS, as necessary. The USFWS will also continue to record hydrologic information through a series of monitoring wells established on the site prior to construction activities. In addition, the USFWS will record and track water use on the site.

3.2 Biotic Monitoring

No habitat monitoring was conducted in FY10 due to ongoing construction activities. Beginning in FY11, habitat monitoring will be conducted that will include such parameters as percent marsh and percent open water, and vegetation species composition and density. USFWS biologists did conduct two marsh bird surveys in the vicinity of HMM on March 24 and April 27. Four survey points were within the area of HMM,

though most points also bordered the Arnett Ditch, which contains some marsh habitat. One YCLR and one least bittern were detected at a single point during the April survey. These birds were most likely using habitat within the ditch, and not HMM, as most of the site was still open water near the survey point. In FY11, USFWS will add an additional four survey points that will allow the entire HMM restored area to be monitored with a 200 m or less overlap between points.

4.0 Established Land Cover and Habitat Credit

The process for Habitat Credit has not been finalized. Once the process is finalized, information in this section will be used to establish credit.

5.0 Adaptive Management

5.1 General

Adaptive Management relies on the initial receipt of new information, the analysis of that information, and the incorporation of the new information into the design and/or direction of future project work (LCR MSCP, 2007). The Adaptive Management Program's role is to ensure habitat creation sites are biologically effective and fulfill the conservation measures outlined in the HCP for 26 covered species, and potentially benefit five evaluation species. Post-development monitoring and species research results will be used to adaptively manage habitat creation sites after initial implementation. Once monitoring data are collected and analyzed for HMM, recommendations may be made through the adaptive management process for site improvements in the future.

Literature Cited

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