Public Notice:

The U.S. Army Corps of Engineers, Los Angeles District (Corps), announces availability of the draft Environmental Assessment for the Alamo Dam Flushing Flow Release. The Corps proposes to release water from Alamo Dam outside of the normal non-flood release schedule in order to facilitate required maintenance activities. The proposed flushing flow release would occur as a flood pulse hydrograph designed to mimic a typical rain event in the downstream watershed released with appropriate seasonal timing. While the exact details of the release are subject to variation based on conditions at the time of release, such as water surface elevation and weather, the release will conform to the following general parameters:

1) Maximum release will not exceed 5,000 cfs.
2) Total release time, including ascending and descending limbs, would not exceed 20 days.
3) Ascending limb of the hydrograph will be moderate.
4) Descending limb of the hydrograph will initially drop steeply, followed by a gradual return to base flow.
5) The peak of the hydrograph will be completed prior to March 15th.

The Corps is soliciting comments from the public; Federal, state, and local agencies and officials; and other interested parties in order to consider and evaluate the impacts of this proposed project and alternatives.

Comments will be accepted from January 10, 2018 to February 10, 2018.

Comments should be mailed to:

U.S. Army Corps of Engineers
Los Angeles District
ATTN: Pam Kostka, CESPL-RGN-L
915 Wilshire Blvd., 13th Floor
Los Angeles, CA 90017

Alternatively, comments can be sent electronically to: pamela.k.kostka@usace.army.mil

Alamo Dam
Flushing Flow Release
Draft Environmental Assessment

US Army Corps of Engineers®

January 2018

1. Introduction

1.1 Alamo Dam Authorizations

Alamo Dam and Lake is a U.S. Army Corps of Engineers (Corps) multi-purpose project authorized under the Flood Control Act of 1944 (Public Law 78-534). The project's initial authorization included authorized flood control and other purposes, such as hydropower generation, water conservation and supply, and recreation. The Water Resources Development Act (WRDA) of 1996 added fish and wildlife benefits as an authorized purpose, provided that those benefits did not reduce existing flood control or recreation (Public Law 104-303). While hydropower was initially authorized for the project, this purpose was not deemed feasible and a powerplant has never been constructed.

1.2 Alamo Dam and Reservoir Details

Alamo Dam is located on the Bill Williams River (BWR), 39 miles (62.8 km) upstream from the Colorado River at Lake Havasu (Figure 1). The dam is on the border of La Paz and Mohave Counties in Arizona. Main access to the dam is from the town of Wenden on US Highway 60, approximately 36 miles to the south.

Alamo Dam was constructed in 1967, and is a zoned earthfill structure with a top elevation of 1265 feet (385.6 m), a crest width of 30 feet (9.1 m), and a crest length of 975 feet (297.2 m). The dam is 283 feet higher than the original Bill Williams River streambed. Both faces of the dam are protected by a layer of stone. The dam has a detached broadcrested spillway with an elevation of 1235 feet (376.4 m) located in the right abutment of the dam. The spillway channel is an unlined trapezoidal channel 550 feet long (167.6 m) cutting through a rock saddle. Spillway discharge flows into a channel fully separated from the right abutment by a rock ridge, and rejoins the BWR about 1500 feet (457.2 m) downstream of the toe of the dam.

The dam outlet works consist of a concrete-lined outlet tunnel 1290 feet long (393.2 m) and 12 feet in diameter (1.7 m) on the southeastern dam abutment. The entrance is covered by a semicircular trashrack and the exit consist of an unlined channel. The gate chamber, just upstream of the axis of the dam, is circular in plan-view and is 26 feet (10.9 m) in diameter.

Alamo Lake boundaries are defined by the extent of land acquired by the Federal government for flood control purposes. The area behind Alamo Dam owned by the Corps encompasses 22,931.74 acres. At inundation up to the spillway crest height, reservoir capacity covers 18,377.74 acres.

1.3 Related Facilities

Alamo Lake is a public recreation facility currently managed by Arizona State Parks (ASP) and Arizona Game and Fish Department (AGFD). Existing facilities include five campgrounds with a total 250 camp sites, three boat launch areas, a privately operated concession and store, and numerous picnic areas. The lake is a popular fishing destination, including hosting several sport fishing tournaments annually.

1.4 Current Operations & Maintenance

Alamo Dam is currently operated as described in the 2003 Water Control Manual (WCM). The operations contained in the 2003 WCM originated in the 1999 Alamo Lake Feasibility Report and Environmental Impact Statement and associated 1999 Alamo Lake Re-operation and Ecosystem Restoration Biological Opinion (BO).

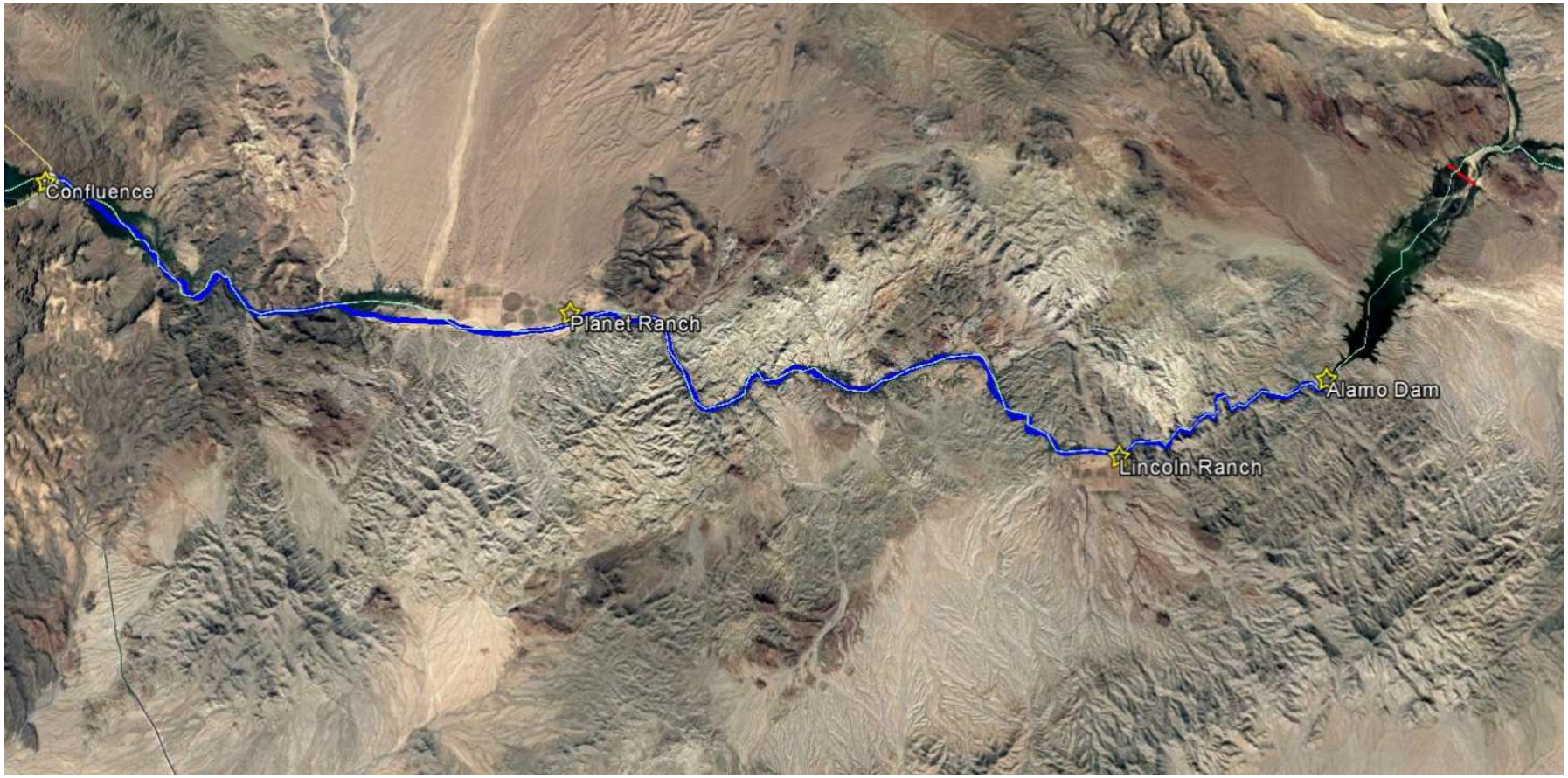

Figure 1. Alamo Dam and Lake region of western Arizona. The blue line represents the Project Area below Alamo Dam along the Bill Williams River. The red line represents the upstream extent the Project Area, the approximate uppermost extent of the reservoir when the lake is at the target elevation of 1125 feet.

Current operations consist of a target water surface elevation (WSE) of 1,125 ft. When the reservoir's WSE is below 1,125 ft, minimal year round base flows between 20 – 50 cfs are maintained in order to sustain downstream habitat. When the WSE exceeds 1,125 ft, flood control releases are implemented, as described in the WCM, to return the WSE to 1,125 ft. The 2003 WCM and associated 1999 EIS and 1999 BO also allow for deviation from these operations for maintenance-related purposes.

The conduit (upper and lower) at Alamo Dam is scheduled for inspection once every 5 years as part of the normal project inspection protocol. However, due to physical limitations of the bulk head gate and operational constraints associated with scheduling an appropriate draw down to facilitate the inspection, regular upper conduit inspections have lapsed considerably. The last upper conduit inspection was conducted in June 1990, more than 27 years ago. The upper conduit inspection that preceded the 1990 inspection occurred October 1977.

The 1990 upper conduit inspection identified nearly $1 million of necessary maintenance and rehabilitation that was subsequently performed. The recurring presence of corrosive H_2S gas, partly due to the accumulation of sediment in the upper conduit that remains stationary and becomes anoxic, is a primary driver of damage in the conduit. This condition corrodes exposed metal components and can effect concrete surfaces. Similar damage has likely occurred since the last inspection.

Inspection of the upper conduit requires installing the bulkhead gate using the following steps:

1) Inspect the bulkhead gate
    a. Mobilize a crane and barge suitable to the task,
    b. Remove the gate from the lake and place on dry ground
    c. Inspect the bulkhead for structural integrity
    d. If necessary, repair the bulkhead
    e. Return the bulkhead to the bulkhead guide for installation
2) Inspect the conduit sill where the bulkhead gate will need to make positive contact
    a. Clean the sill of sediment and debris
    b. Minimize lake depth to increase diver safety
    c. Divers physically inspect the sill with their hands and utilize imaging equipment
    d. Confirm that the bulkhead gate will make a tight seal with the sill
3) Install the bulkhead gate in the sill to seal the conduit from flows (water surface elevation (WSE) must be <1110 ft)
4) Dewater the upper conduit and send in a specialized team to inspect the condition of the conduit and the gates

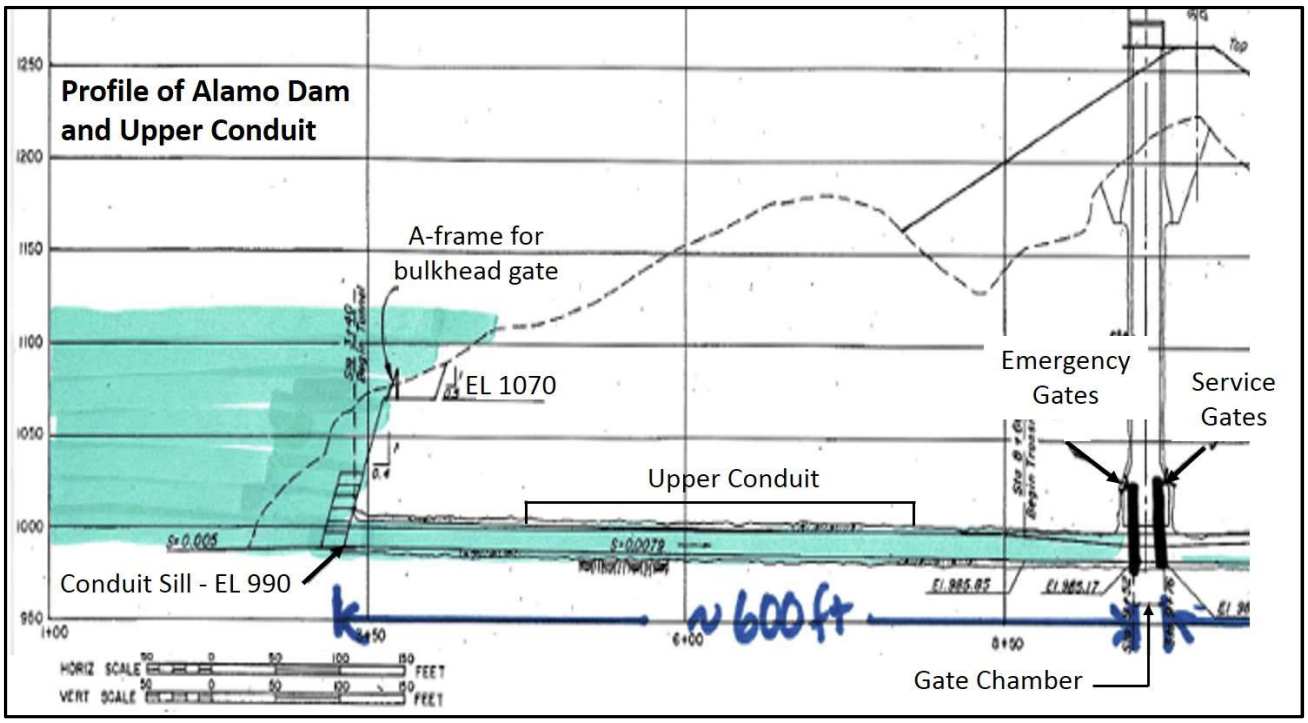

Figure 2. Profile of the Alamo Dam showing the bulkhead gate A-frame, upper conduit, and gate chamber.

1.5 Purpose of the Flushing Flow Release and Supplemental Environmental Analysis

The sill sits at 990 feet elevation. The lake's target elevation is 1125 ft. As a result, the sill is always under substantial depth of water. The sill, cleared of sediment, needs to be inspected manually by divers, and it is important to minimize the water depth to the maximum extent practicable. Every foot of depth added to the lake significantly increases the danger associated with diving. The ideal depth for a safe dive is 95 feet or less (1085 feet lake elevation) as this depth can be performed without the use of a chamber. However, if 1085 is not achievable due to operational constraints, the lake level should be minimized to the extent possible to increase safety, reduce risk, and reduce cost. Divers cannot dive to depths greater than 135 ft. Nationally the Corps rarely conducts dives over 115 feet.

Therefore, the proposed flushing flow serves two purposes with respect to the required sill inspection:

1) Remove accumulated sediment from the sill to ensure all structures are visible by the dive inspection team, and
2) Lower the WSE, reducing the depth of the required dive and increasing diver safety.

2. Project Description

2.1 Alternatives Considered and Eliminated

Dredging Plus Alamo Dam Release

The Corps considered the option to dredge the accumulated sediment off of the sill using a section dredge. While this would remove the accumulated sediment and allow the sill structure to be inspected, it would not alleviate the issue of water depth and the pool would still need to be drawn down. In addition, suction dredging of the sill area would require a diver to operate the suction hose, likely requiring the pool to be drawn down first. This process would eliminate the need for the actual dredging as releasing significant

water from the reservoir is likely to remove the sediment. As a result, this alternative is not considered to be feasible and was eliminated from detailed analysis.

Dredging Plus Natural Draw Down

The Corps considered the option to allow the pool to naturally draw down until the WSE was low enough to allow safe inspections of the sill, following by manual dredging and sill inspection. However, given the unpredictable nature of the regional weather, there is no way to guarantee that weather will allow the pool to be naturally drawn down in the foreseeable future, which would result in the continuation of the already signification maintenance delay. As a result, the Corps determined that this alternative would not reasonably meet the project purpose, and it was eliminated from detailed analysis.

2.2 No Action Alternative

Under the No Action Alternative, the Corps would maintain releases from Alamo Dam at minimal baseflow conditions that typically occur in the absence of a flood or maintenance-based release. Year-round baseflow releases consist of 20-50 cfs releases intended to maintain downstream flow at a level to maintain the downstream riparian ecosystem. Variation between 20-50 cfs releases are dictated based on time of year, and are detailed in the WCM.

2.3 Proposed Alternative

The Corps proposes to release water from Alamo Dam outside of the normal non-flood release schedule in order to facilitate maintenance. The proposed flushing flow release would occur as a flood pulse hydrograph designed to mimic a typical rain event in the downstream watershed released with appropriate seasonal timing. The hydrograph would be shaped similar to a moderate late spring release event as described in the Unified Flow Theory (Shafroth et al. 2010 & Hautzinger et al. 2006; Figure 2). While the exact details of the release are subject to variation based on conditions at the time of release, such as water surface elevation and weather, the release will conform to the following general parameters:

1) Maximum release will not exceed 5,000 cfs.
2) Total release time, including ascending and descending limbs, would not exceed 20 days.
3) Ascending limb of the hydrograph will be steep.
4) Descending limb of the hydrograph will initially drop steeply, followed by a gradual return to base flow.
5) The peak of the hydrograph will be completed prior to March 15th.

The proposed flushing flow will result in flows below Alamo Dam in excess of the typical non-flood baseflow, which normally range from 20-50 cfs. Increased flows would be most evident the base of the Alamo Dam to the reach just above Lincoln Ranch, where the narrow canyon below the dam first opens into a more expansive floodplain. From Lincoln Ranch downstream, the width of the floodplain and absorption of flows into the ground result in varying amounts of flow attenuation in different stretches of river, significantly reducing the effects of increased flows progressively downstream. Further significant flow attenuation would occur at Planet Ranch where the floodplain width and infiltration rates are greatest. Below Planet Ranch, direct effects of the flow are expected to be negligible.

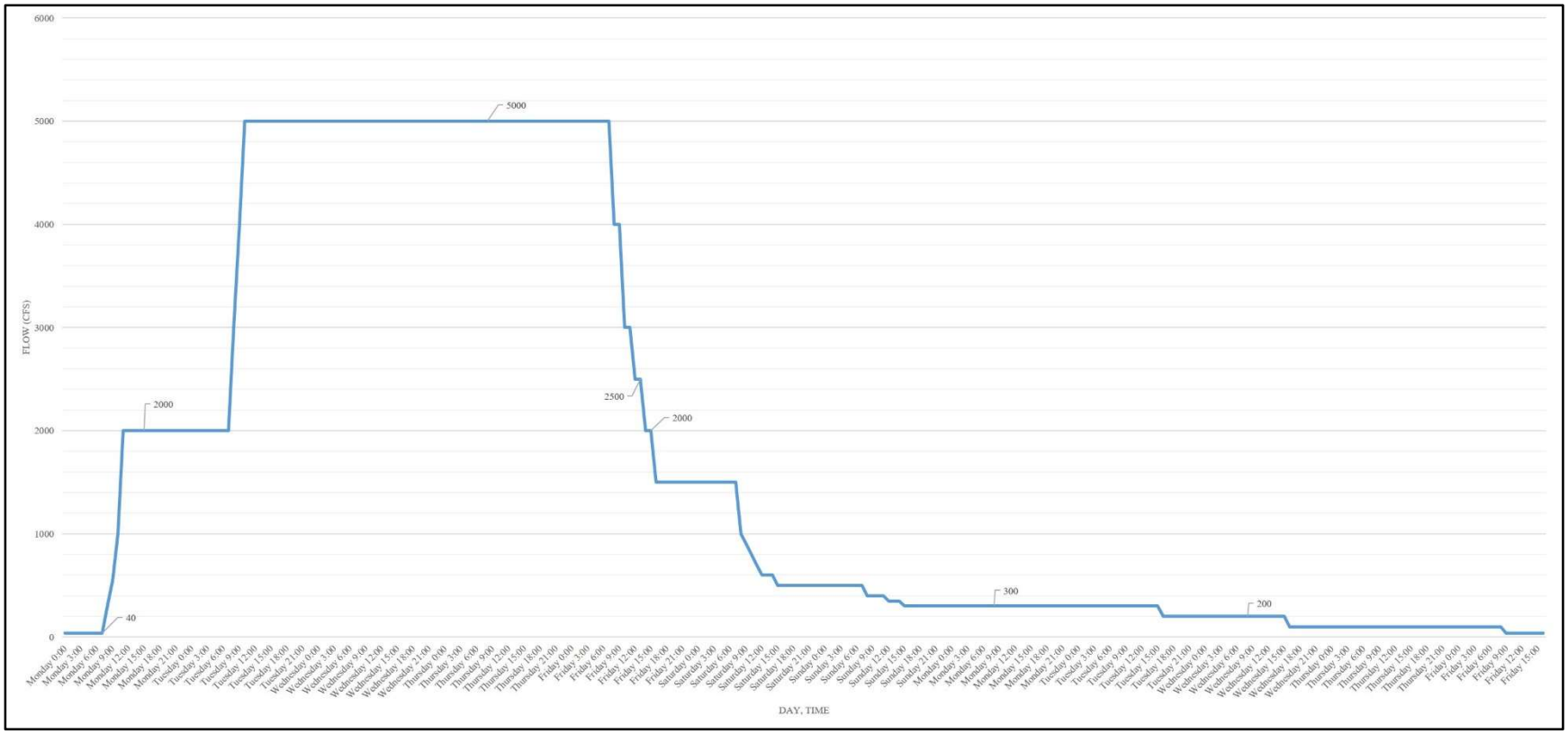

Figure 2. Conceptual hydrograph illustrating shape of the proposed release.

2.4 Project Area

The Project Area above Alamo Dam consists of the Alamo Lake reservoir and adjacent shoreline and recreational facilities. The reservoir area extends above the currently inundated region of the lake to the 1125 ft. elevation line. Below Alamo Dam, the Project Area consists of those areas expected to experience direct and indirect effects associated with the Proposed Action (Figure 1). Discussion of the Project Area below the dam will be primarily confined to those areas potentially inundated by the proposed release (up to 5000 cfs). While there will be minor indirect effects to surrounding upland areas, the predominant effects will be those direct effects related to inundation.

3. Affected Environment

The following sections detail the baseline conditions related to environmental resources in the Project Area. Unaffected environmental resources are discussed together in Section 3.1, while environmental resources that could potentially be affected by a change to operations are discussed in their own sections below.

3.1 Resources Not Affected

The proposed release is consistent with the current operations of Alamo Dam and is covered in the existing WCM. This EA was prepared to discuss those resources whose baseline status has changed since the development of the existing WCM and EIS, and therefore will be affected in ways not fully considered in the previous documentation. Several resources have no potential to be affected, or the baseline conditions have not changed since the development of the existing EIS, and therefore the effects of the release have been covered previously.

Traffic and Transportation

The proposed release does not require the use of any vehicles or construction equipment beyond those vehicles already operating at the dam during day to day operations. No work will occur outside of the Alamo Dam area, and no vehicle use will occur on any public roads. As such, traffic and transportation will not be affected.

Air Resources and Air Quality

As described above, the proposed release will not require the use of any additional vehicles or machinery Therefore, the proposed release will not result in any emissions, and there will be no impacts to air resources or air quality.

Noise

No construction is required as a result of the proposed release. As discussed above, no equipment or vehicles will be utilized beyond those that are already required to operate the facility, a change in operations will not produce any noise, and therefore there will be no noise-related impacts.

Socioeconomics and Environmental Justice

The proposed release will not result in any job creation, resource needs, or impacts to employment opportunities or demographics in local communities and therefore will have no socioeconomic impacts. There are no communities or development in the area, and the proposed release will not result in a disproportionate impact to minority or at-risk communities.

Safety and Hazards

The proposed release will not create any unsafe conditions, as flows of greater magnitude than this release (up to 7,000 cfs) were evaluated in the existing WCM and EIS. As such, no additional safety impacts will result from the proposed release. No hazardous or toxic materials or sites exist in the area, and the proposed water release will not inundate any hazardous sites or transport or release any hazardous or toxic materials. Therefore, no impacts related to hazardous or toxic substances are anticipated as a result of the proposed release.

Land Use and Aesthetics

The proposed release is an action covered in the existing WCM and associated EIS. The area around Alamo Lake and Dam and along the Bill Williams River is an isolated rural area with little development and very little change over the past 50 years with regards to human development. As a result, the proposed release will not affect land use or aesthetics in ways not previously considered.

Earth and Water Resources

The conditions below Alamo Dam are much the same as they were at the time of development of the WCM and associated EIS, and the proposed release of 5,000 cfs is well within the operational range considered in those documents. This volume of water is also well within the normal range of conditions for the downstream watershed. Therefore, earth resources and water quality will not be affected by the proposed release.

Cultural Resources

The proposed release will not result in the erosion, inundation, or alteration of any downstream areas outside of those that can already be inundated by downstream flow conditions evaluated in the previous EIS and WCM, which covers releases up to 7,000 cfs. As a result, no impacts to cultural resources will occur as a result of the proposed release.

Utilities

There are no downstream utilities within the flow corridor of the Bill Williams River that have been developed since the previous WCM and EIS. Flow conditions below Alamo Dam will not exceed those that were evaluated in the previous EIS and WCM, and as a result, no impacts to utilities will occur as a result of the proposed release.

3.2 Recreational Resources

A variety of recreational resources exist in the vicinity of Alamo Dam. The shoreline around Alamo Lake is managed as a park by Arizona State Parks (AZSP) as Alamo Lake State Park. Facilities at Alamo Lake State Park includes 59 developed camp sites and four camping cabins. Sport fishing is also a common recreational activity, with the state park containing several boat launches and hosting sport fishing tournaments throughout the year. The primary sport fishing season on Alamo Lake runs from January through May. However, the recreational resources at Alamo Lake have been established since prior to the existing EIS and WCM, and impacts associated with releases and fluctuating lake levels have been previously evaluated. As such, further discussion of recreational resources will be limited to below the dam where recreational resources have changed since the previous analyses.

Below Alamo Dam, a variety of recreational resources exist, primarily on federal land. These include wilderness areas managed by the Bureau of Land Management (BLM) and the Bill Williams River National Wildlife Refuge (BWRNWR), managed by the U.S. Fish and Wildlife Service (USFWS). In addition, the Bureau of Reclamation (BOR) manages Planet Ranch. Recreation in these downstream areas is limited, and the area is very remote with most locations only accessible via dirt roads or off-highway vehicle (OHV) trails. Recreation in these areas varies by land management agency, but consists of hunting, fishing, hiking, OHV use, and remote camping. Given the minimal width of the Project Area, which is limited to the riparian corridor along the BWR, the majority of recreation options below Alamo Dam are outside of the Project Area. In addition, with the exception of the new OHV network discussed below, the other recreational resources in or adjacent to the Project Area have not changed significantly since the previous EIS.

The Arizona Peace Trail is a network of OHV trails that runs throughout western Arizona. The Peace Trail was first developed by BOR and Arizona Game and Fish Department (AZGFD) but development efforts were later taken over by private recreation interests. The Peace Trail crosses the Project Area in two places, one just west of Planet Ranch and the second in the Swansea vicinity. At these two locations, the Peace Trail has low-water crossings across the BWR (Figure 3). While usage numbers of the various segments of the Peace Trail are not recorded, it is estimated that 3,000 to 5,000 OHVs utilize the trail system annually (Pers. Comm. Alamo State Park Ranger).

3.3 Biological Resources

Since the development of the existing WCM and associated EIS, biological conditions within the Project Area have changed. The primary change during the intervening years is the listing of additional species and habitats under the Endangered Species Act which were not previously protected.

Regional Ecosystem

The BWR lies in the transitional zone between the Mojave and Sonoran Deserts, although the watershed generally falls within the Sonoran Basin and Range Ecoregion (Griffith et al. 2014). Upper portions of the watershed also reach the Arizona and New Mexico Mountains Ecoregion, but these areas are outside of the influence of Alamo Dam operations. Riparian habitat associated with the BWR and Alamo Lake is similar to riparian habitats throughout the desert southwest, and supports a suite of native and non-native vegetation (See Sections 3.3.2 and 3.3.3 below for details). Upland areas throughout the watershed are arid and predominantly mountainous, supporting vegetation typical of the Sonoran and Mojave deserts while minor ephemeral drainages and bajadas throughout the watershed support more mesic desert vegetation.

Figure 3. Location of Arizona Peace Trail low-water crossings of the Bill Williams River.

Terrestrial Habitat and Vegetation Communities

The riparian corridor along the BWR and its tributaries supports several habitat types. Riparian forest habitats in the Project Area are dominated by cottonwood (*Populus fremontii*) and willow (*Salix goodingii*) forest and mesquite (*Prosopis* sp.) bosques, with invasive salt cedar also abundant (*Tamarix* spp.). Limited areas in the Project Area support freshwater fringe marshes along and within the river channel, although substantial marsh habitat occurs in and near the Bill Williams River National Wildlife Refuge (BWRNWR) at the far downstream end of the river. Upland habitats adjacent to the river corridor support various desert scrub plant species but this habitat type is almost exclusively outside of the riparian corridor and therefore outside of the Project Area. Major vegetation in the desert scrub community includes a variety of cactus species (*Cholla* sp., *Opuntia* sp., and *Saguaro gigantea*), as well shrubs and trees such as creosote (*Larrea tridentata*), palo verde (*Cercidium microphyllum*), and mesquite.

Special Status Plant Species

Special-status plant species considered in this document include species listed as threatened or endangered under the federal Endangered Species Act (ESA), or proposed or candidate species under the ESA. The list covers all species known to occur in Mojave or La Paz Counties (Table 3.2-2). However, none of these species are known to be present, have a reasonable potential to occur within the Project Area, or could potentially be affected in downstream areas with implementation of the Proposed Action.

Aquatic Wildlife

Alamo Dam releases water to maintain base flow on the river year round, between 20-50 cfs depending on the time of year. This results in perennial flows below Alamo Dam for a limited distance below the dam. Flows typically become subsurface in the vicinity of Swansea, 2-3 miles upstream of Planet Ranch. The river channel is typically dry for the entire length of Planet Ranch, approximately 6-8 miles, before flows

surface again at the downstream end of Planet Ranch near the mouth of Havasu Canyon. Along the course of the BWR, a variety of pool, riffle, run, backwater and other riverine habitats are maintained. However, much of the aquatic habitat is controlled by the presence of abundant beaver (*Castor canadensis*) and their dams. Previous estimates indicate that the Bill Williams River supports around 100 beavers, converting roughly 7-8 miles of river into lentic habitat (Andersen and Shafroth, 2010).

The BWR historically supported a unique assemblage fish species, although flow regulation on both the Colorado and Bill Williams Rivers has resulted in significant alterations to the aquatic community. Aquatic habitat along the BWR currently supports an assemblage of non-native fish (Pool and Olden, 2014) including the red shiner (*Cyprinella lutrensis*), mosquitofish (*Gambusia affinis*), yellow bullhead (*Ameiurus natalus*), largemouth bass (*Micropterus salmoides*), and green sunfish (*Lepomis cyanellus*). Despite previous attempts to reintroduce native fish fauna to the river, no native fish species are thought to occur between Planet Ranch and the base of Alamo Dam. Several species of amphibian are known to occur in the Project Area, including the Arizona toad (*Anaxyrus microscaphus*), Couch's spadefoot toad (*Scaphiopus couchi*), several other species of toad, and the lowland leopard frog (*Rana yavapaiensis*), while the invasive bullfrog (*Lithobates catesbeiana*) has not yet been documented. The river in the Project Area also supports non-native crayfish.

Table 3.3-1. Special status plant species known from Mojave and La Paz counties.

Common Name (Scientific Name)	Federal Status	State Status	Potential Occurrence
Arizona Cliff-Rose (*Purshia subintegra*)	Endangered	Highly Safeguarded	Unlikely Present
Fickeisen plains cactus (*Pediocactus peeblesianus fickeiseniae*)	Endangered	Highly Safeguarded	Unlikely Present
Gierisch mallow (*Sphaeralcea gierischii*)	Endangered	Highly Safeguarded	Not Present
Holmgren milk-vetch (*Astralagus holmgreniorum*)	Endangered	Highly Safeguarded	Not Present
Jones cycladenia (*Cycladenia jonesii*)	Threatened	Highly Safeguarded	Not Present
Siler pincushion cactus (*Pediocactus sileri*)	Threatened	Highly Safeguarded	Not Present

Terrestrial Wildlife

Despite alterations to the natural flow regime on both the Colorado and Bill Williams Rivers, the BWR continues to support one of the last and largest remnant riparian forests anywhere in the Lower Colorado River basin. Therefore, the BWR corridor continues to support a diverse array of terrestrial wildlife. Over 300 bird species have been recorded along the BWR. Some of the more common breeding birds of the riparian corridor include the song sparrow (*Melospiza melodia*), yellow warbler, (*Setophaga petechia*), Bell's vireo (*Vireo bellii*), Lucy's warbler (*Oreothlypis luciae*), common yellowthroat (*Geothlypis trichas*) and ash-throated flycatcher (*Myiarchus cinerascens*). The riparian corridor and adjacent drier scrub habitats also support other common species such as the black-tailed gnatcatcher (*Polioptila melanura*), black-throated sparrow (*Amphispiza bilineata*), and cactus wren (*Campylorhynchus brunneicappillus*). Other commonly encountered bird species include the northern mockingbird (*Mimus polyglottos*), lesser goldfinch (*Spinus psaltria*), and Gambel's quail (*Callipepla gambelii*).

Common mammals in the Project Area include the beaver, bobcat (*Lynx rufus*), javelina (*Tayassu tajacu*), and mule deer (*Odocoileus hemionus*), as well as established populations of the non-native burro. Common reptiles in the Project Area include the side-blotched lizard (*Uta stansburiana*), desert spiny lizard (*Sceloporus magister*), western whiptail (*Cnemidophorus tigris*), gopher snake (*Pituophis melanoleucus*), coachwhip (*Masticophis flagellum*), western diamondback (*Crotalus atrox*).

For more comprehensive lists of species in the watershed, see the following links:

Fish: https://www.billwilliamsriver-havasufriends.org/fishing.html

Birds: https://www.fws.gov/uploadedFiles/BWR%20NWR%20Birds%202012%20FS.pdf

Mammals: http://billwilliamsriver.org/wildlife/mammallist.pdf

Reptiles: http://billwilliamsriver.org/wildlife/Reptilelist.pdf.

Special Status Wildlife

Special-status wildlife species considered in this document include species listed as threatened or endangered under the federal ESA, or proposed or candidate species under the ESA. ESA species in the project area were identified through the Information for Planning and Consultation (IPaC) website available from USFWS.

Of the species listed in table 3.3-2, all are known to occur in the Project Area with the exception of the bonytail chub (*Gila elegans*), which is currently considered extirpated from the lower BWR. A detailed discussion of each species and associated critical habitats, including their distribution in the Project Area and preferred habitats, can be found in Section 3.0 of Appendix A (Alamo Dam Flushing Flow Biological Assessment).

Table 3.3-2. Species status wildlife & habitats in the Project Area.

Species Name	Species or Habitat	Status
Empidonax traillii extimus	Southwestern Willow Flycatcher	Endangered
	Critical Habitat	Designated
Coccyzus americanus	Yellow-Billed Cuckoo	Threatened
	Critical Habitat	Proposed
Rallus obsoletus yumaensis	Yuma Clapper Rail	Endangered
Thampnophis eque megalops	Northern Mexican Gartersnake	Threatened
	Critical Habitat	Proposed
Gila elegans	Bonytail Chub	Endangered
	Critical Habitat	Designated

4. Environmental Consequences

This section evaluates the impacts of the Proposed Alternative along with the No Action Alternative. Each sub-section corresponds to a specific resource. To further assist the reader, each section contains thresholds of significance, a discussion of potential impacts of the No Action and Proposed Alternatives, a discussion of the significance of potential impacts, and a list of conservation measures included in the Project Description to reduce potential impacts to the resource.

4.1 Recreation Resources

Thresholds of Significance

The impacts to recreational resources would be considered significant if the Proposed Alternative:

1. Resulted in an increased use of parks or recreational facilities to the extent that substantial deterioration of the facility would occur or would be accelerated;

2. Required the construction or expansion of recreational facilities which would have an adverse effect on the environment; or,

3. Resulted in the permanent closure or permanent reduction in use of existing recreational facilities.

Potential Impacts – No Action Alternative

Under the No Action Alternative, releases from Alamo Dam would be maintained at typical base flows of 20-50 cfs for the foreseeable future. Along the BWR downstream of Alamo Dam, flow conditions would remain at 20-50 cfs unless significant rainfall resulted in inflow from minor creeks and streams below the dam. Stream flow would likely continue to be present for some distance below Alamo Dam before disappearing upstream of Planet Ranch. This would leave off-road vehicle crossings open to recreational use.

The No Action Alternative would not result in any increase in the use of recreational facilities (Criteria 1), nor would it require the expansion of existing or construction of new recreational facilities (Criteria 2). The No Action Alternative would not result in the permanent closure or permanent reduction of use of any existing recreational facilities (Criteria 3). Therefore, impacts to recreation resources as a result of the No Action Alternative are not significant and no conservation measures are necessary.

Potential Impacts – Proposed Alternative

Under the Proposed Alternative, a temporary increase in the rate of flow from Alamo Dam would be implemented. This release would not exceed 5,000 cfs or 20 days in total duration. Flow would be increased up to a maximum of 5,000 cfs, which would be maintained for 2-5 days before being gradually returned to base flow.

As a result of the Proposed Alternative, flow conditions below Alamo Dam would be temporarily increased. The proposed release of up to 5,000 cfs for several days would result in water exceeding

the normal low flow channel for a several days. This flow would result in low water crossings at recreational trails being temporarily unavailable to passage. While this would result in several days of limited access to river crossing points, similar conditions can occur during rainfall events when downstream creeks and channels produce inflow to the BWR. The majority of OHV trails adjacent to the BWR would not be affected, with temporary closures only associated with crossing points.

The Proposed Alternative would not result in any increase in the use of recreational facilities below Alamo Dam (Criteria 1), nor would it require the expansion of existing or construction of new recreational facilities below Alamo Dam (Criteria 2). The Proposed Alternative would result in a brief, temporary limitation of recreational crossings of the BWR, but such closures would not be permanent and would not result in the permanent reduction of use of any existing recreational facilities (Criteria 3). Therefore, impacts to recreation resources below Alamo Dam as a result of the Proposed Alternative are not significant.

Conservation Measures

To ensure temporary impacts to recreation are minimized to the maximum extent practicable, the following conservation measures were considered and included in the Project Description:

1. Land management agencies responsible for recreational facilities in the vicinity of Alamo Lake and the BWR have been notified in advance. The proposed release of water from Alamo Dam has been coordinated with Arizona State Parks, Bureau of Land Management, Bureau of Reclamation, and USFWS. All agencies have been notified in advance of the potential for a proposed spring release of water, allowing for advanced notification of all interested recreational groups.

2. The proposed release has been shaped in a way to minimize potential impacts to recreation through shaping of the hydrograph to have a short, high peak. By using a high maximum flow, as opposed to a prolonged release of lesser magnitude, the temporary closure of downstream recreational crossings has been reduced to the maximum extent practicable.

4.2 Biological Resources

Thresholds of Significance

The impacts to biological resources would be considered significant if the Proposed Alternative:

1. Jeopardized the existence of a species listed as endangered or threatened under the ESA;

2. Results in the destruction or adverse modification of critical habitat;

3. Substantial adverse effect or net loss in habitat value of sensitive biological habitats or areas of special biological significance, or

4. Substantial loss to the population of any native fish, wildlife, or vegetation.

Potential Impacts – No Action Alternative

Under the No Action Alternative, releases from Alamo Dam would be maintained at typical base flows of 20-50 cfs for the foreseeable future. The Alamo Lake reservoir would continue to draw down at typical rates in the absence of significant rainfall, with precipitation, evaporation, and the base release controlling the level of the reservoir. Downstream of Alamo Dam along the BWR, native cottonwood willow riparian habitats have been significantly declining due to lack of water availability. This is particularly true between Planet Ranch and the Colorado River. Under the No Action Alternative, and lacking any significant rain events resulting in the water surface elevation exceeding 1125 and triggering a flood release from Alamo Dam, downstream habitats are likely to continue to decline along the current trajectory.

The No Action Alternative would not jeopardize the continued existence of any ESA listed species (Criteria 1), nor would it destroy or modify any designated critical habitat (Criteria 2). While habitat value would continue to decline in downstream reaches under the No Action Alternative, much of this habitat has already suffered significant decline and as such, no substantial adverse effect or loss of sensitive or significant habitats would occur (Criteria 3). The No Action Alternative would not result in a substantial loss of any downstream plant or wildlife populations. Therefore, the No Action Alternative would not result in significant impacts to biological resources.

Potential Impacts – Proposed Alternative

Under the Proposed Alternative, a temporary increase in the rate of flow from Alamo Dam would be implemented. This release would not exceed 5,000 cfs or 20 days in total duration. Flow would be increased up to a maximum of 5,000 cfs, which would be maintained for 2-5 days before being gradually returned to base flow. The increased flow would result in the Alamo Lake reservoir drawing down more rapidly than it would in the absence of an increased release. However, there are no sensitive ESA protected habitats or species, nor sensitive or important biological habitats between Alamo Dam and the upper end of the Project Area.

Below Alamo Dam, the increased release would result in temporarily increased volumes and velocities of water along the BWR. This increase in flow would inundate areas outside of the low flow channel and high velocities would result in some mechanical damage to riparian vegetation at the margins of the channel. Detailed discussion of the extent of these impacts are described in Appendix A (Alamo Dam Flushing Flow Biological Assessment). Briefly, while the inundation and mechanical damage would result in minor impacts to habitat, these impacts would be insignificant in comparison to the quantity of available habitat along the BWR corridor below Alamo Dam.

The proposed release of water is planned for early March of 2018. This time frame was chosen for a variety of reasons, including coinciding with the typical high-flow season for the region and coinciding with the seasonal water needs of the downstream riparian community while also avoiding impacts to ESA-listed species and migratory birds, which tend to arrive in between late March through early May. A detailed discussion of impacts to ESA listed species can be found in Appendix A. Briefly, neither southwestern willow flycatcher nor western yellow-billed cuckoo

will have returned the Project Area at the time of the proposed release. The release also occurs prior to the Yuma clapper rail breeding season. As described in Section 3.3 and in Appendix A, native fish have been almost entirely replaced by non-native species in the BWR and bonytail chub is likely extirpated from the Project Area at this time.

The Proposed Action will result in temporary impacts to populations of northern Mexican gartersnake below Alamo Dam. These impacts are described in detail in Appendix A, and consultation with USFWS has been initiated with regards to impacts to the northern Mexican gartersnake. Coordination with USFWS is ongoing, but based on preliminary discussions, USACE expects to receive a Biological Opinion as a result of this consultation that will confirm that the Proposed Action is not going to jeopardize the continued existence of the northern Mexican gartersnake.

As detailed in Appendix A, the Proposed Action will not jeopardize any species protected under the ESA, nor result in the modification or destruction of any critical habitat (Criteria 1 & 2). The Proposed Alternative will not result in a substantial adverse effect on sensitive biological habitats, nor will it result in a substantial loss to any wildlife or plant populations (Criteria 3 & 4). Therefore, the Proposed Alternative will have not have a significant impact on biological resources.

Conservation Measures

To ensure temporary impacts to biological resources are minimized to the maximum extent practicable, the following conservation measures were considered and included in the Project Description:

<u>Timing of Proposed Release</u>

1) The Proposed Action will be implemented during the normal rainy season in order to ensure that the resulting increase in water corresponds to the life histories and ecological requirements of native species which are adapted to flood flows in the appropriate season. This includes potential benefits to riparian willow and cottonwood vegetation by providing water during spring that would not be available absent a release from Alamo Dam.
2) Peak flows will be finished prior to March 15th. Since peak flows have the potential to mechanically damage vegetation adjacent to the river, flows will be curtailed prior by this date to reduce any potential impacts to riparian breeding birds. By confining the release prior to March 15th, this will ensure no direct effects to SWFL and YBC occur. Neither SWFL nor YBC arrive on breeding grounds along the BWR this early in the season.
3) Confining the peak flow to March 15th or earlier will ensure that the high flow occurs prior to the NMGS breeding season. Gestating females and neonates are more susceptible to high flow events, and therefore confining flows to this season will reduce potential impacts, and thus reduce potential for take, on the NMGS.

Shape of Proposed Hydrograph

4) The hydrograph of the Proposed Action will be shaped, to the maximum extent practicable, to conform to a natural winter-spring flood pulse as described in the Unified Ecosystem Flow theory (Hautzinger et al. 2006), with the exception of a more gradual flow increase as described in 6 below. The Unified Flow Theory was developed by a panel of experts considering potential impacts and benefits that releases from Alamo Dam could have on bird, fish, and riparian vegetation communities.
5) Water released from Alamo Dam will not exceed 5,000 cfs. While Alamo Dam is capable of releasing 7,000 cfs of water, the targeted cfs cap is the approximate flow condition where impacts to downstream vegetation resources are expected to increase in significance, as described in the Unified Flow Theory (Hautzinger et al. 2006). As such, the Corps has capped the upper end of the release to minimize potential impacts to downstream vegetation that could occur due to mechanical damage from high flows.
6) The ascending limb of the hydrograph will be ramped up over an approximate 3 day period. While flows can be increased more rapidly, the reduced rate of increase will provide downstream organisms living in the stream and riparian corridor, particularly the NMGS, additional time to respond to, and avoid, gradually increasing flows. The reduced increase in release is expected to minimize the potential for mortality on the NMGS.
7) The descending limb of the hydrograph will be lengthened with flows in the latter part of the recession decreased slowly. This will bring the total hydrograph length to approximately 20 days. This increase in the length of hydrograph tail ensures that seeds distributed by the high flow, and recently established seedlings, have sufficient water availability to allow for establishment. In addition, increased hydrograph tails are thought to provide competitive advantage to native cottonwood/willow community over the invasive tamarisk. As a result of the prolonged tail, native vegetation downstream is expected to benefit from the increased flow, which will also benefit riparian wildlife such as the SWFL and YBC.

Post-Release Actions

8) After the release of water is complete, the Corps has committed to performing surveys for NMGS. The location of these surveys will be somewhere in Reach 1-2. This survey effort will:
    a. Help to evaluate post-release use of the BWR corridor by NMGS; and
    b. Provide significant additional data on the distribution and abundance of NMGS along the BWR, informing future operational actions at Alamo Dam and along the BWR.
9) Upstream vegetation monitoring will occur above the Alamo Lake reservoir in the vicinity of Brown's Crossing by establishing stationary photopoints. Vegetation will be visually documented from these photopoints before the release, and at several time points following the release, in order to track general vegetation trends in the upstream area. Results of this effort will be coordinated with USFWS.

5. Cumulative Impacts

An evaluation of cumulative environmental impacts associated with the Proposed Alternative and its relationship to other past, present, and reasonably foreseeable future actions are required by NEPA regulations. In accordance with NEPA, past, present, and reasonably foreseeable future projects are assessed by resource area. Cumulative effects may arise from single or multiple actions and may result in additive or interactive effects. The factors considered in determining the significance of cumulative effects are similar to those presented for each resource earlier in Section 4. Only those resources with potential impacts as a result of the Proposed Alternative, Recreation and Biological Resources, are evaluated in the Cumulative Impacts discussion. Identification of relevant projects entailed the following:

1. Coordination with appropriate entities including: BOR, USFWS, and AZSP.
2. Evaluation of the USACE Regulatory permit database to determine if any Regulatory permits or actions were anticipated in the Project Area.

An evaluation of the USACE Regulatory permit database recovered four permits in the Project Area over the past 15 years. These permits included efforts to maintain pipelines upstream of Planet Ranch (2004), repair power lines in the BWRNWR (2005), install boat ramps at Alamo Lake State Park (2008), and run a 12kV powerline across a wash adjacent to Alamo Dam (2004). The actions associated with each of these permits were all minor, with no negative impacts to biological or recreational resources as a result of the permitted actions, and therefore no contribution to cumulative effects when considered in conjunction with the Proposed Action. No pending permits or permits for ongoing or upcoming actions were identified.

The area above Alamo Dam within the Project Area is owned by USACE, and leased for operations to Arizona State Parks. There are no upcoming actions that would contribute to cumulative impacts occurring above Alamo Dam in the foreseeable future. In 2008, new boat ramps were permitted for installation in the state park. While these boat ramps may have resulted in increased use of park facilities, the boat ramps did not result in significant degradation of park facilities, nor did they have negative environmental impacts or require closure of any recreation facilities (Criteria 1-3; Section 4.1).

Based on the evaluations performed in step 1 and 2 above, only a single project below Alamo Dam has the potential to contribute to cumulative impacts, the BOR's recent leasing of Planet Ranch. In 2015, BOR acquired rights to the Planet Ranch property in order to utilize the land to meet habitat management requirements under their Multi-Species Conservation Program. BOR recently finished agricultural irrigation of the property to maintain water rights and intends to manage the property for future habitat restoration. Since the BOR's intent for the property is to restore habitat to benefit protected and sensitive species, the BOR's actions at the property will be beneficial to the BWR ecosystem. Acquiring rights to the property will not alter recreational activities on the property.

Since BOR's actions on the Planet Ranch property will benefit biological resources and will have no impact on recreational resources, when considered in combination with the Proposed Action, no significant cumulative impacts are anticipated.

6. Environmental Compliance and Coordination

The Proposed Action consists of a release of water from the existing Alamo Dam. Operations of Alamo Dam have been previously discussed in the project's WCM, and evaluated in an EIS. In addition, USACE received a Biological Opinion for operations of Alamo Dam from USFWS, covering species in the Project Area protected under the ESA at that time. Since this EA only evaluates those resources with changed conditions subsequent to the last EIS, compliance status of most environmental regulations as discussed in the previous EIS remain valid. In addition to the compliance efforts described in the previous EIS, the following compliance efforts have occurred with respect to the Proposed Action.

6.1 National Environmental Policy Act of 1969

This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969. Section 102 of the NEPA requires that all federal agencies use a systematic, interdisciplinary approach to protection of the human environment. Council of Environmental Quality (CEQ) Regulations on Implementing NEPA Procedures (40 CFR 1500 et seq.) provide for the use of the NEPA process to identify and assess the reasonable alternatives to proposed actions that avoid or minimize adverse effects of these actions upon the quality of the human environment. USACE Environmental Quality Procedures for Implementing NEPA (33 CFR Part 230) provides guidance for implementation of the procedural provisions of NEPA for the Civil Works Program of the USACE.

As specified in NEPA, reasonable alternatives were identified and evaluated, as presented in Sections 2-4. Potential environmental effects were identified and conservation measures were included in the project description to reduce any potentially significant impacts to a less-than-significant level.

6.2 Endangered Species Act (ESA) of 1973, as Amended (Public Law 93-205)

A list of threatened and endangered species that potentially could occur in the study area was determined using the IPAC web service available from USFWS. Section 7 (c) of the Endangered Species Act requires consultation with the USFWS to ensure that an action does not jeopardize the continued existence or result in the destruction or adverse modification of designated critical habitat of any threatened or endangered species. Pursuant to the ESA, request for formal consultation was sent to the USFWS on 15 Nov 2017 to evaluate potential impacts to the northern Mexican gartersnake. At the same time, a concurrence request was submitted to the USFWS for the remaining species and designated critical habitats within the Project Area which could potentially be impacted, but were not likely to be adversely effected. Details of the consultation and concurrences requests can be found in Appendix A. As the result of formal consultation request and request for concurrence, the Corps will receive a final Biological Opinion from USFWS prior to implementation of the Proposed Alternative. The Corps would implement any reasonable and

prudent measures, and associated terms and conditions that accompany the Biological Opinion, thereby complying with the ESA.

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Alamo Dam
Flushing Flow Release
Biological Assessment

US Army Corps
of Engineers®

September 2017

Table of Contents

1.0 Introduction

1.1 Purpose of this Biological Assessment

Pursuant to the requirements of Section 7(c) of the Endangered Species Act (ESA) of 1973, as amended, this Biological Assessment (BA) has been prepared by the U.S. Army Corps of Engineers (Corps) to evaluate the effects of a proposed flushing flow release of water from Alamo Dam on threatened and endangered species and designated and proposed critical habitat known to occur within the Project Area. Section 7(b) of the ESA requires coordination with the appropriate resource agency, in this case the U.S. Fish and Wildlife Service (USFWS).

The primary objectives of this BA are to: (1) provide information on the natural history of the ESA-listed species occurring within the Project Area pertinent to the Proposed Action, (2) describe critical habitat in the Project Area; (2) evaluate the potential effects of the Proposed Action on listed species and critical habitat, (3) describe measures to avoid or minimize adverse effects on listed species and critical habitat; and (4) provide a determination of effects for listed species and critical habitat. A total of five species currently listed under the ESA occur within the Project Area (Table 1).

The Information for Planning and Conservation (IPaC) web portal available from USFWS was used to generate a list of species and critical habitat, protected under the ESA, with potential to occur in the Project Area. The initial list resulted in the identification of eight species and four critical habitats. Based on the lack of modern records and knowledge of the species' habitat requirements and current ranges, three of the species identified by the IPaC have no potential to occur in the Project Area. These species are the California least tern (*Sterna antillarum browni*), the razorback sucker (*Xyrauchen texanus*), and the roundtail chub (*Gila robusta*). Since these species have no potential to occur in the Project Area, these species are not discussed further in this document.

Effects determinations for the remaining five species that may be in the Project Area and their associated critical habitat are discussed in this BA. Formal consultation is only requested on the northern Mexican gartersnake with this BA. Concurrence is requested for the Corps' may affect, but not likely to adversely affect determinations for the yellow-billed cuckoo, Yuma clapper rail, southwestern willow flycatcher, and southwestern willow flycatcher critical habitat. The Corps has determined that the Proposed Action will have no effect on the bonytail chub and associated designated critical habitat. However, the species is included in this BA for consistency of documentation. Effects determinations are described in Section 5.0 of this BA and summarized in Section 6.0. This BA also covers proposed critical habitat within the Project Area. The Corps' has determined that the Proposed Action will not result in destruction or adverse modification of proposed critical habitat for the northern Mexican gartersnake and yellow-billed cuckoo, and no further action from USFWS is requested on these determinations.

Table 1. Species and critical habitat protected or proposed for protection under the ESA occurring within the Project Area

Species Name	Species or Habitat	Status
Empidonax traillii extimus	Southwestern Willow Flycatcher	Endangered
	Critical Habitat	Designated
Coccyzus americanus	Yellow-Billed Cuckoo	Threatened
	Critical Habitat	Proposed
Rallus obsoletus yumaensis	Yuma Clapper Rail	Endangered
Thampnophis eque megalops	Northern Mexican Gartersnake	Threatened
	Critical Habitat	Proposed
Gila elegans	Bonytail Chub	Endangered
	Critical Habitat	Designated

1.2 Project Background and Consultation History

Project Background

Alamo Dam and Lake is a multi-purpose project authorized under the Flood Control Act of 1944 (Public Law 78-534). The project's initial authorization included authorized flood control and other purposes, such as hydropower generation, water conservation and supply, and recreation. The Water Resources Development Act (WRDA) of 1996 added fish and wildlife benefits as an authorized purpose, provided that those benefits did not reduce existing flood control or recreation (Public Law 104-303). While hydropower was initially authorized for the project, this purpose was not deemed feasible and a powerplant has never been constructed.

Consultation History

On April 6, 1994, the Corps initiated consultation with the USFWS on the effects of operating Alamo Dam on the bald eagle which at the time was listed as an endangered species. On February 15, 1996, the Corps received a biological opinion (BO) from USFWS determining that the operations of Alamo Dam were not likely to jeopardize the continued existence of the bald eagle.

On August 18, 1998, the Corps requested initiation of formal consultation on actions contained in the 1998 BA and 1994 Proposed Water Management Plan for Alamo Lake and the Bill Williams River. On March 26, 1999, the USFWS issued a final BO which determined that the effects discussed in the 1998 BA were not likely to jeopardize the continued existence of either the southwestern willow flycatcher (*Empidonax trailli extimus*) or the bald eagle. As a result, the Corps developed the existing 2003 Water Control Manual for Alamo Dam and Lake, which defined the updated operations and maintenance activities still in practice today.

Since the issuance of the 1999 BO, numerous additional species that occur in the vicinity of Alamo Dam are now listed under the ESA, additional critical habitat has been designated in the direct vicinity of Alamo Dam, and the bald eagle was delisted. Since the issuance of the 1999 BO, the Corps has continued to coordinate with USFWS through the Bill Williams River Steering Committee, as well as through informal discussions and technical assistance.

Need for the Proposed Action

The conduit (upper and lower) at Alamo Dam is scheduled for inspection once every 5 years as part of the normal project inspection protocol. However, due to physical limitations of the bulk head gate and operational constraints associated with scheduling an appropriate draw down to facilitate the inspection, regular upper conduit inspections have lapsed considerably. The last upper conduit inspection was conducted in June 1990, more than 27 years ago. The upper conduit inspection that preceded the 1990 inspection occurred October 1977.

The 1990 upper conduit inspection identified nearly $1 million of necessary maintenance and rehabilitation that was subsequently performed. The recurring presence of corrosive H_2S gas, partly due to the accumulation of sediment in the upper conduit that remains stationary and becomes anoxic, is a primary driver of damage in the conduit. This condition corrodes exposed metal components and can effect concrete surfaces. Similar damage has likely occurred since the last inspection.

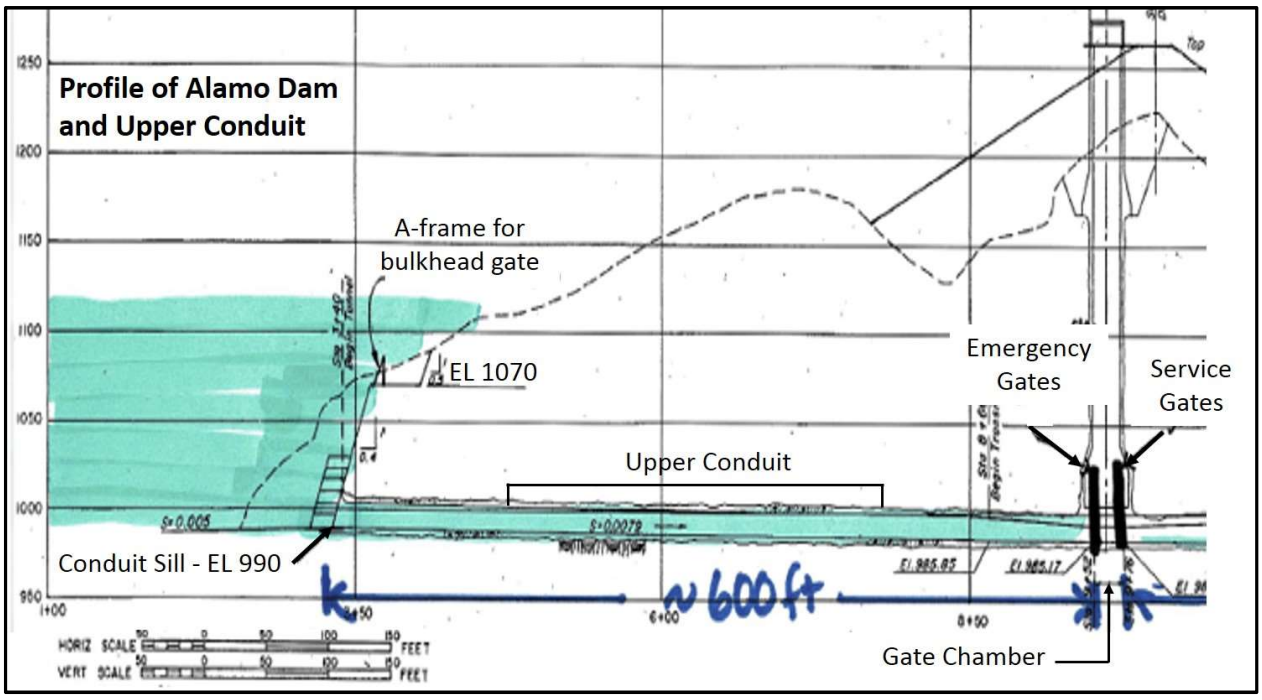

Figure 1. Profile of the Alamo Dam showing the bulkhead gate A-frame, upper conduit, and gate chamber.

Inspection of the upper conduit requires installing the bulkhead gate using the following steps:

1) Inspect the bulkhead gate
    a. Mobilize a crane and barge suitable to the task,
    b. Remove the gate from the lake and place on dry ground
    c. Inspect the bulkhead for structural integrity
    d. If necessary, repair the bulkhead
    e. Return the bulkhead to the bulkhead guide for installation
2) Inspect the conduit sill where the bulkhead gate will need to make positive contact
    a. Clean the sill of sediment and debris
    b. Minimize lake depth to increase diver safety
    c. Divers physically inspect the sill with their hands and utilize imaging equipment
    d. Confirm that the bulkhead gate will make a tight seal with the sill
3) Install the bulkhead gate in the sill to seal the conduit from flows (water surface eleveation (WSE) must be <1110 ft)
4) Dewater the upper conduit and send in a specialized team to inspect the condition of the conduit and the gates

The sill sits at 990 feet elevation. The lake's target elevation is 1125 ft. As a result, the sill is always under substantial depth of water. The sill, cleared of sediment, needs to be inspected manually by divers, and it is important to minimize the water depth to the maximum extent practicable. Every foot of depth added to the lake significantly increases the danger associated with diving. The ideal depth for a safe dive is 95 feet or less (1085 feet lake elevation) as this depth can be performed without the use of a chamber. However, if 1085 is not achievable due to operational constraints, the lake level should be minimized to the extent possible to increase safety, reduce risk, and reduce cost. Divers cannot dive to depths greater than 135 ft. Nationally the Corps rarely conducts dives over 115 feet.

2.0 Summary of the Proposed Action

The Corps proposes a one-time release of water from Alamo Dam outside of the normal non-flood release schedule in order to facilitate maintenance of the bulkhead and associated sill (see Need for Proposed Action in Section 1.2 for details). The purpose of the proposed release is two-fold: to remove approximately 16 cubic yards of sediment from the sill and to draw the lake elevation down to provide safe dive conditions. The proposed flushing flow release would occur as a flood pulse hydrograph designed to mimic a typical rain event in the downstream watershed released with appropriate seasonal timing. The hydrograph would be shaped similar to a moderate late spring release event as described in the Unified Flow Theory (Shafroth et al. 2010 & Hautzinger et al. 2006; Figure 2). While the exact details of the release are subject to variation based on conditions at the time of release, such as WSE and weather, the release will conform to the following general parameters:

1) Maximum release between 4,000 and 5,000 cfs ranging from 1 to 5 days in duration.
2) Total release time, including ascending and descending limbs, would range from 7-20 days, depending on WSE at the time of release.
3) Target WSE would be between 1085-1095 feet.

4) Ascending limb of the hydrograph will be steeper than the descending limb. However, the ascending limb will rise more slowly than a natural hydrograph, reaching peak in approximately 2-3 days depending on conditions at the time of the release.
5) Descending limb of the hydrograph will initially drop steeply, followed by a gradual return to base flow (approximately 20 cfs increments below 500 cfs).
6) The peak of the hydrograph will be completed prior to March 15th.

The proposed flushing flow will result in flows below Alamo Dam in excess of the typical non-flood baseflow, which normally range from 20-50 cfs. Increased flows would be most evident the base of the Alamo Dam to the reach just above Lincoln Ranch (Figure 3), where the narrow canyon below the dam first opens into a more expansive floodplain. From Lincoln Ranch downstream, the width of the floodplain and absorption of flows into the ground result in varying amounts of flow attenuation in different stretches of river, significantly reducing the effects of increased flows progressively downstream. Further significant flow attenuation would occur at Planet Ranch where the floodplain width and infiltration rates are greatest.

With respect to potential impacts to ESA-listed species and habitats in the Project Area, the primary effects from the Proposed Action are considered to be mechanical damage to vegetation, temporary inundation, and temporary increases in velocity and turbidity. Secondary effects expected to have less potential to impact ESA-listed species include minor scour and sedimentation, damage to beaver dams, and effects to the water table. Effects are discussed in detail in Sections 5.0 and 6.0.

2.1 Project Area

The Project Area consists of the Alamo Lake inundation upstream of the reservoir to near the confluence of the Big Sandy and Santa Maria Rivers, and those areas below Alamo Dam expected to experience direct and indirect effects associated with the Proposed Action (Figure 3). Discussion of the Project Area downstream of Alamo Dam will be primarily confined to those areas potentially inundated by the proposed release (5000 cfs). While there will be minor indirect effects to surrounding upland areas, the predominant effects to protected species will be those direct effects related to inundation. For ease of further discussions, the river was broken down into three reaches as shown in Figure 3 (for detailed discussion see Section 4.1).

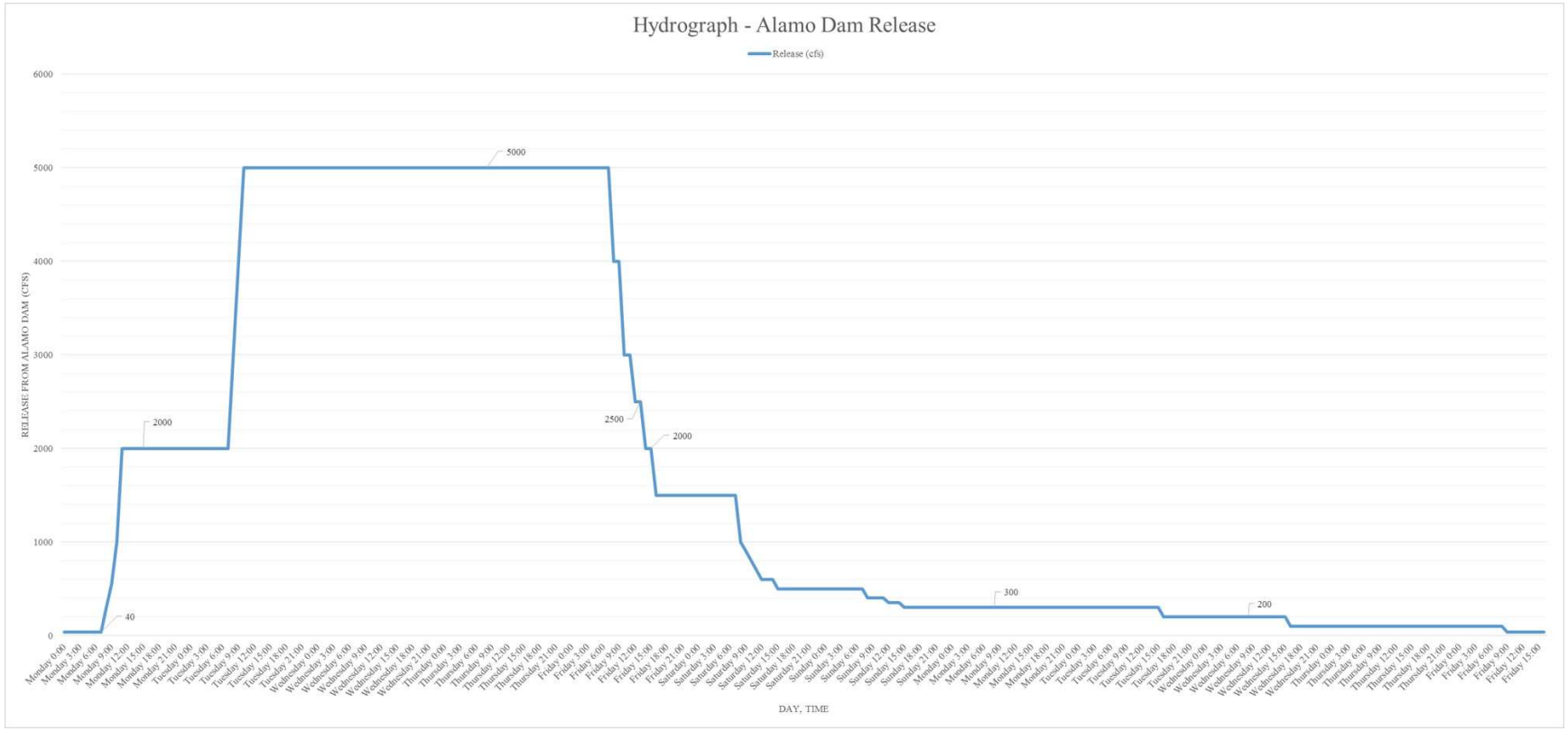

Figure 2. Conceptual hydrograph illustrating shape of the proposed release.

Figure 3. Project Area map extending from Alamo Dam downstream along the Bill Williams River to the confluence with the Colorado River.

3.0 Endangered Species Act (ESA) Listed Species and Critical Habitat in the Project Area

3.1 Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

Status

The Southwestern Willow Flycatcher (SWFL) was listed as endangered on 27 February 1995. Critical habitat was first designated in 1997, with subsequent revisions in 2005 and a revised final designation on 3 January 2013. A detailed description of the SWFL and its life history can be found in the final listing rule (USFWS, 19995), and discussion of critical habitat can be found in the final critical habitat designation (USFWS, 2013a), and will not be discussed in comprehensive detail here. However, life history and habitat characteristics important for evaluating the effects of the Proposed Action on the species and designated critical habitat are described below.

Pertinent Life History and Habitat Details and Status in the Project Area

The SWFL breeds in dense riparian trees and shrubs across southwestern North America, including along the Bill Williams River and just upstream of Alamo Lake along the Bill Williams, Big Sandy, and Santa Maria Rivers. Historically, SWFL nested primarily in willows, buttonbush, and mulefat with a cottonwood overstory (USFWS, 1995). However, as riparian systems throughout the species' breeding range have been altered, SWFL have expanded their preferred nesting habitats to include areas of invasive Russian olive and tamarisk. While various components of riparian vegetation are likely the most important factors in determining suitability of SWFL breeding habitat, floodplain size and distance to water are also apparently important factors of habitat suitability (Hatten et al. 2010), and SWFL are rarely observed in areas of minimal or restricted floodplains (Hatten and Paradzick, 2003).

The precise distribution of SWFL within the Project Area is prone to fluctuation due to temporal variation in climate and hydrology, which effect vegetation. However, suitable SWFL habitat below Alamo Dam is predominantly confined to the two areas identified as critical habitat: the reach just above the Bill Williams National Wildlife Refuge (BWRNWR) to Planet Ranch, and the roughly 11 mile reach between Planet Ranch and Lincoln Ranch (Figures 3 & 4). The reach from the base of Alamo Dam to the Lincoln Ranch reach consists of a narrow canyon with little available floodplain and generally limited areas of appropriate vegetation (see Section 4.0 for details), while the Planet Ranch reach generally lacks appropriate vegetation to support SWFL. Above Alamo Lake, SWFL occupy much of the riparian forest habitat found in the upper end of the reservoir. Due to relatively low water surface elevation of Alamo Lake over the past five years, SWFL nesting has now been documented at sites as low as approximately 1090 feet in elevation (Bureau of Reclamation, 2016; see Figure 16).

While subject to inter-annual variation, the general timeline of SWFL breeding begins with birds returning to nesting grounds in mid-May to early June, with egg laying typically commencing in mid-June. Young generally begin fledging mid-July, with migration to wintering grounds occurring mid-August through mid-September. The SWFL is not present in Arizona from November through March, and only rarely in October or April.

Critical Habitat and Primary Constituent Elements (PCEs)

Critical habitat for the SWFL in the Project Area includes the upper end of Alamo Lake at the origin of the Bill Williams River, and areas in the Bill Williams River below Alamo Dam (Figure 4). The PCEs of SWFL designated critical habitat include:

1. PCE 1: Riparian vegetation. Riparian habitat along a dynamic river or lakeside, in a natural or manmade successional environment (for nesting, foraging, migration, dispersal, and shelter) that is comprised of trees and shrubs (that can include Goodding's willow, coyote willow, Geyer's willow, arroyo willow, red willow, yewleaf willow, pacific willow, boxelder, tamarisk, Russian olive, buttonbush, cottonwood, stinging nettle, alder, velvet ash, poison hemlock, blackberry, seep willow, oak, rose, sycamore, false indigo, Pacific poison ivy, grape, Virginia, creeper, Siberian elm, and walnut) and some combination of:

    a. Dense riparian vegetation with thickets of trees and shrubs that can range in height from about 2 to 30 m (about 6 to 98 ft). Lower-stature thickets (2 to 4 m or 6 to 13 ft tall) are found at higher elevation riparian forests and tall-stature thickets are found at middle- and lower-elevation riparian forests;

    b. Area of dense riparian foliage at least from the ground level to to approximately 4m (13 ft) above ground or dense foliage only at the shrub or tree level as low, dense canopy;

    c. Sites for nesting that contain a dense (about 50 percent or 100 percent) tree or shrub (or both) canopy (the amount of cover provided by tree and shrub branches measured from the ground);

    d. Dense patches of riparian forests that are interspersed with small opening of open water or marsh or areas with shorter and sparser vegetation that creates a variety of habitat that is not uniformly dense. Patch size may be as small as 0.1 ha (0.25 ac) or as large as 70 ha (175 ac).

2. PCE 2: Insect prey populations. A variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, which can include: flying ants, wasps, and bees (Hymenoptera); dragonflies (Odonata); flies (Diptera); true bugs (Coleoptera); butterflies, moths and caterpillars (Lepidoptera); and spittlebugs (Homoptera).

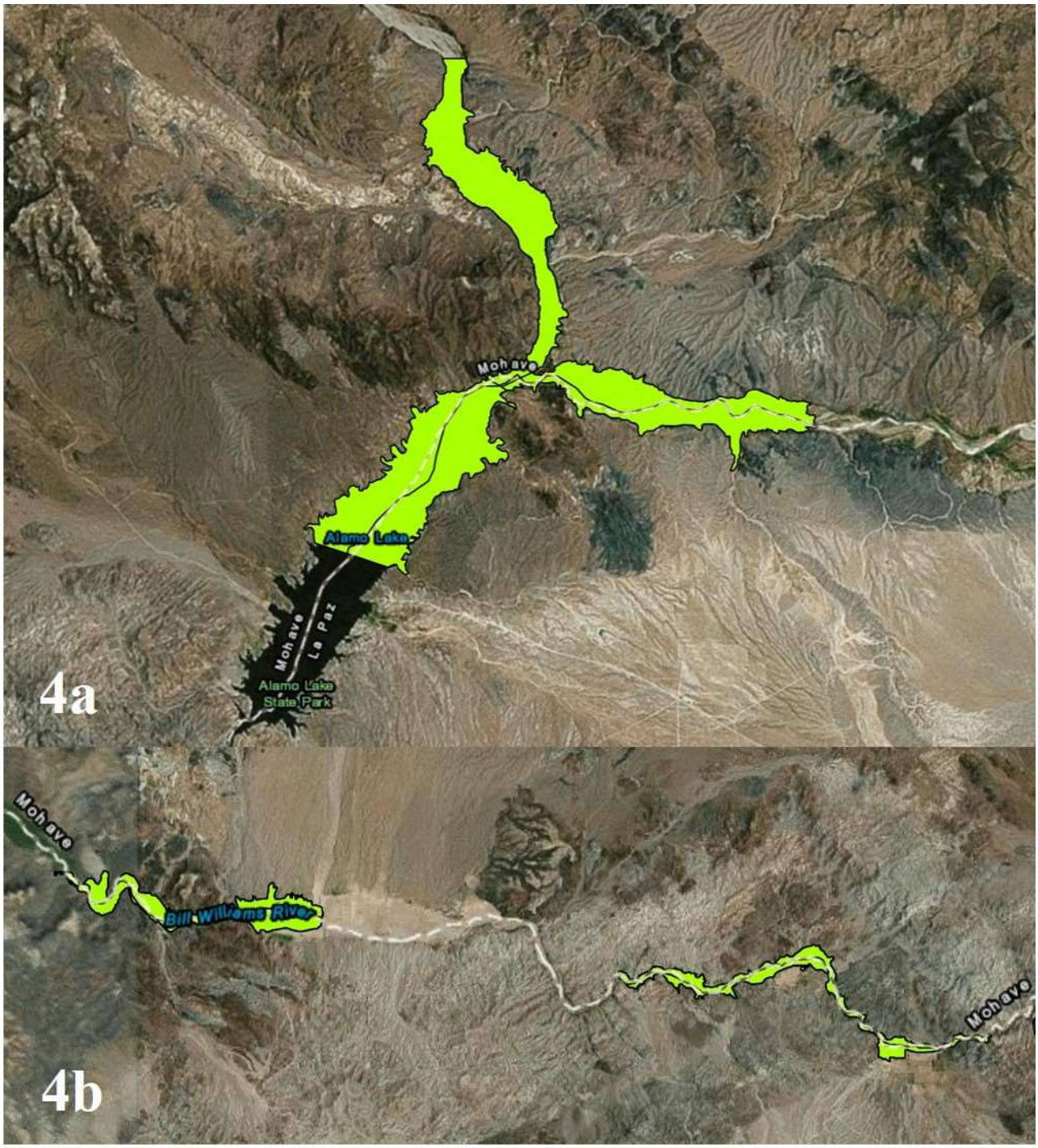

Figure 4. Designated critical habitat for the southwestern willow flycatcher above (4a) and below Alamo Dam (4b) along the Bill Williams River.

3.2 Yellow-Billed Cuckoo (*Coccyzus americanus*)

Status

The Western Distinct Population Segment (DPS) of the Yellow-Billed Cuckoo (YBC) was listed as threatened on 3 October 2014. Critical habitat for the YBC was originally proposed on 15 August 2014. However, as of November 2016, the critical habitat designation has not been finalized. A detailed description of the YBC and its life history can be found in the final listing rule (USFWS, 2014b), and discussion of critical habitat can be found in the proposed critical habitat designation (USFWS, 2014a), and will not be discussed in comprehensive detail here. However, life history and habitat characteristics important for evaluating the effects of the Proposed Action on the species and proposed critical habitat are described below.

Pertinent Life History and Habitat Details and Status in the Project Area

The Western YBC breeds in large mature riparian woodlands with multi-layer canopies, particularly where cottonwood and willow are present. As described in the proposed critical habitat designation, the YBC requires relatively large acreages of appropriate habitat to nest, with anything under 37 acres considered unsuitable, 37-100 acres considered marginal. Habitat patches of 100-200 acres are considered suitable although not consistently used, with patches greater than 200 acres considered optimal (USFWS, 2014a).

Within the Project Area below Alamo Dam, suitable YBC habitat is predominantly confined to the area of proposed critical habitat near the BWRNWR downstream of Planet Ranch (Figures 5). The Bill Williams River upstream of Planet Ranch generally does not contain mature habitat extensive enough to support YBC, as vegetative communities consistent with the YBC's requirements (mature riparian multi-layer canopies) in these reaches are nearly all under 100 acres in size and/or narrower in width than preferred 325 ft. Surveys in 2015 performed by the Bureau of Reclamation in support of the MSCP identified 11 nesting YBC on the BWRNWR below Planet Ranch. We are not aware of any other data regarding YBC breeding on the Bill Williams River below Alamo Dam. Above Alamo Lake, suitable habitat for the YBC occurs at the upper end of the reservoir. While no focused surveys for this species have been performed in this area, Bureau of Reclamation did survey the upstream area for SWFL in 2016 and recorded incidental sightings of YBC. During the 2016 survey season, YBC were recorded at several locations upstream of Alamo Dam (Bureau of Reclamation, 2016; see Figure 16).

In Arizona, nesting is typically initiated in June and July. The time from nest initiation to fledglings leaving the nest is often short, and may occur in as few as 40 to 50 days. Migration back to wintering grounds may begin as early as August and continues through early October. The YBC is normally not present in Arizona from mid-October through early May.

Critical Habitat and Primary Constituent Elements

Critical habitat for YBC has not yet been finalized, although proposed critical habitat does occur in along the Bill Williams River in the lower portion of the Project Area (Figure 5).

The PCEs of YBC proposed critical habitat include:

1. *Riparian woodlands*. Riparian woodlands with mixed willow-cottonwood vegetation, mesquite-thorn-forest vegetation, or a combination of these that contain habitat for nesting and foraging in contiguous or nearly contiguous patches that are greater than 325 ft (100 m) in width and 200 ac (81 ha) or more in extent. These habitat patches contain one or more nesting groves, which are generally willow-dominated, have above average canopy closer (greater than 70 percent), and have a cooler, more humid environment than the surrounding riparian and upland habitats.
2. *Adequate prey base*. Presence of prey base consisting of large insect fauna (for example, cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies) and tree frogs for adults and young in breeding areas during the nesting season and in post breeding dispersal areas.
3. *Dynamic riverine processes*. River systems that are dynamic and provide hydrologic processes that encourage sediment movement and deposits that allow seedling germination and promote plant growth, maintenance, health, and vigor (e.g. lower gradient streams and broad floodplains, elevated subsurface groundwater table, and perennial rivers and streams). This allows habitat to regenerate at regular intervals, leading to riparian vegetation with variously aged patches from young to old.

3.3 Yuma Clapper Rail (*Rallus longirostris yumaensis*)

Status

The Yuma Clapper Rail (YCR) was listed as endangered on March 11, 1967. No critical habitat has been proposed or designated for this species. In 2014, based on the results of genetic analyses, the YCR was transferred from the Clapper Rail complex to a new species, Ridgway's Rail. The YCR represents one subspecies of the Ridgway's Rail complex. A detailed description of the YCR and its life history and habitat requirements can be found in the 2009 Yuma Clapper Rail Recovery Plan draft revisions (USFWS, 2009), with additional detail provided in the Lower Colorado River Multi-Species Conservation Program Species Accounts (Lower Colorado River Multi-Species Conservation Program, 2008), and will not be discussed in comprehensive detail here. However, life history and habitat characteristics important for evaluating the effects of the Proposed Action on the species are described below.

Pertinent Life History and Habitat Details and Status in the Project Area

The YCR is a secretive freshwater marsh dwelling bird that primarily occurs in dense cattails and bulrush, with potentially intermixed shrubs and trees. Nests are constructed just above the ordinary water line in emergent or marginal vegetation on stable clumps of vegetation or at tree bases. Breeding pair formation for the YCR begins as early as February along the lower Colorado. While nests have been recorded as early as March 13th (LCR MSCP, 2008), the average breeding season is considered to be mid-April through May. In the U.S., the YCR is confined to appropriate habitat along the lower Colorado River and its tributaries. Within the Project Area, the YCR breeds along the lower Bill Williams River, predominantly in the delta area at the confluence of the lower Colorado River within the BWRNWR. A few YCR have been intermittently reported in middle reaches of the Bill Williams River but no permanent patches of suitable nesting habitat occurs within the Project Area other than in the reach surrounding BWRNWR.

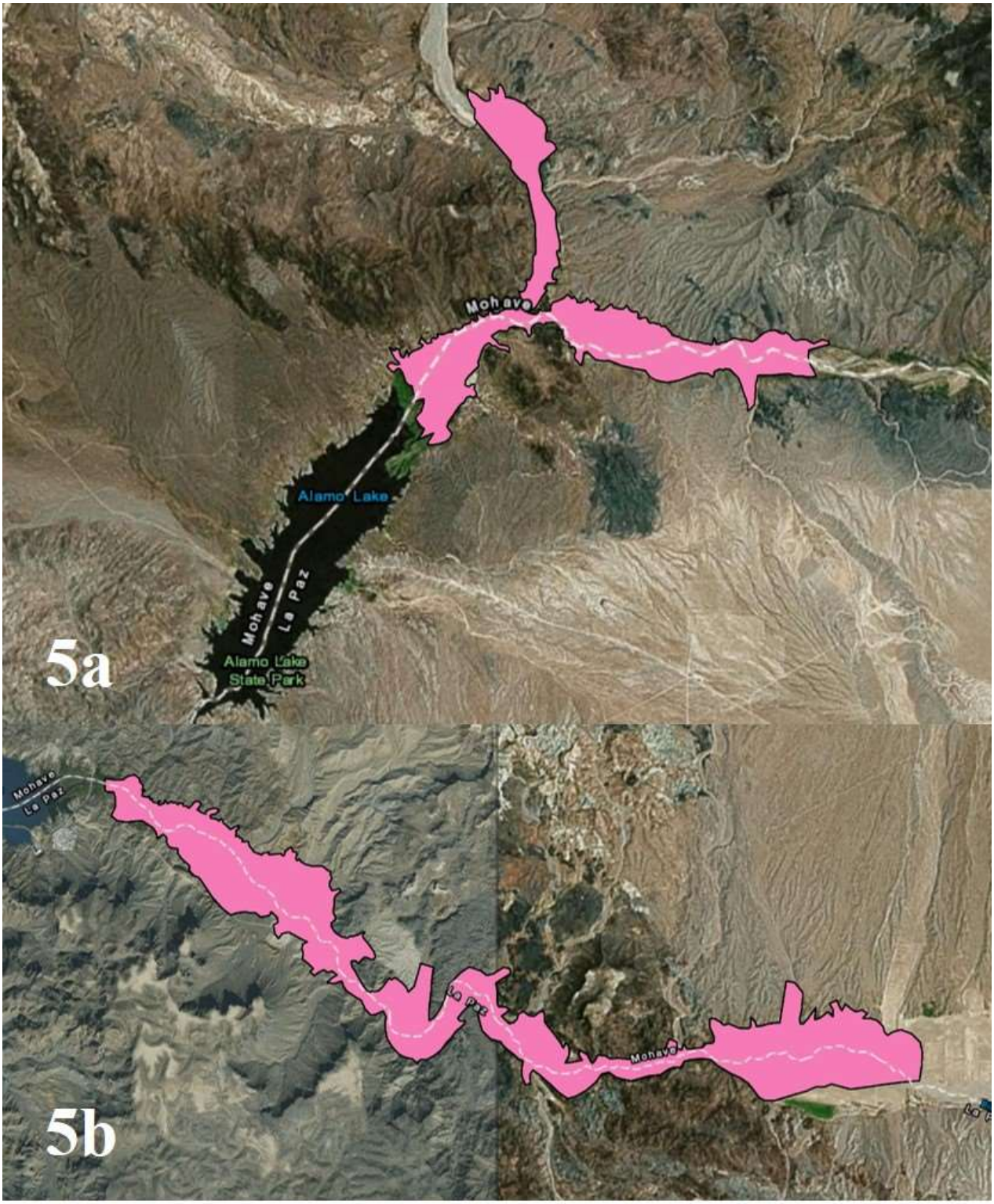

Figure 5. Proposed critical habitat for yellow-billed cuckoo below Alamo Dam along the Bill Williams River.

3.4 Northern Mexican Gartersnake (*Thamnophis eques megalops*)

Status

The Northern Mexican Gartersnake (NMGS) was listed as threatened on 8 July 2014. Critical habitat for the species was proposed on 10 July 2013, but as of November 2016 has not yet been finalized. The Bill Williams River riparian corridor, from the base of Alamo Dam to the confluence of the Colorado River, is included in the proposed critical habitat designation (Figure 6). The NMGS is also listed as a Tier 1b Species of Greater Conservation Need by the Arizona Game and Fish Department (AGFD). A detailed description of the NMGS and its life history and habitat requirements can be found in the final listing decision (USFWS, 2014) and the proposed critical habitat designation (USFWS, 2013), and will not be discussed in comprehensive detail here. However, life history and habitat characteristics important for evaluating the effects of the Proposed Action on the species and proposed critical habitat are described below.

Figure 6. Proposed critical habitat for the northern Mexican gartersnake below Alamo Dam along the Bill Williams River in blue with the area known to be occupied circled in red.

Pertinent Life History and Habitat Details and Status in the Project Area

The NMGS is a terrestrial-aquatic generalist whose primary habitats include isolated wetlands and cienegas, large-river riparian woodlands, and streamside gallery forests. The species apparently prefers protected backwaters, side channels, isolated pools, or beaver ponds and generally occurs away from the mainstem flows. The diet of the NMGS consists primarily of amphibians and fish, although the snake will generally consume other prey it can capture in similar foraging habitats including mice, lizards, worms, and leeches. Breeding season for the NMGS normally occurs in April and May, with birth occurring June to August. Anecdotal evidence suggests that NMGS may also breed in fall, but this has not been confirmed.

The NMGS historically occurred throughout Arizona anywhere that suitable habitat occurred, and had a marginal distribution in adjacent Nevada, New Mexico, and likely California. The NMGS also occurs in Mexico, throughout the Sierra Madre Occidental and Mexican Plateau. Currently,

the NMGS occupies around 10% of its former range in the United States (USFWS, 2014). As of 2014, there were 5 known populations readily detectable and considered viable in the US, one of which is a recently discovered population on the Bill Williams River within the Project Area just upstream of Planet Ranch (Figure 6). To date, no targeted surveys for NMGS have occurred within the Project Area, and therefore little information is available on the distribution of this species below Alamo Dam.

A major factor in the decline of the NMGS has been the introduction and range expansion of harmful exotic species that threaten the snake's prey base. Invasive bullfrogs, crayfish, and green sunfish are cited as the major drivers of a declining prey base in Arizona (Rosen et al. 2001). The NMGS is not capable of preying on most predatory fish species for a variety of morphological and ecological reasons. Fish stocking programs for species such as largemouth bass, sunfish, and various trout species have resulted in a fish species base that excludes native prey (minnows and suckers) with non-native fish that the NMGS cannot utilize as a food source. Therefore, the spread of species such as the bullfrog and crayfish, combined with intentional stocking of predatory sportfish, have both contributed to the decline of the NMGS. On the Bill Williams River, the NMGS likely preys on native amphibians and non-native minnows.

Critical Habitat and PCEs

Critical habitat for NMGS has not yet been finalized, although proposed critical habitat does occur in Project Area (Figure 6).

The PCEs of NMGS proposed critical habitat include:

(1) Aquatic or riparian habitat the includes
    a. Perennial or spatially intermittent streams of low to moderate gradient that possess appropriate amounts of in-channel pools, or backwater habitat, and that possess a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of processing sediment loads; or
    b. Lentic wetlands such as livestock tanks, springs, and cienegas; and
    c. Shoreline habitat with adequate organic and inorganic structural complexity to allow for thermoregulation, gestation, shelter, protection from predators, and foraging opportunities (e.g., boulders, rocks, organic debris such as downed trees or logs, debris jams, small mammal burrows, or leaf litter); and
    d. Aquatic habitat with characteristics that support native amphibian pretty base, such as salinities less than 5 parts per thousand, pH greater than or equal to 5.6, and pollutants absent of minimally present at levels that do not affect survival of any age class of the northern Mexican Gartersnake or the maintenance of prey populations.
(2) Adequate terrestrial space (600ft (182.9m) lateral extent to either side of bankfull stage) adjacent to designated stream systems with sufficient structural characteristics to support life-history functions such as gestation, immigration, emigration, and brumation.
(3) A prey base consisting of viable populations of native amphibian and native fish species.

(4) An absence of nonnative fish species of the family Centrarchidae and Ictaluridae, bullfrogs (*Lithobates catesbeinaus*) and/or crayfish (*Oronects virilis*, *Procambarus clarki*, etc.) or occurrence of these non-native species at low enough levels such that recruitment of northern Mexican gartersnakes and maintenance of viable native fish or soft-rayed non-native fish populations (prey) is still occurring.

3.5 Bonytail Chub (*Gila elegans*)

Status

The bonytail chub was listed as endangered on 23 April 1980 (USFWS, 1980). At the time of listing, no critical habitat was proposed since no areas within the Colorado River drainage were known to remain that could support successful reproduction of the species. Critical habitat was later proposed in 1993, and finalize on 21 March 1994 (USFWS, 1994). The final listing decision and critical habitat designations contain detailed descriptions of the species' life history and habitat requirements, which will not be discussed comprehensively here. However, life history and habitat characteristics important for evaluating the effects of the Proposed Action on the species and designated critical habitat are described below.

Pertinent Life History and Habitat Details and Status in the Project Area

The bonytail chub is extirpated from the Project Area (Pool and Olden, 2014).

Critical Habitat and PCEs

Critical habitat for the bonytail chub was finalized in 1994. Critical habitat is predominantly limited to the mainstem Colorado River, although it also extends up the lower Bill Williams River into the Bill Williams River National Wildlife Refuge (Figure 7).

The PCEs of bonytail chub critical habitat include:

(1) Water: This includes a quantity of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species.
(2) Physical Habitat: This includes areas of the Colorado River system that are inhabited or potentially habitable by fish for use in spawning, nursery, feeding, and rearing, or corridors between these areas. In addition to river channels, these areas also include bottom lands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated provide spawning, nursery, feeding and rearing habitats, or access to these habitats.
(3) Biological Environment: Food supply, predation, and competition are important elements of the biological environment and are considered components of this constituent element. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation and competition, although considered normal components of this environment, are out of balance due to introduced nonnative fish species in many areas.

Figure 7. Designated critical habitat for the bonytail chub in the far downstream extent of the Project Area and along the Colorado River.

4.0 Environmental Baseline

4.1 Climate, Geomorphology, and Hydrology

The Bill Williams River forms just above Alamo Lake by the confluence of the Santa Maria and Big Sandy Rivers. From Alamo Dam, the Bill Williams River flows generally west for around 36 miles before its confluence with the Colorado River just above Parker Dam. The climate in the Bill Williams River consists of short, mild winters and long hot summers. Average rainfall in the watershed increases significantly as you head west, with rainfall near the confluence of the Colorado River averaging 4-8 inches annually, increasing to greater than 20 inches annually in some of the upstream tributaries. Rainfall in the watershed is highest during the summer monsoons (Jul – Sep) and following winter rainy season (Dec – Mar), with late spring and fall being significantly drier.

As a result of the climatic conditions described above combined with regional geomorphology, the Bill Williams watershed is a naturally flashy system, with prolonged low flow periods punctuated by significantly higher flow events as the result of seasonal storms. However, much of the flow variation below Alamo Dam has been eliminated due to the existence of Alamo Dam, which under normal operations releases a steady base flow for prolonged periods of time without the need to release higher volumes of water. The tributaries of the Bill Williams River below Alamo Dam, however, remain entirely uncontrolled and therefore periodic high flows still occur with some frequency in most reaches below Alamo Dam.

Below Alamo Dam, the distribution of vegetation communities and riparian habitats along the Bill Williams River are primarily driven by geomorphologic and hydrologic properties. For ease of discussion, the Project Area below Alamo Dam was broadly classified into six different distinct geomorphologic and hydrologic areas: (1) narrow canyons, (2) dry alluvial basins, (3) broad canyons, (4) wet alluvial basins, (5) upper refuge, and (6) lower refuge (USACE, 1999).

For the ease of further discussions of baseline conditions and the following analysis of effects, the Project Area below Alamo Dam was divided into three reaches (Figure 3). The general distribution of the six geomorphologic and hydrologic areas are described in more detail in the reach descriptions below.

Reach 1: Alamo Dam to Lincoln Ranch

Reach 1 consists of the segment of Bill Williams River beginning at the base of Alamo Dam and running for approximately six miles until reaching Lincoln Ranch (Figures 3, 8 & 9). Reach 1 is the most confined stretch of river in the Project Area as this segment of river follows a narrow canyon (1) through mountains before opening up broadly in Reid Valley at Lincoln Ranch. The canyon bottom of Reach 1 varies in width in most areas from 150-300 feet, although narrower areas are present in limited areas, with base flow normally 25-80 feet in width. Reach 1 is subject to significant scour due to the confining canyon walls, and as a result this reach contains the most restricted band of riparian habitat in the Project Area.

Reach 2: Lincoln Ranch to Planet Ranch

Reach 2 consists of the segment of the approximately 15 mile segment of Bill Williams River running from the Reid Valley at Lincoln Ranch to Planet Ranch (Figures 3, 10 & 11). Reid Valley marks first broadening of the flood plain as the river exits the narrow canyon of Reach 1, and also is the first dry alluvial basin (2). The Reid Valley area is characterized by ephemeral flows and relatively deep groundwater. The area has relatively sparse vegetation across most of the broad valley floor, although this is the first location within the Project Area where moderately sized patches of riparian fringe habitat begin to be found. Below the Reid Valley, Reach 2 enters a broad canyon (3) before opening into a second dry alluvial basin (2) at Rankin Ranch. The canyon below Reid Valley is broader than the narrow canyon (1) of Reach 1.

Figure 8. Upstream end of Reach 1, the narrow canyon below Alamo Dam.

Figure 9. Downstream end of Reach 1, where the narrow canyon opens into the Reid Valley.

The upstream end Rankin Ranch is similar to Reid Valley in geomorphologic, hydrologic, and habitat conditions. Most of the upstream broad valley floor is sparsely vegetated, with denser riparian habitat along the channel fringes. However, the downstream end of Rankin Ranch transitions into a wet alluvial basin (4) before reaching another broad canyon downstream. The wet alluvial basin is characterized by perennial surface flow supporting substantial riparian fringe vegetation, with the dense vegetation continuing into the downstream canyon. As the canyon continues downstream, sparse vegetation is supported by broader alluvial sediments as the canyon approaches the Swansea area and Planet Ranch. Reach 2 also contains the confluence of several tributaries capable of discharging significant flows into the Bill Williams River during rain events.

Figure 10. Upstream end of Reach 2 from Lincoln Ranch at Reid Valley (right) to Rankin Ranch (left).

Figure 11. Downstream end of Reach 2 from Rankin Ranch (right) to Planet Ranch (left).

Reach 3: Planet Ranch to the Colorado River

Reach 3 begins at Planet Ranch, continuing for approximately 15 miles until the confluence of the Colorado River (Figures 12 & 13). Reach 3 is the least confined segment of the Bill Williams River. Planet Ranch Valley is a long, wide, wet alluvial basin (4) along the Bill Williams River, nearly 6 miles long and approximately 1.5 miles wide. A coarse-grained alluvial aquifer underlies Planet Valley, and is an important water resource for the lower Bill Williams River. Due to the significant widening of the floodplain at Planet Ranch, the presence of the permeable alluvial sediments, and the presence of Alamo Dam, surface flow rarely penetrates Planet Ranch. Instead, most flow events on the Bill Williams River become subsurface at Planet Ranch before re-emerging downstream at the mouth of Havasu Canyon. While flow conditions through Planet Ranch are highly variable depending on the frequency of recent storm events and saturation of sediments, significant flows (> 3000 cfs) are generally required to connect surface flows across Planet Ranch.

Figure 12. Reach 3 at Planet Ranch

Below Planet Ranch, the remaining portion of Reach 3 is on the Bill Williams River National Wildlife Refuge. Just below Planet Ranch, the river enters Havasu Canyon on the upper refuge (5). The narrowing of the river alluvium combined with shallow bedrock results in a high water table, re-emergence of perennial flow, and stands of extensive dense riparian and floodplain terrace vegetation. Havasu Canyon gradually opens into the Havasu Delta area as the river enters the lower refuge (6). As the canyon broadens, dense vegetation continues to be present, although the broadened valley floor results in intermittent flow across diverse braided channels. The water table level in this area is subject to substantial seasonal variation in areas away from the primary river channel.

Figure 13. Reach 3 at the Bill Williams National Wildlife Refuge.

The Project Area above Alamo Lake includes the upper end of the reservoir along the confluence of the Big Sandy and Santa Maria Rivers. This broad, flat area occupying the valley floor ranges from roughly half a mile to a mile in width from the upstream to downstream ends. In this area, a braided and meandering channel cuts through various riparian forest stands. Habitat and channel morphology in this area are primarily controlled by rainfall events, water availability, and associated Alamo Dam operations as discussed in the current Water Control Plan. Under normal operations, only minimal releases to maintain downstream habitat are made until the reservoir reaches 1125 feet in elevation. If elevation exceeds 1125 feet, flood control releases are implemented.

In recent years, the operations as described briefly above and detailed in the Water Control Plan, combined with normal precipitation patterns in the region has resulted in only infrequent inundation of the habitat upstream of Alamo Lake. From January of 2013 to January 2017, water levels ranged from approximately 1077 to 1100 feet in elevation, well below the lake's target elevation of 1125. From late January to early March of 2017, a significant series of storms resulted in the water surface elevation increasing from approximately 1082 to 1121 feet. Since March of 2017, rainfall has been minimal and the reservoir has been on a downward trajectory with the current water surface elevation at approximately 1110 feet. The anticipated elevation at the time of the proposed release is approximately 1104.

4.2 Vegetation and Terrestrial Habitat

No recent comprehensive vegetation or habitat surveys have occurred along the entirety of the Bill Williams River, although numerous studies and programs have surveyed vegetation and habitat across all or parts of the river within the past 15 years. The primary habitat type along the Bill Williams River consists of riparian forest communities dominated by willow (*Salix* sp.), cottonwood (*Populus* sp.), and salt cedar (*Tamarix* sp.) interspersed with sparsely vegetated alluvial areas. Salt cedar is more prevalent in lower reaches, although it can be found throughout the Project Area. Some river segments also support bosques dominated by mesquite (*Prosopis sp.*), particularly in areas with more expansive floodplain terraces or uplands. Other common vegetation includes palo verde (*Cercidium micorphyllum*), desert willow (*Chilopsis linearis*), mulefat (*Baccharis salificolia*), and arrow weed (*Pluchea sericea*).

The density and quality of riparian habitat along the river varies greatly by reach due to various hydrologic and geomorphologic factors. Generally, habitat quality and availability is lowest in Reach 1, increasing as you progress downstream through Reach 2. Highest quality habitat in Reach 2 occurs in areas of perennial flow or high groundwater below Rankin Ranch. A large area beginning upstream of Planet Ranch at Swansea and continuing to the upstream end of the wildlife refuge has minimal riparian habitat, while the highest quantity and quality of riparian habitat within the Project Area can be found in Reach 3. Above Alamo Lake, high quality riparian forest habitat exists in the area at the confluence of the Big Sandy and Santa Maria Rivers, down to the upper end of the lake along the Bill Williams River. The habitat in this area is generally similar to riparian forest below Alamo Dam as described in the preceding paragraph.

4.3 Aquatic Habitat

Alamo Dam releases water to maintain base flow on the river year round, between 20-50 cfs depending on the time of year. This results in perennial flows below Alamo Dam through all of Reach 1 and most of Reach 2. Flows typically become subsurface in the vicinity of Swansea, 2-3 miles upstream of Planet Ranch. The river channel is typically dry for the entire length of Planet Ranch, approximately 6-8 miles, before flows surface again at the downstream end of Planet Ranch near the mouth of Havasu Canyon. Along the course of the Bill Williams River, a variety of pool, riffle, run, backwater and other riverine habitats are maintained. However, much of the aquatic habitat is controlled by the presence of abundant beaver (*Castor canadensis*) and their dams. Previous estimates indicate that the Bill Williams River supports around 100 beavers, converting roughly 7-8 miles of river into lentic habitat (Andersen and Shafroth, 2010).

Aquatic habitat along the Bill Williams River supports an assemblage of non-native fish (Pool and Olden, 2014) including the red shiner (*Cyprinella lutrensis*), mosquitofish (*Gambusia affinis*), yellow bullhead (*Ameiurus natalus*), largemouth bass (*Micropterus salmoides*), and green sunfish (*Lepomis cyanellus*). Despite previous attempts to reintroduce native fish fauna to the river, no native fish species are thought to occur between Planet Ranch and the base of Alamo Dam. Several species of amphibian are known to occur in the Project Area, including the Arizona toad (*Anaxyrus microscaphus*), Couch's spadefoot toad (*Scaphiopus couchi*), several other species of toad, and the lowland leopard frog (*Rana yavapaiensis*), while the invasive bullfrog (*Lithobates catesbeiana*) has not yet been documented. The river in the Project Area also supports non-native crayfish.

5.0 Detailed Description of the Proposed Action

5.1 Primary Physical Effects of the Proposed Action

The Proposed Action consists of releasing a flushing pulse of water from Alamo Dam, following the general outline provided in Section 2. As a result of this release, there will be a temporary increase in flow volumes, depths, and velocities downstream resulting in inundation of areas outside of the normal base flow channel. The increased velocity and inundation will be greatest in Reach 1, generally decreasing downstream due to flow attenuation. In addition, short term increases in turbidity are expected as sediment is mobilized due to increase water velocities.

Flow Attenuation

Significant flow attenuation typically occurs between Alamo Dam and the confluence of the Colorado. As described in Section 4.1, the Project Area contains several losing reaches due to the presence of dry alluvial basins. The rate of flow attenuation from Alamo Dam to the confluence of the Colorado River is highly variable, partially controlled by antecedent soil moisture conditions which are in turn driven by recent precipitation and localized groundwater withdrawals.

In 2007 and 2008, Alamo Dam performed releases of approximately 1300 cfs and 2300 cfs respectively. During these flows, attenuation from the base of Alamo Dam and the confluence of the Colorado River resulted in a greater than 80% reduction in flows (Figure 14). Additional measurements from the 2008 pulse indicated that flood inundation just upstream of Planet Ranch

was approximately 80% lower than in the vicinity of Rankin Ranch, based on depth of flood flows (Andersen and Shafroth, 2010).

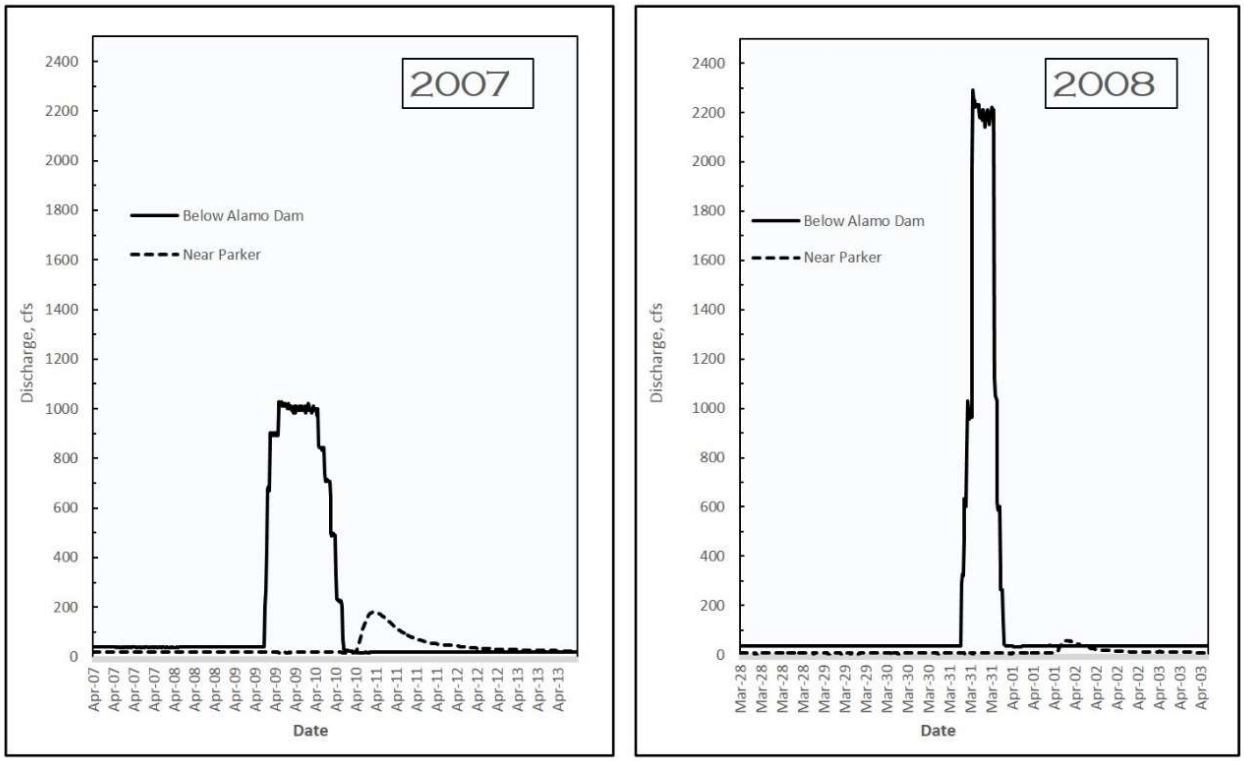

Figure 14. Flow attenuation from two pulsed releases from Alamo Dam in 2007 and 2008; the same events as reported in Andersen et al. 2010.

In 2010, a 3,000 cfs release from Alamo Dam resulted in a peak of 2,200 cfs at the confluence of the Colorado River, an approximate 27% reduction in flow. Similar to the hydrographs shown in Figure 14, increased flows at the Colorado as a result of the 3,000 cfs release lagged behind by nearly 24 hours.

Velocities and Inundation

Flow conditions within the Bill Williams River watershed have been previously studied and discussed at substantial length (Shafroth and Beauchamp, 2006), with considerable attention paid to the potential impacts of flow on ecosystem features and resulting physical and biological effects. Much of the information discussed below is taken whole or in part from this previous work.

The maximum flow under the Proposed Action is 5,000 cfs. Typical velocities associated with this volume within the Project Area range from approximately 2-7 ft/s (Figure 15; adapted from Shafroth & Beauchamp, 2006). As expected, velocities tend to be higher in confined canyon reaches with lower velocities in open reaches. On the Bill Williams River, the 5,000 cfs volume is categorized as the uppermost limit of what is considered a small flood (Hautzinger et al. 2006). As discussed in Hautzinger et al. 2006, expected results of a flow of this magnitude include some mechanical damage to near-channel riparian vegetation, some floodplain wetting, and damage to

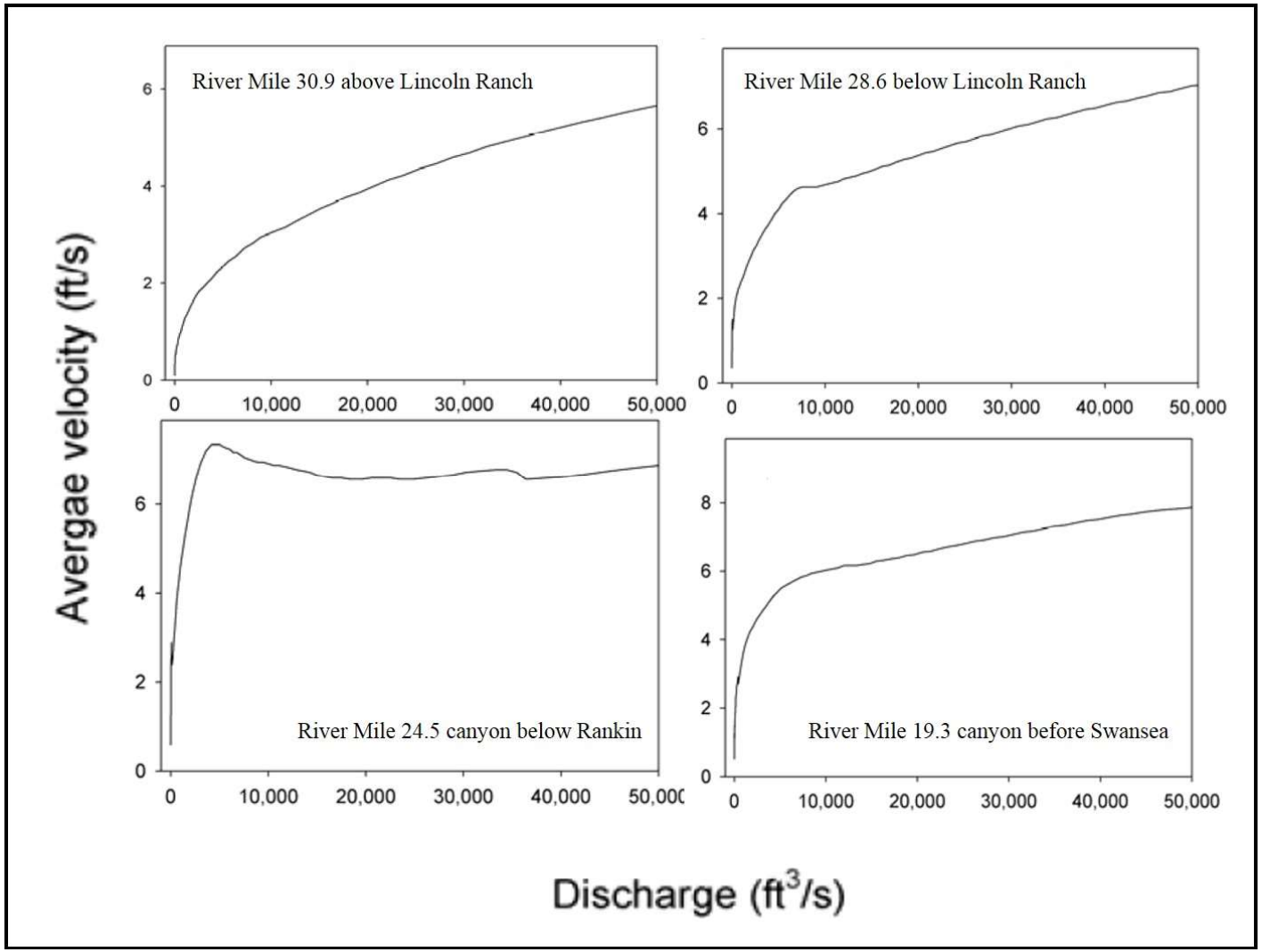

Figure 15. Velocity-discharge relationship on the Bill Williams River (modified from Appendix A of Shafroth and Beauchamp, 2006).

beaver dams with complete removal of a limited number of dams. Impacts to vegetation and beaver dams will be most evident in confined reaches closest to Alamo Dam, with reduced potential for impacts in downstream reaches and in unconfined reaches. Flows of this magnitude are not expected to result in any significant changes to channel morphology.

In addition to the expected minor impacts expected to vegetation, and potential removal of a number of beaver dams, the proposed flood pulse is likely to temporarily displace a proportion of the non-native fish in the reaches directly below Alamo Dam. Before and after the 2008 flood pulse, researchers quantified fish populations at several sites below Alamo Dam (see Pool and Olden 2014 for details). At the time of this study, the fish fauna in the studied reaches below Alamo Dam consisted entirely of non-native fish. The results of this study showed that the number of all fish species was reduced immediately after the flood pulse (2 days), although a substantial number of fish remained present. Fish quickly recolonized these areas, with a significant increase in abundance of fish on days 5 and 8 (Table 2). Overall, while the flood pulse is likely to temporarily reduce fish numbers, particularly in those reaches closest to Alamo Dam, many fish are expected to remain in each reach, and rapid recolonization will quickly re-establish fish numbers.

Table 2. Mean abundance of common fish at three sampling locations below Alamo Dam before and after an experimental release of water in 2008. Data adapted from Pool and Olden 2014.

Species	Pre-Release	Day 2	Day 5	Day 8
Red Shiner	114	62 (54%)	79 (69%)	82 (72%)
Western Mosquitofish	59	17 (29%)	28 (47%)	34 (58%)
Yellow Bullhead	19	8 (42%)	18 (95%)	21 (111%)

5.2 Conservation Measures

From an operational perspective, the easiest method to release water from Alamo Dam is to utilize the fewest steps necessary to ramp up and ramp down flow conditions. This reduces pre-planning and scheduling efforts, reduces staff work load at the project to implement the release, and minimizes potential wear on equipment and machinery from repeated use. However, the Corps has developed the release described in this BA with significant consideration given to potential environmental impacts. While the proposed release is more challenging, both from a pre-planning perspective as well during operational implementation, the development of the proposed release has allowed the Corps to minimize impacts to protected and sensitive biological resources to the maximum extent practicable.

The conservation measures listed below cover the deviations from an operationally-simple release that the Corps incorporated into the development of the flushing flow in order to minimize the effects of the Proposed Action to the maximum extent practicable.

Timing of Proposed Release

1) The Proposed Action will be implemented during the normal rainy season in order to ensure that the resulting increase in water corresponds to the life histories and ecological

requirements of native species which are adapted to flood flows in the appropriate season. This includes potential benefits to riparian willow and cottonwood vegetation by providing water during spring that would not be available absent a release from Alamo Dam.

2) Peak flows will be finished prior to March 15th. Since peak flows have the potential to mechanically damage vegetation adjacent to the river, flows will be curtailed prior by this date to reduce any potential impacts to riparian breeding birds. By confining the release prior to March 15th, this will ensure no direct effects to SWFL and YBC occur. Neither SWFL nor YBC arrive on breeding grounds along the BWR this early in the season.
3) Confining the peak flow to March 15th or earlier will ensure that the high flow occurs prior to the NMGS breeding season. Gestating females and neonates are more susceptible to high flow events, and therefore confining flows to this season will reduce potential impacts, and thus reduce potential for take, on the NMGS.

Shape of Proposed Hydrograph

4) The hydrograph of the Proposed Action will be shaped, to the maximum extent practicable, to conform to a natural winter-spring flood pulse as described in the Unified Ecosystem Flow theory (Hautzinger et al. 2006), with the exception of a more gradual flow increase as described in 6 below. The Unified Flow Theory was developed by a panel of experts considering potential impacts and benefits that releases from Alamo Dam could have on bird, fish, and riparian vegetation communities.
5) Water released from Alamo Dam will not exceed 5,000 cfs. While Alamo Dam is capable of releasing 7,000 cfs of water, the targeted cfs cap is the approximate flow condition where impacts to downstream vegetation resources are expected to increase in significance, as described in the Unified Flow Theory (Hautzinger et al. 2006). As such, the Corps has capped the upper end of the release to minimize potential impacts to downstream vegetation that could occur due to mechanical damage from high flows.
6) The ascending limb of the hydrograph will be ramped up over an approximate 3 day period. While flows can be increased more rapidly, the reduced rate of increase will provide downstream organisms living in the stream and riparian corridor, particularly the NMGS, additional time to respond to, and avoid, gradually increasing flows. The reduced increase in release is expected to minimize the potential for mortality on the NMGS.
7) The descending limb of the hydrograph will be lengthened with flows in the latter part of the recession decreased slowly. This will bring the total hydrograph length to approximately 20 days. This increase in the length of hydrograph tail ensures that seeds distributed by the high flow, and recently established seedlings, have sufficient water availability to allow for establishment. In addition, increased hydrograph tails are thought to provide competitive advantage to native cottonwood/willow community over the invasive tamarisk. As a result of the prolonged tail, native vegetation downstream is expected to benefit from the increased flow, which will also benefit riparian wildlife such as the SWFL and YBC.

Post-Release Actions

8) After the release of water is complete, the Corps has committed to performing surveys for NMGS. The location of these surveys will be somewhere in Reach 1-2. This survey effort will:
    a. Help to evaluate post-release use of the BWR corridor by NMGS; and
    b. Provide significant additional data on the distribution and abundance of NMGS along the BWR, informing future operational actions at Alamo Dam and along the BWR.
9) Upstream vegetation monitoring will occur above the Alamo Lake reservoir in the vicinity of Brown's Crossing by establishing stationary photopoints. Vegetation will be visually documented from these photopoints before the release, and at several time points following the release, in order to track general vegetation trends in the upstream area. Results of this effort will be coordinated with USFWS.

The Proposed Action is a one-time release of water to facilitate maintenance. After the drawdown is complete, a base flow release will be resumed and the water level in the reservoir will primarily be dictated by incoming rain. A single substantial rain event would be still be capable of returning the water surface elevation to the pre-release condition, or higher, as no additional releases outside of the normal base flow are currently planned. As an example, a single series of storms in early 2017 resulted in the reservoir rising nearly 40 feet (1082 to 1021). The primary effects of the Proposed Action are considered to be the immediate impacts to vegetation and wildlife resulting from increased flow velocity and inundation during the peak release downstream of Alamo Dam. Since the release is a one-time event, secondary effects as changes to water table and subsurface hydrology are considered to be primarily controlled by watershed scale weather and land use patterns and with only minimal impacts in the short term due to the Proposed Action. As such, the conservation measures were formulated targeting a reduction of the primary effects of the release.

The incorporation of these conservation measures into the Proposed Action will result in the pulsed release mimicking natural conditions of the watershed to the maximum extent practicable. By mimicking conditions that would occur under natural storm flows during an appropriate time of year, native species in the Project Area will be able to respond appropriately to the increased flows with minimal disruption to their normal life history patterns. The conservation measures also ensure that the increased flows will not result in atypical adverse effects to native vegetation communities. Significant water releases outside of the normal storm season could result in disruption of the recruitment and establishment of native seedlings to the benefit of invasive species such as tamarisk.

6.0 Effects of the Proposed Action to Listed Species

6.1 Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

Direct Effects on the Species

The SWFL typically arrives in Arizona in May, and rarely in late April. The Proposed Action will be completed prior to the arrival of the SWFL, and the species will not be exposed to any direct

effects. The Proposed Action has no potential to result in take of the SWFL. The Proposed Action pulse will have no direct effects on the SWFL.

Indirect Effects on the Species

The Project Area contains SWFL habitat in three primary areas, as described in the critical habitat discussion (Section 3.1). These areas include an 11.0 mile stretch near Lincoln Ranch, a 7.7 mile stretch below Planet Ranch, and the area immediately above Alamo Lake. The downstream areas contain over 3,500 acres of designated SWFL critical habitat while the upstream area contains over 1,700 acres of SWFL habitat along approximately 3 miles of the Bill Williams River below the confluence of the Big Sandy and Santa Maria Rivers. While not all of this habitat is breeding habitat, it does contain some breeding habitat, as well as adjacent areas for foraging, dispersal, and migration.

Flood pulses of similar magnitude to the Proposed Action typically result in some mechanical damage to near-channel riparian vegetation where velocities are greatest (Hautzinger et al. 2006). Mechanical damage may result in either the loss of some existing vegetation, or reduction in quality without complete loss. Herbaceous plants and small woody vegetation adjacent to the channel will be most susceptible to potential damage, and most mature woody vegetation is not expected to sustain significant damage except in limited circumstances. While herbaceous vegetation will be more susceptible to impacts of high flow, the project area typically contains very sparse herbaceous vegetation (Shafroth and Beauchamp, 2006b) and this type of vegetation is not typically considered a significant component of SWFL habitat. While the extent of damage to existing vegetation as a result of the Proposed Action cannot be precisely quantified, the impacts are not anticipated to be widespread, nor result in wholesale removal or die off of any existing vegetation. No changes in vegetative communities, loss of habitat patches, or significant reduction in vegetation is expected as a result of the Proposed Action.

Any mechanical damage to vegetation is anticipated to result from high velocity flows in areas adjacent to the main flow paths in confined or canyon reaches (see Section 5.1 for details), and is also anticipated to be increasingly less likely as one progresses downstream due to flow attenuation and associated reductions in volume and force. Within the Project Area, SWFL habitat overlaps with these high velocity areas in several segments within the upper 11.0 mile stretch of SWFL habitat. The 7.7 mile reach of suitable habitat below Planet Ranch contains very minimal areas where higher velocity flow is anticipated, and this habitat occurs over 20 miles below Alamo Dam were flow attenuation is expected to have substantially reduced flow velocities, volumes, and inundation.

The existing SFWL habitat in most downstream portions of the Project Area is not confined to the fringe adjacent to high flows, but in most areas is much wider, in some areas covering the entire valley floor. Mechanical damage to vegetation in SWFL habitat is expected to be limited to marginal areas along high flow paths, dependent on channel morphology. Also, many of the areas where mechanical damage may occur are in areas where no nesting habitat for SWFL exists and are limited to use during dispersal and foraging. For instance, the roughly 6,000 ft. canyon stretch of habitat upstream of Lincoln Ranch contains a mostly narrow fringe of riparian vegetation with minimal larger pockets of dense riparian vegetation, very little of which appears suitable for SWFL

nesting. Any mechanical damage to vegetation in these areas will not result in changes that appreciably alter existing SWFL uses as the habitat will remain suitable for both foraging and dispersal.

Small spring flood pulses are expected to promote growth of woody overstory and herbaceous plant species (Shafroth and Beauchamp, 2006b). The increased flow will likely result in a temporary increase to the water table in alluvial reaches, which will benefit the mesic riparian vegetation associated with SWFL habitat in these areas. So while minor amounts of mechanical damage to vegetation are expected, benefits to plant growth are also expected as a result of the increased water availability. The Proposed Action will be completed by mid-March, or potentially earlier, nearly two months prior to the normal arrival time of the SWFL. As a result, any damaged or disturbed vegetation will have some time to recover, with additional available water to promote recovery and new growth. As a result of the temporal delay between the impacts to vegetation and the arrival of SWFL allowing a period of regrowth and recovery, any impacts to vegetation are not expected to alter the distribution of SWFL in the project area, nor effect SWFL breeding, foraging, or dispersal.

Above Alamo Dam, no mechanical damage to vegetation will occur as a result of the Proposed Action. The primary upstream change will be a fluctuation in the water level relative to existing habitat. While the Proposed Action will result in water receding farther from some areas of SWFL habitat in the farthest upstream portion of the Project Area, it will also result in the exposure of previously used SWFL habitat that is currently inundated. The current water level of Alamo Lake is approximately 1110-1111 feet (see Figure 16). However, given the current trajectory of the lake, in the absence of any significant rain events, the anticipated lake elevation at the time of the Proposed Action is approximately 1104 feet. The target elevation as a result of the Proposed Action is between 1085 and 1095 feet. The area between 1104 and the target of 1095 is very roughly 100-150 acres. In addition, incoming stream flow from the Big Sandy and Santa Maria Rivers would continue provide base flow water to the upstream riparian habitat regardless of lake level.

Given the recent history above Alamo Dam, the habitat in this area is expected to continue to thrive after the Proposed Action is complete. Water remained below 1100 feet for four consecutive years after earlier inundation. During this period of time, habitat in the area was maintained even with water levels below 1100 feet, with documented SWFL nesting attempts as low as approximately 1090 feet. Given the minimal drawdown of the Proposed Action (from approximately 1104 to somewhere between 1085 and 1095) and the previous performance of the habitat for numerous consecutive years with water levels below 1100 feet, the Proposed Action is both within the normal range of expected conditions without the drawdown, and is not expected to have any discernible impact to the upstream habitat.

Given the large quantity of habitat available, the limited areas where mechanical damage is expected to occur, and the likelihood that any mechanical damage to vegetation will not alter SWFL use of the habitat, downstream effects to SWFL are anticipated to be insignificant. Upstream, no significant changes to habitat are expected. While the location of the reservoir relative to existing habitat will change temporarily, inundated habitat utilized in previous years will also be exposed and incoming base flow will not be effected. Habitat availability upstream will continue to be controlled by larger-scale conditions such as climate, rainfall, and

hydrogeology, with the results of the release not expected to be measurable different from background conditions. Therefore, upstream effects are anticipated to be insignificant. In addition, the release of water from Alamo Dam in a natural hydrograph is likely to have beneficial effects to downstream habitats, particularly in areas suffering from lack of water near the BWRNWR. Since no direct effects are anticipated, no take will occur, and since indirect effects will be insignificant, the Corps has determined that the Proposed Action may affect, but is not likely to adversely affect southwestern willow flycatcher.

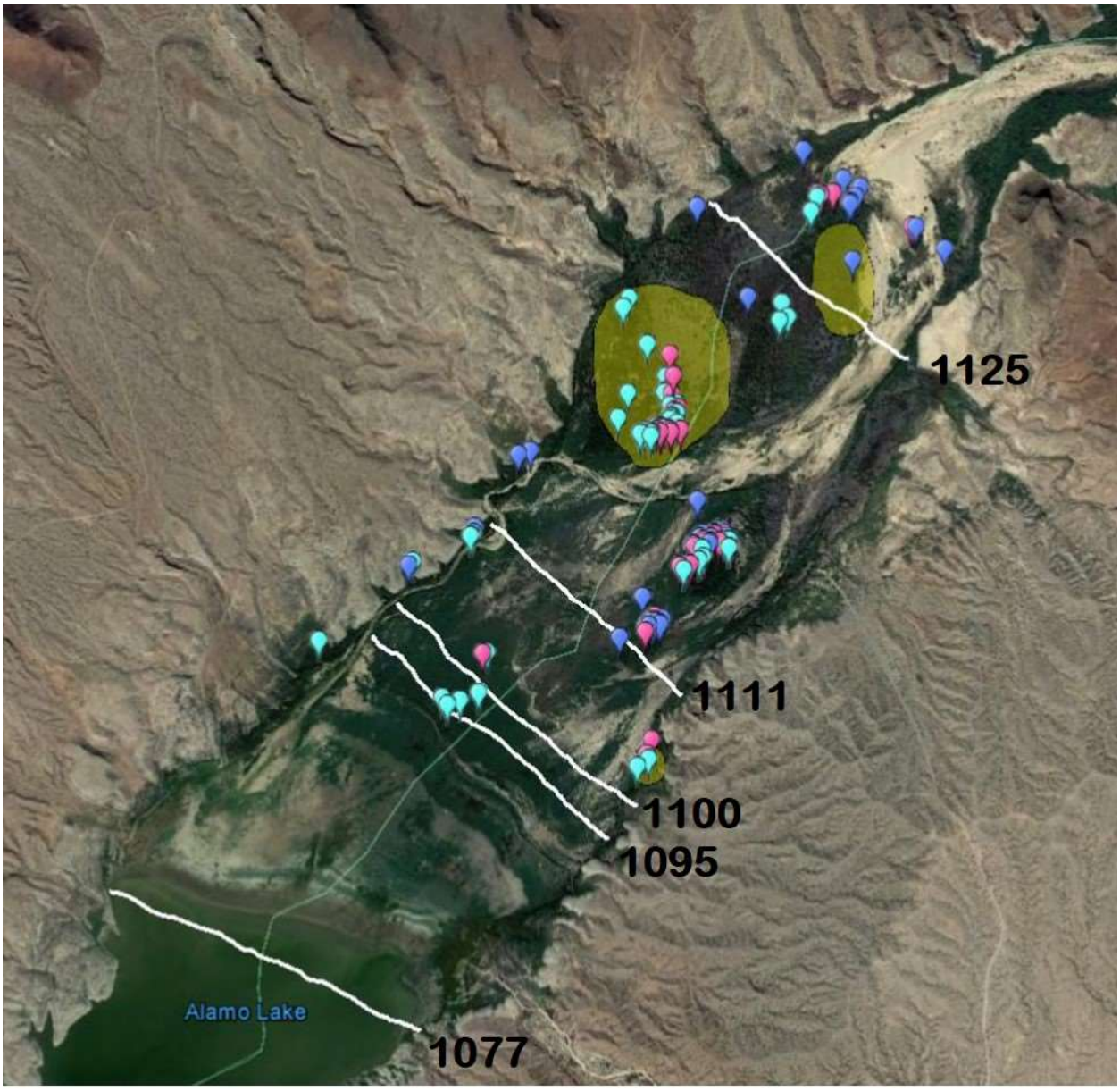

Figure 16. Habitat area above Alamo Lake with approximate water surface elevations marked. Teardrops represent SWFL observations from 2014 (dark blue), 2015 (pink) and 2016 (light blue) as collected by the Bureau of Reclamation. Yellow polygons represent very general areas where YBC were noted in 2016.

Effects to Critical Habitat

As shown in Figure 4, one area above and two areas below Alamo Dam contain designated critical habitat for SWFL. As described in detail in Section 3.1, the PCEs of SWFL critical habitat include appropriate riparian vegetation and insect prey populations. Both of these PCEs are present throughout much of the designated critical habitat. Although not all areas are capable of supporting SWFL nesting, they likely support some other life history component such as migration, dispersal, or foraging.

As described in the previous section on potential impacts to the species, the only expected downstream impacts to habitat are in the form of mechanical damage to vegetation, which are expected to be minimal and will not result in changes to SWFL use of the habitat. Impacts to vegetation will not result in the loss, destruction or removal of any of the PCEs of SWFL critical habitat. Areas utilized for nesting and areas of mature woody vegetation will not be altered, with impacts to vegetation predominantly limited to high flow paths adjacent to main channels of flow in confined areas. Upstream habitat is also not anticipated to be significantly impacted, as the drawdown is minimal with respect to the overall habitat availability, the drawdown will expose currently inundated SWFL habitat, and base flow will continue to provide incoming water. Given the large overall acreage of designated critical habitat within the Project Area, and the minimal potential impacts to vegetation, the overall effects to vegetation are expected to be insignificant.

The Proposed Action is not anticipated to appreciably change the distribution, diversity, or abundance of any insect prey that the SWFL uses as a food source. In addition, since the flow event will occur significantly prior to the arrival of SWFL in the Project Area, any minimal changes to insect populations will likely be imperceptible by the time breeding season arrives.

Given that any impacts to vegetation are expected to be insignificant, and that none of the PCEs of SWFL critical habitat will be lost, destroyed, or appreciably altered, the Corps has determined that the Proposed Action may affect, but is not likely to adversely effect, southwestern willow flycatcher designated critical habitat.

6.2 Yellow Billed Cuckoo (*Coccyzus americanus*)

Direct Effects on the Species

The YBC typically arrives in Arizona in mid-May to early June. The Proposed Action will be completed prior to the arrival of the YBC, has no potential to result in take of the YBC. Therefore, the Proposed Action will have no direct effects on the YBC.

Indirect Effects on the Species

Habitat requirements of the SWFL and YBC overlap to some extent, but the YBC requires larger tracts of more mature vegetation for breeding. As a result, and as reflected in the species proposed critical habitat (see Figure 5), habitat suitable for the YBC below Alamo Dam is confined to the lower portion of the river below Planet Ranch. This are contains approximately 3,400 acres of YBC habitat (USFWS, 2014a). Generally, the habitat upstream of Planet Ranch contains similar

habitat but in most areas is either not appropriately mature, or expansive enough to support the YBC. Above Alamo Dam, the YBC occupies a similar yet smaller amount of habitat than the SWFL. In this area, the YBC has proposed critical habitat of roughly 600 acres at the uppermost end of the Project Area. As described in Section 3.2, the YBC prefers habitat that is at least 325 ft in width, or 200 acres or greater in size. Although patches as small as 100 acres are considered suitable, anything under 100 acres is marginal to unsuitable. Upstream of Planet Ranch, any areas with the appropriate habitat type likely do not meet the YBC's strict habitat size preferences and would be considered marginal at best.

The discussion in Section 5.2 on indirect effects to SWFL are similar to what is expected for the YBC. Due to the more limited distribution of YBC in the Project Area, however, the potential for impacts to vegetation, and the extent of any impacts, to YBC habitat are reduced. The only available habitat for YBC is considerably downstream of Alamo Dam, approximately 20 miles or more. In addition, the YBC does not favor many of the small shrubs and younger woody vegetation typical of less mature riparian fringe habitat, preferring more substantial vegetation like mature cottonwoods, willow, and mesquite.

Also as discussed for the SWFL, the additional water provided by the Proposed Action is expected to promote growth of woody overstory and herbaceous plant species, providing some benefit to existing vegetation and offsetting the potential minor mechanical damage. Also, the temporal delay between the Proposed Action and arrival of the YBC will allow any damaged or disturbed vegetation some time to recover, with additional available water to promote recovery and new growth. As a result of the temporal delay between the impacts to vegetation and the arrival of YBC allowing a period of regrowth and recovery, any impacts to vegetation are not expected to alter the distribution of YBC in the project area, nor effect YBC breeding, foraging, or dispersal.

Given the large quantity of habitat available, the limited areas where mechanical damage is expected to occur, and the likelihood that any mechanical damage to vegetation will not alter YBC use of the habitat, indirect effects to YBC downstream of Alamo Dam are anticipated to be insignificant. Similarly to the upstream effects described for SWFL earlier, upstream effects to YBC are also anticipated to be indirect and insignificant. Given that no direct effects will occur, and indirect effects will be insignificant, the Corps has determined that the Proposed Action may affect, but is not likely to adversely affect yellow billed cuckoo.

Effects to Critical Habitat

Figure 5 illustrates the distribution of proposed critical habitat for the YBC. Similar to the previous discussions for both SWFL and YBC indirect effects, the only potential impacts are minor mechanical damage to vegetation. The proposed critical habitat within the Project Area consists of 3,390 acres below Alamo Dam and roughly 600 acres above Alamo Dam. The Proposed Action will not result in any significant changes to the PCEs of YBC critical habitat, which include riparian woodlands and prey base. In addition, the proposed release has been structured to conform to historic conditions within the watershed, and is consistent with the third PCE, dynamic riverine processes. As a result, the Corps has determined that the Proposed Action will not result in the destruction or adverse modification of proposed critical habitat for the yellow billed cuckoo.

6.3 Yuma Clapper Rail (*Rallus longirostris yumaensis*)

Direct Effects on the Species

As described in Section 3.3, the YCR is a secretive freshwater marsh dwelling bird that prefers emergent vegetation such as dense cattails and bulrush. Appropriate habitat for the YCR within the Project Area occurs in the farthest downstream reach within the Bill Williams National Wildlife Refuge and upstream towards Planet Ranch. While very limited patches of habitat may exist in other portions of the Project Area, numerous bird surveys along the Bill Williams River above the refuge performed by Bureau of Reclamation have never located YCR and habitat in mid-reaches of the river are considered low quality for supporting the YCR (Bureau of Reclamation, 2015). Due to the confined channel, limited habitat development, and lack of significant emergent vegetation, habitat above Lincoln Ranch is considered unsuitable for the YCR. The only known breeding population in the Project Area occurs in the wildlife refuge, and only incidental records of YCR have been reported between Planet Ranch and Alamo Dam.

While some populations of the YCR are migratory, in the Lower Colorado River drainage, the species is present year round and individuals will be present during the Proposed Action. Although nesting has been recorded as early as 13 March, the average nesting season is mid-April into May. As a result, peak flows associated with the Proposed Action will be completed prior to even the earliest known nesting date. However, the YCR will still be present and could be exposed to effects of the flow event temporarily during non-breeding activities such as foraging and dispersal.

Direct effects that individual YCR could be exposed to include increased water velocities, increased water turbidity, changes in water depth, and inundation of dry areas. Any of these effects would be limited in duration to the schedule of the Proposed Action. These effects would be minimal in areas that YCR occur, since YCR habitat occurs almost entirely in wide, flat river segments lacking confining features. As described in Section 5.1, velocity and inundation increases will be most prevalent in confined or canyon reaches, and will be progressively less noticeable as the channel widens.

In addition to the wide channels reducing the direct effects of increased flow, effects would be further limited in intensity due to the large distance between the dam and YCR habitat, allowing for maximal flow attenuation prior to the flow joining the Colorado. Minor changes to conditions such as velocity and depth, particularly pre-breeding season during the typical storm season, are not anticipated to interrupt the species life-history or result in harassment or harm to the species. The direct effects of the short-term flood pulse on the YCR are not expected to be quantifiable and therefore are considered insignificant.

Indirect Effects on the Species

Previous discussions of indirect effects for SWFL and YBC focused on potential impacts associated with mechanical damage to riparian plants. However, this factor is significantly less important to YCR as its favored habitat is well away from areas of confined high velocity flows likely to see mechanical damage. Since emergent vegetation requires stable water depths and low velocities, these areas are limited to wider shallower areas such as the river's delta. These areas

are not expected to be damaged by high-velocity flows. As a result, the only expected effects to YCR habitat will be due to short term changes in water depth, inundation in additional areas, or potentially minor non-damaging increases in velocity. No changes or modifications to YCR habitat are anticipated other than those temporary, minimal effects described, which are considered insignificant. Since both direct and indirect effects are considered insignificant, the Corps has determined that the Proposed Action may affect, but is not likely to adversely effect, the Yuma clapper rail.

6.4 Northern Mexican Gartersnake (*Thamnophis eques megalops*)

Direct Effects on the Species

As discussed in Section 3.4, very little is known about the distribution and abundance of the NMGS in the Project Area. The species has been incidentally found in single reach just upstream of Planet Ranch (Figure 6), but no focused surveys for the species have occurred on the Bill Williams River, and the NMGS likely occupies areas outside of its current confirmed distribution in the watershed. For the purposes of this BA, we assume the species to be present throughout the Project Area where suitable habitat occurs which supports the species' PCEs. The species is likely to be absent from the majority of Reach 1, as this area does not contain significant adjacent uplands (600 ft) or backwater channels which the NMGS can utilize to support all portions of its life history. Reaches 2-3 are assumed occupied based on habitat availability and previous captures.

Direct effects to the NMGS are expected as a result of high flow during the period of release of the Proposed Action. Since the species is a riparian-obligate, it is anticipated that the species will be directly exposed to increased water velocities, and that the species' use of the Project Area will be temporarily altered as the result of increased velocities, deepened water in areas, or inundation of previously dry areas. The duration of exposure to changed conditions will extend the length of the Proposed Action, which will not exceed 20 days. Individuals exposed to the effects of the increased flow are expected to move out of the main channel and into slower backwater areas or adjacent upland refugia, potentially interrupting foraging patterns for a period of days while the hydrograph progresses through the watershed. While these changes would likely alter the behavior of individuals for a short period of time, no significant long-term effects are anticipated. The NMGS is adapted to living in flashy southwestern riparian ecosystems subject to extreme low and high flow conditions, and the Proposed Action is well within the normal hydrologic variation expected in this watershed.

Any alterations to the behavior of individual snakes may result in short-term reductions in fitness. Due to the controlled nature of the release, the flows ramping up over a three-day period, and the timing of the release in a natural high flow season, the probability of lethal effects to individual snakes is anticipated to be considerably lower than temporary alterations to behavior and habitat use.

While the Proposed Action will result in short-term impacts to NMGS in the Project Area, and has the potential to cause lethal effects, the cumulative effect of these impacts will not result in an appreciable reduction in the distribution, numbers, or reproduction of NMGS in the Project Area. NMGS may temporarily be precluded from using portions of the Project Area during the duration

of high flows, a time period of a few days. However, the NMGS will be able to return to any areas it leaves shortly after the flow event ends. Therefore, the species' distribution will not be changed. Since mortality of individual snakes is anticipated to be considerably less likely than effects such as behavioral changes or temporary exclusion, the Proposed Action will not appreciably reduce the species' numbers in the Project Area.

Some individual snakes are likely to change their behavior and habitat use during the Proposed Action, this change could result in a temporary reduction in fitness, which could potentially result in minor reduction in reproductive success. Available data suggests that the Proposed Action will be completed prior to initiation of the species' breeding season in April and May (USFWS, 2014). As a result, no direct impacts to breeding are anticipated, and reproduction would only be impacted if harassment reduced the fitness of an individual to an extent that it altered its ability to breed in the future. Since NMGS breed multiple times over their life, and potentially breed multiple times annually, reduction of reproductive success of a limited number of individuals is only anticipated for a single breeding season. While the number of individuals potentially impacted to this extent is not quantifiable, given that the species is adapted to responding to conditions similar to the Proposed Action, reduced fitness rising to the level of impacting reproductive success is considered a low probability occurrence that would affect a minor proportion of the population. Therefore, the Proposed Action will not result in an appreciable reduction in the reproduction of NMGS within the Project Area.

Indirect Effects on the Species

Two general categories of indirect effects are anticipated as a result of the Proposed Action, habitat alterations that could affect behavior and temporary changes to prey availability and abundance. Minor mechanical damage to riparian vegetation may result in modifications to habitat, which could potentially effect behavior of individual NMGS. However, given the length of the riparian corridor along the Bill Williams, and the minimal extent of anticipated vegetation impacts, any changes to NMGS behavior as a result are expected to be insignificant.

Prey availability is likely to be reduced short term, coinciding to the period of time individual snakes will have to avoid high flow conditions along the river. The NMGS prefers native fish and amphibian as prey. Native fish fauna through the majority of the Project Area has been replaced by non-native species (Pool and Olden, 2014), and native fish are likely only still present below Planet Ranch in perennial reaches still connected to the Colorado River. The existing fish community in the Project Area includes fish from the families Centrarchidae and Ictaluridae, which are considered detrimental to the NMGS. Based on the Pool and Olden (2014), which evaluated the response of existing fish communities to flood pulses on the Bill Williams, the Proposed Action will temporarily reduce the abundance of non-native fish in the Project Area, with the reductions expected to be most pronounced in close proximity to Alamo Dam. However, based on the results of the same study, some fish are expected to remain in each reach, and quick recolonization is likely to occur post-release.

The Proposed Action is also likely to temporarily redistribute amphibian fauna in the Project Area. In addition, overbank flooding may result in additional off-channel pools and backwaters that will provide new short-term amphibian habitat supporting NMGS foraging. Overall, prey base

alterations as a result of the Proposed Action will be temporary in nature, and do not represent a long-term impact to the species. While indirect effects may result in a temporary reduction in fitness of individual snakes, this is reduction in fitness due to indirect effects is not expected to result in the mortality of individual snakes.

Cumulative Effects

Pursuant to the ESA, cumulative effects include effects of future State, tribal, local, and private actions, not involving the Federal action, that are reasonably certain to occur within the Project Area. Since future Federal actions in the Project Area potentially effecting ESA listed species would require separate consultation, these actions are not considered in the analysis of cumulative effects.

The Project Area predominantly consists of federally owned or controlled lands, with a minor amount of privately owned lands. The Bill Williams River National Wildlife Refuge is owned by the Federal government and managed by the USFWS. Above the refuge, Planet Ranch is owned by the state of Arizona but under perpetual control of the Bureau of Reclamation. Ongoing plans for this land are entirely under Federal control. Above Planet Ranch, the river is surrounded by Federal lands for much of the distance to Alamo Dam. These areas include the Swansea Wilderness and Rawhide Mountains Wilderness, managed by the Bureau of Land Management. The primary non-federal areas above Planet Ranch include the Rankin and Lincoln Ranches.

Management of both private ranches are not expected to change greatly in the foreseeable future. Currently, these lands are sparsely developed and utilized for a combination of ranching and recreation activities. Most of these properties occupy upland areas outside of the Project Area, with only minimal effect on the river corridor within the Project Area. Furthermore, any private actions within the high water mark of the river on these ranches likely require Federal permits under the Clean Water Act through the USACE Regulatory Program, triggering consultation. As a result of the substantial Federal involvement in the watershed, and the minimal impact by private actions, no cumulative impacts are anticipated.

Effects to Critical Habitat

The PCEs of NMGS proposed critical habitat generally cover the species' habitat (PCEs 1-2) needs and prey base (PCEs 3-4; Section 3.4). As described in Section 5.1, the Proposed Action is not expected to result in significant changes to the existing channel morphology. The primary changes to habitat anticipated would occur in limited reaches due to damage or potential removal of a limited number of beaver dams, which could alter the ratio of lentic to lotic habitat and result in alteration of NMGS use in these areas.

Based on the results of previous research on the Bill Williams River, which evaluated the impact of flood releases from Alamo Dam on downstream beaver dams, many beaver dams are anticipated to suffer damage as a result of the release but few are likely to be entirely removed (Andersen and Shafroth, 2014), with full removal more likely close to Alamo Dam and increasingly less likely as flow progresses downstream. After the flow event ends, beavers are likely to begin work to rebuild

damaged structures relatively quickly. For example, high flow events in 2004-2005 likely removed nearly all beaver dams on the river. By 2008, approximately 91 dams were found along the river.

Since beaver dams play a significant role in the types of aquatic habitat within the Project Area, NMGS use of habitat in areas where dams are removed or damaged is likely to change. However, the removal or damage of dams will not preclude NMGS of these areas, and the Project Area will still maintain the physical and biological features important to the species' life history described in PCEs 1-2. Other than changes associated with damage or removal of beaver dams, no other changes are expected to any of the components of aquatic or riparian habitat associated with PCE 1 or PCE 2 of NMGS proposed critical habitat.

Prey base associated with PCEs 3-4 are discussed in some detail in the previous section on indirect impacts. Overall, while short term changes to prey abundance and distribution are anticipated, these changes are only anticipated to have a duration on the order of days. As a result, no appreciable reduction of prey is anticipated as a result of the Proposed Action.

The short-term changes to PCEs associated with NMGS proposed critical habitat described above are not expected to appreciably diminish the value of this habitat to the species. As a result, the Corps has determined that the Proposed Action will not result in the destruction or adverse modification of proposed critical habitat.

6.5 Bonytail Chub (*Gila elegans*)

Effects on the Species

Based on the substantial record of surveys discuss in Pool and Olden (2014), bonytail chub have been extirpated from the lower Bill Williams River. Since the species is not present, and not anticipated to be present in the foreseeable future, the Corps has determined that the Proposed Action will have no effect on the bonytail chub.

Effects to Critical Habitat

Designated critical habitat for bonytail chub occurs at the far downstream end of the Project Area within the wildlife refuge at the confluence of the Colorado River (Figure 7). This area will see only minimal effects as a result of the flow release due to flow attenuation over the nearly 35 miles of the river between the dam and the area of critical habitat. The minor, short term changes experienced at the mouth of the river will not alter any of the established PCEs for the bonytail chub. As a result, the Corps has determined that the Proposed Action will have no effect on bonytail chub critical habitat.

7.0 Summary of Effects Determinations and Conclusions

Species/Habitat	Status*	Determination	Request
Southwestern Willow Flycatcher	E	May affect, but not likely to adversely effect	Concurrence
SWFL Critical Habitat	D	May affect, but not likely to adversely effect	Concurrence
Yellow-Billed Cuckoo	T	May affect, but not likely to adversely effect	Concurrence
YBC Critical Habitat	P	Not likely to destroy or adversely modify	None
Yuma Clapper Rail	E	May affect, but not likely to adversely effect	Concurrence
Northern Mexican Gartersnake	T	Likely to Adversely Effect	Formal Consultation
NMGS Critical Habitat	P	Not likely to destroy or adversely modify	None
Bonytail Chub	E	No Effect	No Action Required
Chub Critical Habitat	D	No Effect	No Action Required

* E = endangered, T = threatened, P = proposed, D = designated

8.0 Preparers and Reviewers

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