ATTACHMENT B

November 18, 2005 Biological Analysis for the All-American Canal Lining Project, Potential Species Impacts in the Republic of Mexico

Biological Analysis

All-American Canal Lining Project: Potential Species Impacts in the Republic of Mexico

Prepared by:

U.S. Bureau of Reclamation

November 18, 2005

Summary

This document describes potential, future impacts caused by the All-American Canal (AAC) Lining Project (Project) on species that physically reside in the Republic of Mexico (Mexico) and are listed under the Endangered Species Act in the United States. The AAC Lining Project consists of the construction of a new concrete-lined canal parallel to 23 miles of the earthen AAC. This "Parallel Canal Alternative" was identified as the United States Bureau of Reclamation's (Reclamation's) preferred alternative in the Final Environmental Impact Statement/ Environmental Impact Report and Record of Decision for the Project. Updated parallel canal designs were initiated in 2004, and construction of the Project is scheduled to begin in early 2006.

This report presents an evaluation of the Project's potential, future impacts to Endangered Species Act-listed species occupying habitats in Mexico that may rely on seepage from the AAC. Specifically, the report presents an evaluation of the Project's potential effects on habitats and species in the Andrade Mesa Toe Wetlands (AMTW) area in Mexico. Because Reclamation requires Mexico's permission to collect data within Mexico, this analysis is based on data provided by the government of Mexico, the United States section of the International Boundary and Water Commission, and non-governmental organizations in the United States and Mexico.

Although the contribution of seepage water to the AMTW from the different reaches of AAC is unknown, the AMTW is likely sustained in some part by seepage from the AAC. According to the available information, the AAC Lining Project would likely reduce the water supply to the AMTW. As a result, the Project would likely impact up to 502 acres of marsh habitat, consisting of 58.5 acres of open water, 313.8 acres of cattail/bulrush, and 130 acres of salt grass (acreage based on information from the Sonoran Institute). Reclamation, however, does not estimate that the entire 502-acre area would be impacted because: (1) the AMTW may continue to be supported by other portions of the AAC that will not be lined and will continue to provide seepage water to the area, (2) the unknown effects of adjacent irrigated agriculture and groundwater pumping, and (3) the natural succession resulting from evaporation, siltation, and organic deposition in the marsh habitat of the AMTW is currently contributing to the loss of this habitat type. With the exception of arrowweed and saltcedar, other habitat types and vegetation associations are not expected to be affected to any great degree, if at all. The 164.5 acres of arrowweed and saltcedar in the AMTW may be minimally impacted.

The AAC Lining Project has the potential to impact two species that are listed pursuant to the United States Endangered Species Act: the Yuma clapper rail (*Rallus longirostris yumanensis*) and the southwestern willow flycatcher (*Empidonax traillii extimus*).

The number of Yuma clapper rails potentially impacted would represent a small fraction of the entire United States and Mexico population. For example, when compared to the largest distinct Yuma clapper rail population in Mexico for which data is available, located in the Cienega de Santa Clara, the number of birds potentially affected by the AAC Lining Project would represent less than 3 to 4 percent of the Cienega de Santa Clara population. In addition, Yuma clapper rail is somewhat migratory, capable of significant movements, and can disperse to other habitat areas in the United States and Mexico.

The southwestern willow flycatchers observed in the AMTW were probably using the saltcedar or mesquite proximate to the AMTW marshes during migration, and the saltcedar, and especially the mesquite, may not be substantially impacted by the AAC Lining Project.

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SECTION 1

Background & Scope

1.1 Background

The All-American Canal (AAC) was authorized by the Boulder Canyon Project Act (Public Law 70-642), constructed in the 1930s by the U.S. Bureau of Reclamation (Reclamation), and began delivering water in the 1940s. The AAC conveys over 3 million acre-feet of Colorado River water annually for use in the Imperial Irrigation District (IID) and Coachella Valley Water District service areas. The AAC begins at Imperial Dam, located north of Yuma, Arizona, and generally parallels the United States/Republic of Mexico (Mexico) Border to its terminus in the western Imperial Valley. The general locations of the AAC, adjacent cities, and topographic features are shown on Figure 1. Figure 2 provides recent (June and July, 2005) infrared imagery of the area.

Although lining the AAC has been considered for decades, specific Congressional authorization was lacking until Public Law 100-675 was passed in 1988. Public Law 100-675 authorizes "[t]he Secretary [of the Interior], in order to reduce the seepage" to "construct a new lined canal or to line the previously unlined portions of the All American Canal from the vicinity of Pilot Knob to Drop 4" or to "construct seepage recovery facilities in the vicinity of Pilot Knob to Drop 4." Funding from the California agencies was necessary for the AAC Lining Project (also referred to herein as the "Project") to proceed since Public Law 100-675 precluded the use of Federal funds for conservation of the seepage water.

Reclamation completed a Final Environmental Impact Statement/Environmental Impact Report for the AAC Lining Project in April 1994 (AAC Final EIS/EIR) (Reclamation and IID 1994). This joint document was prepared pursuant to the National Environmental Policy Act of 1969 (NEPA), as amended, the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR § 1500 through 1508), Reclamation's NEPA Handbook, and the California Environmental Quality Act of 1973, as amended. The Record of Decision (ROD) for the Project was signed on July 29, 1994 (Reclamation 1994). The AAC Final EIS/EIR analyzed the environmental impacts of five alternatives; three consisted of lining the AAC, one consisted of the development of a well field to recover seepage, and one was the No Action Alternative.

Potential impacts of the AAC Lining Project to candidate, proposed, and Endangered Species Act (ESA)-listed species in the United States are described in the AAC Final EIS/EIR. In preparation for the Special Status Species analysis section, Reclamation requested and received a Fish and Wildlife Coordination Act (FWCA) Report for the AAC Lining Project in January 1988 and a Final FWCA Report in September 1993 (U.S. Fish and Wildlife Service [Service] 1988 and 1993). This report included a discussion of candidate species. Reclamation prepared and submitted a Biological Assessment which included listed, proposed, and candidate species on September 12, 1989. A Biological/Conference Opinion (BCO), which addressed impacts to species in the United States, was received for the Project's preferred alternative on February 8, 1996 (Service 1996). Reclamation is presently completing the conference opinion requirements.

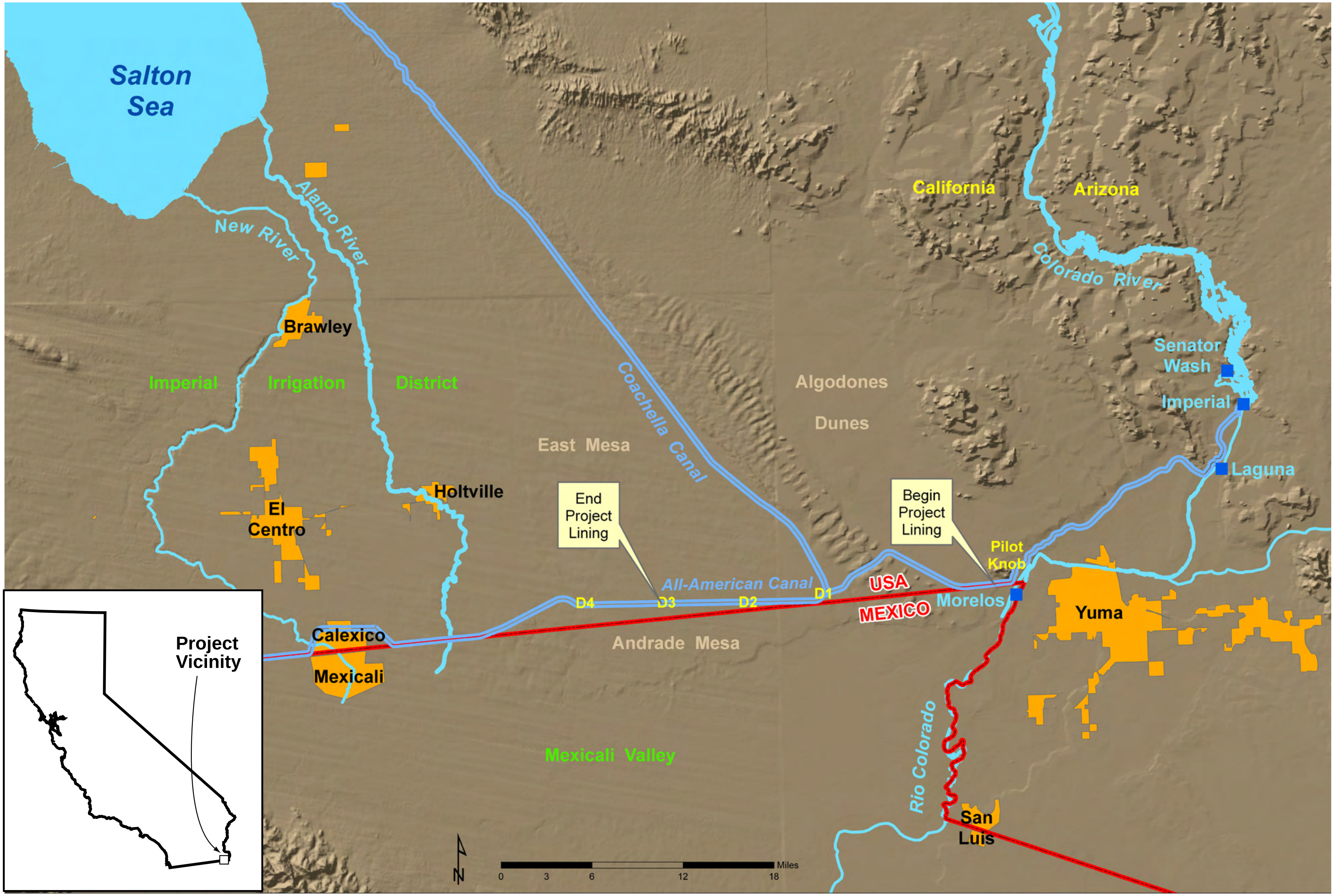

FIGURE 1
General Location of the All-American Canal

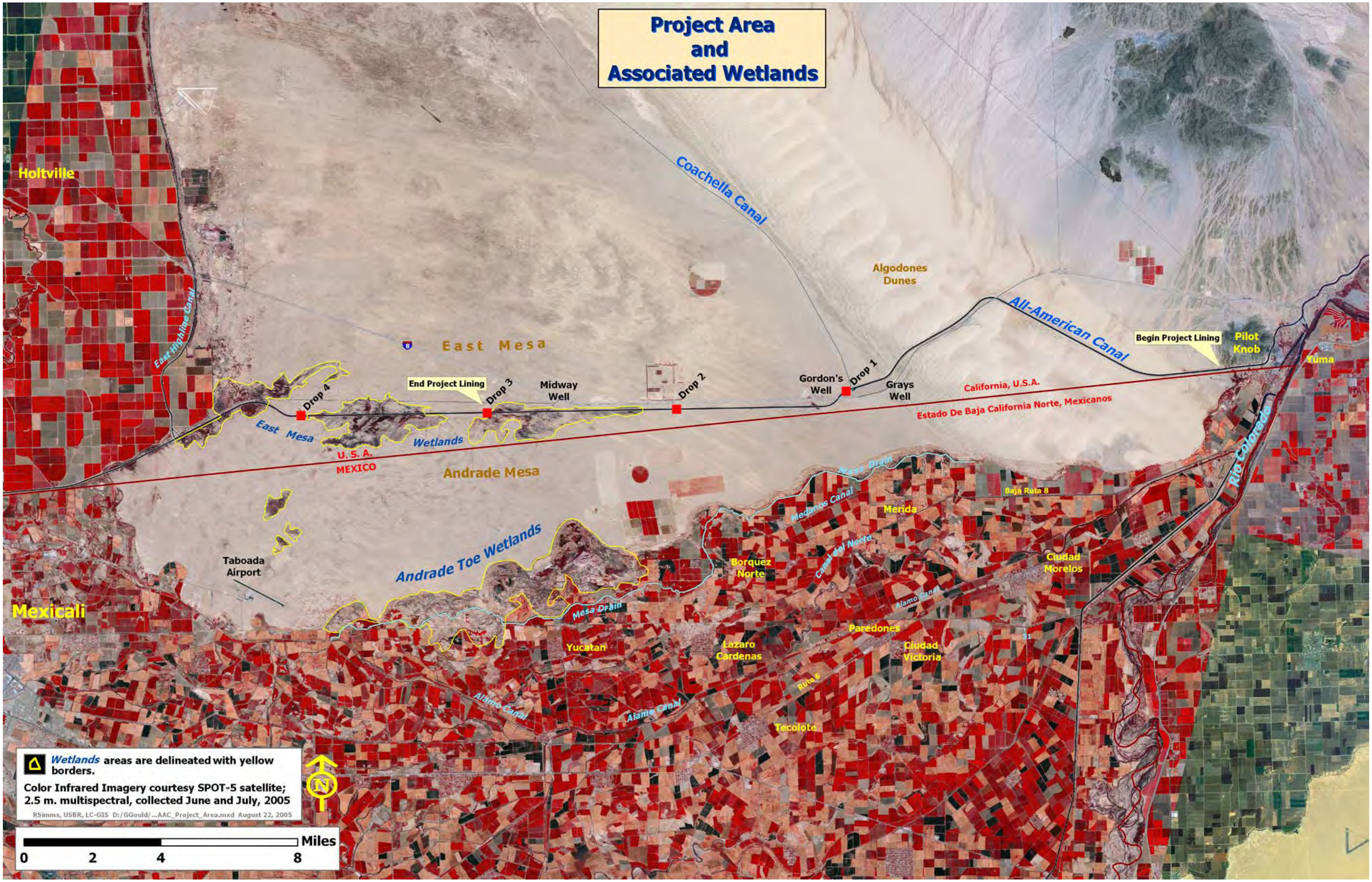

FIGURE 2
Recent (June/July 2005) Infrared Imagery of the Project Area

Although the AAC Final EIS/EIR was completed in 1994, non-federal funding for implementation of the Project was unavailable, and agreements on funding sources and the allocation of water conserved by the Project were unresolved. Ultimately, funding for the AAC Lining Project was authorized by the California Legislature, primarily by Senate Bill 654 (Machado) in September 2003, and final designs were initiated in 2004. Construction of the Project is scheduled for early 2006.

1.2 Scope of this Biological Analysis

This report presents an evaluation of the Project's potential effects to ESA-listed species occupying habitats in Mexico that may rely on seepage from the AAC. Specifically, the report presents an evaluation of the Project's potential effects on habitats and species in the Andrade Mesa Toe Wetlands (AMTW) area in Mexico. Recent (June/July 2005) infrared imagery of the AMTW area is provided as Figure 3.

New information has recently come to light that suggests habitat in Mexico may be affected by the AAC Lining Project. Several vegetation communities were identified on the Andrade Mesa and at the toe of the Andrade Mesa. These collectively were referred to by Mexico as the "Andrade Mesa Wetlands." The majority of the habitat designated, however, would not be considered wetland in the United States. Rather, it would be considered desert scrub (creosote bush and scattered honey mesquite) or otherwise upland communities. For the purposes of this report and analysis, only those acres that would be broadly classified as marsh are analyzed. This marsh area is termed the Andrade Mesa Toe Wetlands because they are found at the base of the Andrade Mesa.

Because the lands in question are located within the Republic of Mexico, Reclamation has not carried out an inventory of the occurrence, distribution, and status of United States-listed species that may occur in the area. Rather, this evaluation is based on information recently made available to the United States by the government of Mexico, the United States section of the International Boundary and Water Commission (USIBWC), and non-governmental organizations in the United States and Mexico regarding possible environmental impacts at the AMTW. For example, there are wetlands near the La Mesa Drain that may also rely on seepage from the AAC (see section 3.1). However, this report does not address the La Mesa Drain Wetlands because Reclamation has no information regarding the presence or absence of listed species in these wetlands.

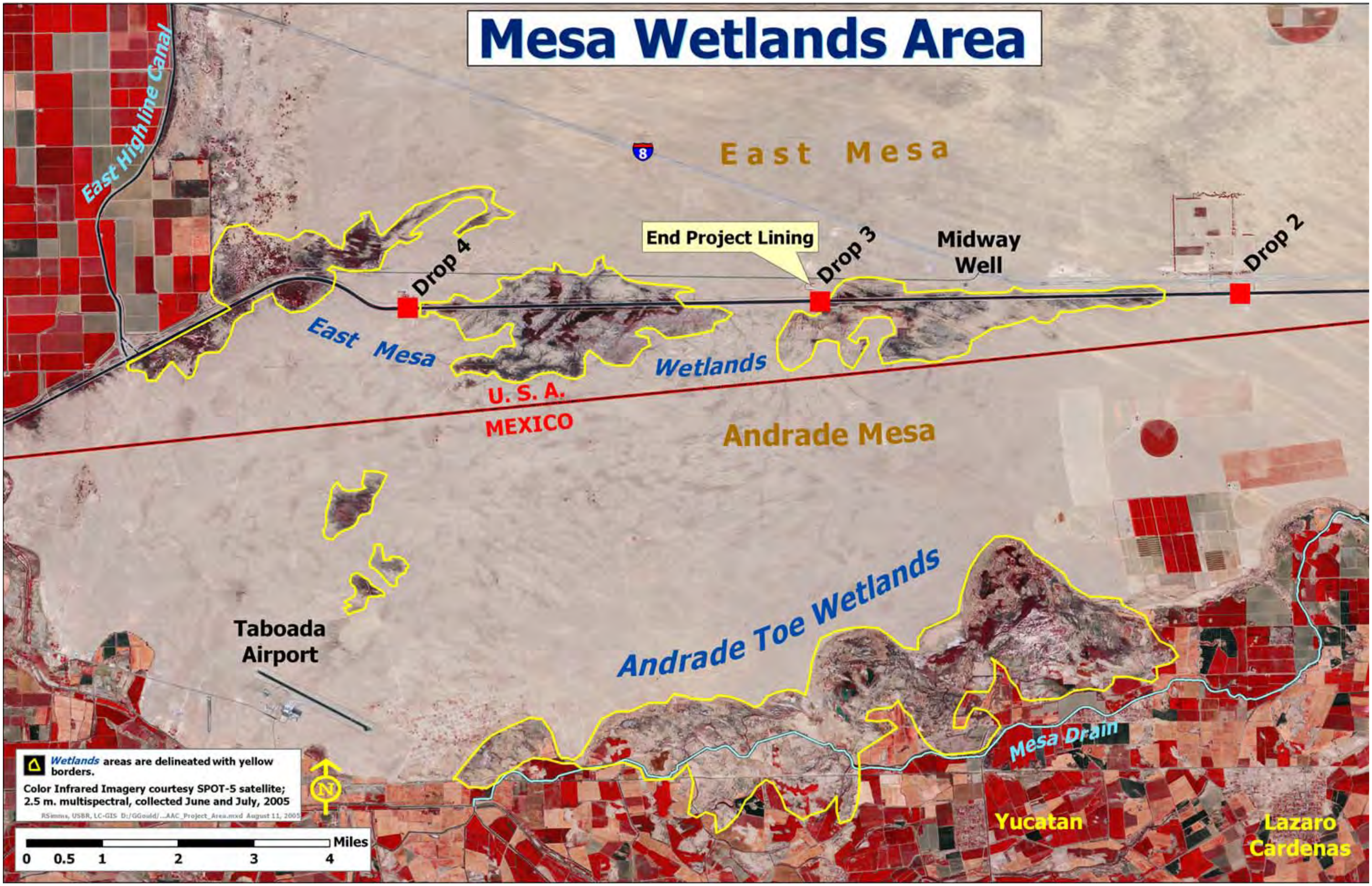

FIGURE 3
Recent (June/July 2005) Infrared Imagery of the Andrade Mesa Toe Wetlands in Mexico

SECTION 2

Project Description

The Parallel Canal Alternative was identified as Reclamation's preferred alternative in the AAC Final EIS/EIR and ROD (Reclamation and IID 1994 and Reclamation 1994). The Parallel Canal Alternative includes the construction of a new concrete-lined canal parallel to 23 miles of the earthen AAC. It would begin approximately one mile downstream from Pilot Knob and end at Drop 3 (see Figures 1 and 2). The Project would occur entirely within Imperial County, California.

The purpose of the AAC Lining Project is to conserve water (approximately 67,000 acre-feet) that is currently lost through seepage along a 23-mile section of the unlined canal. As stated in the AAC Final EIS/EIR, "the conserved water is needed in the Southern California coastal area to offset a projected water shortage of 1.2 million acre feet that is expected by the year 2010" (AAC Final EIS/EIR Summary at S-1).

The AAC Lining Project is a critical component of the California 4.4 Plan, the Quantification Settlement Agreement, the 2003 Colorado River Water Delivery Agreement, and related agreements (Colorado River Board of California 2000, QSA Signatory Agencies 2003, and Secretary of the Interior 2003a and 2003b). The California 4.4 Plan and various agreements are intended to reduce California's use of Colorado River water to its 4.4 million acre-feet apportionment in a normal year. This reduction benefits the entire Colorado River Basin by reducing the long-term overuse of Colorado River water by California. This, in time, should reduce the future risk of shortages on the Colorado River, thereby benefiting Arizona, Nevada, and Mexico (Mexico shares proportionately in shortages pursuant to the 1944 Water Treaty).

SECTION 3

Groundwater Considerations Related to the AAC Lining Project

3.1 Groundwater Flow

Seepage from the AAC flows away from the canal to the north and south. Figure 4 (from the AAC Final EIS/EIR Geohydrology Appendix) shows groundwater elevation in 1982 (flow is normal to the contours). Most of the seepage from the proposed lined reach flows into Mexico because the aquifer is much more transmissive toward Mexico and the gradient is steeper. Figure 5 shows groundwater elevations in 1939 before delivery of water in the AAC.

3.1.1 Wetlands in Mexico near the All-American Canal

Wetlands that appear to be fully or partially supported by seepage from the AAC in Mexico are listed below and are shown on Figure 3.

- **Mexicali Airport Wetlands—**The Mexicali Airport Wetlands are the two relatively small and isolated wetlands north of the Mexicali Airport.
- **Andrade Mesa Toe Wetlands—**The AMTW are north and northwest of the Mexicali Valley town of Yucatan. The AMTW appear to be slightly higher in elevation than the Mexicali Valley. These wetlands are also called the Andrade Mesa Wetlands.
- **La Mesa Drain Wetlands—**The La Mesa Drain Wetlands are the wetlands near and adjacent to the La Mesa Drain along the toe of the mesa.

The wetlands listed above are believed to be fully or partially supported by AAC seepage because they are not believed to have existed before the AAC was constructed. Aerial photos from 1937 do not show wetlands at the Mexicali Airport location. Wetlands likely did not exist along the mesa toe (now the La Mesa Drain alignment) because water was 3 to 4 meters below the ground surface in 1939 (USIBWC 1950).

3.1.2 All-American Canal Lining Affects

The Mexicali Airport wetlands are not expected to be affected by the Project because the AAC west of Drop 3 will remain unlined and seepage will continue.

The wetlands that would likely be affected by AAC Lining Project include the La Mesa Drain Wetlands and the AMTW. Open water in wetlands along the mesa toe reach of the La Mesa Drain would disappear as the post lining water table drops below pre-AAC levels. Groundwater pumping in Mexicali Valley would cause the water table below the mesa toe reach of the drain to drop below pre-AAC levels. The extent of the effect of the lining on the AMTW is uncertain because they are about the same distance from the lined and unlined AAC reaches and seepage from the unlined reach will continue.

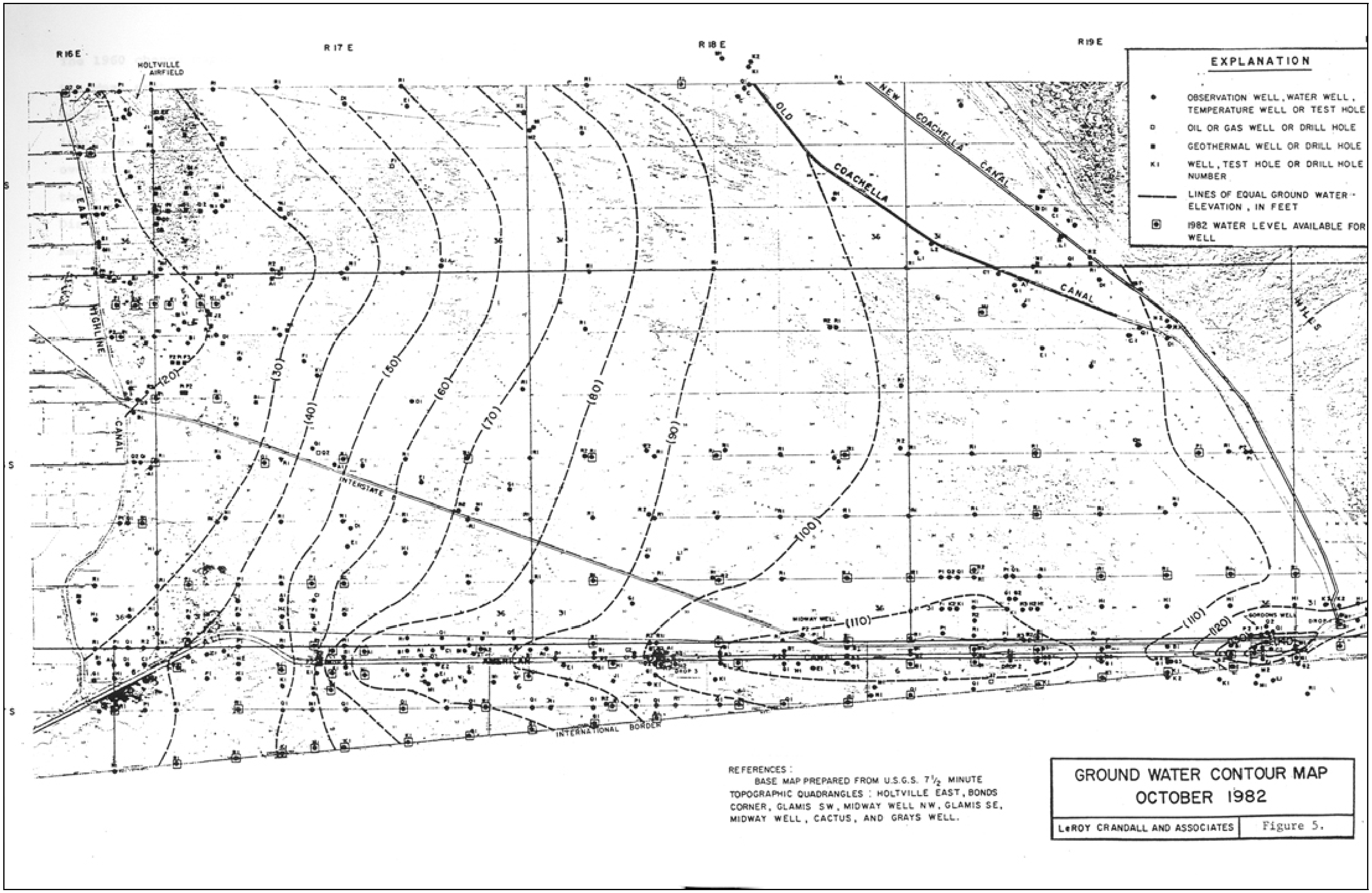

FIGURE 4
Groundwater Elevations in 1982

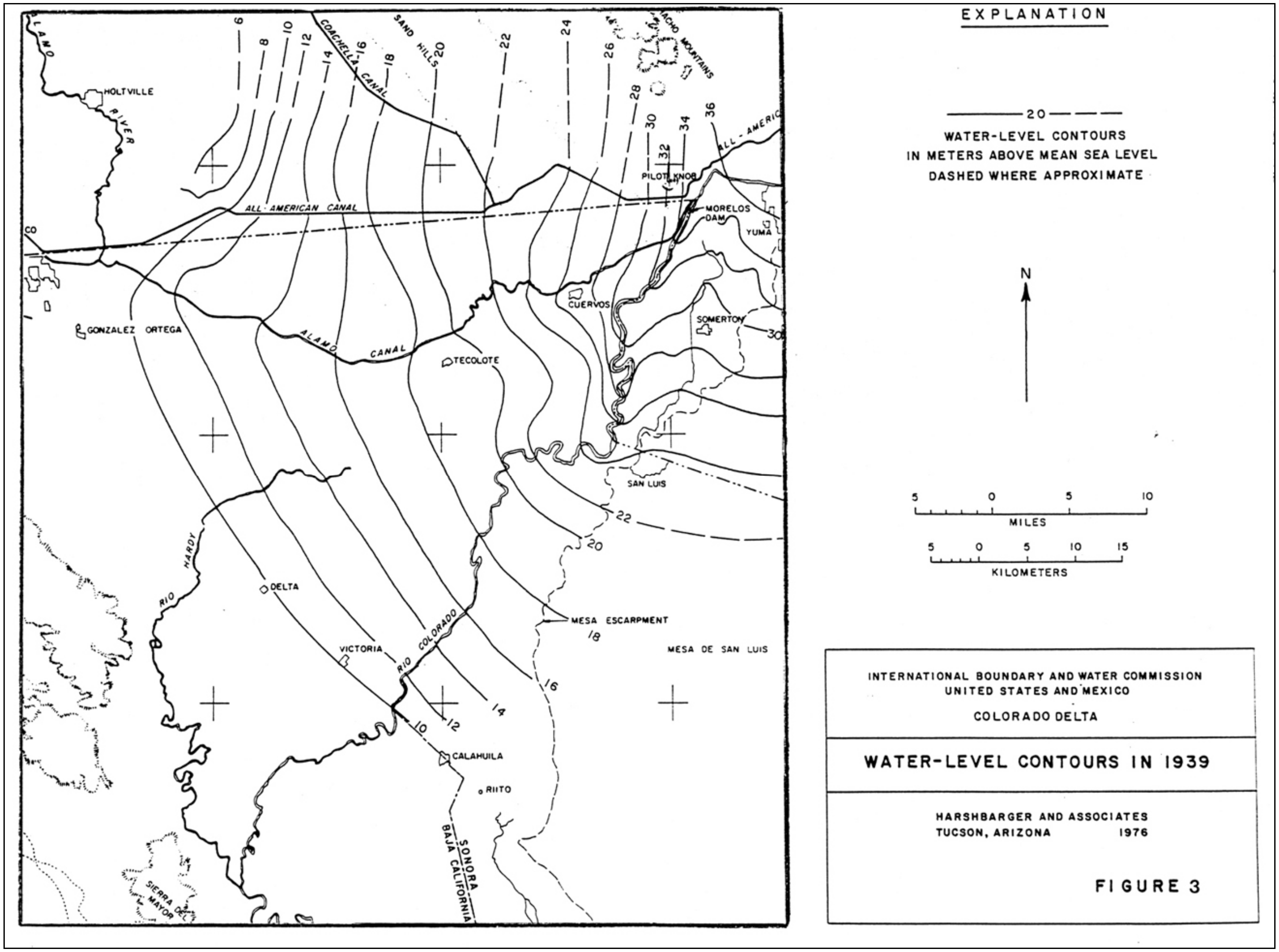

FIGURE 5
Groundwater Elevations in 1939

3.1.2.1 La Mesa Drain Wetlands

Mexico estimates that one half of La Mesa Drain flow is from AAC seepage and the other half is Mexicali Valley irrigation returns (Comisión Nacional del Agua 1991). Most of the apparent AAC seepage inflow to the drain occurs along the eastern reach of the drain where the drain is located along the toe of the mesa. This reach is closest to the AAC. A seepage study by the USIBWC (1950) also indicates that the eastern reach of the drain is most influenced by AAC seepage because this reach shows the largest post AAC water table rise along the mesa toe.

Open water wetlands near the La Mesa Drain reach along the mesa toe are likely to dry out as the post lining water table drops. Groundwater along the La Mesa Drain would be expected to return to pre-AAC levels if AAC seepage was the only major influence on groundwater. Based on the 1950 USIBWC Seepage Study drawing, the pre-AAC depths to water along the mesa toe were 3 to 4 meters. However, about 700,000 acre-feet of groundwater is pumped per year in eastern Mexicali Valley, and that large annual withdrawal would cause the water table to drop far below the pre-AAC water table levels. Groundwater modeling by Mexico suggests that ten years after lining the AAC the depth to the water table would drop 5 to 10 meters.

3.1.2.2 Andrade Mesa Toe Wetlands

The affect of lining the AAC on the AMTW is uncertain for two reasons. First, as a group they are approximately equidistant from the proposed lined reach and the reach which will not be lined. The remaining unlined reach will continue to contribute seepage to the AMTW. However, the degree to which seepage from the unlined reach sustains the marsh is unknown. Second, some of the AMTW are near and adjacent to fields, and irrigation water not used by crops may have more influence on these wetlands because it is much closer than seepage from the AAC.

Seepage from the unlined AAC west of Drop 3 is expected to still flow toward the AMTW after lining. However, the post lining average groundwater elevation at the AAC, which drives the seepage water, would be reduced. This in turn would likely cause the water level to decline in the wetlands most influenced by the seepage. The extent of the water level decline is uncertain.

Existing Seepage Data. Some evidence suggests that portions of the AMTW would remain after lining. An April 1950, USIBWC "Seepage Study" (a large drawing) shows a map with the AAC, the Alamo Canal, and the Sand Mesa (Mesa Arenosa) between Mexicali and the Algodones area. The map has one meter ground elevation contours in the Mexicali Valley but no contours on the mesa[1]. Cross sections were drawn using this seepage study contour map (see Figures 6 through 10)[2]. These cross sections suggest that some of the AMTW

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[1] The seepage study also has an elevation profile of water levels in shallow observation wells installed near the foot of the mesa. In addition, the profile shows the ground elevation along the observation well alignment along with an AAC bottom profile and the AAC design water surface. The profile through the observation wells shows groundwater elevations for January 3, 1939, May 1942, November 18, 1943, and July 1949. The largest groundwater elevation rise after filling the AAC, as expected, was in the eastern part of the profile.

[2] Cross sections of interest were drawn from the AAC below Drop 3 through the apparent location of the Andrade Mesa Toe Wetlands to the observation well alignment. The cross sections show the ground elevation profile south of the mesa

would remain after lining because some of the ground elevations in the wetland area are below the assumed post lining groundwater elevation (see Figures 7 and 8). Where the groundwater table is higher than the ground surface in some areas suggests that wetland areas would persist.

Uncertainties. According to the available information, the AAC Lining Project would affect the AMTW; however, the extent of this effect is uncertain. Reclamation does not have precise water surface elevations or depth information for each wetland, nor does Reclamation have groundwater elevations around these wetlands. Therefore, information on ground flow directions in the area and the relative contribution of groundwater to the AMTW area from surrounding area cannot be determined. The one meter "Seepage Study" contour map (USIBWC 1950) was probably drawn before 1939 and it is not known if this is still an accurate elevation depiction. Recent contour maps to which Reclamation has access are not nearly as detailed as the "Seepage Study" contour map since they have a 10 meter contour interval in the AMTW area. In addition, as discussed in section 5.1.4, other actions such as adjacent irrigated agriculture and groundwater pumping, and the natural succession resulting from evaporation, siltation, and organic deposition in the marsh habitat of the AMTW may be contributing to the loss of this habitat type.

3.1.3 Conclusions

Wetland location relative to the AAC reach to be lined and the reach left unlined generally determines the fate of wetlands in the AAC area after lining. The Mexicali Airport Wetlands near the unlined reach and far from the lined reach would not be affected.

Wetlands at some distance from the AAC but very far from the unlined reach would be affected. The La Mesa Drain Wetlands are in this category. Mexicali Valley groundwater pumping will cause the post lining water table to drop below pre-AAC levels.

The AMTW would be affected by the AAC Lining Project, but the extent of the effect is uncertain because they are about the same distance from the unlined reach and the lined reach. In this case, local details related to the wetlands, such as proximity to irrigated agriculture, will influence the degree of effect. However, as described above in the uncertainties section, Reclamation has limited data to determine localized groundwater flow directions and the relative influence of adjacent agricultural areas.

toe and the assumed post lining groundwater elevation. The assumed groundwater elevation profile is a straight line between the AAC water surface elevation (west of Drop 3) and the pre-AAC groundwater elevation along the observation well alignment.

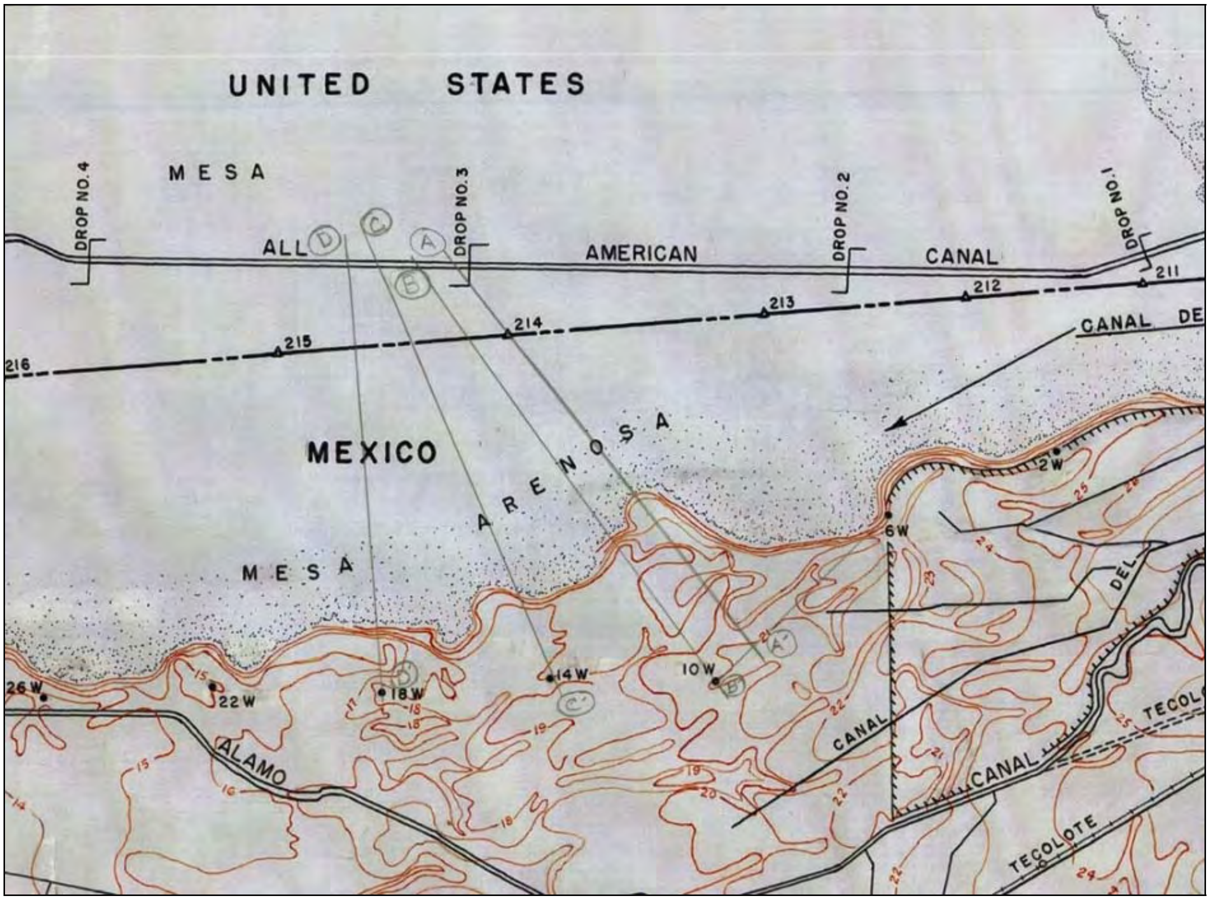

FIGURE 6
Location of Cross Sections shown in Figures 7 through 10

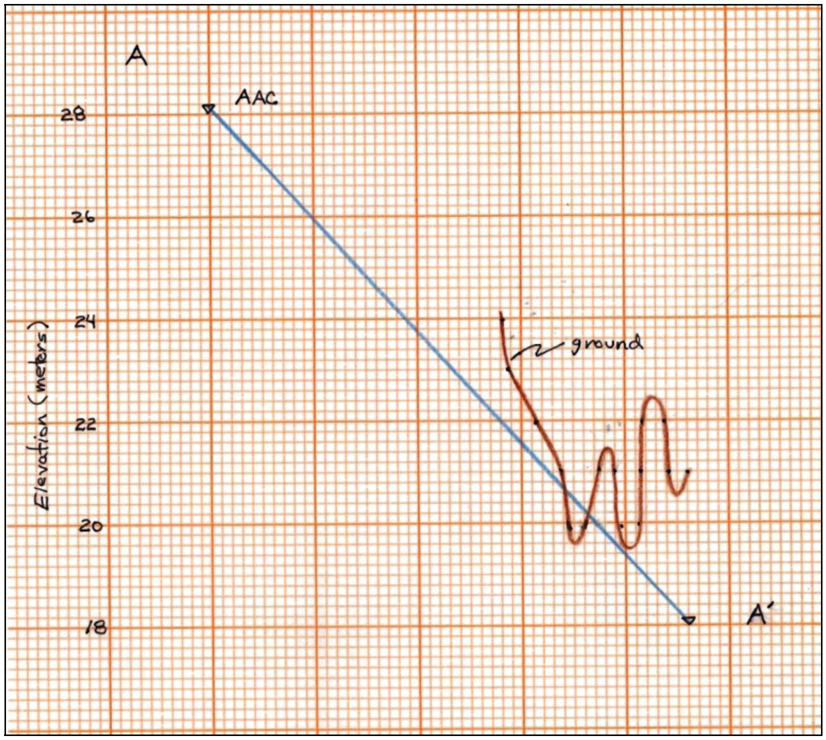

FIGURE 7
Cross Section A to A' shown in Figure 6

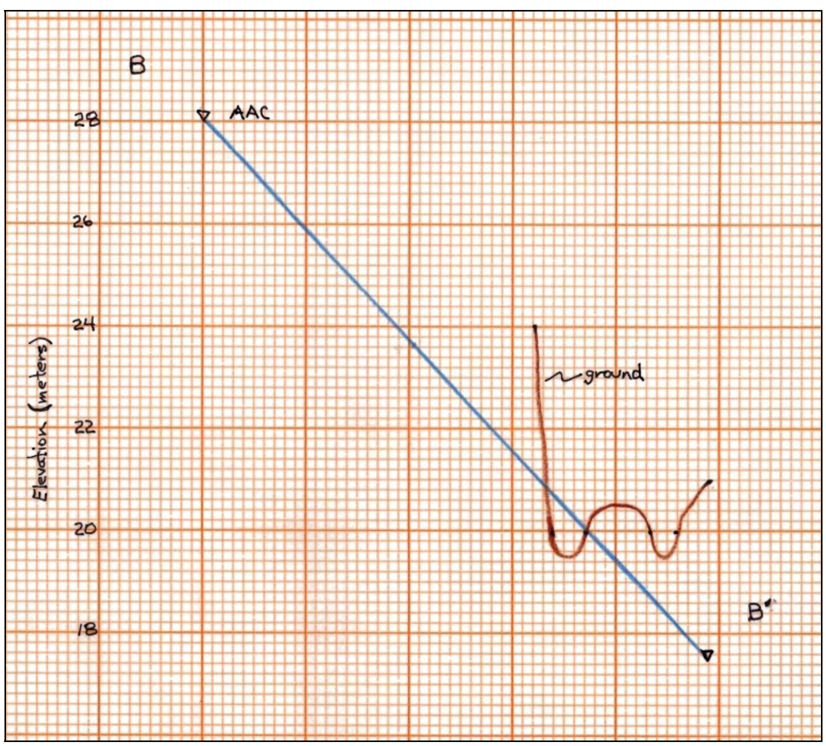

FIGURE 8
Cross Section B to B' shown in Figure 6

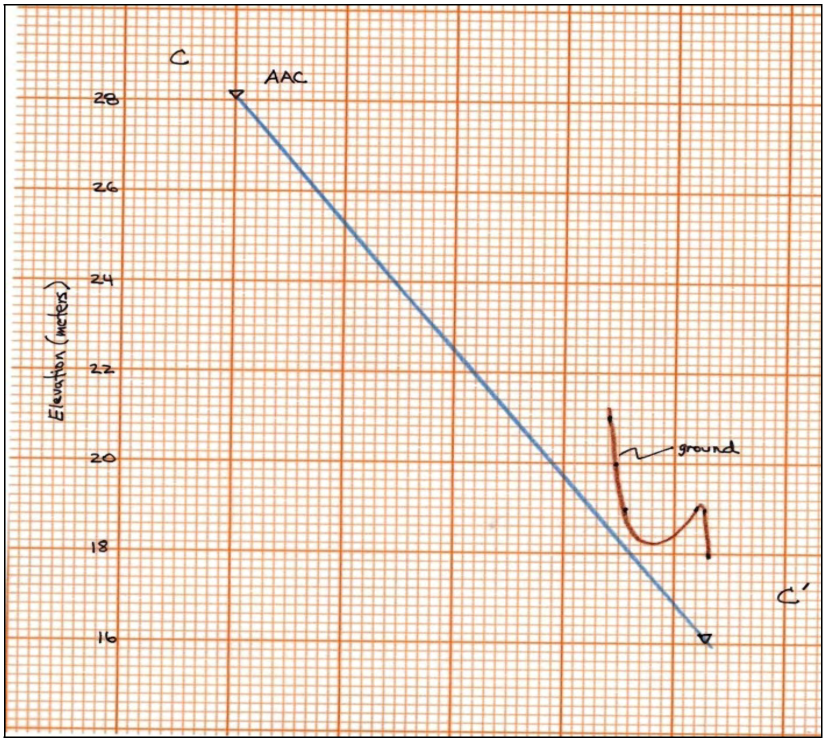

FIGURE 9
Cross Section C to C' shown in Figure 6

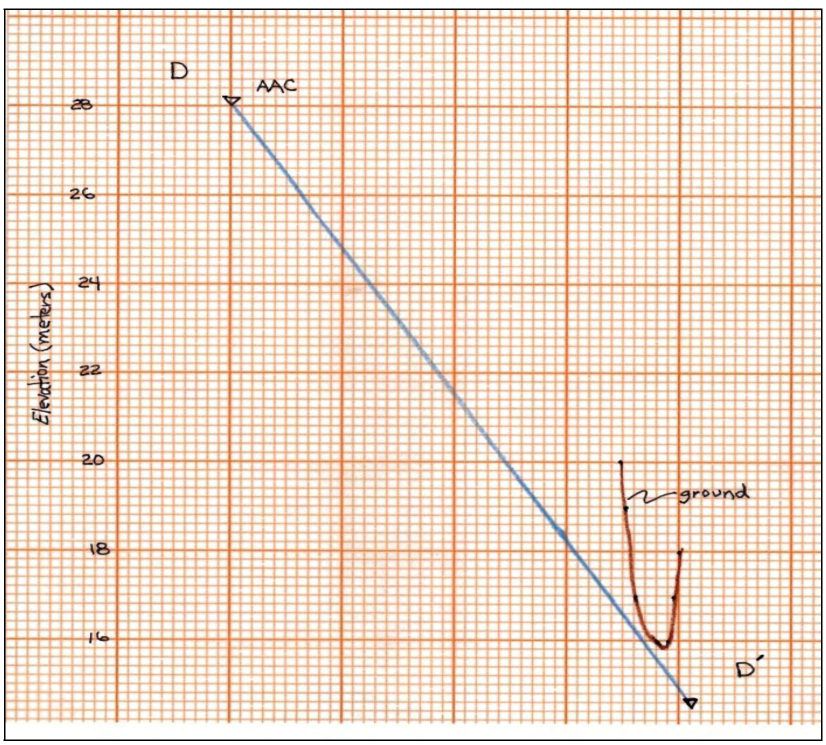

FIGURE 10
Cross Section D to D' shown in Figure 6

3.2 Groundwater Salinity in the Mexicali Valley

3.2.1 Groundwater Salinity

Pumped groundwater supplies an average of about 700,000 acre-feet per year of irrigation water in Mexicali Valley. The groundwater is pumped in the eastern part of Mexicali Valley where the aquifer is thick and mostly sand and gravel. Pumping of large quantities of Mexicali Valley groundwater for irrigation began in the late 1950s. Surface water is also used for irrigation. Nearly 1.5 million acre-feet per year of water is diverted from the Colorado River at Moreles Dam and most of the water is used for irrigation in Mexicali Valley.

Suarez (1989) notes that the impact of irrigated agriculture on groundwater salinization can be divided into three processes: (1) concentration of salts as a result of plant water uptake; (2) movement of salts already in the unsaturated zone down into groundwater as a result of leaching or subsurface mixing of saline water with better quality groundwaters; and (3) intrusion of saline water into high quality groundwaters as a result of groundwater pumping for irrigation. Groundwater salinization in Mexicali Valley is mostly caused by the first process.

Concentration of salts as a result of plant water uptake is unavoidable in that water leaving the root zone is always of higher salinity than rain or irrigation water received at the soil surface. Plants preferentially take up water and leave most of the salts behind in the remaining water. This salinity increase, in the absence of mineral dissolution or precipitation, is equal to the ratio of applied to drained water (Suarez 1989).

Groundwater salinization by pumping groundwater for irrigation is fairly common. For example, Maricopa County in Arizona has experienced 30 to 80 years of groundwater pumping for irrigation. Subsequent percolation of drainage waters has resulted in a 3 to 5-fold increase in salinity in perched zones above the falling water table in several regions of that county. The perched water is transferred to the major aquifers via wells which are perforated in the aquifers and in the perched zones (Suarez 1989). Some other groundwater salinization locations are the San Luis Valley of the Upper Rio Grande (in Colorado) and the Wadi Dhuleil Catchment in Jordan (Suarez 1989).

The salinity of Mexicali Valley groundwater has been increasing at a relatively steady rate. Salinity increases in the groundwater because the dissolved constituents in the groundwater used for irrigation remain in the water that percolates (deep percolation) back to the aquifer after irrigation. Plants generally "take up" only water and leave the dissolved constituents "behind" in the water not used by the plant. Therefore, the salinity of the deep percolation is much higher than the irrigation water because the dissolved constituents are left in much less water. This increased salinity water not consumed by the crop migrates downward to recharge the aquifer. Each repetition of this groundwater irrigation cycle increases the salinity of the aquifer.

Lining the AAC is expected to have a marginal affect on Mexicali Valley groundwater salinity because the practice of irrigating with groundwater significantly recharged by irrigation deep percolation will cause the groundwater salinity to increase with or without lining the AAC. Figure 11, provided by Mexico (April 19, 2005 presentation in Washington D.C. by Mexico), shows what is believed to be an estimate of average Mexicali Valley groundwater salinity 20 years after the AAC is lined. Without the AAC Lining Project the average groundwater salinity after 20 years is estimated to be about 2,330 parts per million (ppm), and with lining the estimate is 2,450 ppm.

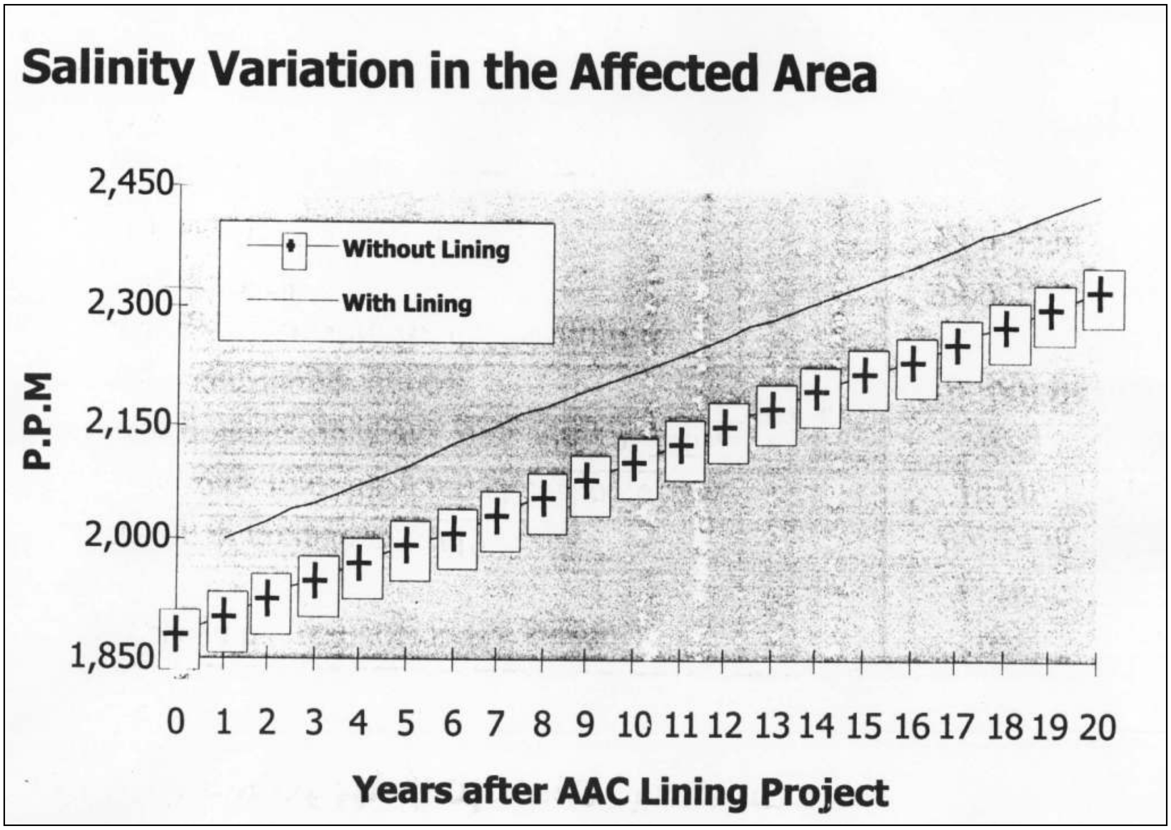

FIGURE 11
Salinity Variation in the Affected Area

3.2.2 Wetland Salinity

The salt concentration (salinity) in the AMTW is probably increasing because there does not appear to be any surface outflow and groundwater through flow is probably small or does not exist. If outflow from the wetlands is primarily by evapotranspiration, the dissolved salts which enter the wetland in the source water are left in the wetland and are concentrated by continuing evapotranspiration.

Once dissolved salts enter a wetland basin they can be concentrated by evaporation and transpiration or removed through surface outflow, groundwater recharge, or both. Wetlands basins that do not lose water to surface outflow, but are groundwater through flow systems, tend, because of low permeability, to be higher in dissolved salts. Wetlands that lose water primarily to the atmosphere by evapotranspiration tend to concentrate salts to high levels (Swanson et al. 1998). The AMTW may have some groundwater flow through but evapotranspiration appears to be the dominate water loss path. As a result wetland salinity would be expected to continuously increase.

SECTION 4

Potentially Affected Environmental Resources

4.1 Potentially Affected Habitats

The first published description of the AMTW was in 2002 (Hinojosa-Huerta 2002). That report stated that the area consists of about 4,747 acres of wetland habitat and about 3,593 acres of terrestrial habitat (Hinojosa-Huerta 2002). Acreages for different habitat types and vegetation associations in the AMTW, as provided by the Hinojosa-Huerta report, are provided in Table 1.

As discussed in section 1.2, the majority of the approximately 4,747 acres of wetland habitat would not typically be considered wetland habitat in the United States. For the purpose of this report, however, both riparian woodland and marsh habitat types are addressed because the Project may impact these habitat types. Desert scrub is not addressed in this report because it is not dependent on high water tables and, therefore, would not be impacted by the Project.

TABLE 1
Habitat in Acres in the Andrade Mesa Toe Wetlands

Habitat Type and Vegetation Associations	Total Acres
Riparian Woodland	
Arrowweed and Saltcedar	164.5
Mesquite and Creosote (10% - 30% cover)	1,482.1
Mesquite and Creosote (30% - 70% cover)	2,575.4
Total Riparian Woodland	**4,222.0**
Marsh	
Open water	58.5
Salt grass	130.0
Cattail	336.9
Total Marsh	**525.4**
Total Wetlands	***4,747.3***[a]
Desert Scrub	
Desert shrub (10% - 30% cover)	2,135.2
Desert shrub (30% - 70% cover)	1,457.6
Total Desert Scrub	**3,592.7**[a]
Total	***8,340.1***[a]

(a) These values was reported in the Sonoran Institute's report; however these values do not add correctly and should be 4,747.4 total wetlands, 3,592.8 total desert scrub, and 8,340.2 total acres.
Source: Arroyo et al. 2005

The following general descriptions of the vegetation associations are based on information provided in the Lower Colorado River Multi-Species Conservation Program Biological Assessment (Lower Colorado River Multi-Species Conservation Program 2004). These descriptions are based on information along the lower Colorado River in the United States and are assumed to be applicable to the AMTW area.

4.1.1 Riparian Woodlands

The AMTW contain approximately 4,222 acres of riparian woodlands, which consist of the arrowweed (*Pluchea* spp.) and saltcedar (*Tamarix* spp.) vegetation association, and the mesquite (*Prosopis* spp.) and creosote (*Larrea tridentate*) (both 10 to 30 percent cover and 30 to 70 percent cover) vegetation association.

4.1.1.1 Arrowweed and Saltcedar

Arrowweed. The arrowweed vegetation association historically formed dense, monotypic, linear belts on drier portions of the Colorado River floodplain, adjacent to stands of cottonwood-willow (*Populus* spp.; *Salix* spp.) (Ohmart et al. 1988). It is currently found along canyon bottoms and irrigation ditches, around springs, and in washes with sandy or gravelly channels (Holland 1986; Brown 1994; Sawyer and Keeler-Wolf 1995).

Arrowweed reproduces both by seed and vegetatively. The seeds (achenes) are tiny (less than 0.04-inch) and have small bristles that facilitate their dispersal (McMinn 1939). Establishment from seed occurs on newly exposed, damp alluvial soils. Once established, arrowweed spreads laterally by underground rhizomes, forming continuous stands that tend to inhibit the establishment of other riparian species and remain dominant in the absence of disturbance. Arrowweed shoots withstand moderate flooding, and although they are unable to withstand strong scouring from floods, they recolonize open alluvial deposits readily by resprouting from roots and buried stems (Stromberg et al. 1991). Arrowweed survives at greater water table depths and tolerates greater soil salinities than Fremont cottonwood (*Populus fremontii*) or Goodding's willow (*Salix gooddingii*) (Ohmart et al. 1988; Busch and Smith 1995). As a result, it has replaced cottonwood-willow vegetation in some areas that are subject to groundwater pumping (Holland 1986). However, arrowweed has been displaced by saltcedar in other areas (Turner and Karpiscak 1980).

Saltcedar. Saltcedar is the common name applied to several nonnative species of shrubs to medium-sized trees of the genus *Tamarix* that have increased in abundance over the last 50 years. The most commonly invasive species are *Tamarix chinensis, T. parviflora,* and *T. ramosissima*. Saltcedar occurs over a wide range of soil conditions found along the lower Colorado River, including areas where lack of flooding and high evaporation allows salts to build up in soils. Saltcedar is also a prolific seeder and, although the seed remains viable for only a few weeks, saltcedar produces seeds over a long period (March through October) relative to native riparian species. The seeds are minute and readily dispersed long distances by wind and water (DeLoach et al. 2000; Lovich 2000). Germination and establishment occur on open sites where soil moisture is high for a prolonged period. Subsequent growth is extremely rapid and tends to preclude the establishment of native riparian species on such sites (Ohmart et al. 1988; Lovich 2000).

Saltcedar has replaced the native woody riparian associations along much of the lower Colorado River, particularly in areas where the native vegetation has been cleared or removed by fire (Brown 1994; Turner and Karpiscak 1980; Ohmart et al. 1988). Saltcedar is able to persist in highly saline soils that are not conducive to the establishment and growth of cottonwood and willow. Saltcedar takes up and excretes salts, increasing soil salinity, and it increases fire frequency by producing large amounts of litter (DeLoach et al. 2000).

Along the lower Colorado River, the saltcedar vegetation association is dominated by nearly monotypic stands of saltcedar that are less than 16 feet tall. Because of its pervasive nature, saltcedar is found interspersed with every other riparian vegetation association.

4.1.1.2 Mesquite and Creosote

Mesquite. Historically, the mesquite vegetation association occurred on the broad alluvial floodplains of the Colorado River on secondary and higher terraces above the main channel. Honey mesquite (*Prosopsis glandulosa* var. *torreyana*), the dominant species in the association, is a facultative upland plant with the potential to occur in both upland and wetland areas (Reed 1988). It is also a facultative phreatophyte[3] that has adapted to avoid water stress through several mechanisms, including a long taproot that is able to reach deep water tables (Nilsen et al. 1983; Ohmart et al. 1988). Riparian honey mesquite has high productivity that results from several physiological and morphological adaptations that allows it to "decouple" from the normal limitations on water and nutrient resources in desert systems (Nilsen et al. 1983). Foremost, a deep root system allows mesquite to tap water sources unavailable to shallower rooted plants, while association with nitrogen-fixing symbionts releases mesquite from nitrogen limitation (Stromberg 1993).

This species cannot tolerate even relatively short inundations during the growing season. Flooding, vegetation clearing, and increased fire frequency (promoted by saltcedar) can eliminate honey mesquite, which does not colonize or reestablish in open areas as readily as saltcedar (Minckley and Brown 1982; Ohmart et at. 1988).

Honey mesquite often forms monotypic stands of trees that are less than 30 feet in height. It can also grow interspersed with or as a mosaic with shrubby species, such as arrowweed, quail bush (*Atriplex lentiformis*), fourwing saltbush (*Atriplex canescens*), allscale (*Atriplex polycarpa*), wolfberry (*Lycium* spp.), and inkweed (*Suaeda torreyana*), among others. Shrub associates are typically found in openings in the canopy and thus do not form a true understory. The canopy can be continuous or open, and the ground layer is typically sparse or grassy.

Creosote. Creosote bush scrub is characterized by widely spaced shrubs approximately 1.6 to 9.8 feet tall, usually with largely bare ground between. This is the basic creosote scrub community of the Colorado Desert, typically occurring on well-drained secondary soils of slopes, fans, and valleys (Holland 1986). Characteristic species include creosote bush (*Larrea tridentata*), burro weed (*Ambrosia dumosa*), brittle brush (*Encelia farinosa*), and ocotillo (*Fouquieria splendens*). Succulents are common in this association, and ephemeral annual herb associates generally bloom during late February and March. Mesquite thickets, an important wildlife habitat component, are also found in creosote bush scrub habitat. Creosote bush scrub occurs along much of the AAC.

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3 A deep-rooted plant that obtains water from a permanent ground supply or from the water table. Phreatophytes are common in riparian habitats.

4.1.2 Marsh

The AMTW contain 525.4 acres of marsh, which consist of open water, cattail (*Typha* spp.), and salt grass (*Distichlis spicata*) vegetation associations. The AMTW marshes are not described in great detail except for avifauna. For example, their precise location, water surface elevations, other nearby water surface elevations, possible other sources of water, and surrounding groundwater elevations are not known.

Cattail. Cattail-dominated vegetation is a common major component of freshwater marsh in the lower Colorado River drainage. Other common components are bulrush (*Schoenoplectus californicus*) or tule and common reed (*Phragmites communis*). Cattails occur in shallow water up to approximately 3 feet in depth. They are generally associated with sloping, stable substrates. Bulrushes (particularly *Schoenoplectus californicus*) can grow adjacent to cattails, but in deeper water. They are found in water as deep as 5 feet, and can extend as high as 10 feet above the water surface. Thick stands of bulrushes occur on unmodified banks in areas along the lower Colorado River. Common reed can also form dense stand along the banks (Ohmart et al. 1988; Brown 1994). Cattail, bulrush, and common reed associations typically intermingle with riparian scrub species (e.g., saltcedar, arrowweed, quail bush, mesquite) at their upper-limits (Brown 1994).

Salt Grass. Salt grass occurs in areas with shallow groundwater and irregular flooding. Salt grass can establish in areas that are permanently saturated and can tolerate alkaline and saline water conditions.

Open Water. The AMTW contain 58.5 acres of open water habitat. The hydrologic characteristics such as maximum, minimum, and average depth of the open water areas are not known.

4.2 Potentially Affected Species

The avifauna of the AMTW were characterized in a report presented to the Mexican National Institute of Ecology by Hinojosa-Huerta et al. in 2004. This report used data collected from 9 site visits from 2002 through 2004. Data collected during these visits included habitat descriptions, bird point counts, bird call response counts, and bird area counts. One hundred species of birds were documented using the AMTW. These were grouped into aquatic birds (43 species), marsh-dependent birds (9 species), desert resident birds (21 species), birds of prey (8 species), neotropical birds (17 species), and exotic birds (2 species). The Yuma clapper rail (*Rallus longirostris yumanensis*) and southwestern willow flycatcher (*Empidonax traillii extimus*) are United States endangered species found in the AMTW, and all of the 100 species found in the AMTW, with the exception of Gambel's quail (*Callipepla gambelii*), Rock dove (pigeon) (*Columba livia*), and common house sparrow (*Passer domesticus*), are listed under the Migratory Bird Treaty Act.

This report focuses on the Yuma clapper rail and southwestern willow flycatcher because these species are listed under the ESA in the United States and rely on the riparian, marsh, and open water habitats that may be impacted by the Project.

4.2.1 Yuma Clapper Rail

4.2.1.1 Species Biology

The Yuma clapper rail, one of seven North American subspecies of clapper rails, occurs primarily along the lower Colorado River in California, Arizona, and Mexico. It is a fairly common summer resident from Topock, Arizona south to Yuma, Arizona in the United States and at the Colorado River delta in Mexico. There are also populations of this subspecies at the Salton Sea in California (Garrett and Dunn 1981) and along the Gila and Salt rivers to Picacho Reservoir and Blue Point in central Arizona (Rosenberg et al. 1991). In recent years, individual clapper rails have also been heard at Laughlin, the Virgin River, and Las Vegas Wash in southern Nevada (Nevada Department of Wildlife 1998; McKernan and Braden 2002).

In the United States, the Yuma clapper rail is associated primarily with freshwater marshes, with the highest densities of this subspecies occurring in mature stands of dense to moderately dense cattails and bulrushes. In Mexico, the subspecies is associated with brackish marshes dominated by dense stands of saltcedar with an understory of iodine bush (*Allenrolfea occidentalis*). The main factors determining the suitability of these vegetation communities as habitat are the annual range in water depth variability and the presence of mats of marsh vegetation. Anderson and Ohmart (1985) found that home ranges of single or paired birds along the lower Colorado River encompassed up to 106 acres, with an average home range of 18.5 acres. Home ranges were found to overlap extensively. Eddleman (1989) reported large seasonal variations in home range sizes.

The Yuma clapper rail begins nesting activities in February. Young hatch in the first week of June and suffer high mortality from predators in their first month of life (Rosenberg et al. 1991). Crayfish (*Procambarus clarkii* and *Orconectes virilis*) are the primary food sources of this subspecies along the lower Colorado River and may be a limiting factor restricting rail occurrence (Ohmart and Tomlinson 1977; Eddleman 1989). Other food items include small fish, isopods, insects, spiders, freshwater shrimp, clams, and seeds (California Department of Fish and Game 1991; Rosenberg et al. 1991; Eddleman and Conway 1998). Rosenberg et al. (1991) noted that relative to other subspecies, the Yuma clapper rail has an increased ability to colonize new habitat because of its partly migratory behavior and the prompt dispersal of juveniles following breeding.

4.2.1.2 Current Condition

There is no accurate estimate of the total population of Yuma clapper rail in either the United States or Mexico. However, the Yuma clapper rail is widely distributed in the Colorado River delta in Mexico, occupying almost all marshlands dominated by cattail. This distribution among marshlands also occurs along the lower Colorado River at least as far north as Laughlin, Nevada. A population estimate is available, however, for the population of Yuma clapper rail in the Cienega de Santa Clara, located in the Colorado River delta in Mexico. The Cienega de Santa Clara likely has the highest concentration of Yuma clapper rail in either the United States or Mexico. The population of Yuma clapper rail in the Cienega de Santa Clara was estimated at 6,629 in 2001 (Hinojosa-Huerta et al. 2001) and approximately 4,000 in 2004 (Hinojosa-Huerta et al. 2004). The current information available for the United States, including the lower Colorado River, is from detection surveys.

Detections are not to be confused with population estimates. Actual detections represent some fraction (40 percent to 60 percent) of the total amount in the survey area. It is unlikely all areas in the United States containing Yuma clapper rail are surveyed in any one year. The number of Yuma clapper rail detected in the United States included 851 in 2003 and 868 in 2004. Detections in the United States in 2005 were 885. Not all areas where Yuma clapper rails were detected in previous years were censused in 2005, so the 885 detections represent a minimum number.

The Yuma clapper rail is listed as endangered under the ESA. The Service is currently conducting a review of the status of the Yuma clapper rail to determine if the species qualifies for delisting. One of the primary criteria for delisting includes a population of 700 to 1,000 breeding birds in the United States. Other criteria include written management plans for the species in areas under State and Federal control, clarification of its wintering and breeding status in Mexico, and surveys for the species and its habitat.

The AMTW contain occupied Yuma clapper rail habitat. A total of 16 individual Yuma clapper rail were counted in a subsection of the marsh in 2004. Based on an extrapolation of this number of individuals to the entire AMTW marsh, a population of 172 individuals was estimated (Hinojosa-Huerta et al. 2004).

4.2.1.3 Critical Habitat

Critical habitat has not been designated for the Yuma clapper rail.

The AMTW is not within the United States, so lands within the AMTW would not be considered for critical habitat designation.

4.2.2 Southwestern Willow Flycatcher

4.2.2.1 Species Biology

The southwestern willow flycatcher is a migratory songbird that breeds in riparian areas along rivers and wetlands between sea level and 7,000 feet elevation in portions of Arizona, California, Colorado, Nevada, New Mexico, and southern Utah. The southwestern willow flycatcher is recognized as one of five subspecies of the willow flycatcher. They are neotropical migrants that were once widespread and locally common throughout the riparian areas in the arid Southwest. The historical breeding distribution included California, southern Nevada, southern Utah, Arizona, New Mexico, and western Texas (Hubbard 1987; Unitt 1987; Browning 1993). However, since the 1800s, the willow flycatcher has experienced extensive population reductions throughout its range (Service 1995; Arizona Game and Fish Department 1997).

Throughout its range, the southwestern willow flycatcher is an insectivorous riparian obligate that breeds in summer along rivers, streams, and other wetlands where dense willow, cottonwood, saltcedar, or other similar structured riparian vegetation occurs (Service 1995 and 2002; Arizona Game and Fish Department 1997). Along the lower Colorado River, southwestern willow flycatchers begin nesting in May and continue through July (McKernan and Braden 2001). They nest in riparian vegetation characterized by low, dense shrubs, such as native willows and nonnative saltcedar, usually with a sparse to dense overstory of Fremont cottonwood or Goodding’s willow; water or moist soil is usually present beneath the canopy (McKernan and Braden 2001). Along the lower Colorado River, saltcedar is a minor to major component in all occupied southwestern willow flycatcher habitat areas except for the Virgin River delta and Lake Mead delta (McKernan and Braden 1998, 1999 and 2001).

Nesting habitat for the southwestern willow flycatcher typically has extensive canopy coverage and is structurally homogenous (Service 1995). Occupied habitat is generally associated with standing or slow-moving surface water or saturated soils and is dominated by shrubs and trees 10 to 30 feet tall that provide dense low and midstory vegetation, with small twigs and branches for nesting. Plant structure and the presence of surface water or saturated soils may be more important than plant species composition in defining suitable flycatcher habitat (Service 1995).

Occupied patch size and shape can vary substantially between occupied southwestern willow flycatcher nesting sites. Sogge et al. (1997) surveyed saltcedar-dominated riparian vegetation at breeding sites in the Grand Canyon that ranged from 1.48 to 2.22 acres, but the flycatchers were reported to use only portions of the vegetation patches. This survey also reported a mean territory size of 0.40-acre (sample size was 8 males, and standard deviation was 0.15), with a range of 0.15 to 1.24 acres. This subspecies also nests in forest tracts larger than 247 acres at Roosevelt Lake (Spencer et al. 1996; Paradzick et al. 2000) and Lake Mead (McKernan 1997). Although most occupied sites are in smaller tracts, this subspecies generally avoids nesting in narrow linear corridors with only a few scattered trees (Service 2002).

Nesting success rates for the southwestern willow flycatcher appear to be affected by habitat fragmentation, resulting in increased rates of predation and high levels of brood parasitism by the brown-headed cowbird (*Molothrus atex*) (Service 1995 and 2002; Arizona Game and Fish Department 1997).

4.2.2.2 Current Condition

The total United States population is estimated to be between 900-1,000 breeding pairs (Service 2002). The southwestern willow flycatcher has not been documented breeding in the Colorado River delta in Mexico. Two southwestern willow flycatchers were observed in the AMTW. These birds were most likely utilizing the saltcedar or mesquite proximate to the marshes during migration (Hinojosa-Huerta et al. 2004).

4.2.2.3 Critical Habitat

The southwestern willow flycatcher was listed as an endangered species on February 27, 1995. The Southwestern Willow Flycatcher Recovery Plan was signed in August 2002. The Service proposed critical habitat on October 12, 2004, and the proposal includes numerous units throughout the range of the species. The Final Rule for critical habitat was published on October 19, 2005.

The AMTW is not within the United States, so lands within the AMTW would not be considered for critical habitat designation.

SECTION 5

Potential, Future Effects of the Lining Project

5.1 Habitat

As discussed above, the AMTW are likely sustained in some part by seepage from the AAC, because about 95 percent of the seepage from the AAC flows towards the Mexicali Valley (Reclamation and IID 1994), and the AMTW are located downgradient of the AAC. Therefore, the AAC Lining Project would likely affect the wetlands. However, the degree of this effect is uncertain because: (1) the water contribution to the AMTW from the AAC reach remaining unlined (a section of the AAC between Drop 3 and Drop 4 will remain unlined and will continue to contribute to groundwater recharge in the area) is unknown; and (2) the contribution to the AMTW from adjacent irrigated agricultural areas is unknown. According to the figure entitled "Depletion of the Groundwater Static Level" presented by the Mexican Delegation to the All-American Canal Meeting of April 2005, groundwater levels in the vicinity of the AMTW are expected to decline by less than 1 meter over 10 years as a result of the AAC Lining Project (Mexican Delegation 2005).

Based on this information and Reclamation's analysis of changes in groundwater elevations in the United States, the following assumptions were used in the present analysis: (1) any change in groundwater would be gradual; (2) seepage contributions would continue west of Drop 3; (3) the Project would affect the AMTW; and (4) the estimate that the groundwater drop in the area of the AMTW would be less than 1 meter is accurate (Mexican Delegation 2005). See section 3.1 for additional discussion of groundwater elevations in the area of the AMTW and potential changes in elevations as a result of the AAC Lining Project.

5.1.1 Riparian Woodlands

The majority of the vegetation associations in the AMTW consist of desert shrub and mesquite/creosote bush mixes (7,650.3 acres, see Table 1). These associations would be minimally affected, if at all, by the AAC Lining Project. According to the figure entitled "Depletion of the Groundwater Static Level" presented by the Mexican Delegation, groundwater levels in the vicinity of the AMTW are expected to decline by less than 1 meter over 10 years as a result of the AAC Lining Project (Mexican Delegation 2005). Mesquite can follow a declining water table some distance, and mesquite roots have been reported to penetrate to a depth of 60 feet (Kearney and Peebles 1951). In addition, once established, creosote bush and other desert shrub species endure some of the harshest natural environments found in the desert ecosystem.

The AMTW contain approximately 165 acres of the arrowweed and saltcedar vegetation association. Arrowweed is a native species typical of areas with high groundwater. Saltcedar is an invasive exotic. While arrowweed and saltcedar may be affected by a drop in groundwater of about 1 meter over 10 years, more than likely the roots would be capable of following the declining water table. This conclusion is based on two assumptions: (1) the water table where the saltcedar and arrowweed are located is the same as the water elevation in the proximate open water marsh; and (2) once established, saltcedar and arrowweed found along the lower Colorado River thrive several meters above the groundwater.

5.1.2 Marsh

The assemblages of open water with associated emergent vegetation, including cattail and to a lesser extent saltgrass, are typical of marsh communities and are of high value in the desert Southwest. The AMTW marsh habitat would be expected to be impacted or eliminated by the Project. However, because the degree to which the AMTW marshes are sustained by seepage from the AAC is unknown, the potential effect of lining the AAC on the AMTW marshes is difficult to determine. As previously described, groundwater levels in the vicinity of the AMTW are expected to decline by less than 1 meter over 10 years as a result of the Project (Mexican Delegation 2005). Based on this expected groundwater decline, surface water elevations in the AMTW could similarly decline by up to 1 meter over 10 years. Emergent vegetation will successively follow the declining surface water elevations. If the marshes are greater than one meter in depth, then some emergent vegetation would remain. However, Reclamation does not have information on the water depth of the existing marshes. As described in section 5.1.3 below, the Sonoran Institute recently prepared a report on the potential effects of the AAC Lining Project and estimated that 502.3 acres of marsh habitat would be lost (consisting of 100 percent or 58.5 acres of open water, 100 percent or 130 acres of salt grass, and 93 percent or 313.8 acres of cattail). Reclamation doubts that the entire 502-acre marsh habitat would be affected because the Sonoran Institute study assumes no contribution to the wetlands from the remaining unlined section of the AAC or adjacent farmlands (see section 5.1.4).

Any impacts to approximately 502 acres of marsh are significant in the Colorado River delta region, which was presumed to have historically supported large areas of marsh before development. While the AMTW marshes are apparently artificially formed and maintained, their presence is nevertheless important for various species of wildlife, including the Yuma clapper rail, a United States-listed species.

5.1.3 Effects of the Proposed Action Determined by Others

A report prepared by the Sonoran Institute for the Ecology Department of the State of Baja California estimated the effects of the AAC Lining Project on the AMTW (Arroyo et al. 2005). Based on the information presented, the AAC Lining Project is "likely to impact 4,648 acres (98 percent) of the wetland habitat and 960 acres (27 percent) of the terrestrial habitat in the Andrade Mesa [Toe] Wetlands." Wetland habitat was defined in that study as marsh, arrowweed, saltcedar, and mesquite/creosote with greater than 10 percent mesquite (Arroyo et al. 2005). Impacts by vegetation type estimated by the Sonoran Institute are provided in Table 2.

As described above, Reclamation does not anticipate that the entire 502-acre marsh area (consisting of open water, salt grass, and cattail vegetation associations) or the entire 165-acre saltcedar and arrowweed area will be lost. Contrary to the Sonoran Institute's estimate and for the reasons described in section 5.1.1 above, Reclamation anticipates that the riparian woodland (specifically the mesquite and creosote vegetation association) and the desert scrub habitat types would be minimally affected, if at all, by the AAC Lining Project.

TABLE 2
Impacts of the AAC Lining Project as Estimated by the Sonoran Institute

Habitat Type and Vegetation Associations	Total Acres	Impacted Acres	Percent Lost
Riparian Woodland			
Arrowweed and Saltcedar	164.5	164.5	100
Mesquite and Creosote (10% - 30% cover)	1,482.1	1482.1	100
Mesquite and Creosote (30% - 70% cover)	2,575.4	2449.6	97
Total Riparian Woodland	**4,222.0**	**4,096.2**	**98.2**
Marsh			
Open water	58.5	58.5	100
Salt grass	130.0	130.0	100
Cattail	336.9	313.8	93
Marsh	**525.4**	**502.3**	**95.5**
Total Wetlands	***4,747.3*** [a]	***4,648.5*** [a]	***98***
Desert Scrub			
Desert shrub (10% - 30% cover)	2,135.2	544.8	26
Desert shrub (30% - 70% cover)	1,457.6	415.9	29
Desert Scrub	**3,592.7** [a]	**960.7**	**27**
Total	***8,340.1*** [a]	***5609.2*** [a]	***67***

(a) These values were reported in the Sonoran Institute's report; however these values do not add correctly and should be 4,747.4 total wetland acres, 4,598.5 total impacted wetland acres, 3,592.8 total desert scrub acres, 8,340.2 total acres, and 5,559.2 total impacted acres.
Source: Arroyo et al. 2005

5.1.4 Other Actions Affecting the AMTW

Marsh Drainage. The AMTW in Mexico are most likely remnants of a larger artificial wetland complex formed by seepage from the AAC. Current satellite imagery shows the presence of a number of dry marshes along the toe of the mesa. These marshes may have dried up because of agricultural drainage activities in Mexico, such as construction of the La Mesa Drain in 1960 to alleviate high groundwater issues resulting from seepage from the AAC. While on one hand drainage activities in the northeastern Mexicali Valley were necessary for agricultural production, those same activities probably initially reduced the amount of marshes along the toe of the Andrade Mesa and continue to suppress the remaining marshes today.

Increasing Salinity. The marsh habitat of the AMTW will probably deteriorate in value due to increasing salinity and natural succession and will become gradually reduced in value regardless of whether the AAC is lined. The rate of this change is unknown at this time. However, evidence of this ongoing change is apparent by a characteristic salt ring around some of the wetland pools and the presence of inland saltgrass and other halophytic[4] plants

4 Vegetation that is adapted to a saline environment.

in the AMTW (see Figure 13). This effect is a result of concentrating salts and other minerals in the marsh habitat by evaporation. Even if the Project does not occur, these marshes may become of limited or no value to wildlife species that currently utilize the marsh area because of increasing salinity and anoxic conditions (see section 3.2 for a discussion of increasing salinities in groundwater in the Mexicali Valley).

Adjacent Agriculture. Some of the marshes are below the level of adjoining fields (see Figures 12 and 13). These locations suggest that such marshes may be sustained in part by seepage from the adjoining agriculture.

FIGURE 12
Portion of the Andrade Mesa Toe Wetland with Adjacent Agriculture Active
Looking southerly. Note water surface elevation of wetland marsh and active irrigation south of the marsh. Photo provided to Reclamation courtesy of the University of Arizona. Approximate date, June 2005.

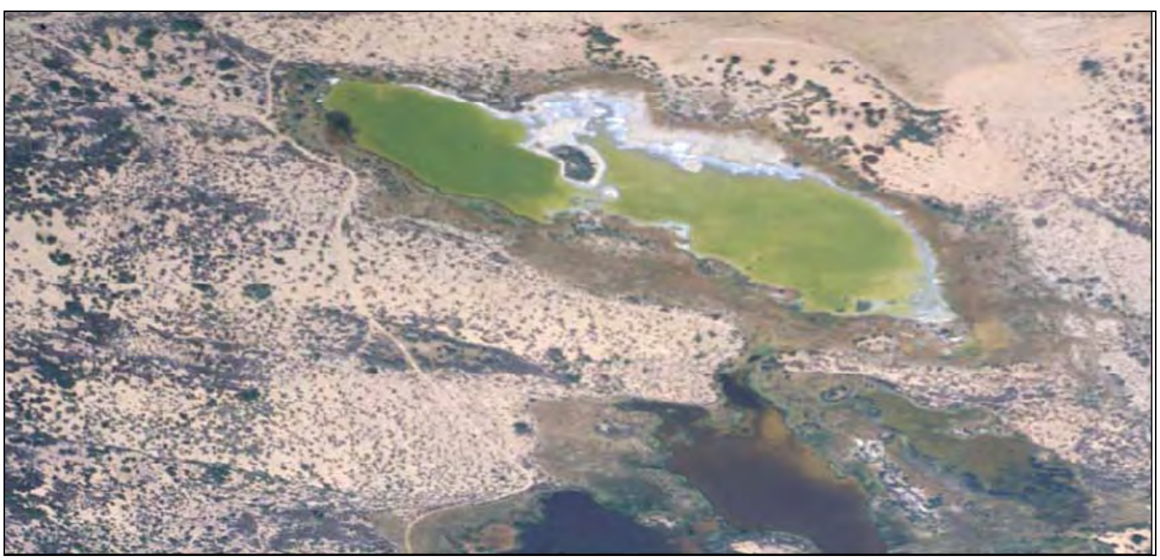

FIGURE 13
Same Portion of the Andrade Mesa Toe Wetland as Figure 12 with Adjacent Agriculture Inactive
Looking southerly. Note lower water surface elevation and saline soils evident at edge and inactive irrigation south of the marsh. Photo provided to Reclamation courtesy of the University of Arizona. Approximate date, September 2002.

Marsh Succession. Marsh succession plays a role in the longevity of the marshes. Isolated backwater marshes along the lower Colorado River typically persist for 50 to 70 years (Ohmart et al. 1975), and the AMTW marshes are similar in characteristics to isolated backwater marshes along the lower Colorado River. Succession in these backwater marshes can occur through evaporation, siltation from runoff and wind blown material, and organic deposition from emergent vegetation.

Mesa Agriculture. Agriculture development on the mesa proximate to and above the eastern portion of the AMTW may also be contributing to deterioration because the agriculture is probably served by wells that may intercept seepage from the AAC to some degree. (See Figure 14.)

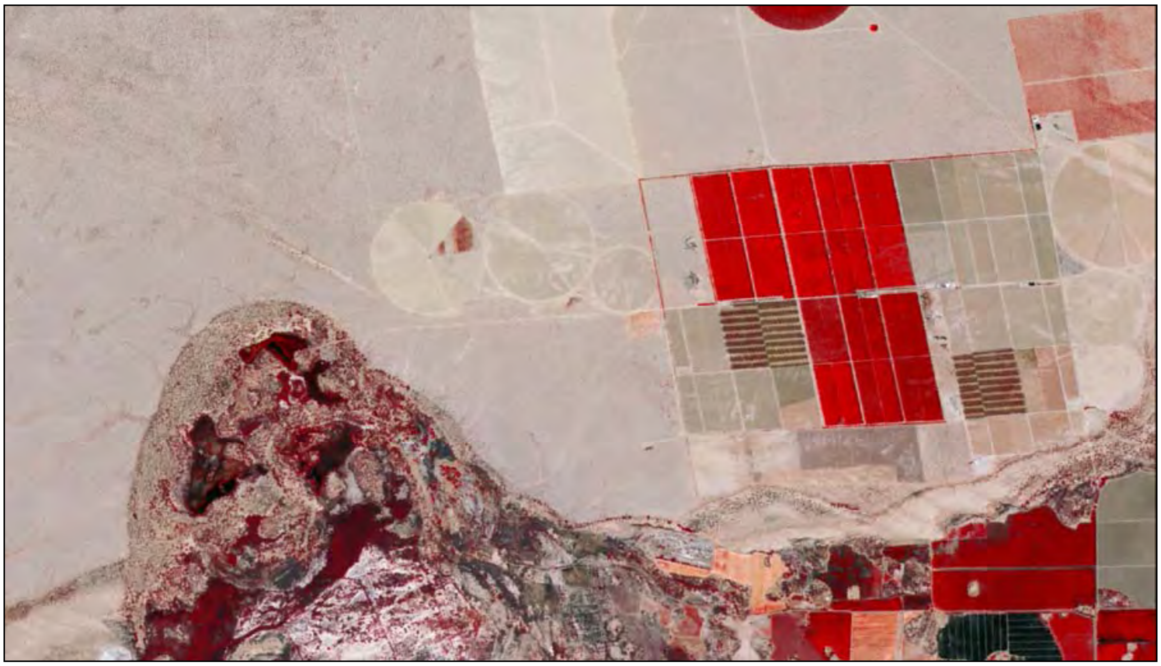

FIGURE 14
Agriculture on Mesa above Marsh Complex in Andrade Mesa Toe Wetland Probably Intercepting AAC Seepage
North is at the top of the photo. Color Infrared Imagery courtesy of SPOT-5 satellite; 2.5 m. multispectural, collected June and July, 2005.

5.2 Species

5.2.1 Yuma Clapper Rail

Operating under the assumptions described in section 5.1, about 502 acres of marsh found in the AMTW would be impacted by the AAC Lining Project. As a result, the Yuma clapper rail estimated population of 172 birds (based on the detection of 16 individuals) in the AMTW would be impacted. This number of Yuma clapper rails would represent a small fraction of the entire United States and Mexico population. For example, when compared to the largest distinct Yuma clapper rail population in Mexico for which data is available, located in the Cienega de Santa Clara, the number of birds potentially affected by the AAC Lining Project would represent less than 3 to 4 percent of the Cienega de Santa Clara population (see section 4.2.1). Also, Yuma clapper rails may be somewhat migratory, although the extent to which these birds move seasonally is not known. However, they are capable of significant movements, and dispersal away from existing population centers is a source of individuals to augment or initiate outlier populations. Nevertheless, the Project may impact Yuma clapper rails by impacting these isolated habitat areas.

5.2.2 Southwestern Willow Flycatcher

The southwestern willow flycatcher observed in the AMTW may have been migratory individuals (Hinojosa-Huerta et al. 2004). These individuals were probably using the saltcedar or mesquite proximate to the AMTW marshes during migration (Hinojosa-Huerta et al. 2004). Depending on how far and fast the water table would drop as a result of the Project, the saltcedar and especially the mesquite may not be substantially impacted. Mesquite can follow a declining water table some distance, and mesquite roots have been reported to penetrate to a depth of 60 feet (Kearney and Peebles 1951). Mesquite can be reasonably expected to follow a declining water table of less than one meter. Saltcedar may only be minimally impacted because it most likely would be able to follow the declining water table or declining open water area. Because the individuals observed may have been migratory and were using the saltcedar or mesquite that is likely to be minimally impacted, if they impacted at all, the Project is not likely to impact the southwestern willow flycatcher.

SECTION 6

Conclusions

6.1 Habitat

Based on available information, the AAC Lining Project would likely reduce the water supply to the AMTW, resulting in the potential to impact up to 502 acres of marsh habitat, consisting of 58.5 acres of open water, about 313.8 acres of cattail/bulrush, and 130 acres of salt grass (based on information in the Sonoran Institute's report; see Table 2). With the exception of arrowweed and saltcedar, the other habitat types and vegetation associations listed in Table 1 are not expected to be impacted substantially, if at all. For the purposes of this report, the approximately 165 acres of arrowweed and saltcedar are assumed to be impacted; however, saltcedar and arrowweed may only be minimally impacted because it most likely would be able to follow the declining water table or declining open water area.

The AAC seepage flow direction and the downgradient AMTW location indicate that AAC seepage is a likely water source for the AMTW, and that AAC Lining Project would likely affect the AMTW. The magnitude of this effect is uncertain because the contribution to the AMTW as a group from the AAC reach to remain unlined is unknown. In addition, the effects to the AMTW from adjoining agriculture (and associated groundwater pumping) are undetermined. Irrigation from adjoining agriculture appears to contribute to the western portion of the AMTW marshes, and nearby groundwater pumping for agriculture on the mesa to the northeast may be reducing seepage flow to the eastern portion of the AMTW marshes.

Predicting when the effects of the Project would be manifested with any reliability is not possible at this time in part due to the uncertainties identified above. The predictions are also complicated by the ongoing succession of the marsh component of the AMTW. As previously identified, similar unmanaged marshes along the lower Colorado River generally last from 50 to 70 years due to natural succession resulting from evaporation, siltation, and organic deposition.

6.2 Species

As described above, about 502 acres of marsh found in the AMTW may be impacted by the AAC Lining Project and, as a result, the Yuma clapper rail estimated population of 172 birds in the AMTW may be impacted. However, the number of Yuma clapper rails that would be impacted is a small fraction of the entire United States and Mexico population, and the species is somewhat migratory, capable of significant movements and may disperse to other habitat areas in the United States and Mexico.

The southwestern willow flycatchers observed in the AMTW were probably using the saltcedar or mesquite proximate to the AMTW marshes during migration. Saltcedar, and especially the mesquite, may not be substantially impacted, if at all. Therefore, the Project is not likely to impact the southwestern willow flycatcher.

SECTION 7

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