3.16 TRANSBOUNDARY IMPACTS

3.16.1 INTRODUCTION

Potential effects on resources in Mexico could occur from changes in the frequency and magnitude of excess flows to Mexico (i.e., flows in excess of scheduled deliveries to Mexico) as a result of adoption of interim surplus criteria. The analysis in this section utilizes results of system modeling as described in Section 3.3 to determine potential changes in excess flows to Mexico and discusses the potential effects on the natural and physical environment within Mexico. The potential effects on scheduled delivery of water to Mexico under the terms of the United States-Mexico Water Treaty of 1944 (Treaty) are presented in Section 3.4, Water Supply.

This analysis of potential impacts in Mexico is fully consistent with Executive Order 12114 - Environmental Effects Abroad of Major Federal Actions and CEQ Guidance on NEPA Analyses for Transboundary Impacts, dated July 1, 1997. Each of these documents are contained within Attachment B, Environmental Guidelines for Transboundary Impacts.

3.16.2 METHODOLOGY

For the analysis of impacts in Mexico, the direct potential effect of interim surplus criteria would be associated with changes in the frequency of excess flows to Mexico. The incremental differences in excess flows to Mexico between baseline conditions and each of the interim surplus criteria alternatives were determined using modeling of the Colorado River system as described in Section 3.3.

Environmental conditions currently existing and those expected to result from the full development of the Upper Division states' apportionments are part of the baseline conditions. The impacts attributable to interim surplus criteria would include changes to excess flow frequency downstream of Morelos Dam and the reduction of available excess flows for irrigation and M&I use in Mexico. However, the potential effects of the reduced excess flows on Mexico's resources cannot be specifically determined due to the uncertainty of water use once it flows across the NIB into Mexico. The waters of the Colorado River, once delivered to Mexico, as agreed upon in the Treaty, are within the exclusive control of Mexico. The Treaty contains no provisions requiring Mexico to provide water for environmental protection, nor any requirements relating to Mexico's use of that water. It is reasonably foreseeable that Mexico will continue to maximize consumptive use of Colorado River water for agricultural, municipal and industrial purposes.

Potentially affected species that occur in Mexico and that are federally listed as endangered under the United States Endangered Species Act (ESA) are the desert pupfish (*Cyprinodon macularius*), Vaquita (*Phocaena sinus*) and totoaba (*Totoaba macdonaldi*); listed bird species which occur in Mexico include the Southwestern willow flycatcher (*Empidonax traillii extimus*) and the Yuma clapper rail (*Rallus longirostris yumanensis*). Consideration is also given to the Yellow-billed cuckoo (*coccyzus americanus*), which is proposed for listing. Additional species of special concern and their habitat that are addressed in this section are the California black rail (*Laterallus jamaicensis coturniculus*), Elf owl (*Micrathene whitneyi)*, Bell's vireo *(Vireo bellii arizonae),* and Clark's grebe *(Aechmophorus clarkii).* The Vaquita and totoaba are species associated with the Colorado River as it flows into the Gulf of California and occur only in Mexico. Critical habitat for species listed under the ESA is only designated within the United States and therefore, habitat in Mexico is not protected under the ESA. The desert pupfish and each of the bird species occur in both the United States and Mexico, and potential impacts to these species and their habitat within the United States are discussed in Section 3.8.

3.16.3 CONSULTATION WITH MEXICO

Pursuant to an international agreement for mandatory reciprocal consultations, Reclamation, through the United States Section of the International Boundary and Water Commission (USIBWC), consulted with Mexico in an effort to identify Mexico's concerns with regard to potential transboundary impacts from adoption of interim surplus criteria.

During the preparation of the DEIS, a meeting was held in Henderson, Nevada, on April 12, 2000, during which the topic of developing interim surplus criteria was described for the Mexican delegation. A subsequent meeting was held in Mexico City, Mexico, on May 11 and 12, 2000. During the May 11-12, 2000 meeting, Reclamation provided additional data which had been requested by Mexico and technical issues were discussed. Reclamation requested that Mexico provide an analysis of how the incremental changes between baseline conditions and the interim surplus criteria would affect Mexico. In response, a letter from Commissioner J. Arturo Herrera of the Mexican Section of the IBWC, was provided to the United States Section of the IBWC on May 22, 2000. The original letter, and an English translation, is included in Attachment T (Mexico advised the IBWC that there is no objection to the public release of this diplomatic document).

In this transmittal, Commissioner Herrera expressed a concern that currently proposed plans for the distribution of surplus water among the Lower Division states tend to reduce excess flows below Morelos Dam over the 15-year period of the interim surplus criteria. Mexico estimates that the elimination of these excess flows would have the following effects on the Mexican natural and physical environment:

1. Effects on the recharge of the aquifer both in quantity and quality, reducing the beneficial use of the same;

2. Increase in salinity in the 200,000 hectares (500,000 acres) of cultivation in the Mexicali Valley, since part of the surplus is used to leach this soil;

3. Deterioration in the quality of water delivered to Mexico at the Southerly International Boundary (SIB), especially in terms of salinity given that the flows of fresh water are used to reduce high concentrations of salinity at this site;

4. Deterioration in the quality of water received by Mexico at NIB in reducing the flow to the value of the Mexican demand and maintaining the discharges to the river from agricultural drains in the Yuma, Arizona area;

5. In the upper part of the Sea of Cortez, species in danger of extinction or which require special protection will be affected, such as the rarest and most scarce cetacean in the world, the sea cow (Vaquita) and the Totoaba. Also, commercial fishing activities will be affected in the region, especially shrimping and two species of Corvina, fish which had not appeared in significant numbers in the last 25 years; and,

6. In terms of the existing flora in the reach between Morelos Dam and the mouth of the Colorado River at the Sea of Cortez, in recent years around 33,000 hectares (85,500 acres) of native riparian vegetation have been restored in the channel, mostly poplars, willows, mesquite and salt cedar, among other species which are fundamental in the ecosystem since many of these are used as nesting areas for a great number of birds, such as the Yuma clapper rail, the yellow seagull, the sea swallow and the royal blue swan, among others, same which would be affected by these measures.

Coordination with Mexico continued during the DEIS review period and development of this FEIS. Reclamation met with representatives of Mexico on August 31, 2000, to brief them on the operational modeling process described in Section 3.3. In response to the DEIS, comment letters were provided to Reclamation from the Border Affairs Coordinator of Mexico's National Water Commission and from the IBWC. Both letters reiterated the issues raised in Commissioner Herrera's May 22, 2000, letter and are included in Volume III of this FEIS along with Reclamation's responses to the specific issues raised in the letters. Mexico provided further correspondence on October 10, 2000, which is also included in Attachment T. In this letter, Mexico suggests there be more consideration of habitat and species information in Mexico.

Although Reclamation recognizes the potential for the United States, acting through the Secretary of State, to continue to work with Mexico on a bi-national basis to clarify and resolve Mexico's concerns, it is not clear that the concerns raised are associated with interim surplus criteria. Issues not arising from interim surplus criteria are outside of the scope of this FEIS. However, such issues could become the subject of other cooperative, bi-national processes of a voluntary nature.

Attachment T also contains a draft document dated December 28, 1999 that states the United States "Authority and Assumptions" for the United States-Mexico consultations under the Treaty and subsequent resolutions and Minutes. Within that document, the

United States acknowledges Mexico's rights under the authority of Article 10 of the Treaty: "Mexico has the right to 1.5 maf annually." As discussed in Section 3.4.4, statistical projections from the model with respect to flows to Mexico indicated that under baseline conditions and each of the interim surplus criteria alternatives, Mexico would receive no less than its apportionment of 1.5 maf per year. Thus, interim surplus criteria would not affect the ability of the United States to meet Treaty obligations. However, as noted in Chapter 1, Mexico would share reductions in delivery if extraordinary drought conditions were to significantly reduce deliveries to Lower Division states below their basic apportionments.

The "Authority and Assumptions" also reiterates the United States position that "Mexico may schedule an additional 200,000 af of surplus annually, but does not have the right to Colorado River water beyond the 1.5 maf" and provides that the United States will develop and supply technical data that identify the potential future deliveries of up to 200,000 af of surplus for use in Mexico. Technical information regarding the frequency of occurrence of Mexico's 200,000 af delivery pursuant to the Treaty is presented with the water supply discussion in Section 3.4.4.5.

Further clarification is needed to distinguish between the delivery of surplus flows and the delivery of excess flows to Mexico. Mexico has an annual apportionment of 1.5 maf of Colorado River water, based on the provisions of the Treaty. Mexico may receive additional Colorado River water (beyond the 1.5 maf) under two conditions. First, when surplus water exists in excess of the amount that can be beneficially used by the Basin States, Mexico is apportioned up to an additional 200,000 af of water. Under current practice, this 200,000 is available when flood control releases are made. This water, which Mexico may schedule throughout the year in accordance with Article 15 of the Treaty, is also referred to as "surplus" water. This class of "surplus" water under the Treaty is distinct however, from surplus water for use in the Lower Basin states as described in Article II(B)(2) of the Decree and Article III of the LROC. Second, the delivery of excess flows to Mexico may result from flood control operations, unanticipated contributions from events such as flooding along the Gila River and/or other factors resulting in canceled water orders by water users below Parker Dam. Excess flows are therefore typically considered to be any flows that are over and above the 1.5 maf normal apportionment (or 1.7 maf in certain years) that may be available to Mexico pursuant to the Treaty. It is acknowledged that Mexico has complete autonomy as to how they choose to manage apportioned and excess Colorado River flows.

3.16.4 AFFECTED ENVIRONMENT

3.16.4.1 HISTORICAL COLORADO RIVER BETWEEN THE SOUTHERLY INTERNATIONAL BOUNDARY AND THE GULF OF CALIFORNIA

The Colorado River flows approximately 1440 miles from its headwaters in the Rocky Mountains to its mouth at the Gulf of California. The location of the Colorado River within Mexico is shown on Map 3.16-1. The 22-mile reach of the river from the NIB to the SIB acts as the east-west boundary between Baja California in Mexico and the state of Arizona in the United States. This section of the river is referred to as the Limitrophe Division.

Although the section of the river between the SIB and the Gulf of California (which is also called the Sea of Cortez) is less than 50 air miles in length, the river meanders as much as 175 miles through this stretch (Browne, 1869; Rudkin, 1953).

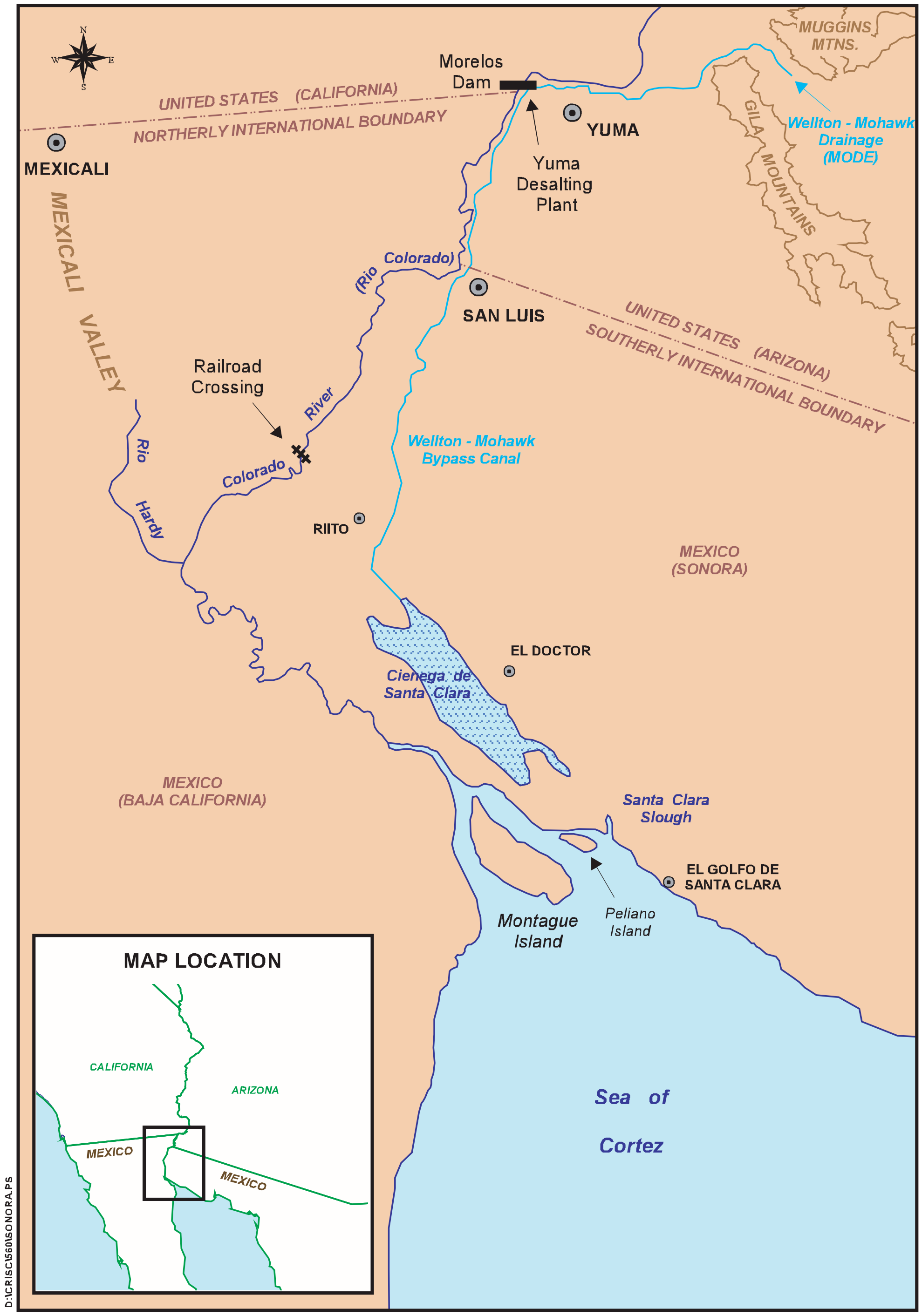
Historically, the portion of the Colorado River within Mexico could be divided into two reaches: the upper reach, which was influenced mainly by flood events; and the lower reach, which was influenced mainly by tidal fluctuations in the Gulf of California. The upper reach extends from the international boundary to approximately the confluence of the Rio Hardy and the Colorado (Mearns, 1907). The plant community found in this reach of the Colorado was similar to that found in the Yuma Valley. Large cottonwoods and dense willow thickets lined the river channel and oxbows within the floodplain (Johnson, 1869; Mearns, 1907). Honey and screwbean mesquites formed large dense thickets in areas that were subject to occasional overbank flooding (Bolton, 1930; Thwaites, 1905). Dense stands of arrowweed were noted in many historical journals throughout this reach of the river (Bolton, 1930; Mearns, 1907). Unlike the portion of the Colorado River that lies within the United States, large marshes were common within this stretch of the river. Several journals note expanses of cattails, rushes, and cane (Twaites, 1905; Mearns, 1907; Bolton, 1930). Large grass savannas were present within the floodplain that supported a cattle industry from the late 1800's through the early 1900's (Mearns, 1907; Kniffen, 1929 *in* Ohmart, 1982; Bolton, 1930).

The ecosystem found in the lower reach of the Colorado River, below the Rio Hardy to the Gulf of California was heavily influenced by tidal fluctuations in the Gulf of California and by heavy soil deposition from annual flood events. As the river meandered south of its confluence with the Rio Hardy, cottonwoods became scarce. Dense thickets of mesquite and arrowweed were still recorded on the upper terraces within this reach of the river. Dense stands of willows formed on newly deposited sediments. Large marshes, comprised mainly of cattails, rushes, and cane, dominated this stretch of the river (United States War Department, 1852; Mearns, 1907). Saltgrass became prevalent at the mouth of the river (Kniffen, 1929 *in* Ohmart, 1982).

3.16.4.2 PRESENT STATUS OF THE COLORADO RIVER BETWEEN THE NIB AND THE GULF OF CALIFORNIA

Human activities have significantly changed the lower Colorado River ecosystem since the early 1900's. Completion of Morelos Dam in 1950 allowed delivery of Colorado River water to irrigate lands in the Mexicali Valley. Flooding along the river is an infrequent event and riparian vegetation is sustained by groundwater, excess flows and/or return flows from agriculture.

Map 3.16-1
Colorado River Location Within Mexico



A 1997 survey of floodplain vegetation along the lower Colorado River (CH2MHill, 1997) classified 88 percent of over 4300 acres of the Limitrophe Division as saltcedar. Saltcedar (also commonly referred to a tamarisk) is an exotic species that appeared along the mainstem Colorado River about 1920 (Ohmart *et al.,* 1988) and has displaced native riparian species throughout the lower Colorado River.

Cottonwood willow communities were mapped on only 7.5 percent of the area, and the historically common and large marshes comprise only 3.5 percent of the communities.

The most current information available on the vegetation composition present along the upper reach of the Colorado River floodplain between the SIB and the Rio Hardy comes from a 1999 study conducted by the University of Monterrey (Guaymas), the University of Arizona, the Environmental Defense Fund, and the Sonoran Institute (Glenn, unpub. data and Luecke *et al.,* 1999). Aerial and remote sensing methods, combined with ground surveys to check accuracy, were used to estimate the number of acres of each habitat type. Habitat types were separated into two broad categories: (1) areas where Fremont cottonwood and Goodding willow comprised greater than 10 percent of the stand (determined by measuring percent vegetation cover by using remote sensing techniques); and (2) areas where Fremont cottonwood and Goodding willow comprised less than 10 percent of the stand. In stands where cottonwoods and willows comprised greater than 10 percent of the vegetative cover, the stands were further subdivided by height class and density (Open Gallery Forest, Closed Gallery Forest, and Shrub Dominated). In stands where cottonwoods and willows comprised less than 10 percent of the vegetative cover, the stands were further divided by species composition (saltcedar/arrowweed and saltcedar/mesquite).

The University of Monterrey study estimated approximately 9545 acres of greater than 10 percent cottonwood-willow habitat, 4492 acres classified as open gallery forest and 5053 acres classified as shrub dominated. Analysis of tree ring data indicated that the majority of these cottonwood-willow stands had been regenerated during high flow events over the last two decades, especially the 1993 Gila River flood event. This study also identified 25,829 acres of saltcedar/arrowweed habitat. Although the study does not specify, it is likely that these stands were actually monotypic saltcedar and monotypic arrowweed stands or clumps as arrowweed does not usually grow as a mixed stand with other vegetation types. Interestingly, this study did not identify any saltcedar/mesquite acreage within the entire study area (E. Glenn, 2000).

In December, 1998, biologists from the Bureau of Reclamation, San Bernardino County Museum, and the Upper Gulf of California and Colorado River Delta Biosphere Preserve conducted an aerial survey of the Rio Hardy and the Colorado River to determine potentially suitable Southwestern willow flycatcher breeding habitat. This survey noted that the vegetation at the confluence of the Rio Hardy and Colorado River was mostly narrow, dry stands of saltcedar. Northeast of the town of Venustiano Carranza, patches of Goodding willow and Fremont cottonwood were evident. Approximately five kilometers north of the Mexican Railroad crossing of the Colorado

River, the river contained long, linear stands of Goodding willow with a few cottonwoods also present. Approximately 15 kilometers south of San Luis, Sonora, the Colorado River begins to broaden out and from this point north to the NIB, a variety of habitats believed to be suitable breeding habitat for Southwestern willow flycatcher were present (McKernan, 1999).

The Cienega de Santa Clara (Cienega) is a large wetland complex located adjacent to the mouth of lower Colorado River in Sonora, Mexico. It is a large basin approximately 80,000 acres in size, including roughly 9700 vegetated acres with the remaining area consisting of highly saline tidal salt flats. The Cienega is typically included in discussions of the region of the Colorado River from the Rio Hardy confluence to the Sea of Cortez.

Geologically, the Cienega was formed by a tectonic slump. The Colorado River probably at many times in the geologic past flowed through the Cienega on its way to the Sea of Cortez. The Cienega retains sea water which intrudes into the southern end as a result of tidal action and evaporation results in TDS of the water exceeding 60,000 ppm in some areas. The upper end of the Cienega has two major brackish water inflows; the Main Outlet Drain Extension (MODE) and the Riito Drain (Drain). The MODE transports saline irrigation return flows from the Wellton-Mohawk Irrigation and Drainage District (WMIDD) east of Yuma, Arizona, and the Drain carries irrigation return flows from the eastern Mexicali Valley in Sonora, Mexico. The MODE and the Drain annually contribute approximately 140,000 and 28,000 af of water, respectively. There are other smaller sources of inflow to the Cienega, including springs along the eastern edge.

Salinity in the MODE water is approximately 3,200 ppm TDS while the salinity of the Drain is approximately 4,600 ppm TDS. This brackish water inflow supports the wetland vegetation at the upper end of the Cienega. The vegetation is limited by the brackish water interface with the highly saline water and soils comprising the extensive salt flats of the southern portion of the Cienega. The salt flats and associated shallow water exceed 60,000 ppm TDS. This is a result of tidal action bringing sea water into the basin, and evaporation and subsurface drainage accounting for water loss from the basin.

The vegetation in the Cienega is dominated by cattail and bulrush. The cattail and bulrush is interspersed with small channels and open water pools. The water depths in the vegetated area vary from one to four feet.

The vegetated area supports a variety of bird species. There is considerable use of the open water by waterfowl, including many varieties of ducks and geese. Several fish species are found in the fresher water areas of the Cienega including largemouth bass, carp, channel catfish, and tilapia. Several species of shiners and mollies are also found in the Cienega. Also notable is the presence of United States Federally listed threatened or endangered species, state designated special status species, and internationally recognized species of concern. These include the Yuma clapper rail, desert pupfish, Bald eagle, and American peregrine falcon.

The present size of the vegetated area of the Cienega is a result of construction of the MODE which carries brackish irrigation return flows from the WMIDD. Prior to the completion of the MODE the vegetated area of the Cienega was less than 500 acres and this consisted mainly of a narrow fringe to the east of the present large vegetated area. Since 1977, when the MODE was completed, the vegetated area has expanded from virtually no vegetation to its present size.

Because flows into the Cienega are from the MODE and Drain and the Cienega is not connected to the floodplain of the Colorado River, natural and physical resources located within the Cienega are not anticipated to be affected by the adoption of interim surplus criteria.

The lower Colorado River supported a large estuary at its mouth in the Sea of Cortez. The historic lower Colorado River exhibited the typical annual fluctuations in flow with the peak flows generally occurring in the spring to early summer. These flows carried nutrients and sediments into the estuary, creating the conditions suited for various phases of the life history of the endemic species.

The upper end of the Sea has remarkably changed due to the lack of annual inflow from the lower Colorado River, following the construction of dams and water diversions upstream. In recent years, there have been only three events of note that have resulted in large quantities of water reaching this estuary from the lower Colorado River. High flows were experienced on the lower Colorado River during flood control operations from 1983 through 1987 and flows from the Gila River through the lower Colorado River reached the estuary in 1993. There were space building flows in the fall of 1997 and fall of 1998 and flood control releases in January 1998. All but the flows of 1983-85 and 1993 probably had little effect on the Sea of Cortez. Therefore, the hydrology of the estuary is primarily dominated by tidal processes and sediment contribution to the estuary is a result of erosion of the delta itself (Carriquiry and Sanchez, 1999).

In spite of the reduced inflow from the lower Colorado River the estuary is extremely rich in nutrients, with the corresponding richness of plankton, leading to rich amounts of organisms on up the food chain. High chlorophyll values are found in the estuary typical of very rich coastal waters (Santamaria-Del-Angel, et al. (1994). Zooplankton biomass values are similar to those of the rich central Sea of Cortez, and the values for the channels around Montague Island at the mouth of the Colorado River are as high as those of estuaries and coastal lagoons (Farfan and Alvarez-Borrego, 1992). The nutrient inflow is primarily a result of agricultural drainage into the Rio Hardy, which joins the lower Colorado River immediately above the Sea.

3.16.5 EXCESS FLOWS TO MEXICO

Currently, water has the potential to flow past Morelos Dam under three circumstances: (1) as a result of operational activities upstream (e.g., canceled water orders in the United States, maintenance activities, etc.); (2) during a Gila River flood event; and (3) during flood control releases along the mainstream Colorado River. However, Mexico has complete autonomy as to how it chooses to manage scheduled and excess flows that arrive at Morelos Dam.

Water released from Parker Dam, under orders from irrigation districts in Imperial Valley, Coachella Valley, and the lower Colorado River Valley, normally takes up to three days to reach its point of diversion. Occasionally, unforeseen events, such as localized precipitation, force the irrigation districts to cancel these water delivery orders after the water has been released at Parker Dam. Usually, the water is diverted at Morelos Dam for use in Mexico; however, some of this water may flow past Morelos Dam. The volume of water passing by Morelos Dam is rarely enough to have much effect on species and habitat in Mexico below the NIB. Adoption of interim surplus criteria will not affect water that flows past the NIB as a result of canceled water orders.

Gila River flood events are extremely rare. Only once has flow been recorded over 4,000 cfs at the Dome, Arizona, gaging station since 1941. In 1993, up to 27,500 cfs flowed past the Dome gaging station as a result of the 1993 Gila River flood (USGS, 1999). The 1993 flood created much of the habitat presently found along the Colorado River below its confluence with the Gila (Glenn, 2000).

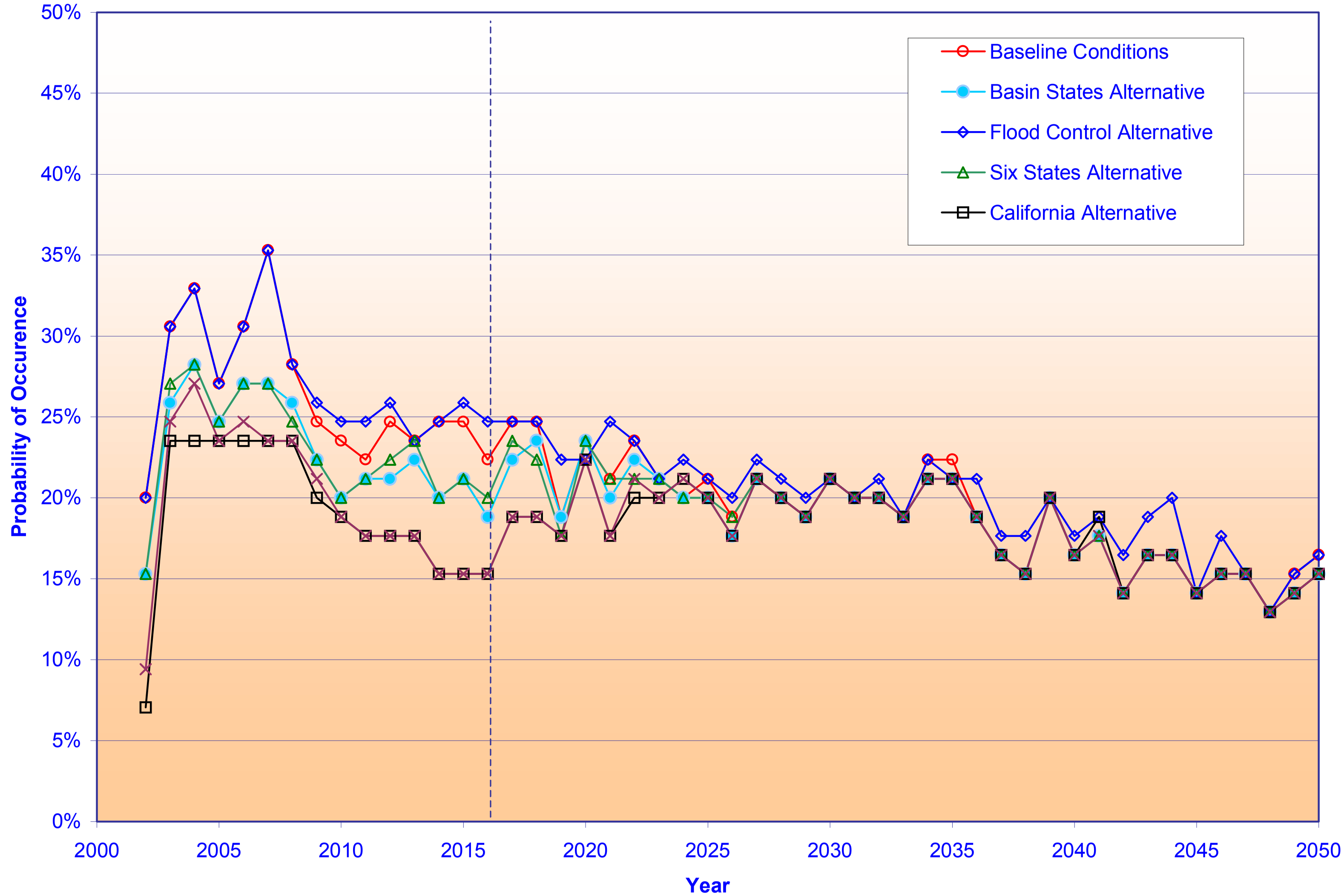
Excess flows to Mexico are almost entirely due to flood control releases originating at Hoover Dam. As discussed in Section 3.3.1.2, these flood control releases are dictated by the flood control criteria established for Lake Mead and Hoover Dam and are dependent upon hydrologic conditions.

3.16.5.1 BASELINE CONDITIONS

The potential range of water deliveries to Mexico under the baseline conditions and surplus alternatives was discussed in Section 3.4.4.5. Flows below Morelos Dam at various seasons were also analyzed in Section 3.3.4.5.4. Both the frequency and magnitude of excess flows are important factors in restoring and maintaining riparian habitat below Morelos Dam and are analyzed in more detail in this section. It should be emphasized that Mexico's management decisions at and below Morelos Dam are not modeled. This is due to uncertainty of what Mexico chooses to do with excess water. Therefore, the hydrologic analyses assume that any water in excess of Mexico's scheduled surplus deliveries are those flows that have the potential to occur below Morelos Dam.

Figure 3.16-1 presents a comparison of the frequency of occurrence of future delivery of excess flows to Mexico observed under the surplus alternatives to those of baseline

Figure 3.16-1
Probability of Occurrence of Excess Flows Below Mexico Diversion at Morelos Dam
Comparison of Surplus Alternatives to Baseline Conditions



conditions. The frequency of occurrence is compiled by counting the number of modeled traces for each year that have excess flows and dividing by the total number of traces. As illustrated in Figure 3.16-1, with the exception of the Flood Control Alternative, the excess flows below Morelos Dam occur less frequently under the surplus alternatives when compared to baseline, during the interim surplus criteria period (2002 to 2016). These differences decrease to negligible amounts after 2027. The low frequency of occurrence in excess flows under the baseline conditions in the first year (2002) can be attributable to the relatively low reservoir starting conditions (approximately 33 feet below full content level at Lake Mead). The differences between the baseline and surplus alternatives, with the exception of the Flood Control Alternative, can be attributed to more frequent surplus deliveries which tend to lower Lake Mead reservoir levels. With lower reservoir levels, the frequency of flood control events (which are the primary source of the excess flows) is decreased.

The maximum frequency under baseline conditions is observed in 2006 (35 percent). Thereafter, a gradual declining tendency is observed to about 16 percent in 2050. The gradual declining trend observed under both the baseline conditions and surplus alternative coincide with the Basin States' plans to maximize consumptive use of their Colorado River water apportionment for agricultural, municipal and industrial use application, as exhibited by the Basin States' demand projections.

It is generally believed that periodic flows of 250,000 af or greater are necessary for maintaining the health of the Colorado River corridor in Mexico and the upper end of the Sea of Cortez (Leucke *et al.,* 1999) and help to restore floodplain habitat. Figure 3.16-2 presents the probability of occurrence of excess flows greater than 250,000 af and Figure 3.16-3 shows the probability of occurrence of excess flows greater than 1,000,000 af below the Mexico Diversion at Morelos Dam.

Figure 3.16-2
Potential Magnitude of Excess Flows Greater than 250,000 Acre-Feet Below Mexico Diversions at Morelos Dam
Comparison of Surplus Alternatives to Baseline Conditions

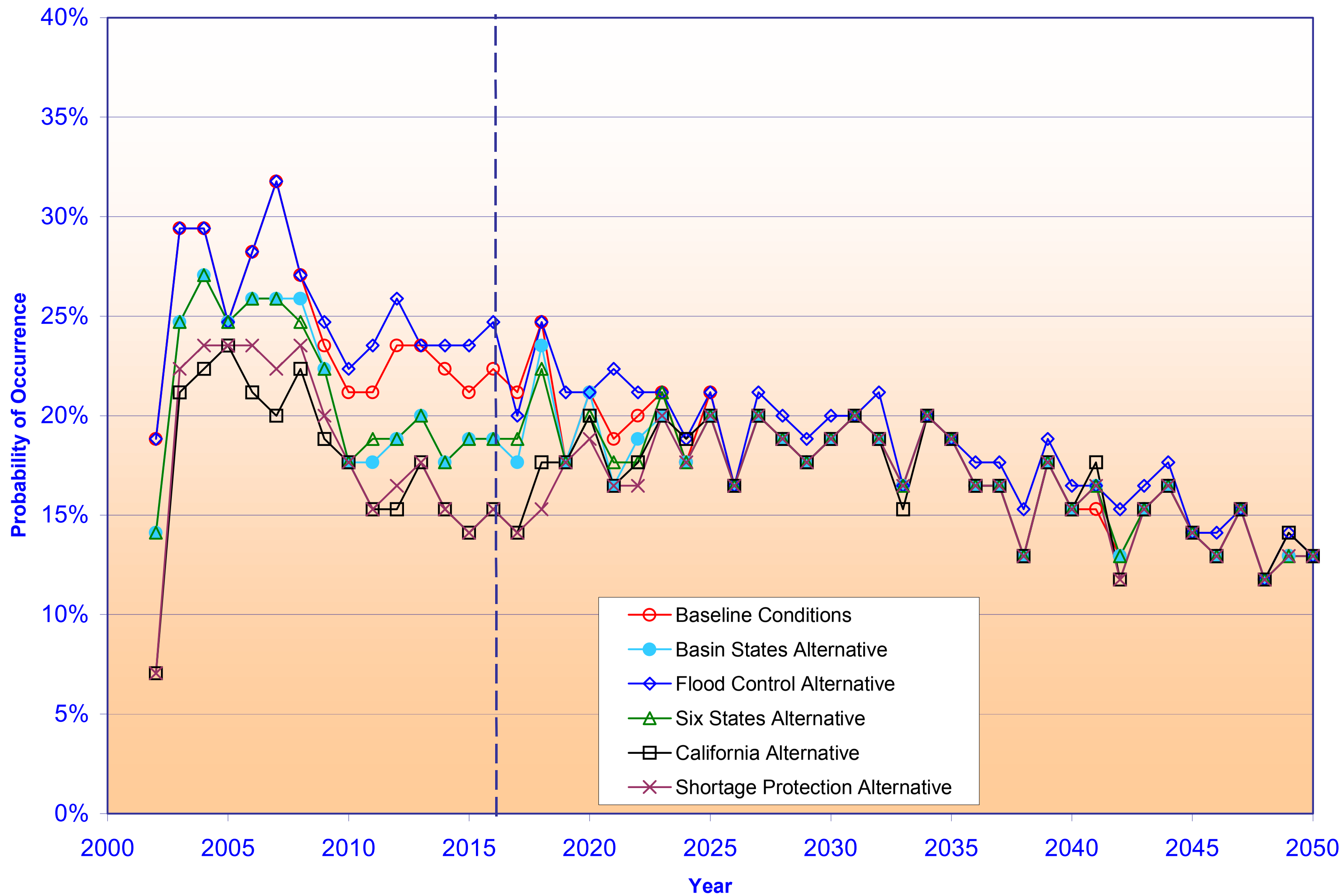
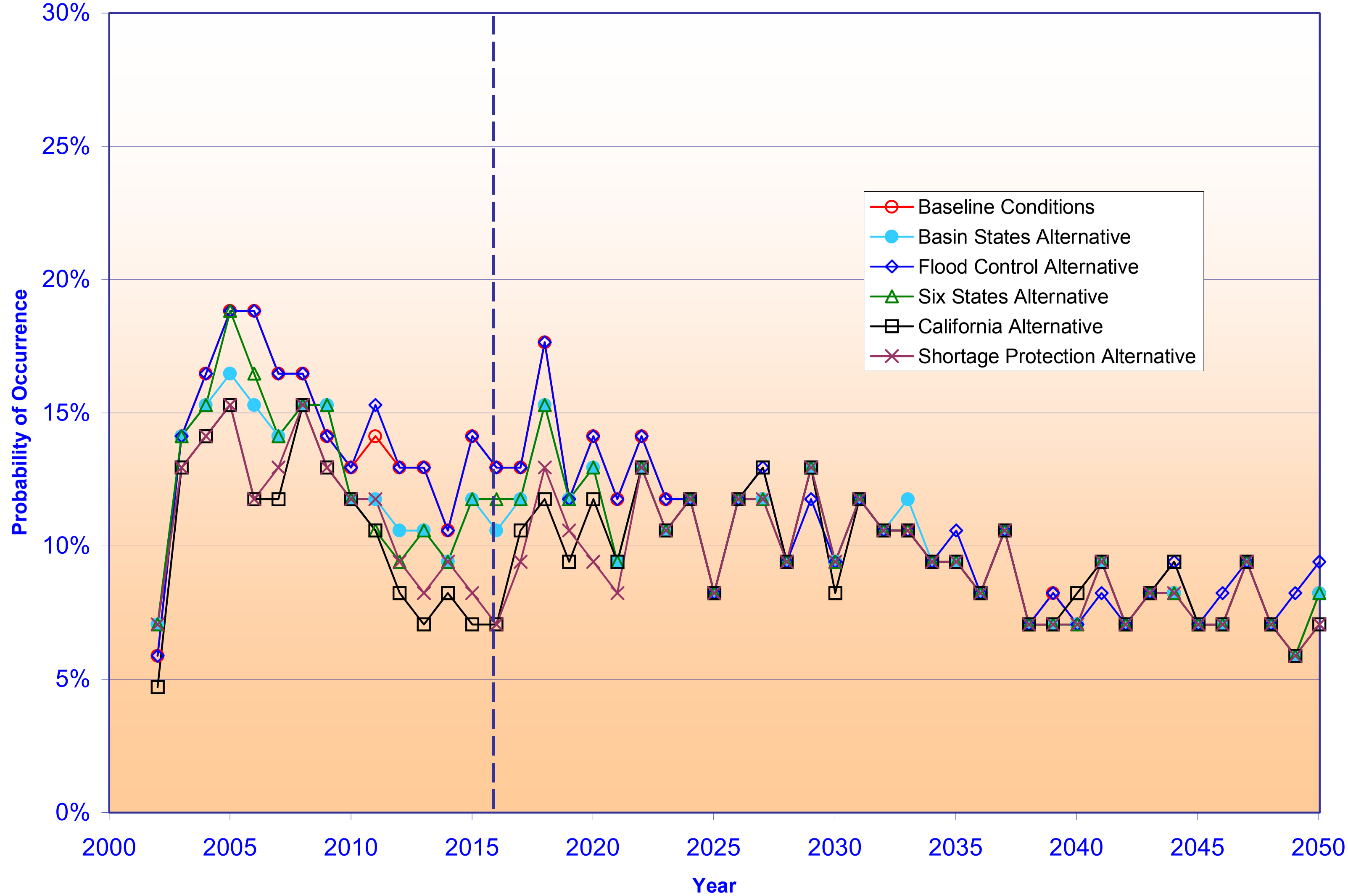


Figure 3.16-3
Potential Magnitude of Excess Flows Greater Than 1,000,000 Acre-Feet Below Mexico Diversion at Morelos Dam
Comparison of Surplus Alternatives to Baseline Conditions



3.16.5.2 COMPARISON OF SURPLUS ALTERNATIVES TO BASELINE CONDITIONS

Figure 3.16-1 presented a graphical comparison of the probability of delivery of future excess flows to Mexico under the surplus alternatives to those under the baseline conditions. A similar comparison for selected years is presented in tabular format in Table 3.16-1. In general, the Flood Control Alternative provides the highest frequency while the California and Shortage Protection alternatives provide the lowest frequency. The largest difference in frequency observed at the end of the interim surplus criteria period (2016) and is about seven percent for the California and Shortage Protection alternative compared to baseline conditions. This difference is reduced to approximately one percent by 2026. In 2016, the difference in frequency between the Basin States and Six States when compared to baseline conditions is three and two percent, respectively. After 2016, the differences in frequency between the surplus alternatives and baseline conditions gradually decreases to one percent or less by 2050.

Table 3.16-1
Frequency Occurrence of Excess Flows Below Mexico Diversion at Morelos Dam
Comparison of Surplus Alternatives to Baseline Conditions

	Baseline Conditions	Basin States Alternative	Flood Control Alternative	Six States Alternative	California Alternative	Shortage Protection Alternative
2002	20%	15%	20%	15%	7%	9%
2003	31%	26%	31%	27%	24%	25%
2004	33%	28%	33%	28%	24%	27%
2005	27%	25%	27%	25%	24%	24%
2006	31%	27%	31%	27%	24%	25%
2007	35%	27%	35%	27%	24%	24%
2008	28%	26%	28%	25%	24%	24%
2009	25%	22%	26%	22%	20%	21%
2010	24%	20%	25%	20%	19%	19%
2011	22%	21%	25%	21%	18%	18%
2012	25%	21%	26%	22%	18%	18%
2013	24%	22%	24%	24%	18%	18%
2014	25%	20%	25%	20%	15%	15%
2015	25%	21%	26%	21%	15%	15%
2016	22%	19%	25%	20%	15%	15%
2026	19%	18%	20%	19%	18%	18%
2050	16%	15%	16%	15%	15%	15%

As discussed in Section 3.3.4.5.4, the annual volume of excess flows can be compared for the surplus alternatives and baseline conditions. Figures 3.16-4 and 3.16-5 show the cumulative distributions for years 2016 and 2050, respectively (Figure 3.3-28 showed the data for 2006). Although the frequency of occurrence of flows of a particular magnitude is decreased, the range of excess flows is preserved for the surplus alternatives when compared to baseline conditions.

Figure 3.16-4
Potential Magnitude of Excess Flows Below Mexico Diversion at Morelos Dam
Comparison of Surplus Alternatives to Baseline Conditions for Modeled Year 2016

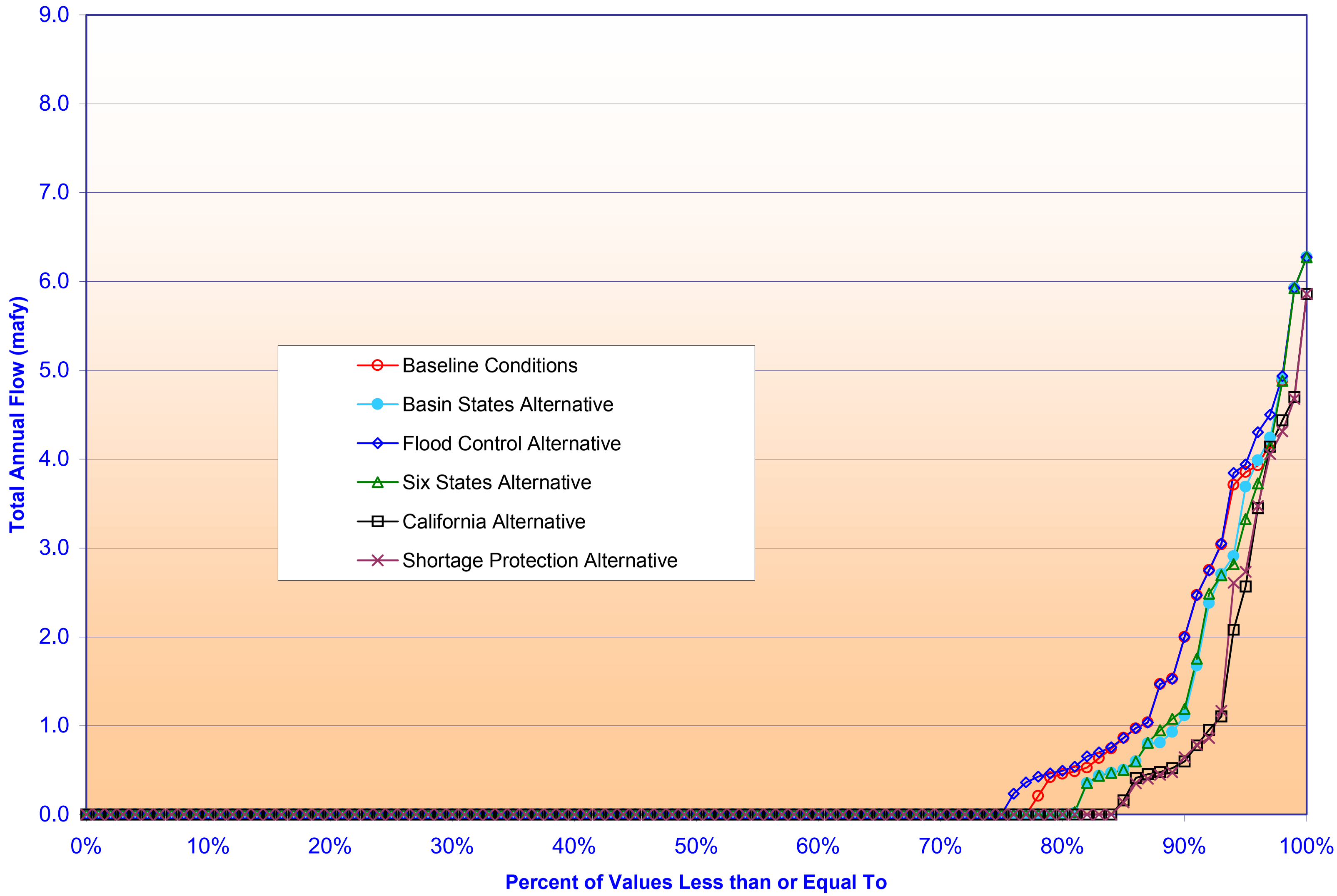
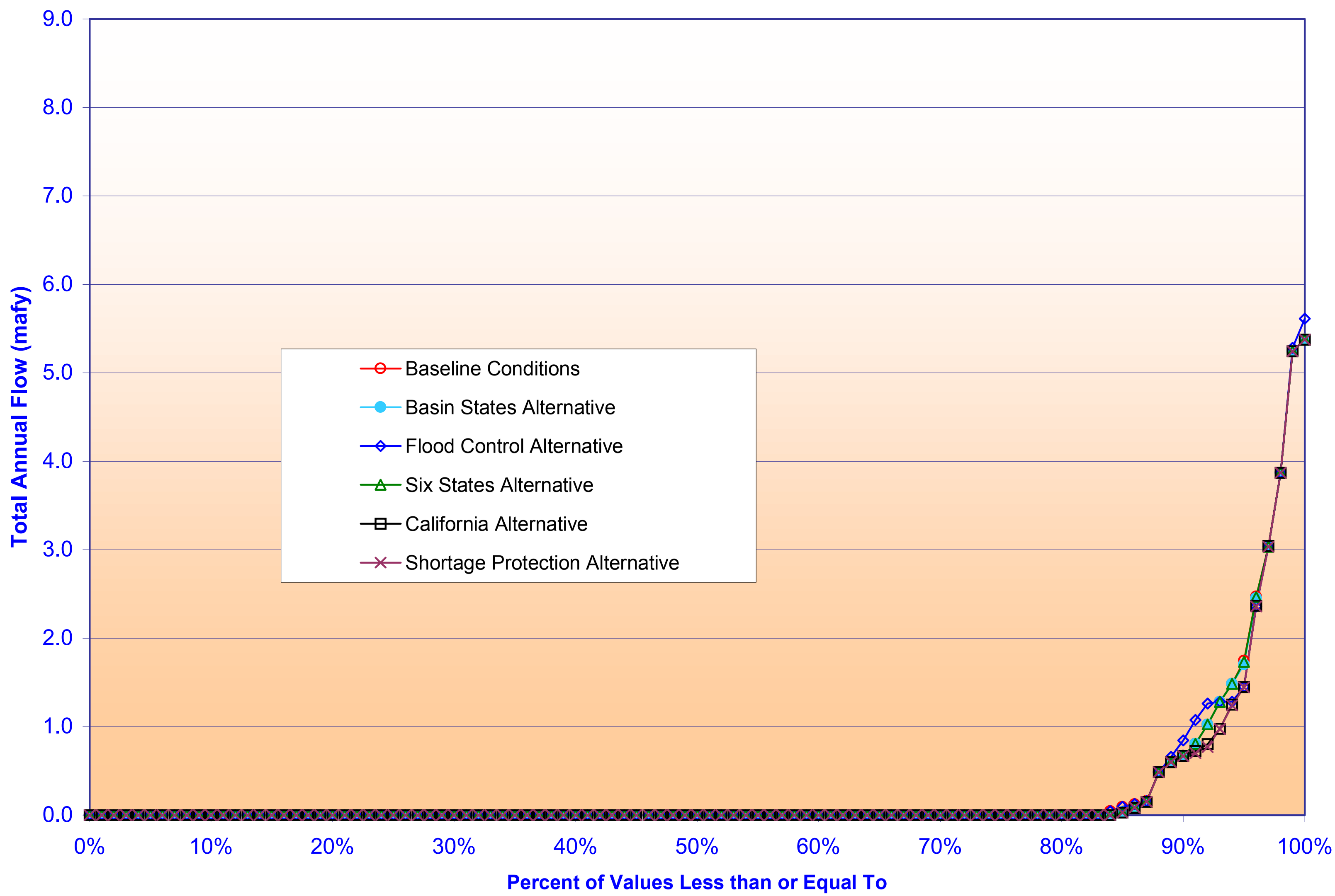


Figure 3.16-5
Potential Magnitude of Excess Flows Below Mexico Diversion at Morelos Dam
Comparison of Surplus Alternatives to Baseline Conditions for Modeled Year 2050



Alternatively, the potential magnitudes of excess flows for the 75th and 90th percentiles are shown in Figure 3.16-6. The 75th and 90th percentile values are also presented in tabular format for years 2002 through 2026 in Table 3.16-2 and Table 3.16-3, respectively. The 75th percentile flow is defined as the flow that would not be exceeded 75 percent of the time (i.e., the minimum flow that would be expected to occur 25 percent of the time) and likewise, the 90th percentile flow would be expected to occur 10 percent of the time.

In summary, there are only minor differences in the potential magnitudes and potential frequencies of excess flows between baseline conditions and the Basin States Alternative. During the interim surplus criteria period, the average frequency of occurrence of beneficial flows (exceeding 250,000 af) in any year is 24.5 percent for baseline conditions, which is equivalent to approximately one year in four. This compares to a frequency of 17.8 percent for the California Alternative (one year in six) and 21.3 percent for the Basin States Alternative (one year in five). After the interim surplus criteria period, the average frequency of occurrence is approximately the same for all surplus alternatives and baseline (ranging between 17.0 percent and 18.2 percent or about one in every six years).

The above probabilities indicate conditions below Morelos Dam would be similar to those presumed to be beneficial. Leucke, et al, 1999 states it is not yet possible to quantify with certainty the required volume and frequency of these high flows.

While the probable frequency of approximately one in four years under the baseline would change to a probable frequency of approximately one in five years under the Basin States Alternative, the change in benefits to species and habitat would likely be insignificant. The riparian vegetation existing along the Colorado River corridor in Mexico is extremely resilient.

Mexico has complete discretion over the use of water entering that country. As stated before, excess flows are generally diverted when possible species and habitat can benefit only when the amount of water arriving at Mexico is in excess of that which can be diverted.

Figure 3.16- 6
Potential Magnitude of Excess Flows To Mexico
90th and 75th Percentile Values

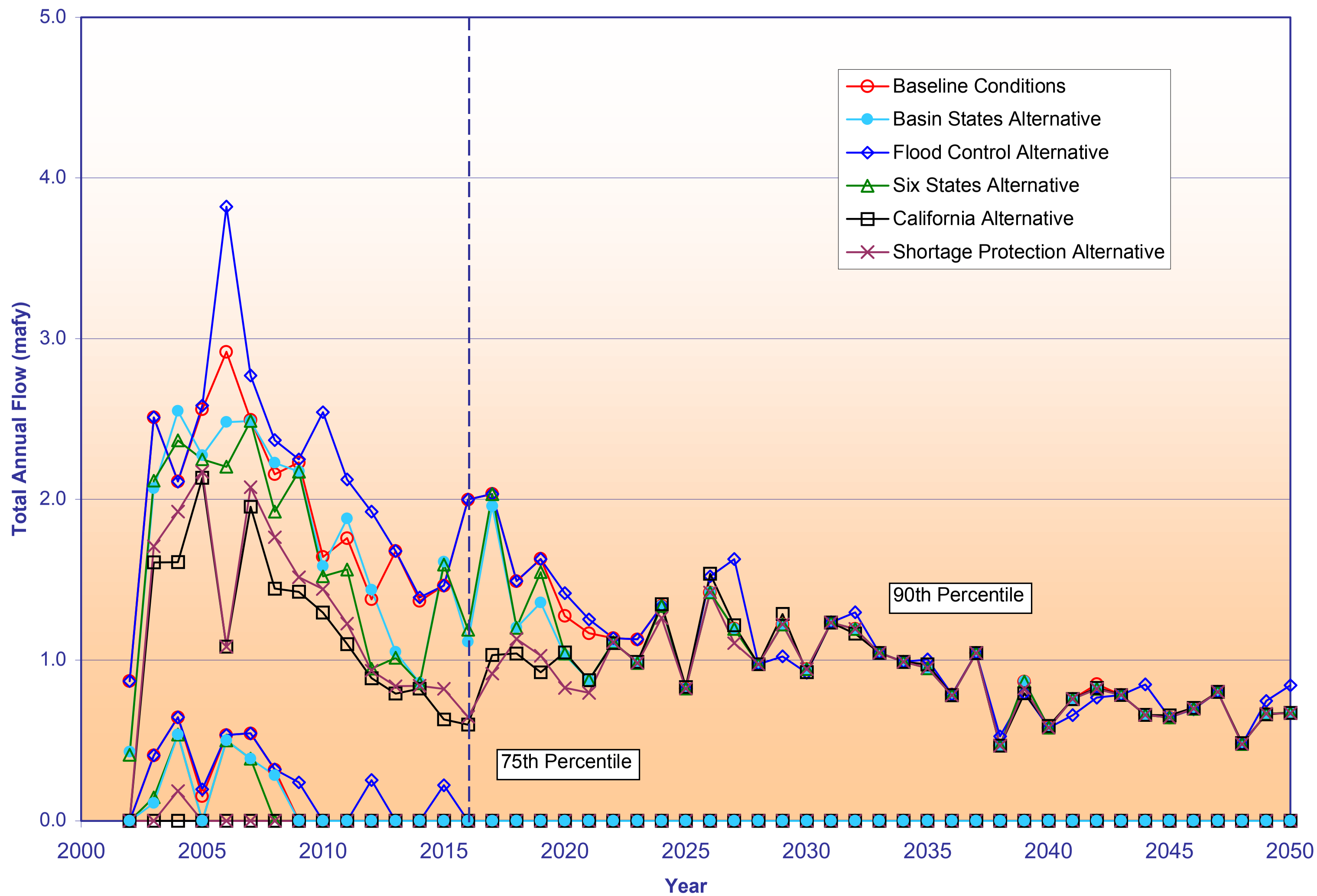


Table 3.16-2
Excess Flows Below Mexico Diversion at Morelos Dam
Comparison of Surplus Alternatives to Baseline Conditions
75th Percentile Values for Selected Years (kaf)

	Baseline Conditions	Flood Control Alternative	Six States Alternative	Basin States Alternative	California Alternative	Shortage Protection Alternative
2002	0	0	0	0	0	0
2003	406	406	146	109	0	0
2004	645	645	536	536	0	186
2005	153	195	0	0	0	0
2006	534	534	500	500	0	0
2007	545	545	386	386	0	0
2008	318	319	0	282	0	0
2009	0	239	0	0	0	0
2010	0	0	0	0	0	0
2011	0	0	0	0	0	0
2012	0	253	0	0	0	0
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
2015	0	221	0	0	0	0
2016	0	0	0	0	0	0
2017	0	0	0	0	0	0
2018	0	0	0	0	0	0
2019	0	0	0	0	0	0
2020	0	0	0	0	0	0
2021	0	0	0	0	0	0
2022	0	0	0	0	0	0
2023	0	0	0	0	0	0
2024	0	0	0	0	0	0
2025	0	0	0	0	0	0
2026	0	0	0	0	0	0

Table 3.16-3
Excess Flows Below Mexico Diversion at Morelos Dam
Comparison of Surplus Alternatives to Baseline Conditions
90th Percentile Values for Selected Years (kaf)

	Baseline Conditions	Flood Control Alternative	Six States Alternative	Basin States Alternative	California Alternative	Shortage Protection Alternative
2002	870	870	412	429	0	0
2003	2510	2510	2116	2068	1608	1709
2004	2112	2111	2368	2550	1610	1924
2005	2560	2584	2249	2274	2135	2171
2006	2918	3822	2203	2481	1083	1083
2007	2495	2772	2489	2489	1954	2076
2008	2157	2369	1924	2227	1445	1765
2009	2230	2249	2172	2175	1426	1516
2010	1641	2542	1522	1583	1295	1441
2011	1758	2124	1563	1881	1100	1226
2012	1378	1924	947	1438	887	934
2013	1680	1680	1014	1049	792	837
2014	1368	1391	857	857	823	840
2015	1464	1464	1595	1611	631	821
2016	1999	1999	1189	1114	599	647
2017	2034	2034	2033	1957	1032	915
2018	1492	1492	1201	1201	1041	1132
2019	1630	1629	1548	1358	924	1028
2020	1276	1417	1041	1032	1048	828
2021	1167	1254	876	876	876	796
2022	1136	1136	1112	1112	1106	1112
2023	1130	1130	981	981	988	981
2024	1338	1336	1338	1338	1348	1261
2025	823	823	823	823	833	823
2026	1422	1521	1422	1422	1537	1422

3.16.5.3 POTENTIAL TRANSBOUNDARY EFFECTS OF REDUCED FLOOD FLOW FREQUENCY

As discussed in the previous sections, modeling of baseline conditions and each of the interim surplus criteria alternatives indicates a potential for reductions in the frequency of excess flows delivered to Mexico throughout the period of analysis. Excess flows can have both positive and negative impacts on salinity, groundwater, and water available for diversion by Mexico at Morelos Dam. This section discusses the general effects of excess flows to Mexico, and the potential impacts of reduced frequencies of such flows. Potential effects on floodplain habitat and species within Mexico could also occur from a reduction in excess flows to Mexico are discussed in Section 3.16.6.

3.16.5.3.1 General Effects of Flood Flows

On the positive side, excess flows to Mexico are lower in salinity than normal flows (i.e., flows associated with traditional downstream requirements and deliveries). These flows can, therefore, improve the water quality of deliveries to farms in the United States and Mexico, thereby reducing the salinity of the deep percolation from farm application and gradually improving the quality of groundwater and drainage return flows.

Because the volume and quality of water arriving at the NIB is larger and better during flood flow conditions, the salinity levels at NIB will be lower than in normal years. The salinity of flows carried to the SIB and into Mexico closely reflect the salinity of flows arriving at NIB. These high quality flows will tend to improve the groundwater quality and raise the groundwater levels along the river channel downstream of Morelos Dam.

However, on the negative side, higher river elevations resulting from flood control releases can cause groundwater levels to rise. In agricultural and urban areas, higher groundwater levels can cause crop damage or damage to municipal facilities. Higher groundwater levels can also require increased drainage pumping after flood conditions occur to return groundwater levels to normal, non-damaging conditions.

In addition, flood flows carry more sediment, which is deposited in the river channel both upstream and downstream of Morelos Dam. This sediment deposition will have the tendency to raise river levels for normal flow conditions, raise the groundwater levels near the river and reduce flow carrying capacity of the river channel both above and below Morelos Dam.

Flows in excess of 15,000 cfs below Imperial Dam and below Morelos Dam can be very destructive and can cause substantial damage to levees, river structures, and other private and public facilities. Considerable expense can be incurred to protect these facilities.

3.16.5.3.2 Effects of Reduced Excess Flows

As discussed in Section 3.16.5.1 and 3.16.5.2, modeling indicates an increasing likelihood over time of reduced frequency of excess flows to Mexico. Such reductions would occur to varying degrees under baseline conditions and each of the alternatives. The potential effects in Mexico of reduced excess flow frequencies could include the following:

- Mexico would have fewer opportunities to take water in excess of their maximum water order for uses such as groundwater recharge for agricultural and municipal wells, leaching of salts from farm soils, raising of additional crops, and improvement of water quality being delivered to farms along the east bank of the Colorado River.

- Groundwater levels downstream of areas being farmed in the United States and Mexico would decline and salinity levels of the groundwater would be expected to increase. However, damage caused by high groundwater would be less frequent and less substantial than experienced in the past. Also, it would take less time and less volume of additional drainage pumping to return groundwater to acceptable levels, reducing impacts to the salinity of flows arriving at NIB once deliveries to Mexico return to normal levels.

- The frequency of future excess flows would likely be less than those experienced in the past, reducing the potential for damage to public and private facilities and reducing costs associated with floods and flood control releases. Also the duration of flood control releases would be less, further reducing damage to levees and river control structures.

- Less sediment control work would be required in the river channel, reducing maintenance costs for both Mexico and the United States.

3.16.5.4 SUMMARY OF POTENTIAL EFFECTS TO SPECIAL-STATUS STATUS AND HABITAT IN MEXICO

3.16.5.5 POTENTIAL EFFECTS TO HABITAT IN MEXICO

The historic reduction in Colorado River flows below the NIB affected the ecosystem of the delta. However, these reductions have been instituted while meeting the requirements of an international treaty and the diversion and use of such treaty water is solely at Mexico's discretion. Except for periods of high flow or flood control operations, little water reaches the delta and the upper Gulf. It is not within Reclamation’s discretionary authority to make unilateral adjustments to water deliveries to the international border.

Riparian habitat, along the Colorado River between the NIB and the Gulf of California, requires scouring flood events for regeneration. Both the frequency and magnitude of excess flows are important for this regeneration. As discussed previously, changes in the potential frequency and magnitude of beneficial excess flows (flows greater than 250,000 af) is not significantly affected by interim surplus criteria. As shown in Figure 3.16-4, under baseline conditions, the frequency of such excess flows to Mexico could potentially decrease over the next 25 years. The frequencies under the interim surplus alternatives follow this trend albeit lower during the interim surplus criteria period, with the maximum differences between the surplus alternatives and the baseline conditions occurring in 2015.

It is difficult to quantify the effect of reduced frequencies of excess flows to the existing habitat. The majority of the existing cottonwood-willow habitat regenerated during the 1983-87 Colorado River and 1993 Gila River flood events. This habitat has been sustained by a variety of potential water sources, including high groundwater and agricultural runoff.

Special status species that utilize riparian habitat along the Mexican reach of the Colorado River could be affected by the decrease in frequency of flood control releases and excess flows that occur below the Mexico Diversion at Morelos Dam. Existing habitat is, and will continue to be adversely affected by wildfire, agricultural clearing, and clearing for channel maintenance and flood control. New habitat is less likely to regenerate due to the decrease in flood frequency. However, these events are likely to occur whether or not surplus criteria are implemented. As shown in Figure 3.16-1, all alternatives (including the baseline condition) indicate a decrease in frequency of flood control releases and excess flows over the period of analysis (2002 through 2050), due to increased Upper Basin depletions.

The Cienega de Santa Clara is the largest wetland in the delta. This action will not affect the habitat occurring there, as the Cienega is sustained by irrigation return flows from the United States that will not be affected by the proposed action. The Rio Hardy wetlands occurring at the confluence of the Rio Hardy are also expected not to be affected by the action. These wetlands are also sustained by agricultural runoff, from the west side of the Mexicali Valley.

3.16.5.5.1 Potential Effects to Special Status-Species in Mexico

3.16.5.5.2 Desert pupfish

The desert pupfish (*Cyprinodon macularius)* is a small killifish with a smoothly rounded body shape. Adults generally range from 2-3 inches in length. Males are smaller than females and during spawning the males are blue on the head and sides and have yellow edged fins. Most adults have narrow, dark, vertical bars on their sides. The species was described in 1853 from specimens collected in San Pedro River, Arizona. There are two recognized subspecies and possibly a third form (yet to be described). The nominal subspecies, *Cyprinodon macularius macularius*, occurs in both the Salton Sea area of southern California and the Colorado River delta area in Mexico and is the species of concern, herein. The other subspecies is *C.m. eremus* and is endemic to Quitobaquito Spring, Arizona.

The desert pupfish was listed as an endangered species on March 31, 1986. Critical habitat for the species was designated in the United States at the time of listing and included the Quitobaquito Spring which is in Organ Pipe Cactus National Monument, and San Felipe Creek along with its two tributaries Carrizo Wash and Fish Creek Wash in southern California. All of the former and parts of the latter were in federal ownership at the time of listing. Reclamation purchased the remaining private holdings along San Felipe Creek and its tributary washes and turned them over to California Department of Fish and Game in 1991. All of the designated critical habitat is now under state or federal ownership.

Desert pupfish are adapted to harsh desert environments and are extremely hardy. They routinely occupy water of too poor quality for other fishes, most notably too warm and too salty. They can tolerate temperatures in excess of 110° F; oxygen levels as low as 0.1 ppm; and salinity nearly twice that of sea water (over 70,000 ppm). In addition to their absolute tolerance of these parameters, they are able to adjust and tolerate rapid, extreme changes to these same parameters (Marsh and Sada 1993). Pupfish have a short life span, usually only two years, but they mature rapidly and can reproduce as many as three times during the year.

Desert pupfish inhabit desert springs, small streams, creeks, marshes and margins of larger bodies of water. The fish usually inhabit very shallow water, often too shallow for other fishes. Present distribution of the subspecies *C. m. macularius* includes natural populations in at least 12 locations in the United States and Mexico, as well as over 20 transplanted populations.

One of the natural populations in Mexico is in the Cienega de Santa Clara, a 100,000-acre shallow basin on the Colorado River delta 60 miles south of the United States/Mexico border. The area is about 90 percent unvegetated salt flats with a number of small marsh complexes along the eastern edge of the bowl where it abuts an escarpment. The area is disconnected from both the Colorado River and the Gulf (Sea of Cortez), however extreme high tides result in the lower half of the basin becoming inundated to a level of one foot or less of salt water from the gulf. The marsh areas on the east side are small and are spring fed. The largest marsh complex is on the northeast side where two agricultural drains provide relatively fresh water inflows. The desert pupfish occur in a number of these marsh complexes.

Reclamation biologists discovered this population of desert pupfish in 1974 during preproject investigations for a feature of the Colorado River Basin Salinity Control Project. At that time, inflow to the Cienega was by agricultural return flows from the

Riito Drain in Mexico which provided about 35 cfs flow. The project feature being investigated was construction of a bypass canal for drain water from WMIDD.

Desert pupfish were found in the marsh along with mosquito fish, sailfin mollies, carp and red shiners. The bypass canal was completed in 1978 and provided a steady flow of over 150 cfs to the marsh. Based upon aerial surveys, the added inflow caused the marsh to grow from an estimated 300 acres of vegetated area in 1974 to roughly 10,000 acres in 1985. Recent aerial surveys show that while the inflows have continued, the marsh has not continued to grow in size. Desert pupfish continue to exist in the marsh. The fish tend to inhabit the shallow edges of the marsh in vegetated areas. Desert pupfish from the Cienega were transported to Dexter National Fish Hatchery during May 1983, and many of the transplanted populations in the United States are of this subspecies and stem from this initial transplant.

Reclamation has determined that desert pupfish would not be affected by the implementation of interim surplus criteria. The main population exists in the Cienega de Santa Clara which is not dependent on flows from the lower Colorado River. As such, the potentially reduced frequency of excess flows that may occur as a result of the adoption of interim surplus criteria would not have a direct effect on the water in the Cienega. The other populations of desert pupfish are not found proximate to the Colorado River.

3.16.5.5.3 Vaquita

The Vaquita (*Phocaena sinus)* is a small porpoise and is widely believed to be the most endangered marine cetacean in the world (Klinowska 1991; Taylor and Gerrodette 1993). It is also the only endemic species of marine mammal from the Gulf.

The Vaquita was listed as “Vulnerable” in 1978 by the IUCN-The World Conservation Union [formerly the International Union for Conservation of Nature and Natural Resources (IUCN)] in their Red Data Book and also in the Mexican list of wild vertebrates in danger of extinction. The Vaquita was also listed in Appendix I of the Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora on 28 June 1979, and in February 1985 as an endangered species under the United States Endangered Species Act. Recently, this porpoise was classified as “Endangered” in the IUCN Cetacean Red Data Book.

The Vaquita is very similar in external morphology to the harbor porpoise (*Phocaena phocaena*). Based on a very small sample and a maximum recorded total length of about five feet, the Vaquita may be the smallest of all the delphinoids (Brownell *et al.,* 1987). The pectoral fins are larger and the dorsal fin is higher proportionally to the body length than in any other extant porpoise species (Brownell *et al.,* 1987).

The coloration of adult Vaquitas is unique. On the dorsal portion, the color is dark gray, the sides are pale gray, and the ventral surface is white with some pale-gray elongated spots. The porpoise has a large, dark eye spot and lip patches that contrast with the gray background (Ramirez, 1993).

The life history of the Vaquita appears, in many ways, to be similar to its better-studied congener, the harbour porpoise, from the Bay of Fundy, Canada and the Gulf of Maine. Both species have a maximum longevity of about 20 years (Hohn, *et al.,* 1996). Little is known about the reproductive biology of the species. It has been suggested that calving occurs in the spring and mating in late spring or soon thereafter (Vidal, 1990). Food habits are also practically unknown; Fitch and Brownell (1968) reported small fish such as grunt (*Orthopristis reddingi*) and croaker (*Bairdiella icistia*) from stomach contents and Brownell (1982) also reported squid. More details regarding the life history of the Vaquita are documented in Vidal (1995) and Hohn, *et al.,* (1996).

The range of the Vaquita is restricted to the northwestern corner of the Gulf of California, Mexico (Jaramillo-Legorreta, *et al.,* 1999), representing the most restricted range for any cetacean species (Ramirez 1993). Stranding data, mortalities in fishing nets and sightings of live animals all confirm that the present distribution of Vaquita is concentrated in a small area rear Rocas Consag in the northwestern Gulf of California (Gerrodette, *et al.,* 1995). Sightings outside of this region (south of 30E 45' N latitude) may represent occasional departures by some individuals from the center of distribution (Silber and Norris, 1991) or temporary extensions in distribution due to climatic changes (Vidal, 1990). The region south of Puerto Penasco, Sonora, Mexico, remains insufficiently monitored to further increase the accuracy of population estimates and to establish the southern limit of the geographic range of the species (Ramirez 1993). The range of the Vaquita overlaps that of the endangered totoaba, to which it may be linked ecologically (Ramirez 1993).

A number of factors make the Vaquita an extremely difficult species to survey; habitat characteristics such as turbid water, fraction of the time spent at the surface, elusive behavior, and its erratic surfacing mode (Ramirez 1993). Despite these difficulties, and biases in collection of survey data, it is clear that the species is rare. The total population size is estimated to be 567 animals, with a 95 percent confidence interval from 177 to 1073 (Jaramillo-Legorreta, *et al.,* 1999).

The Vaquita is particularly vulnerable to incidental mortality in gillnets. The Vaquita has probably been incidentally caught in gillnets since the mid-1920's. It can be assumed the significant expansion of the fishing industry during the early 1940's further reduced the population (Vidal, 1995). Vaquita bycatch in gillnet fisheries was identified as a defining factor which may drive the species to extinction. The total estimated incidental mortality caused by the fleet of El Golfo de Santa Clara was 39 Vaquitas per year, over 17 percent of the most recent estimate of population size. El Golfo de Santa Clara is one of three main ports that support gillnet fisheries throughout the range of the Vaquita. The fishing effort for San Felipe, Baja California appears to be similar to that of El Golfo de Santa Clara, suggesting that this estimate of incidental mortality of Vaquitas represents a minimum (D'Agrosa, *et al.,* 2000).

Ramirez (1993) identified three actual and potential impacts to the Vaquita: incidental mortality caused by fishery activities, reduced Colorado River flows into the Gulf of California and pollution from various sources associated with Colorado River flows into the Gulf.

Rojas-Bracho and Taylor (1999) concluded habitat alteration from reduced flow of the Colorado River does not currently appear to be a risk factor because productivity remains high in Vaquita habitat. Pollutant loads are low and pose low to no risk. Reduced fitness from inbreeding depression and loss of genetic variability are unlikely to pose high risk currently, though risk will increase if Vaquitas remain at low abundance over long periods of time. Mortality resulting from fisheries is the greatest immediate risk for Vaquitas.

Therefore, Reclamation concluded that the implementation of any of the interim surplus criteria alternatives would have no effect on the Vaquita.

3.16.5.5.4 Totoaba

The totoaba *(Totoaba macdonaldi)* is a fish endemic to the Gulf of California. In 1976 the species was listed as threatened under the Convertion on International Trade in Endangered Species (CITES). On May 21, 1979, the totoaba was listed in the United States as endangered pursuant to the Endangered Species Act (44 FR 99).

Totoaba are large schooling fish that undertake a seasonal migration within the Gulf and may live to 25 years of age (Cisneros-Mata *et al.,* 1995). Totoaba are the largest of the sciaenid fish, with a maximum reported weight of over 100 kg and a length of over two meters (Flanagan and Hendrickson 1976). Adults spawn in the shallow waters of the Colorado River delta in the upper Gulf where they remain for several weeks before migrating south. Spawning originally occurred from February to June. More recently, it has been determined that spawning takes place from February through April (Cisnereo-Mata, *et al.,* 1995). Juveniles are thought to emigrate south after spending two years in the upper Gulf, which is considered their nursery ground (Flanagan and Hendrickson 1976).

Juvenile fish eat small benthic organisms, mainly crabs and fish, amphipods, and shrimp; adults eat larger more pelagic items, such as sardines and adult crabs (Flanagan and Hendrickson 1976, Cisneros-Mata *et al.,* 1995). Many aspects of the biology and ecology of this species are unknown.

The totoaba is thought to have ranged from the mouth of the Colorado River to Bahia Concepcion on the west coast of the Gulf and to the mouth of the El Fuerte River in the east (Jordan and Everman 1896 *cited in* Berdegue 1955). Historically, millions of totoaba migrated north in the spring to spawn at the mouth of the Colorado River (Gause 1969).

A more thorough description of the life history of the totoaba is found in Cisneros-Mata, *et al.,* 1995.

The first commercial harvesting of totoaba began in the early 1890s and by 1942, annual catches peaked at 2.3 million kg. In 1975, the catch had declined to 59,142 kg (Lagomarsino 1991). Beginning as early as 1940, the Mexican government imposed restrictions on the commercial fishery for totoaba, and in 1975, the government designated totoaba as endangered and declared an indefinite prohibition on all types of commercial and recreational fishing (Flanagan and Hendrickson 1976).

In April-June 1994, the School of Marine Sciences of the Autonomous University of Baja California developed a field technique that permitted successful capture and transport of totoaba broodstock from the Upper Gulf to the laboratory at Ensanada (True *et al.,* 1997). They were able to keep these specimens of totoaba alive and successfully spawned them. In October of 1997 they released 250 juveniles, back into the upper gulf. These were four months old and 20-25 cm long.

Despite the closure of the fishery, illegal exploitation continues. It is believed that the incidental catch of juvenile totoaba in the shrimp trawling fishery is the principal factor affecting recovery of the species (Barrera-Buevara, 1990). Much of the illegal gillnetting for totaba occurs during the spawning migration. Current knowledge indicates that decrease of the adult stock may be responsible for the decline experienced by the totoaba population (Cisneros-Mata, *et al.,* 1995).

Cisneros-Mata, *et al.,* (1995) concluded that a negative impact on totoaba due to decreased flow from the Colorado River may be questionable because the claimed effects would have caused extinction of totoaba over 40 years time. Flanagan and Hendrickson (1976) concluded that recruitment and over-fishing explained the decline better than habitat alteration. It is estimated that a steady flow of water reaching an annual total of 1.6 maf would be necessary to restore the brackish water conditions that historically occurred in the estuary (US Bureau of Reclamation file data). Even if that amount of water were available at present, Reclamation has no control over Colorado River water once it reaches the NIB.

As illustrated in Figure 3.16-1, the adoption of interim surplus criteria has the potential to reduce the frequency of occurence of excess flows below the Mexico diversion of Morelos Dam by as much as seven percent during the interim surplus criteria period (California and Shortage Protection alternatives in year 2016). However, the range of excess flows (magnitude) that are expected to occur, albeit less frequent, under the surplus alternatives are not expected to vary from those observed under baseline conditions (see Figures 3.16-4 and 3.16-5). Therefore, based upon this potential reduced frequency of excess flows, the inadvertent mortality resulting from commercial fishing as described above and Reclamation's lack of discretion over Colorado River water in Mexico led Reclamation to determine that the interim surplus criteria may affect but is not likely to adversely affect the totoaba.

3.16.5.5.5 Southwestern Willow Flycatcher

Willow flycatchers (*Empidonax traillii extimus)* are found throughout North America and are further divided taxonomically into four subspecies, *E.t. brewseri, E.t. adastus, E. t. traillii,* and *E.t. extimus.* The latter, *E.t. extimus*, the southwestern willow flycatcher, breeds on the Lower Colorado River and its tributaries (McKernan *et al.,* 1996, 1997, 1998, 1999, 2000). In January 1992, the Service was petitioned to list the southwestern willow flycatcher, *Empidonax traillii extimus* as an endangered species. In July 1993, the species was proposed as endangered with critical habitat (58 FR 39495). On February 27 1995, the Service listed the southwestern willow flycatcher as an endangered species (60 FR 10694). The Service has not issued a recovery plan to date and the designated critical habitat does not include the lower Colorado River (60 FR 10694).

As a member of the genus *Empidonax,* Willow flycatchers are known for the difficulty in identifying individuals to species in the field (Phillips *et al.,* 1964; Peterson 1990; Sogge *et al.,* 1997a). The Southwestern willow flycatcher is a small bird, approximately 5.75 inches in length, with a grayish green back and wings, whitish throat, light grey olive breast, and pale yellowish body. Two white wing bars are visible. The upper mandible is dark, the lower light. The most distinguishable taxonomic characteristic of the Southwestern willow flycatcher is the absent or faintly visible eye ring. The Southwestern willow flycatcher can only be positively differentiated in the field from other species of its genus by its distinctive "fitzbew" song.

Southwestern willow flycatchers nest in riparian habitat characterized by dense stands of intermediate sized shrubs or trees. Most Southwestern willow flycatcher nests are located in the fork of a shrub or tree from four to 25 feet above the ground (Unitt 1987; Sogge *et al.,* 1997a). These trees are either in or adjacent to soils that are either saturated or have surface water (Phillips *et al.,* 1964; Muiznieks *et al.,* 1994, McKernan 1998). The southwestern willow flycatcher is an insectivore, foraging within and above dense riparian habitat, catching insects in the air or gleaning them from the surrounding foliage. It also forages along water edges, backwaters, and sandbars adjacent to nest sites. Details on specific prey items can be found in Drost *et al.,* (1998). On the Lower Colorado River, Southwestern willow flycatchers begin arriving on breeding territories in early May and continue to be present until August, with some records into early September (McKernan, 1998). Recent studies have documented nest building as early as May 1 (McKernan 1997) and fledging dates as late as September 9 (McKernan 1998).

A long-distance migrant, the Southwestern willow flycatcher winters in Mexico from Nayarit and southwestern Oaxaca south to Panama and possibly extreme northwestern Columbia and migrates widely through the southern United States occurring as a regular migrant south to the limits of the wintering range (Peterson 1990; Sogge *et al.,* 1997a, AOU 1998). Recent field studies in Costa Rica by Koronkiewicz and Whitfield (1999) and studies of museum specimens by Phil Unitt (1999) collaborate previous information on the species' range. One specimen of willow flycatcher captured in Costa Rica during the winter of 1999 was banded at the Ash Meadows National Wildlife Refuge (NWR) in southern Nevada in July 1998 (Koronkiewicz and Whitfield 1999). The Ash Meadows NWR is within the identified breeding range of this southwestern subspecies and thus the capture in Costa Rica is the most recent confirmed wintering site of *E.t. extimus*. Breeding range for the species as a whole extends as far south as northern Sonora, and northern Baja California (AOU 1998) and north into Canada.

Breeding range for the southwestern subspecies of the willow flycatcher, *E. t. extimus*, extends from extreme southern Utah and Nevada, through Arizona, New Mexico, and southern California, but records from west Texas and extreme northern Baja California and Sonora, Mexico remain lacking to date (Unitt 1987). Molina (1998) observed the species in exotic plantings in the El Golfo de Santa Clara fishing village, and in the saltcedar-mesquite-acacia woodland corridor along the pozos near El Doctor in 1997. The species has also been documented at El Doctor wetlands, Colorado River delta, Sonora, Mexico June 7 and 8, 1999 (Hinojosa-Huerta, 2000). These sighting confirm the area is used for migration, but does not confirm breeding. The presence of the subspecies after June 15 is required to confirm breeding (Sogge *et al.,* 1997; Braden and McKernan 1998). A survey for southwestern willow flycatcher was conducted on the Copopah Indian Reservation near Yuma, Arizona in 2000. Twenty-six birds were detected on May 22 and June 6, 2000, and none later. It was concluded the riparian habitat on the Reservation was being used as a stopover area during the migration (Garcia-Hernandez, *et al.,* 2000).

The majority of Southwestern willow flycatchers found during the past five years of surveys on the Lower Colorado River have been found in saltcedar, *Tamarix ramosissima*, or a mixture of saltcedar and native cottonwood and willow, especially Gooddings willow, *Salix gooddingii*, coyote willow, *S. exigua* and Fremont cottonwood, *Populus fremontii.* Based on available information at the time of this writing, aside from this general description, no clear distinctions can be made based on perennial species composition or foliage height profiles, as to what constitutes appropriate southwestern willow flycatcher habitat. Due to the difficulty in determining the presence of this species in dense habitat, their presence should not be ruled out until surveys have been conducted if habitat meeting the general description given above is present.

Historically, the Southwestern willow flycatcher was widely distributed and fairly common throughout its range, especially in southern California and Arizona (Unitt 1987; Schlorff 1990). Nest and egg collections by Herbert Brown suggest that the Southwestern willow flycatcher was a common breeder along the lower Colorado River near Yuma in 1902 (Unitt 1987).

Grinnell (1914) also believed that the Southwestern willow flycatcher bred along the lower Colorado River due to the similarities in habitat between the lower Colorado

River and other known breeding sites. He noted the abundance of Southwestern willow flycatchers observed in the willow association and possible breeding behavior. However, the date of his expedition corresponds more to the migration season of the Southwestern willow flycatcher with only a small overlap with the beginning of the breeding season.

In 1993, the Service estimated that only 230 to 500 nesting pairs existed throughout its entire range (58 FR 39495). However, since extensive surveying has been implemented, this number has likely increased, especially on the lower Colorado River where the species was thought to have been extirpated (Hunter *et al.,* 1987b; Rosenberg *et al.,* 1991; McKernan and Braden 1999). Sixty-four nesting attempts were documented on the lower Colorado River from southern Nevada to Needles, California in 1998 (McKernan and Braden 1999).

Several factors have caused the decline in Southwestern willow flycatcher populations. Extensive areas of suitable riparian habitat have been lost due to river regulation and channelization, agricultural and urban development, mining, road construction, and overgrazing (Phillips *et al.,* 1964; Johnson and Haight 1984; Unitt 1987; Rosenberg *et al.,* 1991; Sogge *et al.,* 1997a). The total acreage of riparian vegetation has changed little in the last 20 years (Anderson and Ohmart 1976; Younker and Anderson 1986), although there is less native vegetation and more non-native present (Rosenberg *et al.,* 1991). The most recent estimate of historical, potentially suitable willow flycatcher habitat as delineated from 1938 aerial photography from the Grand Canyon to Mexico is 89,203 acres (USBR 1999d). Only some portion of this potentially suitable habitat can be assumed to be suitable habitat for the flycatcher, as the microclimate and other factors required which existed at the time are undeterminable. The total amount of occupied habitat for willow flycatchers along the lower Colorado River in the United States is estimated to be slightly over 6,000 acres (USBR 1999). A certain amount of habitat that apparently has the necessary components to be utilized as breeding habitat is not always being used (McKernan and Braden, 1998). This could indicate that lack of breeding habitat may not be what is limiting the Southwestern willow flycatcher's population.

In December, 1998, biologists from the Bureau of Reclamation, San Bernardino County Museum, and the Upper Gulf of California and Colorado River Delta Biosphere Reserve conducted an aerial survey of the Rio Hardy and the Colorado River to determine potentially suitable Southwestern willow flycatcher breeding habitat. Results of this survey indicate suitable habitat is present in the vicinity of Campo Mosqueda and Cucapa El Mayor and San Luis, Sonora along the Rio Colorado. Southwestern willow flycatchers utilize dense riparian habitat with moist soil or standing water present. Large volume flood control releases and Gila River flood flows are the primary condition under which riparian habitats are established in the delta and a high ground water table is needed to maintain this habitat. Potential reductions in the frequency of excess flows below Morelos Dam resulting from the adoption of either the Basin States, Six States, California or Shortage Protection alternative could potentially reduce the amount of water available for groundwater recharge in the areas adjacent to the main channel of the Colorado River over an extended period of time. This, coupled with continued groundwater production in these areas, could affect the high groundwater table that is needed to maintain habitat used by the Southwestern willow flycatcher. However, Reclamation believes that groundwater recharge in these area is more a result of percolation induced by agricultural irrigation, drainage water and the more frequent but lower-volume excess flows that are attributable to unused water delivery orders (by users in the Lower Basin states) that make it past Morelos Dam. This belief, considered with the uncertainty associated with excess flows, led to Reclamation's determination that the adoption of interim surplus criteria may affect, but is not likely to adversely affect the Southwestern willow flycatcher.

3.16.5.5.6 Yuma Clapper Rail

Yuma clapper rails (*Rallus longirostris yumanensis*) are federally endangered. They are found in emergent wetland vegetation such as dense or moderately dense stands of cattails (*Typha latifolia* and *T. domingensis*) and bulrush (*Scirpus californicus*) (Eddleman 1989; Todd 1986). They can also occur, in lesser numbers, in sparse cattail-bulrush stands or in dense reed (*Phragmites australis*) stands (Rosenberg *et al.,* 1991). The most productive clapper rail areas consist of a mosaic of uneven-aged marsh vegetation interspersed with open water of variable depths (Conway *et al.,* 1993). Annual fluctuation in water depth and residual marsh vegetation are important factors in determining habitat use by Yuma clapper rails (Eddleman 1989).

Yuma clapper rails may begin exhibiting courtship and pairing behavior as early as February. Nest building and incubation can begin by mid-March, with the majority of nests being initiated between late April and late May (Eddleman 1989, Conway *et al.,* 1993). The rails build their nests on dry hummocks, on or under dead emergent vegetation and at the bases of cattail or bulrush. Sometimes they weave nests in the forks of small shrubs that lie just above moist soil or above water that is up to about 2 feet deep. The incubation period is 20-23 days (Ehrlich *et al.,* 1988, Kaufman 1996) so the majority of clapper rail chicks should be fledged by August. Yuma clapper rails nest in a variety of different micro habitats within the emergent wetland vegetation type, with the only common denominator being a stable substrate. Nests can be found in shallow water near shore or in the interior of marshes over deep water (Eddleman 1989). Nests usually do not have a canopy overhead as surrounding marsh vegetation provides protective cover.

Crayfish (*Procambarus clarki*) are the preferred prey of Yuma clapper rails. Crayfish were introduced into the lower Colorado River about 1934. This food source and the development of marsh areas resulting from river control such as dams and river management helped to extend the breeding range of the Yuma clapper rail. The original range of the Yuma clapper rail was primarily the Colorado River delta. The southernmost confirmed occurrence of Yuma clapper rail in Mexico was three birds collected at Mazaltan, Sinaloa; Estero Mescales, Nayarit; and inland at Laguna San Felipe, Puebla (Banks and Tomlinson 1974).

Crayfish comprise as much as 95 percent of the diet of some Yuma clapper rail populations (Ohmart and Tomlinson 1977). Availability of crayfish may be a limiting factor in clapper rail populations and is believed to be a factor in the migratory habits of the rail (Rosenberg *et al.,* 1991). Eddleman (1989), however, has found that crayfish populations in some areas remain high enough to support clapper rails all year and that seasonal movement of clapper rails can not be correlated to crayfish availability.

One issue of concern with the Yuma clapper rail is selenium. Eddleman (1989) reported selenium levels in Yuma clapper rails and eggs and in crayfish used as food were well within levels that will cause reproductive effects in mallards. Rusk (1991) reported a mean of 2.24 ppm dry weight selenium in crayfish samples from six lower Colorado River backwaters from Havasu National Wildlife Refuge, near Needles, California to Mittry Lake, near Yuma, Arizona. Over the past decade, there has been an apparent two to five fold increase in selenium concentrations in crayfish, the primary prey species for the Yuma clapper rail (King *et al.,* 2000). Elevated concentrations of selenium (4.21- 15.5 ppm dry weight) were present in 95 percent of the samples collected from known food items of rails. Crayfish from the Cienega de Santa Clara in Mexico contained 4.21 ppm selenium, a level lower than those in the United States, but still above the concern threshold. Recommendations from this latest report on the subject conclude that if selenium concentrations continue to rise, invertebrate and fish eating birds could experience selenium induced reproductive failure and subsequent population declines (King *et al.,* 2000).

Yuma clapper rail may be impacted by man-caused disturbance in their preferred habitat. In recent years the use of boats and personal watercraft has increased along the lower Colorado River. This has led to speculation that the disturbance caused by water activities such as those may have a negative impact on species of marsh dwelling birds.

This subspecies is found along the Colorado River from Needles, California, to the Gulf, at the Salton Sea and other localities in the Imperial Valley, California, along the Gila River from Yuma to at least Tacna, Arizona, and several areas in central Arizona, including Picacho Reservoir (Todd 1986; Rosenberg *et al.,* 1991). In 1985, Anderson and Ohmart (1985) estimated a population size of 750 birds along the Colorado River north of the International Boundary. The Service (1983) estimated a total of 1,700 to 2,000 individuals throughout the range of the subspecies. Based on call count surveys, the population of Yuma clapper rail in the United States appears to be holding steady (Service, Phoenix, Arizona, unpublished data). Due to the variation in surveying over time, these estimates can only be considered the minimum number of birds present (Eddleman 1989; Todd 1986).

The range of the Yuma clapper rail has expanded in the past 25 years and continues to do so (Ohmart and Smith 1973; Monson and Phillips 1981; Rosenberg *et al.,* 1991, SNWA 1998, McKernan 1999), so there is a strong possibility that population size may increase. Yuma clapper rails are known to expand into desired habitat when it becomes available. This is evidenced by the colonization of the Finne-Ramer habitat management unit in Southern California. This unit was modified to provide marsh habitat specifically for Yuma clapper rail and a substantial resident population exists there. There is also recent documentation of the species in Las Vegas Wash, Virgin River and the lower Grand Canyon (SNWA 1998; McKernan 1999).

A substantial population of Yuma clapper rail exists proximate to the Colorado River delta in Mexico. Eddleman (1989) estimated a total of 450 to 970 Yuma clapper rails were present there in 1987. The birds were located in the Cienega, Sonora, Mexico (200-400 birds), along a dike road on the delta proper (35-140 birds), and at the confluence of the Rio Hardy and Colorado River (200-400 birds). Piest and Campoy (AGFD) detected a total of 240 birds responding to taped calls in the Cienega. From these data, they estimate a total population of around 5,000 rails in the approximately cattail habitat the Cienega. Data from 1999 estimated the clapper rail population in the Cienega at 6400.

Yuma clapper rail were thought to be a migratory species, the majority of them migrating south into Mexico during the winter, with only a small population resident in the United States during the winter. Eddleman (1989) concluded the Yuma clapper rail was not as migratory as once thought and estimated approximately 70 percent remained in or near their home range during the winter.

A Recovery Plan was implemented in 1983 for the Yuma clapper rail. The criteria for downlisting of the species states there must be a stable breeding population of 700-1000 individuals for a period of 10 years. Other goals to be met include:

- Clarifying the breeding and wintering status in Mexico.
- Obtaining an agreement with Mexico for management and preservation of the species.
- Development of management plans for federal and state controlled areas where the rails are known to breed.

Written agreements are made with federal and state agencies to protect sufficient wintering and breeding habitat to support the proposed population numbers.

As of 1994 not all of the above recovery actions had been met, and the Yuma clapper rail remains classified as endangered. The recovery goals are currently being clarified by the Service based on information provided by rail experts in 1999.

Yuma clapper rail use dense stands of cattail marsh habitat in the delta. The currently known populations of Yuma clapper rail in Mexico are found in areas supported primarily by agricultural drainage water and would therefore, not be affected by potential reductions in excess flows available to Mexico as a result of the adoption of surplus criteria. Therefore, Reclamation determined that the Yuma clapper rail would not be affected by implementation of any of the interim surplus alternatives.

3.16.5.5.7 Yellow-billed Cuckoo

The Yellow-billed cuckoo is proposed for listing under the Endangered Species Act. Cuckoos are riparian obligates, found along the lower Colorado River in mature riparian forests characterized by a canopy and mid-story of cottonwood, willow and saltcedar, with little ground cover (Haltermann 1998). Within the area of interest, cuckoos occur during the breeding season from interior California and the lower parts of the Grand Canyon, and Virgin River delta in southern Nevada (McKernan 1999) south to southern Arizona, Baja California, Chihuahua, Choahuila, Nuevo Leon, and Tamaulipas and have been recorded breeding as far south as Yucatan. The species winters in the southern United States, and from northern South America to Northern Argentina (AOU 1998, Hughes 1999). Cuckoos are largely insectivorous, with cicadas, (*Diceroprocta apache*) comprising 44.6 percent of their diet on the Bill Williams River National Wildlife Refuge (Halterman 1998). The Bill Williams River is a tributary of the lower Colorado River near Parker Dam, Arizona. The lower 10 miles of this tributary is designated as the Bill Williams River National Wildlife Refuge, comprised of a large expanse of native cottonwood and willow habitat, interspersed with saltcedar. This area is believed to contain the largest cuckoo population in the lower Colorado River Valley.

In February 1998, the western subspecies of the Yellow-billed cuckoo, *C. a. occidentalis,* was petitioned for listing under the ESA. The Service determined that the petition presented substantial scientific or commercial information to indicate that the listing of the species may be warranted (Service 2000). Surveys for this species were conducted throughout Arizona in 1998 and 1999 (Corman and Magill 2000), and have been conducted on the Bill Williams River NWR, beginning in 1993 (Halterman 1994). In 2000, surveys have been expanded into southern Nevada and also include the Bill Williams River and Alamo Lake in Arizona.

As presented in Table 3.16-4, the numbers of cuckoos detected have fluctuated widely since surveying began in 1993 on the Bill Williams River. In 1997, on the Kern River in California, numbers of cuckoos detected declined in a similar manner as that seen on the Bill Williams River during the same time period, 1994-1997. On the Kern River, cuckoos detected declined from 14 pairs in 1996 to six pairs in 1997 (Halterman 1998); on the Bill Williams, cuckoos detected declined from 26 pairs to 12 pairs. In 1990, numbers were back up on the Bill Williams, but down again in 1999. In other areas of the lower Colorado River in the United States, cuckoos have been detected as far south as Gadsden and Imperial National Wildlife Refuge (Corman and Magill 2000, McKernan 1999).

Table 3.16-4
Yellow-billed Cuckoos Survey Results

Survey Results BWRNWR	1993	1994	1997	1998	1999
Pairs Detected	22	26	12	20	6
Single Birds Detected	11	14	11	11	8
Nests Found	6	5	3	4	2
Date First Pair Encountered	June 25	June 27	June 20	June18	June 5

Without complete and standardized surveys, it can only be speculated that the birds are present in the Colorado River delta in Mexico. The range of this species includes the Colorado River delta (AOU, 1998).

Yellow-billed cuckoos utilize mature riparian habitat with some mid- and under-story present. Large volume flood control releases and Gila River flood flows are the only condition under which riparian habitats are established in the delta, and a high ground water table is needed to maintain this habitat. Potential reductions in the frequency of excess flows below Morelos Dam resulting from the adoption of either the Basin States, Six States, California or Shortage Protection alternative could potentially reduce the amount of water available for groundwater recharge in the areas adjacent to the main channel of the Colorado River over an extended period of time. This, coupled with continued groundwater production in these areas, could affect the high groundwater table that is needed to maintain habitat used by the Yellow-billed cuckoo. However, Reclamation believes that groundwater recharge in these area is more a result of percolation induced by agricultural irrigation, drainage water and the more frequent but lower-volume excess flows that are attributable to unused water delivery orders (by users in the Lower Basin states) that make it past Morelos Dam. This belief, combined with the uncertainty associated with excess flows, led to Reclamation's determination that the adoption of interim surplus criteria may affect, but is not likely to adversely impact the Yellow-billed cuckoo.

3.16.5.5.8 California Black Rail

California black rail (*Laterallus jamaicensis coturniculus*) is a federal species of concern and is protected by the state of California as a threatened species. Black rails are most often found in shallow salt marshes, but also utilize freshwater marshes, wet meadow-like areas and riparian habitat along rivers. Both males and females of this species exhibit slate black plumage with narrow, white barring on the back and flanks and a chestnut nape with a very short tail and a small black bill. Juveniles look much the same as adults, but their eyes are brown or olive rather than red like those of adults. Full grown birds measure about five to six inches in length.

The life history and status of the California black rail are poorly known (Wilbur 1974, Evens *et al.,* 1991), due to its secretive nature and tendency to inhabit densely vegetated marshes. The preferred habitat of the California black rail is characterized by minimum water fluctuations that provide moist surfaces or very shallow water, gently sloping shorelines, and dense stands of marsh vegetation (Repking and Ohmart 1977). California black rails are most often found in areas where cattails (*Typha* sp.) and California bulrush (*Scirpus californicus*) are the predominant plant species (Rosenberg *et al.,* 1991). While California black rails are more commonly associated with cattail and bulrush, habitat structure as described above was more effective than plant composition in predicting California black rail use of habitat. Water depth appeared to be a limiting factor, as the California black rails prefer shallow water (Flores and Eddleman 1995). The breeding season along the lower Colorado River extends from April through July (Flores and Eddleman 1995). California black rails eat mainly aquatic insects and some seeds (Ehrlich 1988, Rosenberg *et al.,* 1991, Kaufmann 1996).

This subspecies of California black rail occurs along the California coast from Tomales Bay in Marin County, south to San Diego and extreme northern Baja California and Veracruz. It also occurs in interior California around the Salton Sea and along the Colorado River from Imperial National Wildlife Refuge south to the International Boundary (Peterson 1990; Rosenberg *et al.,* 1991, AOU 1998). The species has also been recorded as recently as 1997 at the Bill Williams River National Wildlife Refuge and at Havasu National Wildlife Refuge. Historically, the California black rail primarily occurred along the California coastline. In the mid-1970s, an estimate of between 100 and 200 individuals was given for the area between Imperial National Wildlife Refuge and Mittry Lake, Arizona (Repking and Ohmart 1977). No quantitative data are yet available on the current populations of the California black rail along the lower Colorado River or in the Colorado River delta area, although the species is present in both areas. Surveys are currently underway on the Lower Colorado River between Havasu National Wildlife Refuge and Yuma, Arizona. Various agencies, including BLM and the Service, survey California black rail concurrently during surveys for the Yuma clapper rail.

California black rails utilize very shallow marshes containing cattail and bulrush and are sensitive to small changes in water levels. Some surface water is necessary for their presence to occur. Like the Yuma clapper rail, they are primarily found in areas supported by agricultural drainage water and would not be affected by the potential reduction in the frequency of occurrence of excess flows that may result from the adoption of interim surplus criteria. Therefore, Reclamation believes the California black rail will not be affected by implementation of any of the interim surplus alternatives.

3.16.5.5.9 Elf Owl

The Elf owl (*Micrathene whitneyi*) is listed as endangered species by the state of California. The Elf owl is near the limit of its northwestern (central Riverside County, California) range along the Colorado River (AOU 1998,) and, as such, has never been abundant here (Rosenberg 1991). However, declines associated with loss of trees containing suitable cavities for nesting and loss of appropriate foraging habitat are indicated (Rosenberg 1991). Elf Owls utilize abandoned woodpecker cavities or natural cavities for nesting. Declines in populations of woodpeckers on the lower Colorado River have been documented as well (Rosenberg 1991). In other parts of its range, namely central Arizona, saguaro cacti are more often used by Elf owls than on the lower Colorado River. Although saguaros are utilized along the Colorado River to some degree (as well as cottonwood, willow and mesquites), this cacti species is at its northwestern range, not extending further north than Fort Mojave, Arizona on the river. Therefore, it is less abundant in the Mohave Desert than in the Sonoran Desert.

To the south in Mexico, the winter range of Elf owls is from southern Sinaloa, Michoacan, Morelos and Guerrero, Pueblo and northwestern Oaxaca (AOU 1998). Breeding occurs in Coahuila and Nuevo Leon south to Sonora, Guanajuato and Puebla and in southern Baja California (AOU 1998). Elf owls have been documented during breeding season as far south as Picacho, Imperial Co., California as recently as 1998 (McKernan 1999). Recent field documentation of breeding for this species in the Colorado River delta are not available at this time. However, there is suitable habitat present there (Briggs and Cornelius 1998 Glynn 1999), and similar species, such as the great horned owl, have been recently documented there (Hinojosa-Huerta, 2000). As with the willow flycatcher, if suitable habitat is present, the presence of the species should not be ruled out until adequate surveys have been conducted.

Elf owls utilize mature riparian habitat with trees large enough to contain either natural cavities or cavities excavated by woodpeckers. Large volume flood control releases and Gila River flood flows are the only conditions under which riparian habitats are established in the delta and a high ground water table is needed to maintain this habitat. Potential reductions in the frequency of excess flows below Morelos Dam resulting from the adoption of either the Basin States, Six States, California or Shortage Protection alternative could potentially reduce the amount of water available for groundwater recharge in the areas adjacent to the main channel of the Colorado River over an extended period of time. This, coupled with continued groundwater production in these areas, could affect the high groundwater table that is needed to maintain habitat used by the Elf owl. However, Reclamation believes that groundwater recharge in these area is more a result of percolation induced by agricultural irrigation, drainage water and the more frequent but lower-volume excess flows that are attributable to unused water delivery orders (by users in the Lower Basin states) that make it past Morelos Dam. This belief, combined with the uncertainty associated with excess flows, led to Reclamation's determination that the adoption of interim surplus criteria is not likely to adversely impact the Elf owl.

3.16.5.5.10 Bell's Vireo

Bell's vireo (*Vireo bellii arizonae*) is protected as an endangered species by the state of California. It is a small, insectivorous grayish to greenish-yellow bird is found in riparian habitat along the lower Colorado River and its tributaries in dense brush, including willow, cottonwood, mesquite and saltcedar. In the vicinity of the lower

Colorado River, the species breeds from interior California, southern Nevada and northwestern and east-central Arizona to northern Baja California, south through Sonora, southern Durango, Zacatecas, and southern Tamaulipas. During winter, it can be found as far south as north-central Nicaragua (AOU 1998). Bell's vireos experienced a decline in southern California and throughout the lower Colorado River beginning in the 1950s. Between 1974-1984, breeding was documented at only a few locations on the river, all north of Cibola NWR (Rosenberg *et al.,* 1991). Loss of habitat due to extensive flooding in 1983 is thought to have contributed to this decline. Stable populations in other parts of its range, including northern Mexico, prevented the species from being listed as endangered after being proposed in 1981 (Rosenberg *et al.,* 1991).

Without standardized surveys, it is difficult to determine the species' current abundance. The species appears to be recovering from previous lows as its presence has been documented recently as far north as Meadow Valley Wash and the lower Virgin River in southern Nevada and below Imperial Dam to the south (McKernan 1999) and is one of the most frequently heard species throughout the area. Habitat does exist across the border in Mexico similar to what is utilized by this species in the United States and observations of this species there confirm its presence during the breeding season (Hinojosa-Huerta, 2000).

Bell's vireos utilize mature riparian habitat with dense saltcedar, mesquite cottonwood and willow stands present. Large volume flood control releases and Gila River flood flows are the only conditions under which riparian habitats are established in the delta and a high ground water table is needed to maintain this habitat. Potential reductions in the frequency of excess flows below Morelos Dam resulting from the adoption of either the Basin States, Six States, California or Shortage Protection alternative could potentially reduce the amount of water available for groundwater recharge in the areas adjacent to the main channel of the Colorado River over an extended period of time. This, coupled with continued groundwater production in these areas, could affect the high groundwater table that is needed to maintain habitat used by the Bell's vireo. However, Reclamation believes that groundwater recharge in these area is more a result of percolation induced by agricultural irrigation, drainage water and the more frequent but lower-volume excess flows that are attributable to unused water delivery orders (by users in the Lower Basin states) that make it past Morelos Dam. This belief combined with the uncertainty associated with excess flows, led to Reclamation's determination that the adoption of interim surplus criteria may affect but is not likely to adversely impact the Bell's vireo.

3.16.5.5.11 Clark's Grebe

Clark's grebe (*Aechmophorus clarkii*) is a species of special concern to the state of– Arizona. Extensive knowledge of this species in the Colorado River delta in Mexico is not available, so any speculation on its abundance and status there is based on known available habitat only. Clark's grebes utilize marshes, lakes and bays with emergent vegetation and can also be found on inland reservoirs and rivers (AOU 1998, Kaufman 1996, Rosenberg 1991). In the area of interest, the species is resident year round in Mexico south to Guerrero and western Puebla, and north of Mexico on lakes that do not freeze in winter, and winters from central California south to southern Baja California (AOU 1998). Clark's grebes have been documented at the Cienega de Santa Clara (Hinojosa-Huerta, 2000). The species is present during winter on the lower Colorado River and has been documented nesting in cattail marshes on the lower Colorado River at Havasu National Wildlife Refuge, near Needles, California in recent years (M. Connolly Havasu National Wildlife Refuge, pers.comm).

Threats to this species include recreation during breeding, as increased boating activity can swamp nests. In addition, as with other fish-eating species on the river, bioaccumulation of selenium in grebes is a potential threat both in the United States and in Mexico (King *et al.,* 2000).

Clark's grebes utilize marsh habitat for nesting and some surface water is needed to maintain this habitat. They also require open water and a prey base of small fish and crustaceans for foraging. Like the Yuma clapper rail, they are primarily found in areas supported by agricultural drainage water and would not be affected by potential reductions in the frequency of occurrence of excess flows that may result from the adaptation of the interim surplus criteria. These factors led Reclamation to determine that the Clark's grebe will not be affected by implementation of any of the interim surplus alternatives.