



UNITED WATER CONSERVATION DISTRICT
“Conserving Water Since 1927”

Revised
Lower Piru Creek Herpetological Monitoring Plan
Santa Felicia Project - FERC No. 2153 - Article 404

May 2012

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1.0 BACKGROUND

United Water Conservation District (United) owns and operates the Santa Felicia Project (Project) on Piru Creek in Ventura County, California. The Federal Energy Regulatory Commission (FERC) issued a new license (License) to United for the operations of the Project on September 12, 2008 (FERC Project No. 2153-012). Article 404 of the License requires United to file a herpetological monitoring plan for lower Piru Creek. To comply with this requirement, United developed “Lower Piru Creek Herpetological Monitoring Plan”, dated October 2009 (October 2009 Plan). FERC issued an order approving the October 2009 Plan on January 19, 2011.

The October 2009 Plan requires United to implement various activities in a study area defined as the entire length of Piru Creek between Santa Felicia Dam and its confluence with the Santa Clara River (6.6 miles) and the entire spillway channel including spillway pools (0.56 miles). Following receipt of FERC’s approval, United began preparations to implement the October 2009 Plan. However, an obstacle to this implementation emerged. Much of lower Piru Creek and the spillway channel pass through private property as shown in Figure 1 and Tables 1 and 2.

**Table 1 -
Piru Creek Ownership**

Owner	Miles	Percent of Creek
Camulos Ranch	0.91	14%
Nature Conservancy	0.17	3%
Naumes Trust	0.01	0%
Paul Constance S	0.18	3%
Rancho Temescal	4.71	71%
United Water Cons District	0.53	8%
Ventura County Trans Com	0.09	1%
Total	6.6	100%

**Table 2 -
Spillway Pool and Channel Ownership**

Owner	Miles	Percent of Channel
United	0.25	44%
Rancho Temescal	0.31	56%
Total	0.56	100%

United's property along Piru Creek captures only 8% of the creek, split between the area directly below the Santa Felicia Dam (0.24 miles) and the area just above the confluence of Piru Creek with the Santa Clara River (0.29 miles). Most of the remaining creek falls on the privately owned Rancho Temescal (71%) and Rancho Camulos (14%). United owns about 44% of the spillway channel, including several pools. The remaining 56% of the spillway channel passes through Rancho Temescal.

To successfully implement the October 2009 Plan, United must access and carry out specific activities along the entire length of Piru Creek and the spillway channel, 89% of which United does not own. As of December 1, 2011, the owner of Rancho Temescal has prohibited United from accessing the property for the purposes of implementing License requirements. In a letter dated May 1, 2012, the owner of Rancho Camulos terminated an access agreement that had allowed United to "perform various studies, surveys and monitoring activities" in support of the License. Therefore, at this time, United can only undertake activities on 11% of the study area, as established in the October 2009 Plan.

The purpose of this document, "Revised Lower Piru Creek Herpetological Monitoring Plan" (Revised Plan), is to present how United will proceed given this situation. In a meeting on January 6, 2012, United consulted with the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), and National Marines Fisheries Service (NMFS) on this issue. At that meeting, the approach described below was developed collaboratively with USFWS and CDFG. NMFS stated that because they have no regulatory authority over the species under consideration, they had no input to provide. United presented the approach contained in the Revised Plan to the U.S. Forest Service (USFS) during the annual consultation meeting on February 2, 2012. Because the revisions do not affect USFS lands, they had no comments.

United is incorporating the entire content of the October 2009 Plan into this Revised Plan as Appendix A. By doing this, the Revised Plan is a stand-alone document that replaces the October 2009 Plan. Below is further description of the approach that United will implement under the Revised Plan along with an explanation for why this approach is being taken.

2.0 OVERALL APPROACH

The tasks that United is required to implement, as described in the October 2009 Plan (Appendix A), fall into five categories as follows.

1. Monitoring surveys for target native species
2. Habitat suitability mapping
3. Operational mitigation and minimization measures for arroyo toads
4. Aquatic exotic species management
5. Reporting

Of these categories, tasks under categories 3 and 5 do not require accessing private property to complete. However, to fully implement the specific tasks within categories 1, 2, and 4, United must have permission to access private property and undertake these tasks on that property.

This was discussed during the consultation meeting with USFWS, CDFG, and NMFS. The group came to the following conclusions:

- The October 2009 Plan cannot be implemented as written without permission to access private property;
- The agencies will not require United to exhaust every possible means available to obtain access;
- The October 2009 Plan has important goals, and United should implement the plan if permission for suitable access is obtained;
- Until United obtains permission for suitable access, it will implement an agreed-upon variation on the October 2009 Plan.

Section 3.0 describes the variations that United will implement until permission for suitable access is obtained. For ease of reference, this is called the “No Access Plan”. Section 4.0 describes the process that will be used to determine when the tasks contained in Appendix A (October 2009 Plan) would be implemented. Again for ease of reference, this is called “Access Plan.”

3.0 NO ACCESS PLAN

The tasks that United is required to implement, as described in the October 2009 Plan (Appendix A), fall into five categories as follows.

1. Monitoring surveys for target native species
2. Habitat suitability mapping
3. Operational mitigation and minimization measures for arroyo toads
4. Aquatic exotic species management
5. Reporting

For consistency purposes and ease of implementation, the No Access Plan is structured around these same categories. This section describes what tasks, if any, United will undertake for each category and provides an explanation of why these tasks were selected.

Category 1 - Monitoring surveys for target native species

Category 2 – Habitat suitability mapping

During the January 6, 2012, consultation meeting, USFWS and CDFG agreed that implementing the tasks contained in the October 2009 Plan for categories 1 and 2 solely on United’s property would not produce meaningful results. Based on this determination, the No Access Plan will not include any tasks for either of these categories.

Category 3 – Operational mitigation and minimization measures for arroyo toads

The tasks contained in the October 2009 Plan and incorporated in Appendix A for category 3 only apply to USFS property. Therefore, under the No Access Plan, United will implement the tasks as described for this category, starting on page 15 of Appendix A.

Category 4 - Aquatic exotic species management

During the January 6, 2012, consultation meeting, USFWS and CDFG agreed that implementing the tasks contained in the October 2009 Plan for category 4 in the spillway pools that occur on United's property would produce meaningful results. Therefore, under the No Access Plan, United will implement the "Aquatic Exotic Species Management Program" as described starting on page 17 of Appendix A for the spillway pools as shown in Figure 2.

The October 2009 Plan calls for the exotics management plan to be implemented along the entire length of the spillway channel and for the first mile of Piru Creek below Santa Felicia Dam. For the No Access Plan, there are several reasons for implementing removal activities at the spillway pools but not the other areas. The pools are not hydrologically connected to Lake Piru or Piru Creek except under spill conditions. This means that, theoretically, no aquatic exotic species enter the pools except when a spill occurs. Removing exotic species from the pools will have a biological benefit until the next spill occurs. USFWS, CDFG, and United agree that the pools have the potential to provide suitable habitat for the California red-legged frog, among other important native species. Removing the exotics that predate upon or compete with these natives may create an opportunity for them to move into and use the pools. In contrast, undertaking removal activities on the entire portion of the spillway channel that United owns makes little sense because the channel (outside of the pools) is dry except during spills. Finally, with respect to the first mile of Piru Creek below Santa Felicia Dam, United only owns the first 0.24 miles. USFWS, CDFG, and United all agreed that there is no biological benefit to be gained by removing exotics from this 0.24-mile portion of creek. The section is short and hydrologically connected at all times to the rest of the creek. Any exotics removed would be quickly replaced by others moving in from downstream.

Category 5 – Reporting

United's ability to issue annual reports is not affected by the access situation. However, the October 2009 Plan (page 24 of Appendix A) requires that the annual report contain information that United would not be collecting under the No Access Plan. Therefore, under the No Access Plan, United will prepare an annual report that discusses the following:

1. Effectiveness of aquatic exotic species eradication management efforts;
2. Assessment of implementation and effectiveness of the Revised Plan;

3. Recommendations for changes to the Revised Plan;
4. Update status of access to private property;
5. Updated record of consultation with participating agencies; and
6. California Natural Diversity Database forms shall be completed for all sensitive species documented during implementation of the Revised Plan. Forms shall be submitted to the Biogeographic Data Branch, CDFG, 1807 13th Street, Suite 202, Sacramento, California 95811 (also accessible online at <http://www.dfg.ca.gov/biogeodata/cnddb>).

United will complete the annual report by December 31st of each year and provide a copy of it to USFWS, CDFG, USFS, NMFS and FERC. Within 3 months following submittal of the annual report, United will host a meeting to discuss the effectiveness of the aquatic exotic species management program and any operational mitigation or minimization measures performed during the year. All consulting federal and state agencies (USFWS, CDFG, USFS, NMFS and FERC) will be invited to attend.

4.0 ACCESS PLAN

Under the Access Plan, United will implement the tasks contained in Appendix A, either in their entirety or with some modification as agreed upon by United, USFWS, CDFG, USFS, NMFS, and FERC, when appropriate access to private property is obtained. Considering that the term of the license is 40 years (expiring September 12, 2048) and that United is unable to anticipate the details of access to private property that may be granted in the future, United will follow the procedure described below for determining when to implement the Access Plan and what exact tasks will be implemented under the plan.

- 1) United will provide an update on the access situation in the annual report as required in the No Access Plan described above;
- 2) At the annual consultation meeting with agencies, United will discuss the current status of access;
 - a) If there is no change, United will continue to implement the No Access Plan;
 - b) If the access situation has or is expected to change before the end of the calendar year, United will proceed to implement the subsequent steps in this procedure.
- 3) United in consultation with USFWS, CDFG, USFS, and NMFS will evaluate the following information to make a determination on whether United will implement the Access Plan, when that implementation will commence, and which tasks will be implemented;

- a) Details of the access including the portions of Piru Creek that can be accessed, timing and duration of access, and other conditions for access;
 - b) Habitat conditions in Piru Creek, the spillway channel, and the area where access has been granted;
 - c) Status of the targeted species.
- 4) United will prepare a report (Access Plan Report) explaining the results of the evaluation and what determinations were made in step 3 above. United will request written concurrence from USFWS, CDFG, USFS, and NMFS on the Access Plan Report and file statements of concurrence or comments along with documentation of the consultation history with FERC for approval;
- 5) United will implement the No Access Plan until receiving approval from FERC to implement tasks deemed appropriate through consultation and outlined in the Access Plan Report.

**Figure 1 -
Map showing property ownership along lower Piru Creek**

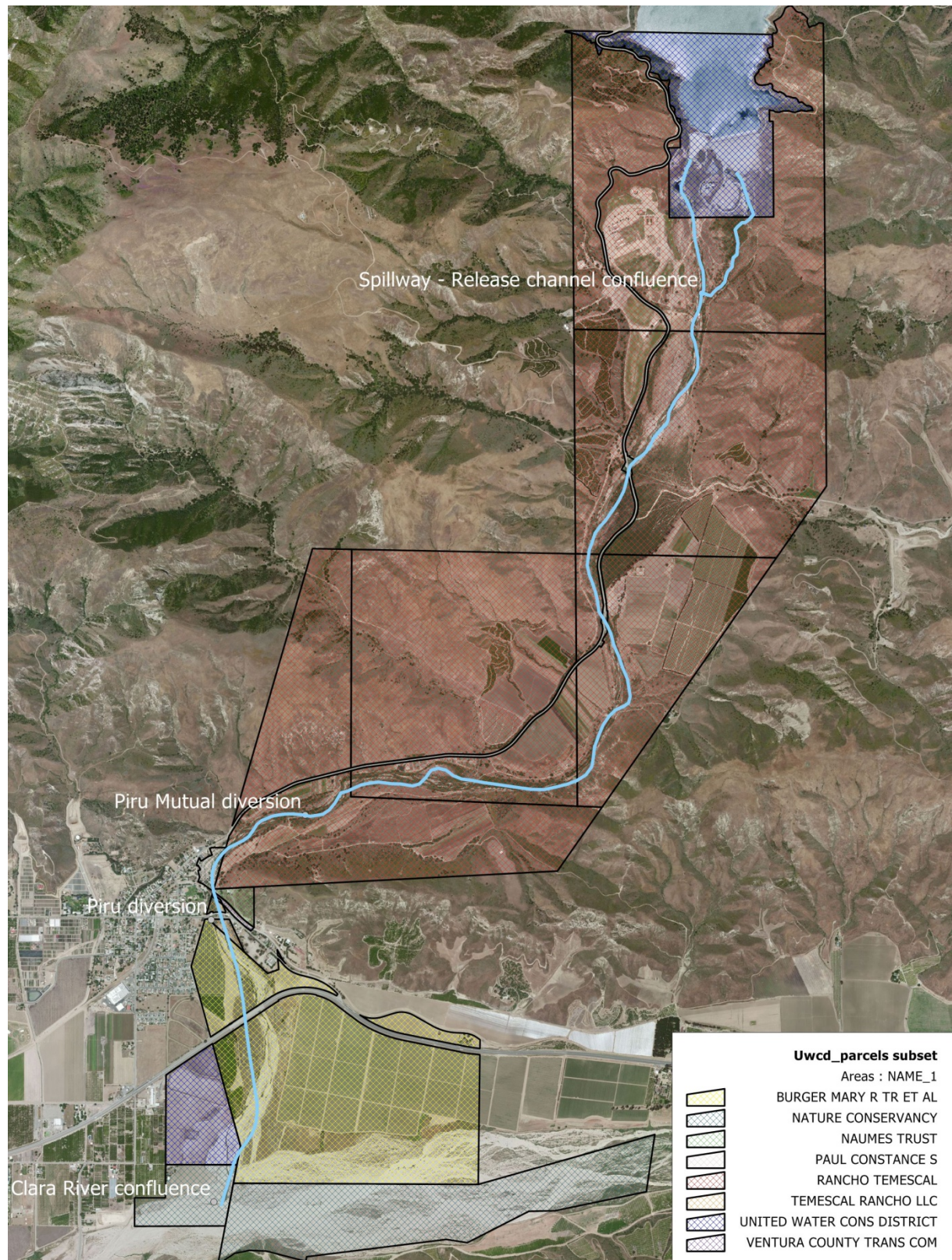
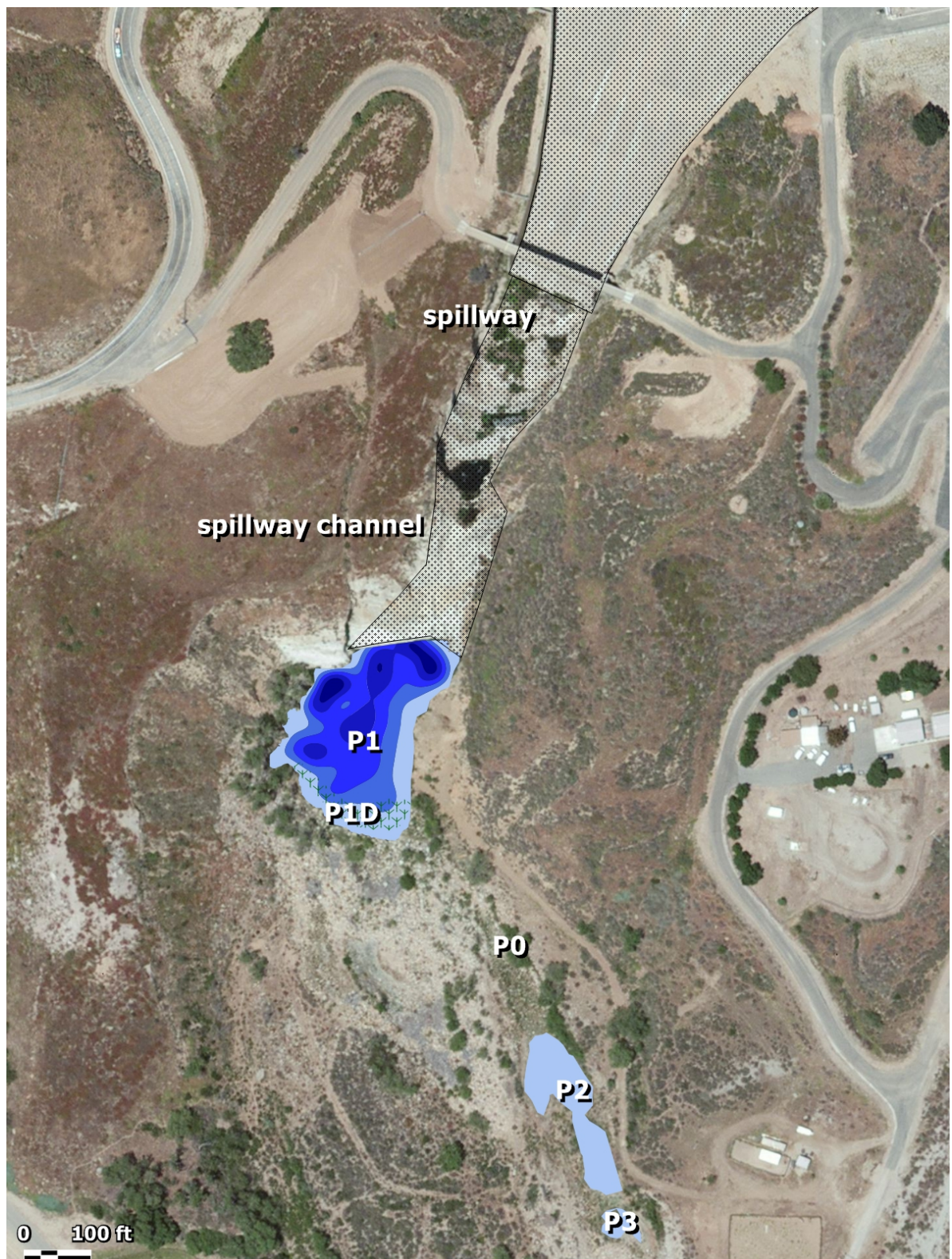


Figure 2 -
Map showing spillway pools where exotic species management will occur under the
No Access Plan



Appendix A
Lower Piru Creek Herpetological Monitoring Plan
From October 2009

Lower Piru Creek Herpetological Monitoring Plan

Santa Felicia Project - FERC No. 2153 - Article 404

Final Report



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EXECUTIVE SUMMARY

A Herpetological Monitoring Plan has been prepared to identify and monitor populations of four (4) regionally sensitive amphibian and aquatic reptile species for the Santa Felicia Project area, which include:

- Arroyo Toad (*Anaxyrus* (= *Bufo californicus*) [Federally endangered, State species of special concern];
- California Red-legged Frog (*Rana aurora draytonii*) [Federally threatened, State species of special concern];
- Two-striped Garter Snake (*Thamnophis hammondi*) [State species of special concern, Forest Service sensitive], and the
- Southwestern Pond Turtle (*Actinemys* (= *Clemmys*) *marmorata pallida*) [State species of special concern, Forest Service sensitive].

Key provisions of this plan propose to:

- characterize and map suitable potential breeding, foraging, and aestivation habitat for each of these target species;
- monitor population fluctuations, if detected, of each target species;
- design and implement an aquatic exotic species management program.

INTRODUCTION

The United Water Conservation District's (UWCD or Licensee) original fifty-year license for the Santa Felicia Project (including water releases into lower Piru Creek), which was issued by the Federal Energy Regulatory Commission (FERC or Commission) on December 20th, 1954, expired on April 30th, 2004. Accordingly, the UWCD has been operating under an annual license pending the agreement and approval of the new license issued on September 12th, 2008 (Project No. 2153-012). As a condition of the UWCD 2008 license, a herpetological monitoring plan must be developed and implemented by September 12th, 2009 (i.e., one year following permit issuance). Specifically, Article 404 requires the development of a herpetological monitoring plan for lower Piru Creek that includes the provisions presented in the final arroyo toad (*Bufo californicus*) protection plan (Article 401, Condition Item 4(e)16: Commission Approval, Reporting, and Filing of Amendments and United States Department of Agriculture – Forest Service 4(e) Terms and Conditions (Appendix A – Agency Contacts)).

PURPOSE AND GOALS

The goal of the lower Piru Creek Herpetological Monitoring Plan (HMP) is to document the licensee's responsibility to determine presence/absence of the arroyo toad and California red-legged frog, and to monitor potential population fluctuations of the two-striped garter snake and southwestern pond turtle within the Santa Felicia Project

spillway channel, and the portion of the lower reach of Piru Creek that extends approximately six miles from the Santa Felicia Dam to the confluence of the Santa Clara River (Study Area). The HMP will also include and implement an aquatic exotic species eradication program within the upper 1 mile reach of lower Piru Creek and the spillway pool as shown in Figure 1, *Study Area Map*. Although no arroyo toads or California red-legged frogs have been documented from the Study Area during recent survey efforts, historically this region likely supported populations of both species. The two-striped garter snake and southwestern pond turtle were documented within lower Piru Creek during focused surveys conducted in 2004 (Sandburg 2004, Entrix 2004). As a result of the recent survey efforts, suitable potential breeding, foraging, and aestivation habitat is present for all four (4) target species (personal observation 2009).

Therefore, specific goals of the HMP would:

1. Identify, and if located, monitor arroyo toad and California red-legged frog populations within the Study Area by conducting annual presence/absence surveys over five consecutive years followed at three year intervals until the species are detected, after which surveys will be conducted annually;
2. Monitor population trends of the two-striped garter snake and southwestern pond turtle within the Study Area by conducting annual surveys efforts;
3. Implement an arroyo toad, California red-legged frog, two-striped garter snake and southwestern pond turtle habitat (three-components of breeding, foraging & aestivation) suitability mapping program for five consecutive years followed at three-year intervals until the species are detected, after which mapping efforts will be conducted annually;
4. Design and implement a site-specific aquatic exotic species management plan.

This HMP would also incorporate site-specific arroyo toad protection measures for those lands included in both the Santa Felicia Project Area and National Forest System lands located upstream of Piru Reservoir per Article 401 - Forest Service Condition Item 4(e) 16).

AGENCY CONSULTATION HISTORY

This HMP has been developed in consultation with federal and state resource agencies, including the United States Fish and Wildlife Service (USFWS), Angeles National Forest, Los Padres National Forest, California Department of Fish and Game (CDFG), National Marines Fisheries Service (NMFS), and FERC.

The consultation history also includes miscellaneous e-mails and phone calls identifying the progress and responsibilities to review and approve specific sections of the document. As a result, a draft report "Lower Piru Creek Herpetological Monitoring Plan" was submitted to all participating agencies (Attachment A) in August 2009.

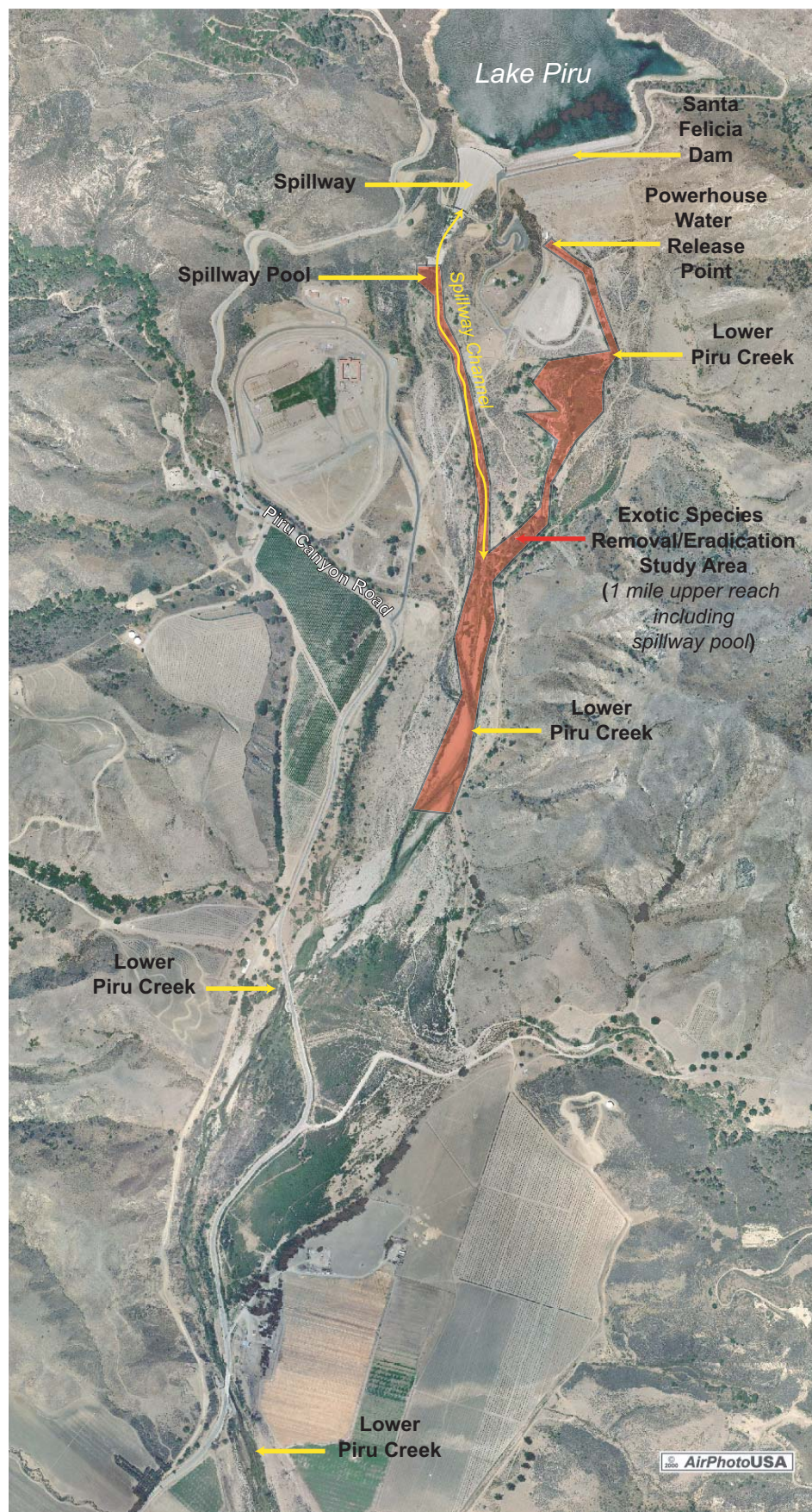


Figure 1 - Study Area Map

Lower Piru Creek Herpetological Monitoring Plan
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CADRE
 Environmental



Comments were received from the CDFG in September 2009. Recommendations included the inclusion of the two-striped garter snake as a monitored species, an annual progress meeting be held following the submittal of annual reports, and all sensitive species observations be recorded and submitted using the California Natural Diversity Database reporting form. All recommendations have been incorporated into the Plan.

STUDY AREA ENVIRONMENTAL SETTING

Location and Description

The Study Area includes the portion of the lower reach of Piru Creek (including floodprone area) that extends approximately six (6) miles from the Santa Felicia Dam powerhouse (including spillway) to the confluence with the Santa Clara River as shown in Figure 1, *Study Area Map*. As stated by the UWCD:

“The lower portion of Piru Creek consists of a relatively low gradient, broad alluvial valley surrounded by agricultural land use. Major tributaries below Lake Piru include Modelo Canyon, Holster Canyon, Lime Canyon, Blanchard Canyon, and five unnamed tributaries. The effective watershed of this lower reach of Piru Creek is approximately 15 square miles” (UWCD 2004).

Vegetation Communities

Vegetation communities documented within and/or immediately adjacent to the Study Area include sage scrub, mixed chaparral, annual grassland, freshwater emergent wetland, riparian forest and woodlands, southern willow scrub, mule fat scrub, oak woodland, agricultural, urban developed, and barren (UWCD 2004).

WATER SUPPLY OPERATIONS

The UWCD’s original fifty-year license for the Santa Felicia project was issued by the Commission on December 20th, 1954. Following expiration of the permit on April 30th, 2004, the UWCD has been operating under an annual license pending the agreement and approval of the new license that was issued on September 12th, 2008.

As stated in the FERC order issuing new license:

“Minimum flows would affect ESA listed amphibians as well as listed steelhead. In the final EA, staff found that providing United’s proposed minimum flow, the natural inflow to Lake Piru plus 1 cfs and within a range of 1.4 to 5 cfs, would support natural riparian habitat functions and would mimic the natural hydrograph and likely improve the habitat for the listed arroyo toad downstream of Santa Felicia Dam. Additionally, mimicking the natural hydrograph (below 5 cfs) would reduce the habitat availability for exotic aquatic species such as bullfrog that prey upon arroyo toad and the listed California red-legged frog” (FERC 2008).

Past surface flow regimes from Santa Felicia Dam have allowed the bullfrog to become the dominant amphibian species within the Study Area (Sandburg 2004).

Simulated natural flows that were instituted upstream of the Study Area and above Lake Piru in middle Piru Creek during the winter of 2005 resulted in an exceptional year of arroyo toad reproduction (Sandburg 2005).

As stated by Sandburg:

“Higher than normal flood events in 2005 flushed silts, vegetation and channels, returning middle Piru Creek to an earlier channel successional stage that resulted in a high numbers of arroyo toad clutches” (Sandburg 2005).

Specifically, a total minimum of 145 and maximum of 165 arroyo toad clutches were documented during the 2005 survey effort as compared to twelve (12) in 2002, zero (0) in 2003, and thirteen (13) in 2004 (Sandburg 2005, 2007). A total minimum of 97 arroyo toad clutches were detected within middle Piru Creek during the 2008 spring survey season (Ecological Sciences, Inc. 2009).

The new license requires that minimum flow releases mimic (restore) natural flow rates as described above. The minimum flow releases will be implemented until a permanent release schedule is developed and approved by the NMFS and the Commission.

PROTECTION STATUS AND NATURAL HISTORY

California Red-legged Frog

The California red-legged frog is the largest native frog in the western United States, and is one of two subspecies of the red-legged frog (*Rana aurora*). In 1996, USFWS listed the California red-legged frog as a Federally Threatened species (USFWS 1996b). It is also a Species of Special Concern protected by the California Department of Fish and Game (CDFG 2009). The Study Area is not located within USFWS designated critical habitat for this species (USFWS 2001b).

California red-legged frogs may also have red on their lower abdomen and on the underside of the hind legs, though this is highly variable. The dorsal surface may be brown, gray, olive, or reddish and is often covered with small black flecks and larger, irregular dark spots. Males are substantially smaller than females and possess more webbing between their toes (USFWS 1996b).

Historically, the range of the California red-legged frog extended from the vicinity of Redding, Shasta County, west to the coast and south to northwestern Baja California, Mexico (Jennings and Hayes 1994). The California red-legged frog once occupied 46 counties, but is now present in only 31 counties, having been eliminated from 70 percent of its former range (USFWS 1996b). Currently, the California red-legged frog is locally abundant only in a few localities in the San Francisco Bay area, and along the central coast (USFWS 1996b). It is also known from one isolated locality in the Sierra Nevada, and from a small number of localities along the northern coast, and in the northern Transverse Ranges. In southern California, it has been extirpated from nearly every

known historic locality (USFWS 1996b). At present, the known populations south of the Santa Clara River include Cole Creek (Riverside County) (approximately 2 male frogs), and east fork Las Virgenes Creek (Los Angeles County) (approximately 25 adult frogs). A population of California red-legged frogs is also located north of the Santa Clara River within San Francisquito Creek (Los Angeles County) (estimated 10-12 adult frogs).

The species is threatened within its remaining range by a wide variety of human induced impacts, including agriculture, urbanization, mining, overgrazing, recreation, timber harvesting, water impoundments and diversions, degraded water quality, invasion of non-native plants, and exotic predators such as bullfrogs, African clawed frogs (1996b), mosquitofish (*Gambusia affinis*), bass (*Micropterus salmoides*), carp (*Carassius auratus*), green sunfish (*Lepomis cyanellus*), red swamp crayfish (*Procambarus clarkii*), and others (USFWS 1996b).

California red-legged frogs utilize several types of aquatic, riparian, and upland habitats, which include ephemeral ponds, riparian corridors, intermittent streams, seasonal wetlands, springs, seeps, permanent ponds, lake margins, perennial creeks, dune ponds, marshes, lagoons, blackberry (*Rubus* sp.) thickets, non-native annual grasslands, oak savannas and some man-made aquatic features. The species favors slow-moving streams, pools, and ponds greater than 2.3 feet deep that are surrounded by dense herbaceous or shrubby riparian vegetation, which provides stream shading, an important habitat component (USFWS 2000; Hayes and Jennings 1994). The species diet is highly variable and includes aquatic and terrestrial insects, crustaceans, worms, fish, tadpoles, other frogs, and small mammals such as deer mice (*Peromyscus maniculatus*). Larvae foraging ecology is not well known, but it is assumed they are algal grazers (USFWS 1996b).

Adults are recognized for making substantial shifts within their local aquatic habitats (Jennings and Hayes 1994). However, during wet periods, some individuals may disperse and/or move through upland habitats (USFWS 1996b). The species has been recorded within streams at distances more than 2 miles from the breeding site, and have been observed up to 100 feet away from water in adjacent dense riparian vegetation for up to 77 days (USFWS 1996b). Other evidence indicates that in some areas the species may move extensive distances (well over 1 mile) overland between water sources.

The breeding season for California red-legged frogs occurs from late November through April (USFWS 1996b). The location where eggs are deposited in winter and early spring is often different from the feeding habitat occupied during spring and summer. Juveniles commonly utilize shallow water with dense submerged vegetation, or emergent vegetation in the vicinity of breeding pools. Juvenile frogs are active diurnally and nocturnally, whereas the adult frogs are often, but not invariably nocturnal (USFWS 1996b).

Arroyo Toad

As stated by the UWCD:

“The arroyo toad (Bufo californicus) is a federally listed endangered amphibian (USFWS 1994), and a California Species of Special Concern

(Jennings and Hayes 1994). The USFWS designated 11,695 acres of critical habitat for the arroyo toad on April 13th 2005. However, the entire reach of Piru Creek including the Study Area was excluded from critical habitat designation under section 4(b)(2) of the endangered species act for economic reasons (USFWS 2005).

The extirpation of arroyo toad from approximately seventy-six percent of its historic range (Jennings and Hayes 1994) is attributed to human related activities that have altered or destroyed suitable habitat and natural hydrologic regimes, and the introduction of exotic predator species.

Habitat requirements for the arroyo toad include shallow, gravelly overflow pools adjacent to sandy terraces, with low current velocity, and sparse emergent vegetation. Most toad sites are slightly downstream of third and higher order confluences (Sweet 1992). Pools relatively free of silt are required for larvae to feed (USFWS 1999). Stabilized sandbars with capillary-fed moisture are essential for the survival of newly transformed juveniles during the summer (Sweet 1992), as they may remain on the stream banks to feed for up to four months before dispersal. Adult and subadult toads aestivate during summer and winter months, emerging to feed and hydrate. Burrow locations are usually located in dry or slightly damp fine sand and often in the canopy edge of willow or cottonwood. Holland (2001) documented that arroyo toads will travel up to 1.12 km from the edge of the riparian ecotone for burrowing and night foraging. The major food source consists of ants and other small invertebrates. Predators include native and exotic species in both aquatic and terrestrial life stages of arroyo toads. Bullfrogs and non-native fish (Sweet 1992) can be especially effective predators" (UWCD 2004).

Two-striped Garter Snake

As stated by UWCD:

"The two-striped garter snake is a California Species of Concern" and a Forest Service Sensitive Species. This snake is believed to be declining in southern California, due primarily to habitat loss but also to collection for pets. This species occurs along permanent rocky and sandy stream courses in southern and coastal central California, within a variety of terrestrial habitats from chaparral to pine forest. The two-striped garter snake feeds primarily on fish, but frogs and perhaps aquatic invertebrates are also included in its diet (Jennings and Hays 1994). This species bears live young, sometimes in litters of as many as 25." (UWCD 2004).

Southwestern Pond Turtle

As stated by the UWCD:

“The southwestern pond turtle is a subspecies of the western pond turtle (Clemmys marmorata). It is a California Species of Special Concern. Western pond turtle is an aquatic turtle that usually leaves the aquatic site to reproduce, to aestivate, and to overwinter. Habitat requirements typically include basking sites and protected upland areas for aestivation and nesting. Western pond turtles may overwinter on land or in water, or may remain active in water during the winter season. This pattern may vary considerably with latitude and habitat type and is not well understood (CDFG 1994). Mating, which has been rarely observed, typically occurs in late April or early May. Females emigrate from the aquatic site to an upland location that may be a considerable distance from the aquatic site to nest” (UWCD 2004).

HISTORICAL DISTRIBUTION WITHIN STUDY AREA

California red-legged frog

No California red-legged frogs were detected within the Study Area during focused USFWS surveys conducted from March to July 2004 (Sandburg 2004).

As stated by Sandburg:

“Historically, red-legged frogs have been found and documented in the focused project area along Piru Creek with observations and specimen collections dating from 1940 to 1983” (Sandburg 2004). Although no California red-legged frog were documented during the 2004 survey effort, Sandburg comments that small residual populations may be present, but not detected due to the limited survey efforts conducted in this region of the Study Area” (Sandburg 2004).

As stated by UWCD:

“[California Red Legged Frog (CRLF)] were historically documented in Piru Creek from above the confluence of Aqua Blanca Creek, along the Lake Piru shoreline, and approximately a mile from Lake Piru on Piru Creek (CDFG 2003b, 2004). The California Academy of Sciences has several specimens of this species collected in 1949 from Piru Creek (CAS 2004). There are no [California Natural Diversity Data Base (CNDDB)] occurrences for CRLF within the Project area (CDFG 2003b, 2004)” (USCD 2004).

Arroyo Toad

No arroyo toads were detected within the Study Area during focused surveys conducted from March to July 2004 (Sandburg 2004).

As stated by Sandburg:

“Arroyo toads have been documented in Piru Creek above the Reservoir, but were likely located throughout the Study Area before construction of Santa Felicia Dam degraded downstream habitat.” Although no arroyo toads were documented during the 2004 survey effort, Sandburg comments: “that small residual populations may be present, but not detected due to the limited survey efforts conducted in this region of the Study Area” (Sandburg 2004).

As stated by UWCD:

“Arroyo toad is known to occur in Piru Creek from Blue Point Campground upstream for 3.5 miles to Lower Piru Gorge (Sweet 1992, USFWS 1999, CDFG 2003), a stretch that is adjacent to but outside of the Project area. Larvae were recorded there as recently as 2002 (Sandburg 2004, Appendix B). In addition, informal USFS reports have indicated arroyo toad presence below Blue Point Campground. Arroyo toads may have been present historically throughout the Study Area prior to the construction of Santa Felicia Dam and other developments. Arroyo toads are not likely to occur in Piru Creek between the Santa Felicia Dam and the Santa Clara River confluence, because of the absence of confluence overflow pool habitat and the presence of high silt levels throughout the reach” (UWCD 2004).

Two-striped Garter Snake

As stated by UWCD:

“These snakes have been reported from throughout the Piru/Creek/Santa Clara River basin. A two-striped garter snake was encountered near Blue Point Campground along Piru Creek on May 7, 2004” (UWCD 2004).

Two-striped garter snakes have also documented in middle Piru Creek in 2009 by Aspen Environmental Group and in lower Piru Creek by Entrix in 2004.

Southwestern Pond Turtle

Western pond turtles have been documented both up and downstream of Lake Piru including the middle reach of Piru Creek and lower Piru Creek located downstream of the Santa Felicia Dam Study Area (Sandburg 2004). With the exception of developed lands, the western pond turtle is expected to breed and use upland habitats within the Study Area for oviposition (Sandburg 2004).

Sandburg states:

“Due to the current low level of impacting uses on terrestrial habitat, turtle mortality is not expected to be a significant factor related to breeding” (Sandburg 2004).

INITIAL IMPLEMENTATION MEASURES

Several natural resource studies were conducted prior to and in association with the relicensing of the Santa Felicia project. For the purpose of this document, only those studies conducted for the arroyo toad, California red-legged frog, two-striped garter snake, and southwestern pond turtle are discussed below. As a result of these initial studies, several permit requirements were added to the relicensing agreement, including the development of an arroyo toad protection plan and a herpetological monitoring plan.

California Red-legged Frog

Focused California red-legged frog surveys were conducted throughout the Study Area from March to July 2004 by Nancy Sandburg.

As stated by UWCD:

“Preliminary reconnaissance surveys indicated that suitable habitat for California red-legged frog could occur within the Project Area... CRLF surveys were conducted in 2004 within the selected units of the focused study area by herpetologist Nancy Sandburg, in accordance with current protocol requirements (USFWS 1997)... Potential red-legged frog habitat is present in Piru Creek both upstream and downstream of Lake Piru... Better potential habitat for CRLF occurs below the reservoir in Lower Piru Creek. Key areas there include: the spillway pool; a large pool at River Mile 2; and several other small, isolated pools along lower Piru Creek” (UWCD 2004).

No California red-legged frogs were detected during the surveys conducted from March to July 2004 (UWCD 2004).

Arroyo Toad Focused Surveys

Focused non-protocol arroyo toad surveys were conducted throughout the Study Area from March to July 2004 by Nancy Sandburg.

As stated by Sandburg:

“All surveyed areas received a minimum of one night and one day survey with the exception of the recreationally developed portions of the southwest side of the Reservoir” (Sandburg 2004).

Specifically, only a 0.5-mile reach of lower Piru Creek was surveyed for arroyo toads during the 2004 spring season. Although no arroyo toads were documented during the 2004 survey effort, Sandburg comments that small residual populations may be present, but not detected due to the limited survey efforts conducted in this region of the Study Area (Sandburg 2004).

Two-striped Garter Snake

Although no focused surveys or habitat assessment were conducted in lower Piru Creek for the two-striped garter snake, all incidental observations were recorded during the various focused surveys conducted in this region for the arroyo toad, California red-legged frog and southwestern pond turtle. A two-striped garter snake was documented in lower Piru Creek approximately 1,000ft downstream of the Piru Creek/spillway channel confluence (Entrix 2004).

Southwestern Pond Turtle

A habitat assessment was conducted throughout the Study Area on June 15th, 2004. Juvenile southwestern pond turtles were documented within the Study Area at an abandoned United States Geological Survey gauging station (Mile 3.4) (UWCD 2004).

Habitat Suitability Mapping

No arroyo toad suitable habitat was mapped within the Study Area during the initial biological survey efforts conducted by Entrix (UWCD 2004). The lack of suitable arroyo toad breeding habitat detected within the Study Area may have been due to unfavorable conditions resulting from extensive water releases at the time of the survey. However, during a site visit to lower Piru Creek in June 2009 during a 5 cfs water release, several isolated reaches were identified that represent potential suitable arroyo toad breeding habitat (personal observation 2009). Also, potential foraging and aestivation habitat was also documented within the floodprone area and adjacent terraces throughout most of the Study Area.

Suitable habitat for both the California red-legged frog and southwestern pond turtle was documented within the Study Area during the initial biological survey efforts conducted by Entrix (UWCD 2004). The suitable habitat was mapped primarily in the extreme northern and southern regions of the Study Area. This effort will represent the baseline conditions by which future habitat suitability mapping efforts will be compared to. No habitat suitability mapping was conducted for the two-striped garter snake during the initial habitat assessment efforts conducted by Entrix in 2004. However, the species is known to occur within lower Piru Creek and habitat suitability will be mapped and monitored for this species as part of this Plan.

MONITORING SURVEYS

The results of the arroyo toad, California red-legged frog, two-striped garter snake, and southwestern pond turtle monitoring surveys and identification of suitable breeding, foraging, and aestivation habitat mapping program shall be considered when developing and implementing any future water release schedules.

California Red-legged Frog

A five-year California red-legged frog location and monitoring program will be initiated throughout the Study Area. Following the completion of the annual five-year monitoring program, survey efforts will be conducted at three-year intervals until the California red-legged frog is detected within the Study Area, after which, surveys will be conducted on

an annual basis. Specifically, surveys for the California red-legged frog will be conducted as outlined in the USFWS protocol guidelines "*Revised Guidance on site assessment and field surveys for California red-legged frog*" (USFWS 2005). Although the USFWS protocol guidelines are not intended to be utilized for monitoring trends of existing California red-legged frog populations, no individuals have been documented within the Study Area. Therefore, the USFWS guidelines are adequate for meeting the goal of determining presence/absence of the species within the Study Area. Survey efforts shall be conducted by individuals familiar with identifying all life stages of the species and familiar with both aquatic and upland habitat suitability assessments.

If detected, GPS data will be collected and incorporated into a GIS database which will include at a minimum the following fields: Date, Observer, Species, Sci_Name, and Age_Class (adult/juvenile/larvae/clutch). Also, if detected, the HPM will be updated to include monitoring guidelines that focus on detecting population fluctuation/distribution within the Study Area.

Arroyo Toad

A five-year arroyo toad location and monitoring program will be initiated throughout the Study Area. Following the completion of the annual five-year monitoring program, survey efforts will be conducted at three-year intervals until the arroyo toad is detected within the Study Area, after which, surveys will be conducted on an annual basis. Specifically, surveys for the arroyo toad will be conducted as outlined in the USFWS protocol guidelines "*Survey protocol for the arroyo toad*" (USFWS 1999). Although the USFWS protocol guidelines are not intended to be utilized for monitoring trends of existing arroyo toad populations, no individuals have been documented within the Study Area. Therefore, the USFWS guidelines are adequate for meeting the goal of determining presence/absence of the species within the Study Area. Survey efforts shall be conducted by individuals familiar with identifying all life stages of the species and assessing both aquatic and upland habitat suitability.

If detected, GPS data will be collected and incorporated into a GIS database which will include at a minimum the following fields: Date, Observer, Species, Sci_Name, and Age_Class (adult/juvenile/larvae/clutch). Also, if detected, the HPM will be updated to include monitoring guidelines that focus on detecting population fluctuation/distribution within the Study Area.

Two-striped Garter Snake

Annual two-striped garter snake location and monitoring surveys will be initiated throughout the Study Area and conducted concurrent with those described for the southwestern pond turtle. The annual monitoring effort will include a single visual survey of the entire Study Area (floodprone area) conducted between June 1st and August 31st. Survey efforts shall be conducted by individuals familiar with identifying all life stages of the species and assessing both aquatic and upland habitat suitability. The survey effort will be complemented during the initial five (5) years of monitoring by incidental two-striped garter snake observations made during at least nine (9) annual diurnal protocol surveys conducted as part of the arroyo toad and California red-legged frog survey efforts.

The survey effort shall begin at the downstream reach of Lower Piru Creek and extend upstream toward the powerhouse located at the base of Santa Felicia dam. The spillway channel shall also be surveyed starting at the confluence of Lower Piru Creek and extending upstream toward the spillway pool. All individuals observed shall be classified (adult/juvenile) and mapped (GPS – State Plane NAD83). The GPS data will be incorporated into a GIS database which includes at a minimum the following fields: Date, Observer, Species, Sci_Name, and Age_Class (adult/juvenile).

Southwestern Pond Turtle

Annual southwestern pond turtle location and monitoring surveys will be initiated throughout the Study Area. The annual monitoring effort will include a single visual survey of the entire Study Area (floodprone area) conducted between June 1st and August 31st. Survey efforts shall be conducted by individuals familiar with identifying all life stages of the species and assessing both aquatic and habitat suitability (basking/refugia/uplands). The survey effort will be complemented during the initial five (5) years of monitoring by incidental southwestern pond turtle observations made during at least nine (9) annual diurnal protocol surveys conducted as part of the arroyo toad and California red-legged frog survey efforts.

The survey effort shall begin at the downstream reach of Lower Piru Creek and extend upstream toward the powerhouse located at the base of Santa Felicia dam. The spillway channel shall also be surveyed starting at the confluence of Lower Piru Creek and extending upstream toward the spillway pool. All individuals observed shall be classified (adult/juvenile) and mapped (GPS – State Plane NAD83). The GPS data will be incorporated into a GIS database which includes at a minimum the following fields: Date, Observer, Species, Sci_Name, and Age_Class (adult/juvenile).

HABITAT SUITABILITY MAPPING

Concurrent with the focused survey efforts discussed above, a habitat suitability assessment and mapping program will be conducted throughout the Study Area for each of the four (4) target species. The results of each assessment will be incorporated into a GIS database for a simple analysis of annual variation and distribution of suitable habitat and assist in determining to what extent the operational mitigation/minimization measures are having on restoring or degrading habitat for the California red-legged frog, arroyo toad, two-striped garter snake, and southwestern pond turtle.

Photostations will be placed at 1-mile intervals throughout the Study Area including the spillway channel. A GPS record of each photostation will be collected during the initial monitoring effort in order to assist with locating stations during subsequent annual surveys. Both upstream and downstream representative photographs will be taken at each of the photostations once per year between March and June. In addition to photodocumenting the Study Area, general notes of geomorphology and vegetation communities will be collected during all habitat suitability and monitoring survey efforts.

California Red-legged Frog Monitoring Surveys

Previous habitat suitability mapping for the California red-legged frog within the Study Area was based on physical channel characteristics, surface flow, and USFWS habitat

descriptions (Sandburg 2004). Specifically, suitable breeding habitat was characterized as those locations where pools were at least 1 meter deep during spring, emergent vegetation/bank cover, and sufficient surface flow to allow for metamorphosis to complete (Sandburg 2004). Suitable breeding, upland and aestivation habitat suitability mapping will be based on general habitat characterizations described in the *“Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frog”* (USFWS 2005b).

The entire Study Area (lower Piru Creek, spillway channel and floodprone area) shall be evaluated to determine and map suitable California red-legged frog habitat. As previously stated, the survey effort shall be conducted by an individual knowledgeable of both aquatic and upland habitat utilization for the species. All mapped habitats shall be incorporated into a GIS database that includes at a minimum the following fields: Date, Observer, Species, Sci_Name, and Veg_Type (Holland Classification), Acres.

Arroyo Toad Monitoring Surveys

Arroyo toad habitat suitability mapping efforts will be conducted as part of the arroyo toad monitoring program. As previously stated, survey efforts will be conducted annually for five years, followed at three-year intervals until the arroyo toad is detected within the Study Area, after which, surveys will be conducted on an annual basis. A biologist familiar with arroyo toad natural history will map and characterize all areas within the Study Area that represent potential breeding and upland habitat use areas. Suitable breeding, upland and aestivation habitat suitability mapping will be based on general habitat characterizations described in the *“Recovery Plan for the Arroyo Southwestern Toad”* (USFWS 1999a).

The entire Study Area (lower Piru Creek, spillway channel and floodprone area) shall be evaluated to determine and map suitable arroyo toad habitat. As previously stated, the survey effort shall be conducted by an individual knowledgeable of both aquatic and upland habitat utilization for the target species. All mapped habitats shall be incorporated into a GIS database that includes at a minimum the following fields: Date, Observer, Species, Sci_Name, Veg_Type (Holland Classification), Acres.

Two-striped Garter Snake

The entire Study Area (lower Piru Creek, spillway channel and floodprone area) shall be evaluated to determine and map suitable two-striped garter snake habitat. As previously stated, the survey effort shall be conducted by an individual knowledgeable of both aquatic and upland habitat utilization for the species. Habitat suitability mapping will be based on general habitat characterizations described in the *“Amphibian and reptile species of special concern in California”* (Jennings and Hayes 1994).

All mapped habitats shall be incorporated into a GIS database that includes at a minimum the following fields (Date, Observer, Species, Sci_Name, Veg_Type (Holland Classification), Acres.

Southwestern Pond Turtle

As previously stated, habitat suitability mapping for the southwestern pond turtle was conducted by Entrix (UWCD 2004).

As stated by UWCD:

“Intermittent pools over one meter in depth are formed beneath cliff protrusions (miles 5.5 and 10.3). These pools are sufficiently deep for western pond turtles. Terrestrial oviposition sites for western pond turtles are frequent along Piru Creek, with the exception of the developed lands. These developments include the vicinity of the town of Piru, and intermittent agricultural and road uses on Temescal Ranch” (UWCD).

The entire Study Area (lower Piru Creek, spillway channel and floodprone area) shall be evaluated to determine and map suitable southwestern pond turtle habitat. As previously stated, the survey effort shall be conducted by an individual knowledgeable of both aquatic and upland habitat utilization for the species. Suitable breeding, basking and upland habitat suitability mapping will be based on general habitat characterizations described in the “A synopsis of the Ecology and Status of the Western Pond Turtle” and “The Western Pond Turtle; Habitat and History, 1993-1994” (Holland 1991, 1994).

All mapped habitats shall be incorporated into a GIS database that includes at a minimum the following fields (Date, Observer, Species, Sci_Name, Veg_Type (Holland Classification), Acres.

OPERATIONAL MITIGATION AND MINIMIZATION MEASURES

Prior to the initiation of any UWCD activities that have the potential to impact arroyo toads on Forest Service land located within the Project Area boundary, the following mitigation/minimization measures shall be implemented, as warranted:

1. Conduct arroyo toad habitat assessment of proposed project site including both temporary and permanent impact areas. The initial survey effort will focus on determining if potential arroyo toad breeding and/or upland habitats would be directly and/or indirectly impacted as a result of project initiation. The survey will be conducted by a qualified biologist familiar with breeding, upland habitat utilization, activity patterns and movement potential of the species;
2. If the proposed activity would not directly or indirectly result in “take” of the arroyo toad including temporary or permanent impacts to breeding or upland habitats, no additional mitigation/minimization measures would be conducted for this species.
3. If suitable arroyo toad habitat (breeding/upland/movement routes) is documented within or adjacent to the proposed project area, either focused surveys would be conducted to determine presence/absence, or the species will be presumed present. If focused surveys are conducted and no arroyo toads are documented within or adjacent to the proposed project site, no additional mitigation/minimization measures would be conducted for this species. If the

species is documented within or adjacent to the proposed project area or presumed present, the following minimization measures shall be implemented:

- a. If the proposed project would result in potential direct/indirect impacts to arroyo toad breeding habitat, no activities will be initiated during the breeding season. In an effort to determine the status of arroyo toad breeding, a qualified biologist shall monitor breeding activity within and adjacent to the proposed project site to determine when all larvae have completed metamorphosis. This effort will generally involve a combination of diurnal clutch/larvae and nocturnal surveys;
- b. Immediately following the completion of the breeding season and prior to the initiation of aestivation, an exclusionary fence shall be installed around the perimeter of the proposed project area. A qualified biologist would conduct at least three (3) consecutive day (juvenile detectability highest) and night (adult detectability highest) surveys to translocate individuals from the impact area. Surveys will continue until no arroyo toads have been documented for at least two (2) consecutive nights. The surveys would be conducted no more than one (1) week prior to project initiation. By initiating the relocation surveys immediately following the breeding season, detectability and successful translocation of individuals outside of the impact area is increased;
- c. A project specific arroyo toad translocation plan shall be developed and approved by the Forest Service and USFWS prior to initiating the translocation survey efforts. At a minimum, the report would describe the type of exclusionary fencing proposed, location of fencing, translocation site characterization, and reporting requirements;
- d. An environmental awareness briefing will be conducted prior to the initiation of project related activities in order to fully inform all onsite personnel of the biologically sensitive resources associated with the proposed project. The briefing will also inform all personnel of the terms and conditions associated with Forest Service and USFWS authorization to proceed (informal consultation) or as outlined in a biological opinion (formal consultation). A handout will also be created and distributed that describes and illustrates the species, including contact information and course of action if detected within the proposed project site;
- e. The integrity of the exclusionary fencing shall be assessed by on site personnel on a daily basis. All breaches shall be immediately repaired. Areas of the fencing breached each day for construction access, shall be repaired prior to completion of each days efforts;
- f. A biological monitor will visit the proposed project site at least once a week to insure that the fencing has not been breached and all project related general best management practices are being successfully implemented; and

- g. A Forest Service and USFWS approved biologist will be onsite during all project related exclusionary fence installation, vegetation clearing/grubbing and ground disturbance.
4. The results of the initial arroyo toad habitat assessment and proposed minimization measures (if warranted) would be submitted to the USFWS and Forest Service for review and authorization to implement site specific measures and to determine if formal consultation is warranted.

AQUATIC EXOTIC SPECIES MANAGEMENT PROGRAM

Purpose and Goals

The impact of exotic invasive species on native species, communities, and ecosystems has been widely recognized for decades (Simberloff 1996). Biological invasion poses severe negative consequences to native biodiversity and community structure (Parker et al. 1999; Wilcove et al. 1998; Allan & Flecker 1993). Amphibians are of particular concern because of global population declines (Blaustein & Wake 1990; Wake 1991), their sensitivity to a wide array of environmental stressors (Blaustein et al. 1994a), and their susceptibility to local and global extinctions (Blaustein et al. 1994b).

Declines of native amphibians in western North America have coincided with introductions and subsequent range expansions of the bullfrog, *Rana catesbeiana* (Moyle 1973; Bury & Luckenbach 1976). More recently their declines have been associated with the establishment of the red swamp crayfish (*Procambarus clarkii*) and the African clawed frog (*Xenopus laevis*). Both experimental studies and correlative field surveys have implicated these species as major contributors to the decline of native amphibian populations, and in some instances local extirpation (Kats & Ferrer 2003).

The introduction of non-native and/or invasive fishes has occurred in California for 130 years (Moyle 1976). Predatory fish efficiently capture amphibian larvae and are considered the only aquatic predators capable of completely eliminating species' tadpoles (Kats et al 1988; Petranka et al. 1987). There is evidence that the extent of the impact of these introductions is negative on native amphibians (Knapp & Matthews 2000, Hecnar & M'Closkey 1997) and may include reduction in abundance, eliminate subpopulations or cause local extinctions, and alter distribution patterns (Bradford et al. 1993; Sih et al. 1992).

Once invasive species are established, complete eradication at a landscape scale is unlikely. However, control efforts aimed at reducing population growth, spread, and the ensuing negative impacts to the native ecosystem should be considered (Pitt et al. 2005). This includes management strategies that attempt to reduce the invasive species to a level of insignificance in order to facilitate the recovery of native species (Kats & Ferrer 2008).

The Aquatic Exotic Species Management plan is intended to reduce the negative impacts of the invasive bullfrog, crayfish, African clawed frog, and non-native freshwater fishes by controlling their respective populations through intensive management practices. These include, but are not limited to: (1) targeted removal of breeding adult

and sub-adult (non-reproductive, completed metamorphosis) bullfrogs and African clawed frogs during the breeding season (approximately mid-March through June); (2) targeted removal of bullfrog and African clawed frog egg masses and emergent aquatic larvae (as well as 2nd year bullfrog larvae) following breeding (approximately early June through end of July); (3) targeted removal of aquatic bullfrog and African clawed frog larvae during metamorphosis and invasive freshwater fish species present in any persistent pools (will be scheduled to follow the Fall Conservation Release); and (4) targeted crayfish trapping (all size/age classes) concurrently with each of the previously identified tasks.

These practices may be modified as conditions warrant in an adaptive management strategy. The core tasks will focus on minimizing the short-term impacts of heavy predation and intense competition by the invasive adults on the native amphibians coincidental with their most conspicuous behavior (e.g. breeding aggregations in the watercourse). By targeting the most susceptible age classes over successive years the long-term impacts of the invasive species will be minimized through the disruption of their life history, and demography, as well as reducing their population density in habitats critical to the native species.

Treatment Area

The aquatic exotic species eradication program Study Area includes the upper 1-mile reach of lower Piru Creek and the spillway pool as shown in Figure 1, *Study Area Map*. Although the eradication efforts are focused on the upper reach of Lower Piru Creek, the overall approach has been developed to indirectly reduce the population and distribution of introduced species downstream as well. Implementing eradication measures for only one mile of lower Piru Creek when the majority of this reach is inundated year-around and represents refugia for invasive aquatic species is senseless. Invasive aquatic species will continue to reestablish the treatment area in the absence of a collective approach to eradicate introduced aquatic species from lower Piru Creek in its entirety.

Aquatic Exotic Species Background

Red Swamp Crayfish

The red swamp crayfish (*Procambarus clarkii*) was introduced to California in the early 1900's from Louisiana. It was likely introduced by several sources, including aquaculture and recreational angling as it is a popular bait for largemouth bass (*Micropterus salmoides*) (Kats & Brewer 2007). It is now found throughout southern California, in the heavily agricultural Central Valley, and in parts of the Sacramento-San Joaquin Delta in freshwater and brackish environments.

This species is aggressively territorial, grows to 5 inches (12.70 centimeters [cm]) in body length and feeds on plants, benthic invertebrates, flocculent, amphibian egg masses and aquatic larvae, snails, and fish. The crayfish is apparently immune to the toxins of the native coast range newt and has been cited for declines in newt populations (CDFG 2007). Furthermore, suppression of native benthic invertebrate species and consumption of flocculent by red swamp crayfish results in water quality declines and reduced native prey densities (Kats & Brewer 2007; CDFG 2007).

American Bullfrog

The American bullfrog (*Rana catesbeiana*) occurs naturally east of the Rocky Mountains. Its original invasion east of the Colorado River appears to have been through accidental introduction to trout streams and lakes during the Colorado Divisions of Wildlife fish stocking operations in the early 1900's (Murphy 2003). In California, bullfrogs were first introduced in 1896 (Heard 1904) for human food after populations of native frogs, particularly *Rana draytonii* (or *Rana aurora draytonii*), the California red-legged frog, were overharvested (Jennings & Hayes 1985). The effects of bullfrogs on native ranid populations throughout California are poorly understood because there have often been concurrent alterations of aquatic habitats, changes in land use of adjacent terrestrial habitats, and introduction of non-native fishes (Hayes and Jennings 1986), which can devastate populations by predation on tadpoles (Bradford 1989, Bradford et al. 1993).

The American bullfrog is the largest true frog found in North America, with adults often weighing more than one pound (0.45 kilograms [kg]) and exceeding 8 inches (20.32 cm) in snout to vent length (SVL). Breeding occurs from February through July with an individual female laying up to 20,000 eggs in a single clutch. Tadpoles may not metamorphose for up to 3 years, overwintering and exceeding lengths of 3 inches (7.62 cm) before metamorphosing. Larvae eat organic debris, algae, plant tissue, suspended matter and small aquatic invertebrates. Adults consume any animal that can be swallowed and predation of amphibians (including cannibalism), reptiles, birds, and mammals has been documented (Robson, pers. observation).

African Clawed Frog

The African clawed frog (*Xenopus laevis*) is native to the cooler regions of sub-Saharan Africa. It was shipped around the world in the 1940's and 1950's for use in human pregnancy tests after it was discovered that female African clawed frogs begin laying eggs when injected with a pregnant woman's urine. The frogs were intentionally released from laboratories around the world when new technologies for pregnancy testing were developed in the late 1950's. Other modes of introduction include intentional releases of unwanted pets and pet escapes from aquariums. With ongoing use of the African clawed frog in cell and molecular biology research, laboratory escapes are another potential introduction pathway (Measey 1998).

The African clawed frog was first documented in greater Los Angeles in 1969 from specimens collected in 1968 from the Santa Ana River drainage. In 1974 it was recorded in Placerita Canyon in northern Los Angeles County. Eradication efforts were initiated at that time in order to protect the unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*). Subsequent surveys in 1990 documented enormous populations in man-made ponds and intervening streams in Placerita, Soledad, and Agua Dulce Canyons (Tinsley & McCoid 1996).

The African clawed frog is most commonly found in stagnant or still waters of ponds or sluggish streams, but may also inhabit fast flowing water. Individuals reach sexual maturity in 10 to 12 months. A female can produce up to 27,000 eggs per reproductive session and can produce multiple clutches per season in favorable conditions. In its native range, its breeding season can last up to 10 months and in California its breeding season is year round. Adults can live 16 years in the wild and 20 years in captivity (Tinsley et al. 1996).

The African clawed frog is a scavenger and eats living, dead, or dying arthropods and other pieces of organic waste. Adults have a voracious appetite preferentially preying on aquatic insects, but will eat fish, amphibians and have even been reported to eat newly hatched birds (McCoid & Fritts 1980). Tadpoles are exclusively filter feeders. All frog stages are cannibalistic, with tadpoles typically comprising a substantial proportion of the diet (Schoonbee et al. 1992; Avila & Frey 1978).

Invasive Fishes

Several species of both native and non-native fishes have been introduced for various reasons. Green sunfish (*Lepomis cyanellus*), largemouth bass (*Micropterus salmoides*), rainbow trout (*Oncorhynchus mykiss*), black bullhead catfish (*Ameiurus melas*), and brown bullhead catfish (*Ameiurus nebulosus*) have been introduced for sport fishermen and are all found in Lower Piru Creek (Howard, pers. comm.). Additionally, mosquitofish (*Gambusia affinis*), fathead minnow (*Pimephales promels*), prickly sculpin (*Cottus asper*), partially armored threespine stickleback (*Gasterosteus aculeatus microcephalus*), Owens sucker (*Catostomus fumeiventris*), Santa Ana sucker (*Catostomus santaanae*), and arroyo chub (*Gila orcuttii*) have all been identified in persistent pools (United 2004). These are all presumably introduced from the dam during normal releases of water into Lower Piru Creek or intentional releases directly into the creek for controlling mosquito populations and in some cases to re-introduce certain species within their historical range.

Fish are the most widespread alien predator on amphibians and nearly all of the fish species identified within Lower Piru Creek are documented to have negative effects on native species of amphibians; including preying on eggs, larvae, metamorphs and adults (Matthews et al. 2001; Knapp & Matthews 2000; Goodsell & Kats 1999).

Current Distribution of Exotic Species in Treatment Area

Although bullfrog were detected throughout the Study Area, second year larvae were not detected. The general absence of second year bullfrog larvae is attributed to large >400cfs releases from Santa Felicia Dam that are expected to flush individuals to the lower reaches near the confluence of the Santa Clara River (Sandburg 2004). Although African clawed frogs have not been documented within the lower reach of Piru Creek, there remains a potential for the presence of the species. The extent and general nature of subsurface flows between lower Piru Creek and the confluence of the Santa Clara River have been proposed as a potential factor in preventing the expansion of this species distribution into the Study Area (Howard, pers. comm.).

Red swamp crayfish and introduced non-game fish are expected to be present throughout the inundated regions of lower Piru Creek.

Removal/Eradication Protocol

The removal/eradication methodology consists of the four tasks previously discussed:

1. Removal of breeding adult bullfrogs and African clawed frogs will be conducted from mid-March through the end of June, and corresponds roughly to the

USFWS guidelines for focused surveys for arroyo toad. This serves the two-fold purpose of increasing any immediate benefits should arroyo toad be present by removing potential predators and competitors as well as increasing the chance of detecting any arroyo toad in the stream course. Repeated visits to areas of heavy infestation with the goal of removing as many individuals of all three invasive species as possible addresses the greatest predatory threat to native wildlife.

Removal efforts begin one hour to one-half hour prior to local sunset when night temperatures remain greater than 50°F (10°C) and may last as long as individuals are vocalizing and/or seen. In a stream alignment (linear), the site may be divided into manageable sections that can be adequately surveyed (typically 0.5 to 0.75 miles of stream course). Subsequent surveys begin where the previous survey terminated until the entire site has been completed. Initially four such complete surveys are conducted during this period.

The primary methods of removing post-metamorphic bullfrogs and African clawed frogs are a telescoping frog gig (5-pronged fish spear on an aluminum pole that telescopes from 3.5 to 9 feet) and an air rifle (0.22 caliber break-barrel with alloy pellets). Bullfrogs are identified by eye shine and/or visual confirmation using powerful headlamps (500 lux or greater at 2 meters). Additionally, African clawed frogs are captured using large “walk-in” traps utilizing inverted entrance cones, baited with fresh fish and left overnight half-submerged in shallow water (Schramm 1987). Crayfish are captured using cylindrical Jackpot© collapsible traps consisting of 1-inch nylon mesh netting over a metal coil (approximately 10-inch diameter and 18-inch length). These traps are baited with fresh fish, chicken, crayfish and commercial bait depending on efficacy.

2. Typically, egg masses and newly hatched tadpoles of both native and invasive species of amphibians are present in persistent water and may be visible from early May through August depending on the species and conditions. Due to the limited ability of detecting invasive egg masses as well as removing significant numbers of early stage tadpoles, a limited number of eradication visits focused on this task are conducted from early June through the end of July.

This task involves using dip nets and fish seines to remove egg masses and tadpoles. Surveys are conducted during appropriate conditions conducive to locating and identifying the invasive species egg masses and tadpoles.

Appropriate sites for this targeted activity are identified from the previous surveys conducted during the breeding season and therefore don't necessarily involve a complete survey of the entire site.

Moreover, recent modeling suggests that partial removal of bullfrog tadpoles (early in development) may lead to higher tadpole survival and development rates and higher post-metamorphic survival due to decreased competition (Govindarajulu et al. 2005).

Continued crayfish trapping, African clawed frog trapping and removal of adult bullfrogs is conducted during this period.

3. The removal of bullfrog and African clawed frog larvae during metamorphosis in late summer and early fall is reported to be the most effective method of decreasing population growth rates (Govindarajulu et al. 2005). The model utilized in the Govindarajulu et al. (2005) assessed the sensitivity of a given life stage to variable mortality rates and compared the effectiveness of alternate control strategies. Reducing metamorph survival leads to greater declines in population growth rates. This decrease in recruitment coupled with the substantial removal of successful breeding in the spring (Task 1) is the basis of long-term population control of these invasive species at drastically reduced densities.

This task involves using dip nets, fish seines, gigs and air rifles to remove metamorphs and will be conducted following the annual Fall Conservation Release. Surveys are conducted during appropriate conditions conducive to locating and identifying the invasive species metamorphs. Appropriate sites for this targeted activity are identified from the previous surveys and therefore don't necessarily involve a complete survey of the entire site.

Any identified invasive fish species occupying pools in late summer will be also be removed. Continued crayfish trapping, African clawed frog trapping and removal of adult bullfrogs is conducted during this period as well.

Specific dates for each task are dependent on local conditions. Heavy/light rainfall associated with El Niño/La Niña events, discharge events, local temperature regimes, onset of breeding activity, and larval growth rates all affect the timing of each task. Additionally the adaptive management strategy will transition from intensive removal efforts at all life stages to the incorporation of site specific demographic data in constructing a analytical tool to qualitatively assess the outcome of specific control strategies.

Program Monitoring and Evaluation

Task 1 (mid-March through June)

A removal sampling regime will be conducted concurrently with the arroyo toad survey period for estimating the initial population of bullfrog, crayfish and African clawed frog within the Study Area

Data collected will be used to determine:

1. basic demography of population for each invasive species;
2. "initial conditions" or status of each invasive species within Study Area (relative density, relative distribution, "hot spots", habitat utilization, dispersal/introduction corridors, etc.);
3. mapping of existing pools (GPS input to GIS), pool parameters (e.g., max depth, total surface area, vegetative characteristics, dissolved oxygen, pH, temperature, and alkalinity, etc).

Task 2 (early June through end of July)

A removal sampling regime will be conducted for bullfrog and African clawed frog eggs and newly emerged tadpoles in order to estimate the annual reproductive capacity for each species. Continued crayfish trapping during this time period allows further refinement of crayfish population dynamics.

Task 3 (Following the annual Fall Conservation Release)

A removal sampling regime will be conducted for bullfrog and African clawed frog metamorphs. These data will allow refinement of annual growth rates, annual reproductive capacity, and basic demography. Continued crayfish trapping during this time period allows further refinement of crayfish population dynamics.

Invasive fish removal conducted during this time will allow specific characterization of the extent of fish species occurrence, distribution, relative density and diet.

Pools parameters will be re-measured in order to determine seasonal changes in persistence of pools, and pool parameters.

Data collected from the above Tasks will allow between year evaluations for the following:

1. annual population size estimate for bullfrog, African clawed frog and crayfish;
2. changes in basic demography in each species (e.g., age/size-structure shifts, rate of population decline);
3. annual estimates of reproductive output (e.g., numbers of eggs, tadpoles, metamorphs & growth rates for tadpoles);
4. relative frequency, density, and distribution of fish species, age/size-classes of individuals;
5. number and distribution of pools, and pool parameters.

Effectiveness of the Aquatic Exotic Species Management Program after 3 years of implementation will be assessed based on achieving the following goals:

1. elimination/removal to the limits of detection of all post-metamorphic bullfrog and African clawed frog within the Study Area;
2. demonstrable (i.e., statistically significant) decreases in estimated population size and increase in rate of population decline for bullfrog, African clawed frog and crayfish;
3. demonstrable decrease in annual reproductive capacity for bullfrog, African clawed frog and crayfish;

4. elimination/removal to limits of detection of all invasive fishes within the Study Area;

IMPLEMENTATION SCHEDULE

The Plan shall be implemented following review and concurrence from participating agencies shown in Attachment A (Agency Contacts) followed by final review and approval by the Commission.

REPORTING

Following agency approval all associated monitoring results, reports, and evaluations shall be provided to the USFWS, CDFG, United States Forest Service, and the Commission. Specifically, an annual report shall include discussion of the following:

1. Results of focused surveys for arroyo toad, California red-legged frog and southwestern pond turtle;
2. Results of arroyo toad, California red-legged frog and southwestern pond turtle habitat suitability mapping efforts, including comparative analysis;
3. Effectiveness of aquatic exotic species eradication management efforts;
4. Assessment of implementation and effectiveness of the HMP;
5. Recommendations for changes to the HMP; and
6. Updated record of consultation with participating agencies.
7. California Natural Diversity Database forms shall be completed for all sensitive species documented during implementation of the Plan. Forms shall be submitted to the Biogeographic Data Branch, CDFG, 1807 13th Street, Suite 202, Sacramento, California 95811 (also accessible online at <http://www.dfg.ca.gov/biogeodata/cnddb>).

Within 3 months following submittal of the annual report, UWCD will host a meeting to discuss biological monitoring efforts conducted within the project area. All agencies listed in Appendix A will be invited to attend including academicians and appropriate parties studying or interested in the biological resources present within the project area.

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APPENDIX A – Agency Contacts

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