

**RECOVERY ACTION PLAN FOR THE  
SAN FRANCISCO GARTER SNAKE**

**WEST-OF-BAYSHORE PROPERTY,  
SAN FRANCISCO INTERNATIONAL AIRPORT**

**SAN MATEO COUNTY, CALIFORNIA**

**LSA**

April 24, 2008

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## 1.0 INTRODUCTION

### 1.1 PURPOSE AND NEED

Over the past 15 years, several investigators and agencies have reported a decreasing trend in the population of the federally endangered San Francisco garter snake (*Thamnophis sirtalis tetrataenia*; SFGS) on the West-of-Bayshore (WOB) property owned by the San Francisco International Airport (SFO) (Figure 1) (Wharton 1989, Wharton *et. al.* 1989, Larsen 1994, USFWS 2006). One of the primary causes of this decline may be decreased numbers of California red-legged frogs (*Rana draytonii*; CRLF), an important food item for adult SFGS (Larsen 1994). The decline in CRLF has been attributed to a variety of factors, including reduced open-water habitat due to excessive vegetation buildup and sediment deposition in Cupid Row and South Lomita Canals (USFWS 2005a). Although some amount of dense emergent vegetation is important as escape cover for both SFGS and CRLF, areas that are completely covered by cattails (*Typha* sp.) or other emergent vegetation provide limited conditions known to support CRLF breeding habitat (*i.e.*, still or slow-moving pools; open water with some emergent vegetation along margins).

Another likely cause of reduced numbers of CRLF is the limited hydroperiod of the on-site seasonal wetlands. CRLF larvae require approximately four to seven months of ponding (typically March to September) for successful metamorphosis. Based on the results of eight years of sensitive species monitoring on the property, as well as several focused hydrologic studies of seasonal wetlands with potential CRLF breeding conditions, most standing water on the site only persists in localized areas until June, even in years with above-average precipitation. In addition, most of the seasonal wetlands on the WOB property dry out by early to mid-May (LSA obs.).

Wetland and adjacent upland habitat for both SFGS and CRLF near the canals is also periodically disturbed due to as-needed flood control maintenance activities. Although these activities incorporate strict measures to minimize take of SFGS, some individuals could potentially be injured or killed due to the frequency of maintenance (*i.e.*, every 5 to 10 years). Establishment of more permanent open-water conditions necessary for successful amphibian breeding in both canals should have an indirect benefit of reducing the frequency of flood control maintenance work and associated disturbance to SFGS and their habitat.

Given the above information, this Recovery Action Plan (Plan) aims to increase the population of SFGS at WOB by creating habitat conditions that will result in increased numbers of its primary prey species, CRLF and Pacific treefrogs (*Pseudacris regilla*). Enhancing CRLF habitat within an area known to support SFGS may contribute to the recovery of both listed species (USFWS 2003). Specifically, the primary habitat goals of the Plan are to: (1) expand open-water aquatic habitat for CRLF and Pacific treefrog breeding along the two canals; (2) deepen existing shallow seasonal wetlands throughout the property to create additional open-water habitat; and (3) enhance upland habitat for SFGS through the removal of non-native plants and by creating suitable debris mounds for upland cover. In addition, the overall habitat enhancements throughout the WOB property will compensate for the short-term, localized construction impacts associated with implementation of specific Plan activities.

Figure 1: Project Site Location

## 1.2 RELEVANCE TO EXISTING RECOVERY PLANS

The Plan will contribute to recovery actions identified by the U.S. Fish and Wildlife Service (USFWS) in their formal recovery plans for SFGS (USFWS 1985) and CRLF (USFWS 2002). Those actions relevant to the WOB property, followed by a brief explanation of how the Plan will address each action, are listed below.

### 1.2.1 San Francisco Garter Snake

The following recovery actions (in italics) are taken from the “Step-down Outline” on pp. 21–25 of the 1985 SFGS recovery plan (USFWS 1985):

*241. Secure cooperation with the City of San Francisco and San Francisco Airport to manage and protect the SFGS at the Millbrae site.*

The Plan represents a cooperative effort between the USFWS, SFO, and CDFG to ensure the long-term management and protection of SFGS on the WOB property (*i.e.*, “Millbrae site”). The Plan will also form the basis of a cooperative partnership between SFO and the San Bruno Creek Flood Control Zone (SBCFCZ) of the San Mateo County Flood Control District, which is responsible for maintaining the flood storage capacity of Cupid Row Canal. Section 1.3 below presents further details on the collaborative nature of this planning effort.

*242. Develop and implement a management plan for the SFGS at the San Francisco Airport/Millbrae site.*

The Plan is essentially a 10-year management plan for SFGS on the WOB property. The proposed habitat enhancements constitute management actions that are intended to increase habitat suitability for SFGS and its primary prey species (CRLF). Further management actions in Phases 2 and 3 of the Plan will be developed based on the monitoring results of the Phase 1 habitat enhancement activities. Additional information on the development of Phase 2 and 3 actions are provided below in Section 2.5.

*243. Prevent illegal entry.*

*2431. Maintain the fence*

*2432. Provide frequent patrols.*

SFO has been actively maintaining the perimeter fence around the WOB property since the late 1990’s. During this time, SFO has repaired broken portions of the fence, added “Environmentally Sensitive Area” signs at all access points and gates throughout the property, and provided regular patrols of the fence and access points.

*244. Monitor the SFGS at the Millbrae site.*

The Plan includes three intensive trapping efforts (baseline, Year 5, and Year 10) that will track SFGS population size over the 10-year period in which habitat enhancement activities will occur. Information from these studies will assist in determining whether such activities are resulting in increased SFGS abundance. As described in Section 5.4.1 below, the Plan also includes short-term

monitoring of SFGS at the major habitat enhancement areas in the interim years between intensive trapping efforts.

*245. Minimize degradation and/or loss of SFGS habitat.*

The Plan represents an inherent minimization of SFGS habitat degradation and/or loss since its primary goal is to increase habitat quality for SFGS at the WOB property.

*246. Identify areas at the Millbrae site that are important for the maintenance of the garter snake.*

Two studies conducted since the 1985 Recovery Plan (Wharton 1989, Larsen 1994) have already identified specific areas within the property known to support SFGS. In addition, eight years of qualitative monitoring for the RMP have revealed the importance of South Lomita Canal for CRLF breeding, as well as habitat conditions along Cupid Row Canal that do not appear to support large numbers of CRLF and SFGS. In 2007, a baseline trapping survey for SFGS conducted as part of the Plan (see Section 5.4.1.1 below) revealed additional areas that support high numbers of SFGS. Further monitoring efforts conducted as part of the Plan (*i.e.*, Year 5 and 10 trapping surveys) will assist in corroborating these previous findings and identifying potential new areas where SFGS are abundant.

## **1.2.2 California Red-legged Frog**

The Plan will contribute to the following CRLF recovery guidelines and tasks as outlined in USFWS (2002):

*Guideline 1a. Encourage and assist counties and owners of large tracts of natural lands to develop preserves, conservation banks, and/or mitigation banks.*

As a “large tract of natural lands,” the WOB property essentially serves as a preserve for CRLF and other native wildlife species. The Plan represents SFO’s continued commitment to managing the property for the benefit of SFGS, CRLF, and other native species.

*Guideline 4f. Remove arundo, tamarisk, cape ivy, and other non-native plant species if they are threatening habitat suitability.*

This guideline will be addressed through the removal of iceplant (*Carpobrotus* sp.) and pampas grass (*Cortaderia jubata*) throughout the WOB property, as described below in Section 2.3.2.

*Task 5.0. Work with county planners and local water districts to minimize the effects of urban and suburban development and associated activities by developing regional plans and/or habitat conservation plans.*

The Plan will form the basis of a cooperative partnership between SFO and the SBCFCZ of the San Mateo County Flood Control District, which is responsible for maintaining the flood storage capacity of Cupid Row Canal. Section 1.3 below presents further details on the collaborative nature of this planning effort.

*Task 7.0. Develop and implement guidelines for improving water quality within the range of the California red-legged frog.*

The collection of salinity data as part of the Plan's monitoring program (see Section 5.7 below) will help ensure that water quality on the WOB property is maintained at appropriate conditions known to support CRLF.

*Task 11.3. Monitor known California red-legged frog populations.*

As described below in Section 5.4.2, the Plan includes a monitoring plan for the CRLF population as a continuation of eight years of CRLF monitoring efforts by SFO on the WOB property since 1998.

*Task 13.0. Assess effects of various conservation efforts on co-occurring, native species.*

The monitoring of Pacific treefrogs (see Section 5.4.3 below) will assist in determining what effect, if any, the proposed habitat enhancement activities have on native species known to co-occur with CRLF at the WOB property.

## **1.3 PARTICIPATING ORGANIZATIONS**

This Plan is a continuation of SFO's commitment to manage and protect SFGS and represents a major step forward in the long-term protection and recovery of the species on the WOB property. The Plan also demonstrates SFO's desire to create and maintain a cooperative partnership with the USFWS and California Department of Fish and Game (CDFG) in the recovery of the WOB SFGS population. In addition, the plan will form the basis of a cooperative partnership between the SBCFCZ of the San Mateo County Flood Control District and SFO. This partnership will enable SFO to coordinate activities implemented by the SBCFCZ for their Cupid Row Canal flood control maintenance responsibilities, which will also streamline future regulatory review associated with flood control issues on the WOB property. In addition, SFO and SBCFCZ will also work proactively with jurisdictions upstream of the canal to identify sources of sediment accompanying stormwater runoff.

## **1.4 REGULATORY CONTEXT**

### **1.4.1 U.S. Fish and Wildlife Service**

The USFWS has jurisdiction over federally listed threatened and endangered plant and animal species. The federal Endangered Species Act (ESA) protects listed species from harm or "take," broadly defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Any activity can be defined as a "take" even if it is unintentional or accidental. Listed plant species are typically provided less protection than listed animals.

An endangered species is one that is considered in danger of becoming extinct throughout all or a significant portion of its range. A threatened species is one that is likely to become endangered in the foreseeable future. Any activity that could result in the take of a federally listed species requires an ESA Section 10 take permit from USFWS, or an ESA Section 7 consultation with USFWS in conjunction with a federal permit process. Section 7 of the ESA requires other federal agencies

involved in permitting projects that may result in take of federally listed species (*e.g.*, U.S. Army Corps of Engineers) to consult with USFWS prior to allowing any activities that may result in take.

#### **1.4.2 California Department of Fish and Game**

The CDFG has jurisdiction over State-listed endangered, threatened, and rare plant and animal species under the California Endangered Species Act (CESA). In addition, species proposed for listing under CESA are protected by its provisions. CDFG is also responsible for enforcing the California Fish and Game Code, which contains several provisions potentially relevant to construction projects. For example, Section 1602 of the Fish and Game Code governs the issuance of Lake and Streambed Alteration Agreements by CDFG. Lake or Streambed Alteration Agreements are required whenever project activities substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake designated as such by CDFG.

The Fish and Game Code also lists animal species designated as Fully Protected or Protected, which may not be taken or possessed without a permit from the Fish and Game Commission and/or CDFG. These take permits do not allow “incidental take” except for necessary scientific research, including efforts to recover Fully Protected, threatened or endangered species and are more restrictive than the take allowed under Section 2081 of the CESA. Fully Protected species are listed in Sections 3511 (birds), 4700 (mammals), 5050 (reptiles and amphibians), and 5515 (fish) of the Fish and Game Code, while Protected amphibians and reptiles are listed in Chapter 5, Sections 41 and 42.

#### **1.4.3 U.S. Army Corps of Engineers**

The U.S. Army Corps of Engineers (Corps) is responsible under Section 404 of the Clean Water Act to regulate the discharge of fill material into waters of the United States. Waters of the U.S. and their lateral limit are defined in 33 CFR Part 328.3(a) and include streams that are tributaries to navigable waters and their adjacent wetlands. The lateral limits of jurisdiction for a non-tidal stream are measured at the line of the Ordinary High Water Mark (33 CFR Part 328.3[e]) or the limit of adjacent wetlands (33 CFR Part 328.3[b]). Any permanent extension of the limits of an existing water of the U.S., whether natural or man-made, results in a similar extension of Corps jurisdiction (33 CFR Part 328.5).

#### **1.4.4 San Francisco Bay Regional Water Quality Control Board**

All Corps permits require water quality certification under Section 401 of the Clean Water Act. In the Bay Area, this regulatory program is administered by the San Francisco Bay Regional Water Quality Control Board (RWQCB). Project proponents who propose to fill wetlands or other waters of the U.S. must apply for water quality certification from RWQCB. RWQCB has adopted a policy requiring mitigation for any loss of wetland, streambed, or other jurisdictional area.

RWQCB is also authorized under the Porter-Cologne Water Quality Control Act to regulate the discharge of waste that could affect the quality of the State’s waters. RWQCB asserts jurisdiction over isolated waters and wetlands, as well as waters and wetlands that are regulated by the Corps. Therefore, even if a project does not require a federal permit, it still requires review and approval by

RWQCB. When reviewing applications, RWQCB focuses on ensuring that projects do not adversely affect the “beneficial uses” associated with waters of the State. In most cases, RWQCB seeks to protect these beneficial uses by requiring the integration of waste discharge requirements into projects that will require discharge into waters of the State. For most construction projects, RWQCB requires the use of construction and post-construction Best Management Practices (BMPs).

## 1.5 SITE DESCRIPTION

### 1.5.1 Land Use History

The WOB property was within the original San Francisco Bay tidelands and historically consisted of tidal salt marsh. Records indicate that the historic shoreline of San Francisco Bay in the vicinity of SFO was located near the current alignment of the Caltrain tracks at the western edge of the site. When the Old Bayshore Highway (now South Airport Boulevard) was constructed in the 1940’s, the roadway was built on a rubble berm through the historic tidal marsh, separating the WOB parcel from the tidal waters of the Bay. Later construction of US 101, I-380, and San Bruno Avenue, along with the installation of tide gates on the drainage canals, have fully eliminated tidal influence. In addition, SFO and Caltrans have historically placed fill on portions of the site between the 1920’s and 1960’s. During that period, portions of the site were also used for cattle grazing. With the exception of the recent construction of the BART extension, the site has remained in essentially its present condition since 1970.

### 1.5.2 Topography and Hydrology

Overall, the site is relatively level, ranging in elevation from approximately -9.0 feet (NGVD) in the lowest portions of South Lomita Canal at its south end, to approximately 10.0 feet in the north-central portion of the site. The site is underlain by Bay mud which is encountered anywhere from approximately 2.5 feet to greater than 6.0 feet in depth from the ground surface.

The WOB property consists of a mosaic of seasonally inundated wetlands interspersed with upland areas. In addition, several drainage canals have been constructed on the site. The site receives water from three sources: direct precipitation, runoff from adjacent residential areas in Millbrae and San Bruno, and some runoff from the watershed that lies between these urban areas and the Crystal Springs area to the west.

The seasonal wetland habitat consists of numerous natural and constructed depressions throughout the property that typically hold water for an extended period of time (*i.e.*, 3 to 6 months). Overall, the duration of surface ponding is variable; however, in most years ponding extends to mid-May. In dry years, surface water will dry up as early as the end of March. In contrast, surface ponding in a wet year will persist until mid-July. Based on hydrology monitoring (via groundwater/staff gauge monitoring locations at seasonal wetlands scattered throughout the WOB property) conducted over the past several years as part of SFO’s Resource Management Plan (RMP) (LSA 1998) and Adaptive Management Plan (AMP) (LSA 1999, 2001), there appears to be a strong correlation between on-site hydrology and local groundwater table levels.

Stream habitat on the WOB property is represented by two constructed drainage canals, Cupid Row Canal and South Lomita Canal. Cupid Row Canal enters the property off the end of First Street near

the San Bruno Community Gardens and 4-H Club, crosses the property in an easterly direction and then bends north, extending along the eastern property boundary parallel to US 101. The canal exits the property via a box culvert under San Bruno Avenue. At San Bruno Avenue, Cupid Row Canal becomes North Channel, which flows in a northeasterly direction from San Bruno Avenue under US 101 and enters San Francisco Bay adjacent to North Access Road. A tide gate constructed in 1948 (owned by SFO and maintained by SBCFCZ) located near the United Airlines Maintenance and Operations Center limits saltwater intrusion into North Channel/Cupid Row Canal drainage system.

South Lomita Canal, which drains the southern portion of the property, enters the eastern side of the parcel in the vicinity of the Lomita Park neighborhood in the City of Millbrae and then extends southward parallel to the Caltrain tracks. Just north of Madrone Street, South Lomita Canal bends east and flows across the property to its eastern edge. At the point where it meets the eastern boundary, the canal bends to the south, paralleling US 101 and ultimately entering the Millbrae Pump Station. Due to grade differentials, water must be pumped from South Lomita Canal into the Millbrae High-Line Canal. This canal flows easterly, draining into San Francisco Bay just north of the Millbrae Avenue-Old Bayshore Highway intersection.

Because both South Lomita and Cupid Row Canals are artificial channels with shallow gradients that receive urban runoff, they are subject to sedimentation and the growth of dense emergent vegetation (*i.e.*, cattails). The flat gradients prevent scouring velocities in both canals. Without human intervention, both canals become completely choked with sediment and emergent vegetation, resulting in substantial impairment of their flood control function.

Portions of the WOB property are within the 100-year floodplain as defined by the Federal Emergency Management Act. Some of the developed upstream areas are also within the 100-year floodplain, and the extent of upstream flooding is affected by the downstream drainage capacity of South Lomita and Cupid Row Canals. Until the early 1980's, SFO and San Mateo County regularly dredged both canals to keep them clear for drainage purposes. Because most of the water in the canals originates from the urban drainage system in Millbrae and San Bruno, they can be expected to contain typical urban pollutants.

### 1.5.3 Vegetation

The WOB property supports the following plant communities: annual grassland, upland ornamental, seasonal wetland, willow riparian, and freshwater marsh. In general, the higher elevations on the site typically support annual grassland while lower elevations are dominated by seasonal wetlands.

**Annual Grassland.** Annual grassland is dominated by non-native grasses and ruderal species, such as Italian ryegrass (*Lolium multiflorum*), velvet grass (*Holcus lanatus*), and Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*). Other grasses and forbs present include annual fescue (*Vulpia bromoides*), wild oats (*Avena fatua*), ripgut brome (*Bromus diandrus*), wild radish (*Raphanus sativa*), mustard (*Brassica* sp.), prickly lettuce (*Lactuca serriola*), vetch (*Vicia benghalensis*), bristly ox-tongue (*Picris echioides*), Italian thistle (*Carduus pycnocephalus*), and yellow starthistle (*Centaurea solstitialis*).

**Upland Ornamental.** This community is dominated by a mix of non-native trees and shrubs, including eucalyptus (*Eucalyptus* sp.), acacia (*Acacia* sp.), myoporum (*Myoporum laetum*), and

pyracantha (*Pyracantha* sp.). These species were likely planted as landscaping buffers at various locations along the site boundary in the past (US 101 right-of-way, neighborhoods in the City of Millbrae and City of San Bruno, *etc.*) and in many areas, these species have naturally colonized the site. This community is present in scattered locations throughout the property, including the US 101 right-of-way (along the eastern site boundary) and in the vicinity of Station MA. Two significant eucalyptus stands occur along the western boundary in the vicinity of the Caltrain tracks and along the east-west reach of Cupid Row Canal. Individual eucalyptus trees are also scattered throughout the property.

**Seasonal Wetland.** Depending on their ponding duration, the seasonal wetlands are dominated by a mix of spike rush (*Eleocharis macrostachya*), smartweed (*Polygonum lapathifolium*), cocklebur (*Xanthium strumarium*), fathen (*Atriplex triangularis*), brass buttons (*Cotula coronopifolia*), bird's-foot trefoil (*Lotus corniculatus*), and cattail. In some areas, the seasonal wetlands are dominated by a variety of hydrophytic grasses including rabbit's-foot grass (*Lolium multiflorum*), Italian ryegrass, Mediterranean barley, and velvet grass.

**Freshwater Marsh.** With the exception of several small areas on the site, this community is found primarily in South Lomita and Cupid Row canals. Vegetation is generally dense and consists primarily of cattail. This community is found in areas of permanent or semi-permanent water that remain inundated or saturated into the summer months. Other common species present include brass buttons and willow (*Salix* sp.). The canal banks primarily support a mix of ruderal and annual grassland vegetation, as well as small areas of creeping wildrye (*Leymus triticoides*), a native grass species.

**Willow Riparian.** This community consists of dense stands of arroyo willow (*Salix lasiolepis*) that typically occur in or near seasonal wetlands and freshwater marsh habitats where surface and/or ground water is readily available. The largest areas of willow riparian habitat occur along the central and upstream portions of South Lomita Canal, the upstream end of Cupid Row Canal, and in the seasonal wetlands east of the 4-H Club and San Bruno Community Gardens.

#### 1.5.4 Wildlife

Upland habitats on the WOB property, including annual grassland, upland ornamental, and eucalyptus trees, support many generalist wildlife species that have adapted to human-modified landscapes. Species known to occur in upland habitats on the site include the following: northern American racer (*Coluber constrictor*), gophersnake (*Pituophis melanoleucus*), California slender salamander (*Batrachoseps attenuatus*), western fence lizard (*Sceloporus occidentalis*), southern alligator lizard (*Elgaria multicarinata*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), killdeer (*Charadrius vociferus*), rock pigeon (*Columba livia*), mourning dove (*Zenaidura macroura*), American crow (*Corvus brachyrhynchos*), barn swallow (*Hirundo rustica*), European starling (*Sturnus vulgaris*), northern mockingbird (*Mimus polyglottis*), savannah sparrow (*Passerculus sandwichensis*), white-crowned sparrow (*Zonotrichia leucophrys*), Brewer's blackbird (*Euphagus cyanocephalus*), western meadowlark (*Sturnella neglecta*), house finch (*Carpodacus mexicanus*), house sparrow (*Passer domesticus*), black-tailed jackrabbit (*Lepus californicus*), and Botta's pocket gopher (*Thomomys bottae*). Domestic cats (*Felis catus*) have been observed on several occasions at various locations throughout the property.

Species known or expected to use the various wetland areas include the following: Pacific treefrog, western toad (*Bufo boreas*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), American wigeon (*Anas americana*), American coot (*Fulica americana*), great egret (*Ardea alba*), great blue heron (*Ardea herodias*), Wilson's snipe (*Gallinago delicata*), black phoebe (*Sayornis nigricans*), song sparrow (*Melospiza melodia*), and red-winged blackbird (*Agelaius phoeniceus*). Fish species known to occur in the canals include three-spine stickleback (*Gasterosteus aculeatus*), rainwater killifish (*Lucania parva*), and mosquito fish (*Gambusia affinis*).

## 1.6 SPECIES ACCOUNTS

### 1.6.1 San Francisco Garter Snake

**1.6.1.1 Distribution and Description.** SFGS was listed as a federally endangered species in March 1967 and subsequently State-listed as endangered in 1971. This snake is endemic to the San Francisco Peninsula as is known to occur in approximately 30 locations ranging from northern San Mateo County south along the east slope of the Santa Cruz Mountains and west to Point Año Nuevo. SFGS have a burnt-orange head, green to blue belly, a wide greenish-yellow stripe on the back edged with black, and unbroken red stripes on either side bordered with black (Stebbins 2003). Adult SFGS range in size from 46 to 132 centimeters (18–52 inches) long.

**1.6.1.2 Habitat.** SFGS are most commonly associated with emergent vegetation along the borders of marshes, ponds, and lakes. The area between aquatic sites (*i.e.*, stream or pond) and grasslands or bank sides is used for basking, while nearby dense vegetation or water often provide escape cover. Rodent burrows are an important component of upland habitat as they provide hibernation sites and escape cover.

**1.6.1.3 Breeding and Foraging Behavior.** Breeding occurs in spring or fall but typically after SFGS emerge from winter dens in spring. Gestation occurs in early summer with birth of the young typically occurring between July and August. SFGS forage in and along the banks of water bodies with emergent vegetation. The preferred prey of adult SFGS are frogs (*i.e.*, juvenile CRLF, treefrogs, toads, and their tadpoles), but they also take fish, salamanders, and earthworms. Juvenile snakes require small prey and primarily consume amphibians and fish (*e.g.*, juvenile treefrogs, CRLF tadpoles, slender salamanders, and newts) (Larsen 1994).

**1.6.1.4 Life History.** Females can bear 3–85 live young, but usually average between 12 and 24. Young are born in secluded sites, such as beneath logs and in dense bank vegetation. SFGS are active throughout most of the year, except during periods of cold weather. In summer, SFGS are most active during morning and late afternoon. During inactive periods, SFGS retreat underground using rodent burrows, cracks, or other features for cover.

### 1.6.2 California Red-legged Frog

**1.6.2.1 Distribution and Description.** CRLF was listed as a federally listed species on June 23, 1996. Currently, CRLF occur in the central Coast Range of California, from Marin County on the coast and southwestern Lake County in the interior to central Santa Barbara County, at elevations below 5,000 feet. Isolated occurrences are also known in Los Angeles, Riverside, Yuba, El Dorado,

Nevada, and Tehama Counties. Historically, the species ranged throughout the Central Valley and Sierra Nevada foothills from Shasta County to Kern County, but has now been virtually eliminated from these areas. The species is also believed to be extirpated from the southern Transverse and Peninsular Ranges, but it is still present in Baja California, Mexico (Stebbins 2003).

CRLF is the largest frog native to California and can be identified by skin coloration and form. Males range from 78 to 116 millimeters (3.1 to 4.6 inches) in body length, while females are larger and range from 87 to 138 millimeters (3.4 to 5.4 inches) (Hayes and Miyamoto 1984). The dorsal side is brown or reddish brown to dark brown with dark brown to black spots. Some frogs lack red pigment almost entirely, but red is usually present on the undersurface of the lower belly, thighs, legs, and feet. A key diagnostic feature of CRLF throughout its range is the presence of dorsolateral skin folds that run along the back from the eye to the posterior end. CRLF become sexually mature at the age of 2–4 years and may live a decade or more.

**1.6.2.2 Habitat.** CRLF typically occur in and along freshwater marshes, drainages, ponds, and other semi-permanent water sources. Intermittent drainages also provide suitable habitat, as long as some surface water exists. Shorelines with extensive emergent vegetation, undercut banks, and semi-submerged rootballs provide concealment from predators. Habitats with the highest densities of CRLF contain dense emergent or shoreline riparian vegetation closely associated with deep (greater than 2.3 feet), still, or slow-moving water (Jennings and Hayes 1994). The types of riparian vegetation that appear to be the most suitable for CRLF are willows, cattails, and bulrushes (Jennings and Hayes 1994). Breeding areas are usually large ponds or pools that contain water through late summer (September) and wetland plants such as tules or cattails for concealment and attachment of eggs.

**1.6.2.3 Breeding and Foraging Behavior.** Adult CRLF are primarily aquatic, although adjacent upland habitats are also important since they are used by adult and juvenile CRLF while dispersing to other aquatic habitats, escaping high water during flood events, and estivating. Like most frog species, CRLF are opportunistic feeders and will eat nearly any animal prey that can be swallowed. Prey items vary by location and season but typically include invertebrates (*e.g.*, beetles, water striders, spiders, sowbugs, and snails) and occasional vertebrates such as treefrogs.

**1.6.2.4 Life History.** CRLF breed from late November through April (Hayes and Jennings 1986). The specific environmental cues that trigger breeding are not entirely known, although local precipitation and ambient temperature are likely important. The start of breeding can fluctuate by year and location. Breeding and egg mass deposition typically occur within a 2- to 4-week period. Eggs are laid in a loose, gelatinous mass on the water surface and attached to emergent vegetation. Each egg mass may contain several hundred to 6,000 eggs. Embryos probably have a temperature tolerance maximum of 21 degrees Celsius (70 degrees Fahrenheit) (Nussbaum *et al.* 1983). This intolerance of high temperatures is an important contributing factor to the CRLF's early breeding season. CRLF also have low tolerance for salinity, which may be a substantial source of mortality in coastal populations that occur in habitats subject to tidal influence. The maximum salinity tolerance of adult CRLF is approximately 9 parts-per-thousand (ppt), with embryos becoming deformed or dying at concentrations greater than 4 ppt (Jennings and Hayes 1990).

CRLF tadpoles metamorphose within 3–5 months, usually from July through September. This developmental attribute is an important adaptation to California's Mediterranean climate, where

seasonal water bodies hydrate in the winter and dry out by late summer or early fall. Following metamorphosis, juvenile CRLF are semi-terrestrial and often bask in the sun along channel banks or in shallow water near emergent vegetation.

## 2.0 DESCRIPTION OF PROPOSED ACTIONS

The Plan will be based on a phased approach for implementing habitat enhancement activities, consistent with an adaptive management strategy. Phase 1, which will encompass the first three years of the Plan, will implement habitat enhancement activities on portions of the canals and other aquatic habitats that have been closely studied since 1999, and will focus on expanding and maintaining open-water conditions in these areas. This approach is based on the assumption that more open-water areas will create additional breeding opportunities for CRLF, Pacific treefrogs, and other amphibian prey sources for SFGS. Previous CRLF tadpole trapping efforts along South Lomita Canal (LSA 2006), as well as qualitative observations by LSA biologists, have documented higher tadpole abundance in portions of the canal with deep pools that are exposed to sunlight (*e.g.*, in the vicinity of Station MA), which provide an ideal thermal environment for tadpole development. SFGS at WOB are known to lie on the water surface of such pools and capture tadpoles as they rise to the surface (Wharton 1989). Therefore, the creation of additional open water will also directly benefit SFGS by increasing the amount of suitable foraging habitat, as well as long-term benefits of increased prey numbers. Phase 1 will also involve other enhancement actions throughout the WOB property to benefit SFGS and CRLF, such as removal of invasive plant species, fuel abatement, deepening/enhancement of existing seasonal wetland and aquatic habitats, access road restoration, and monitoring water quality (*e.g.*, salinity) in the canals and on-site wetlands.

Phase 2 (Years 4–6) and Phase 3 (Years 7–10) habitat enhancements will be determined based on the results of monitoring and data collection following the implementation of Phase 1, in conjunction with input from the agencies. At the end of each phase, an interim report summarizing the monitoring results to date, acres of SFGS and CRLF habitat temporarily impacted by the enhancement activities, and proposed habitat enhancement measures for the next phase will be submitted to the regulatory agencies for review and approval. Under the adaptive management program, habitat enhancements for future phases will be based, in part, on successful strategies that were implemented during the prior phases of the Plan. Therefore, Phases 2 and 3 habitat enhancement activities could potentially consist of implementing other channel widening/channel opening projects, additional seasonal wetland deepening, or other enhancement actions. Details of the proposed Phase 1 habitat enhancements and further information regarding the development of Phase 2 and 3 enhancements are presented below.

### 2.1 PHASE 1 SOUTH LOMITA CANAL ENHANCEMENTS

#### 2.1.1 Channel Openings

The first component of the proposed habitat enhancements will involve the creation of four channel opening areas (ranging in size from 50 to 100 feet long by 25 to 35 feet wide) at locations along the reach of South Lomita Canal between Station MA and the Millbrae Pump Station (Figures 2 and 3). These openings are designed to provide additional aquatic breeding habitat for CRLF and other amphibians, as well as foraging habitat for SFGS. An approximately 5-foot-wide band of vegetation (*i.e.*, cattails) will be allowed to grow around the margins of these openings as escape cover and to

Figure 2: South Lomita Canal

Figure 3: Proposed South Lomita Canal Enhancements Conceptual Location of Channel Openings

provide egg mass attachment sites. Several strategies (*e.g.*, soft armoring, excavating to a sufficient depth to prevent rooting) will be employed to discourage the growth of cattails across the entire opening (Figure 4). Information on successful strategies implemented in Phase 1 to control the growth of cattails from the edge of the canal into the channel openings will be incorporated into future enhancement programs to be implemented during Phases 2 and 3. Minor adjustments to the specific locations of the four channel opening areas along South Lomita Canal may be necessary based on final engineering design considerations. Final design/engineering plans will be developed during the Summer of 2008 and will be forwarded to the agencies for their review and input prior to implementation in the Fall of 2008.

The overall water level in South Lomita Canal is controlled, in part, by reaching elevations that are high enough to start the Millbrae pump station at the downstream end of the canal. Therefore, during the rainy season, it is anticipated that sufficient water will be available to flood and maintain the expanded aquatic breeding habitat in the channel opening areas.

A detailed hydrological and sediment load study of South Lomita Canal has been conducted (see Appendix A), which concluded that sediment input into the South Lomita Canal system is minimal compared to that of Cupid Row Canal. In addition, the study concluded that concrete-lined apron near Landing Lane (located immediately west of the BART/Caltrain tracks as shown on Figure 2) and the constructed wet pond (located immediately east of the BART corridor at the upstream end of South Lomita Canal) are effective in removing some of the in-stream sediment load, which further reduces overall sediment input into the South Lomita Canal system. Therefore, the channel opening areas should remain as open-water habitat and are not expected to fill up with sediment.

### **2.1.2 Channel Widening**

In South Lomita Canal, one of the major constraints to maintaining open-water habitat is the historical accumulation of sediment and vegetation at the concrete bend due to restrictions in water flow and associated sediment deposition patterns. Consequently, the second component of habitat improvement work will be to widen and re-align the concrete bend to create additional open-water habitat for CRLF and other amphibians (Figures 5 and 6). A small segment of the existing concrete wall (approximately 40 feet long) at the northeast corner of the bend will be removed to allow for a smoother hydraulic transition and facilitate the establishment of the additional aquatic habitat (Figure 6). The new segment of canal at the location of the former concrete wall will be constructed with gradual 5:1 (horizontal:vertical) side slopes. Minor adjustments to the specific construction limits of the concrete bend realignment and canal widening work may be necessary based on final engineering design considerations. Final design/engineering plans will be developed during the Summer of 2008 and will be forwarded to the agencies for their review and input prior to implementation in the Fall of 2008.

## **2.2 PHASE 1 CUPID ROW CANAL ENHANCEMENTS**

### **2.2.1 Sediment Trap**

In Cupid Row Canal, one of the major constraints to maintaining suitable aquatic habitat conditions is the accumulation of sediment (especially in the upstream end of the canal) and growth of in-stream vegetation (*i.e.*, cattails and willows). Therefore, a sediment trap will be installed at the upstream end

Figure 4: Proposed South Lomita Canal Channel Openings Conceptual Cross-Section A

Figure 5: Proposed South Lomita Canal Enhancements Conceptual Channel Widening Area

Figure 6: Proposed South Lomita Canal Channel Widening Area Conceptual Cross-Section A

of the canal (Figure 7). The sediment trap will involve modifying the existing concrete apron and adding a 60-foot concrete extension on the downstream side of the apron. The purpose of the sediment trap will be to immediately capture sediment from storm flows entering the canal at its inflow point, resulting in decreased sediment deposition along its entire length. The design of the sediment trap is shown on Figure 8 and is reviewed in the detailed study of the hydrology and sediment load conditions in Cupid Row Canal (see Appendix B). SFO is currently revising the sediment trap design to incorporate the specific recommendations for modifying the sediment trap design as discussed in the hydrology and sediment load study in Appendix B. Annual maintenance of the sediment trap is described below in Section 6.1.

### **2.2.2 Canal Widening**

Compared to South Lomita Canal, the amount of open-water habitat in Cupid Row Canal is especially limited due to excessive vegetation and sediment build-up. Therefore, the primary habitat improvement for this area will be the widening of the east-west (upstream) segment of the canal (Figure 9) by excavating portions of the southern bank to create additional aquatic habitat that is suitable for amphibian breeding (Figure 10). The newly excavated portion of the channel will provide substrate for a band of cattail growth along the bank, which will function as escape cover for CRLF and SFGS while increasing the amount of open-water habitat. Currently, cattail growth within the east-west segment is limited to reaches of the canal that receive sufficient sunlight. Several portions of the east-west segment are characterized by dense willows that inhibit extensive cattail growth. The aim of habitat enhancement work in this area is to maximize habitat diversity for SFGS and CRLF by maintaining some of these existing willow-dominated stretches (primarily open-water habitat) while opening up others (mix of open water and emergent vegetation [cattails]). Minor adjustments to the specific construction limits of the canal widening work may be necessary based on final engineering design considerations. Final design/engineering plans will be developed during the Summer of 2008 and will be forwarded to the agencies for their review and input prior to implementation in the Fall of 2008.

The establishment of additional aquatic habitat in Cupid Row Canal is somewhat constrained by reduced water availability when compared to South Lomita Canal due to a comparatively smaller supporting watershed. In addition, Cupid Row Canal drains slowly to the Bay due to the relatively flat gradient in sections of the canal, as opposed to South Lomita Canal which drains only when high water levels trigger the start of the Millbrae pump station at the downstream end. As such, the increase in amphibian numbers at Cupid Row Canal may not be as pronounced as that expected in South Lomita Canal due to the overall limited availability of water and variable flow conditions during storm events.

## **2.3 WETLAND DEEPENING/ENHANCEMENT**

Between 1999 and the present, SFO has been collecting and analyzing baseline data on existing seasonal wetlands in the southern portion of the WOB property as part of the AMP (LSA 1999, 2001), which was partial mitigation for wetland impacts associated with SFO's 1999 Consolidated Wetland Fill Project. This data gathering effort included topographic surveys of the existing wetlands and uplands, hydrological monitoring of the wetlands via seven ground water/ponding level monitoring stations, installation of weir structures at each wetland to assist in understanding how

Figure 7: Cupid Row Canal

Figure 8: Proposed Cupid Row Canal Sediment Trap

Figure 9: Proposed Cupid Row Canal Enhancements

Figure 10: Proposed Cupid Row Canal Enhancement Conceptual Cross-Section A

Chen Consultants to evaluate four different strategies to increase ponding duration in the seasonal wetlands (“base case,” wetland impoundment, wetland deepening, combination of impoundment and deepening). Of the four alternatives analyzed, wetland deepening yielded the greatest increase in ponding duration (LSA 2001). On average, wetland deepening resulted in an approximate two-month (66 days) extension of ponding beyond the natural conditions simulated in the “base case” alternative. In theory, wetland deepening increases the length of ponding duration by intercepting and exposing the local groundwater table as surface water levels recedes below the existing pond bottoms during the dry season.

### **2.3.1 7th Avenue Ditch Enhancement**

As discussed above, breeding opportunities for CRLF on the WOB property are currently limited due, in part, to the short hydroperiods of existing seasonal wetlands, particularly in the northern and southern portions of the property. To increase the amount of aquatic breeding habitat in the northern portion of the site, the Plan proposes to enhance existing aquatic habitat at the 7<sup>th</sup> Avenue Ditch as part of Phase 1. The proposed enhancement work involves expanding and deepening the ditch in two separate locations, each approximately 0.16 acre in size, at the upstream end (Figure 11). The ditch will be widened at each location by removing the eastern bank and grading the adjacent upland areas down to an elevation of -1.0 foot (NGVD), which is approximately 2 feet below the current bottom elevation of the ditch. This target elevation was selected to maximize the hydroperiod of the widened location and is based on the bottom elevation of the adjacent PG&E pond that supports breeding CRLF; the PG&E pond will not be disturbed by the 7<sup>th</sup> Avenue Ditch enhancement work. The enhanced portions of the ditch are expected to become naturally colonized by associations of facultative-wet and obligate hydrophytic species. Final design/engineering plans will be developed during the Summer of 2008 and will be forwarded to the agencies for their review and input prior to implementation in the Fall of 2008.

### **2.3.2 Wetland Deepening**

As part of the Phase 1 habitat improvements, SFO proposes to deepen two existing seasonal wetlands by approximately 3 feet below the existing ground surface elevation: one in the central portion of the property just north of South Lomita Canal (Wetland Deepening Central), and the other in the southern portion of the property approximately 500 feet south of Station MA (Wetland Deepening South) (Figure 11). Excavation work at both sites will occur within a 0.05-acre area at the center of the seasonal wetland depression/basin, where the likelihood of ponding is greatest. These two locations were carefully selected using data and information from the AMP hydrology analysis and by identifying a work area in the field that utilizes existing topographic features to promote ponding while minimizing the overall excavation work.

In addition, the proximity of these wetlands to existing maintenance roads will minimize habitat disturbance associated with temporary equipment access for each wetland deepening location.

The wetland deepening work will be conducted with a Gradall XL 5200 excavator owned by SFO (the same piece of equipment successfully used for the 1998 and 2003 canal dredging projects). All work will be conducted by SFO staff who are familiar with the WOB property and who have previous experience working under avoidance and minimization measures to protect SFGS and CRLF. The

Figure 11: Location of Wetland Enhancement/Deepening Locations

work will specifically involve the excavation of approximately 240 cubic yards of material from an approximately 60-foot by 35-foot area within each wetland. If necessary, due to soft ground conditions or other issues, a low ground pressure, rubber-tire loader will be used to move the excavated material from the excavation site to the truck turn-around within the designated construction access area. The excavated material will be placed into a haul truck and transported off site to an upland disposal site. The deepened wetlands will have relatively steep side-slopes to maximize volume and ponding duration.

## 2.4 OTHER PHASE 1 IMPROVEMENTS

### 2.4.1 Upland Habitat Enhancement

**Vegetation Debris Piles.** To increase the amount of upland refugia and provide cover for both SFGS and CRLF, a total of 15 vegetation debris piles (each approximately 100 square feet in size) will be placed at various locations within 50 feet of the two canals and/or important seasonal wetlands. Cattail cuttings collected during vegetation management activities in the canals will provide a ready source of organic material for use in creating the debris piles. The specific locations of the vegetation debris piles will be determined in the field by the biological monitor supervising vegetation removal. Prior to the placement of material, the monitor will select an area within 50 feet of the two canals that is relatively free of rodent burrows. The monitor will then clear the designated area of vegetation down to a height of approximately 4–6 inches using hand tools and inspect the area for any SFGS, CRLF, or other animals that may be present prior to depositing the cut vegetation.

**Invasive Plant Removal.** SFO will remove large areas of existing iceplant and pampas grass on the property to restore SFGS and CRLF upland habitat. Specifically, a large area of iceplant (approximately 0.5 acre in size) is located on the southern portion of the WOB property near the Millbrae Pump Station. The iceplant in this area will be removed and replaced with annual grassland habitat as part of the Phase 1 enhancement activities. Other locations where these non-native species have colonized will be identified and prioritized for future removal.

### 2.4.2 Fuel Abatement

During the summer, grasses and other vegetation on the WOB property become extremely dry and combustible. To reduce the potential for wildfires and associated adverse impacts to SFGS, SFO will continue their annual fuel abatement activities in three areas along the western edge of the WOB property. A maximum 20-foot-wide fire break extends from the northern tip of the site (in the vicinity of San Bruno Avenue) along the western side and terminates at the San Bruno Community Gardens and 4-H Club. The fire break continues just south of Station MA in the vicinity of the PG&E substation/maintenance yard and terminates at the Millbrae pump station road adjacent to the southern property boundary.

Vegetation will be cut to a height of approximately 6 inches using weed-eaters and/or non-mechanized hand tools. This height standard is used to retain cover for SFGS and to minimize the potential for accidental injury to SFGS from hand tools. Cut vegetation will then be gathered and loaded onto a truck and removed from the site. An alternative to hand crews will be the use of goats to control vegetation. No stockpiling of cut material will be allowed during the fuel abatement

activities. Fuel abatement activities are typically conducted in the month of April, unless otherwise authorized by USFWS and CDFG.

### 2.4.3 Access Road Restoration

The existing access roads on the WOB property are used by SFO maintenance staff for on-going operations and maintenance work associated with airport-specific infrastructure on the property. In addition, a variety of other entities (*e.g.*, SBCFCZ, PG&E, City of Millbrae, San Mateo County Mosquito and Vector Control District) frequently use the access roads for inspection, monitoring, maintenance of infrastructure, and mosquito abatement purposes. In general, many of the access roads are in a state of disrepair with many areas overgrown by weeds and in some cases, are not readily distinguishable from the adjacent uplands. The lack of a clear, visible alignment in such areas often makes it difficult for maintenance personnel to avoid inadvertent intrusions into adjacent undisturbed habitat.

Rodent burrows in uplands, especially those adjacent to the canals, are known to support hibernating SFGS during the winter (Larsen 1994) and may provide cover throughout the rest of the year (USFWS 2006). As such, ongoing use of access roads in these areas increases the likelihood of SFGS mortality both below ground (in burrows) and above ground, given the limited visibility of the road surface in many areas.

To reduce potential long-term impacts to SFGS and CRLF, the Plan proposes to restore specific segments of existing access roads that receive high levels of use by re-grading the original road alignment and applying an all-weather, lignin-based soil stabilizer (*e.g.*, Earthbind, Dustex) to the road surface. The following WOB road segments will be restored as part of the Phase 1 activities: (1) between Station MA and the Millbrae Pump Station; and (2) along the east-west segment of Cupid Row Canal.

Lignosulfonates (*i.e.*, lignin-based products) are non-toxic and have long been used on roads for dust control and surface stabilization (Lignin Institute 1992). Due to their natural adhesive property, these soil stabilizers create a denser, firmer road cap than traditional gravel or dirt roads, reducing or eliminating the need for routine re-grading and maintenance (Lignin Institute 1992). Also, the increased compaction and density of lignin-treated road surfaces reduces the likelihood of weedy vegetation becoming established. As a result, drivers will be better able to see the road surface and avoid any SFGS or CRLF crossing the roadway. The installation of speed bumps or dips at regular intervals along the roads will keep vehicle speeds down, further reducing the likelihood of SFGS mortality due to vehicle traffic. In addition, the establishment of a permanent travel route in specific locations will prevent vehicle intrusion into the adjacent undisturbed upland habitat. The above-described road improvements will result in an initial loss of SFGS upland habitat, but are expected to benefit SFGS and CRLF in the long-term by reducing the possibility of mortality from individuals being crushed in rodent burrows and/or run over on the ground surface, as well as discourage drivers from establishing their own travel routes through undisturbed habitats.

The roadway segment along the east-west portion of Cupid Row Canal (*i.e.*, immediately downstream of the sediment trap) was not restored to its original elevation following completion of the BART project. Therefore, the Plan proposes to raise the elevation of the road to its original design elevation (Figure 9) based on information developed by SBCFCZ during the Summer of 2008. The restoration

of the access road along the north side of the east-west segment of Cupid Row Canal will be accomplished in conjunction with the Cupid Row Canal widening project described above in Section 2.2.2. Spoils from the aquatic habitat creation activities described above or clean aggregate road base material will be added to the surface of the existing access road to increase its grade. A lignin-based soil stabilizer would then be applied to the road surface to increase its density and durability.

The access roadway between Station MA and the Millbrae pump station is poorly defined in several sections, and several off-road bypass routes have been previously established around low spots and areas overgrown with dense vegetation. Therefore, this access road along South Lomita Canal will be restored in conjunction with the implementation of the South Lomita Canal Channel Openings and Wetland Deepening South projects as described above in Sections 2.1.1 and 2.3.2, respectively.

As part of the road restoration work, SFO will implement a property access awareness education program. Key components of this program include restricting all vehicular traffic to a 5-mile-per-hour speed limit and installing permanent signs in prominent locations at entry gates and at regular intervals along the access road(s) alerting maintenance personnel to the presence of SFGS, CRLF, and sensitive habitats.

## **2.5 DEVELOPMENT OF PHASE 2 AND 3 ENHANCEMENTS**

Phase 2 (Years 4–6) and Phase 3 (Years 7–10) habitat enhancements will be determined in conjunction with the agencies based on the results of monitoring and data collection following the implementation of Phase 1. Potential Phase 2 and 3 habitat enhancements may include additional non-native vegetation removal, deepening of existing seasonal wetlands, and/or creating new wetlands and channel openings. At the end of each phase, an interim monitoring report summarizing the monitoring results to date and proposed habitat enhancement measures for the next phase will be submitted to the regulatory agencies for review and approval. The Phase 1 interim monitoring report will be submitted by December 31, 2011, and will include three years of monitoring data collected since the implementation of Phase 1 activities in the Fall of 2008. Consistent with the adaptive management approach as an underlying strategy for implementation of the Plan, Phase 2 habitat enhancements will be based, in part, on successful activities that were implemented and monitored in Phase 1. Similarly, Phase 3 habitat enhancements will be based, in part, on successful activities that were implemented and monitored during Phases 1 and 2.

### **3.0 EFFECTS ON LISTED SPECIES**

Although the activities described above in Section 2.0 are expected to benefit both SFGS and CRLF populations in the long term, many of the activities may result in short-term, temporary effects to SFGS, CRLF, and their habitat. All of the impact assessments described below are based on the fundamental premise that temporary impacts to SFGS and CRLF and their habitat will be avoided or minimized through the implementation of the avoidance and minimization measures listed below in Section 4.0. In addition, all temporary, localized impacts will be offset by implementation of the overall habitat enhancements throughout the WOB property and associated benefits to the SFGS population.

It is anticipated that an unquantifiable number of SFGS and/or CRLF would be harassed, injured, killed, or otherwise harmed during implementation of the enhancement actions. However, implementation of the proposed avoidance and minimization measures is expected to reduce this impact. The number of SFGS and CRLF subject to harassment, injury, mortality, *etc.*, is impracticable to estimate. Therefore, the amount of incidental take has been quantified as the number of acres of habitat for breeding, foraging or shelter that will become temporarily unsuitable as a result of project implementation, which is consistent with the approach used by USFWS in prior Biological Opinions for activities on the WOB property. For the purposes of this Plan, “suitable habitat” for both listed species is considered one in the same, since both species are known to use wetlands and adjacent uplands.

As discussed below, a total of approximately 13.57 acres of habitat for SFGS and CRLF are anticipated to be affected by the Phase 1 habitat enhancement and management activities proposed as part of this Plan. This total consists of 0.07 acre of permanent effects associated with the construction of the Cupid Row Canal Sediment Trap and 13.50 acres of temporary effects associated with the implementation of the remaining enhancement actions, as well as related construction areas, staging, temporary access roads, and vegetation management.

The potential biological impacts and the level of anticipated take resulting from implementation of the Phase 1 habitat enhancement and management activities are described in more detail below.

#### **3.1 PHASE 1 HABITAT ENHANCEMENT AND MANAGEMENT ACTIVITIES**

##### **3.1.1 South Lomita Canal Enhancements**

The proposed South Lomita Canal enhancements consist of the creation of four channel openings (ranging in size from 50 to 100 feet long by 25 to 35 feet wide), realigning the concrete bend and associated channel widening, and vegetation management activities to restore open-water conditions between the upstream end of the canal and the downstream limit of the realignment and widening work. The potential biological effects and anticipated take resulting from of these enhancements are discussed below.

### *Potential Biological Effects*

- **Adverse:** harassment, injury, or mortality of SFGS and CRLF from vehicle strikes on access roads; equipment operation, and/or increased human presence in or near the canal; grading/excavation associated with the proposed enhancements; displacement of individuals into adjacent unsuitable areas; temporary loss of escape cover; entrapment in small mammal burrows; alteration of breeding and foraging behavior due to increased noise levels and human activity, potentially resulting in increased predation and stress.
- **Beneficial:** increased breeding and foraging habitat for CRLF and Pacific tree frog; increased foraging habitat for SFGS; increased numbers of CRLF which will result in increased prey availability for SFGS; improvements to water quality conditions by preventing the formation of stagnant water conditions and increasing dissolved oxygen levels.

### *Anticipated Take*

- The planned enhancements in South Lomita Canal are anticipated to result in temporary adverse effects to approximately 1.98 acres of suitable habitat. The projected acreage associated with each activity is specifically broken down as follows.
  - Channel Openings = 0.82 acre (Excavation Area = 0.45 acre; Temp. Construction Area = 0.37 acre)
  - Channel Widening = 0.75 acre (Excavation Area = 0.20 acre; Temp. Construction Area = 0.55 acre)
  - Vegetation Management = 0.41 acre

## **3.1.2 Cupid Row Canal Enhancements**

The proposed Cupid Row Canal enhancements consist of the installation of a sediment trap at the upstream end of the canal, canal widening along the east-west segment, and vegetation management activities to ensure the channel remains open and free of excess vegetation. The potential biological effects and anticipated take resulting from these enhancements are discussed below.

### *Potential Biological Effects*

- **Adverse:** harassment, injury, or mortality of SFGS and CRLF from vehicle strikes on access roads, equipment operation, and/or increased human presence in or near the canal; grading/excavation associated with the proposed enhancements; temporary displacement of individuals into adjacent unsuitable areas, temporary loss of escape cover; entrapment in small mammal burrows; alteration of breeding and foraging behavior due to increased noise levels and human activity, potentially resulting in increased predation and stress.
- **Beneficial:** increased breeding and foraging habitat for CRLF and Pacific treefrog; increased foraging habitat for SFGS; increased numbers of CRLF and Pacific treefrog which will result in increased prey availability for SFGS; improvements to water quality and habitat conditions by reducing sediment input; maintenance of open-water conditions resulting in greater habitat diversity.

### *Anticipated Take*

- The planned enhancements in Cupid Row Canal are anticipated to result in permanent and temporary adverse effects to approximately 4.69 acres of suitable habitat. The projected acreage associated with each activity is specifically broken down as follows:
  - Sediment Trap = 0.12 acre (Excavation Area = 0.07 acre; Temp. Construction Area = 0.05 acre)
  - Canal Widening = 2.55 acres (Excavation Area = 0.65 acre; Temp. Construction Area = 1.90 acres)
  - Vegetation Management = 2.02 acres

### 3.1.3 Other Phase 1 Enhancements

In addition to the habitat enhancement activities proposed for South Lomita and Cupid Row Canals, other enhancement actions are proposed for the WOB property. These enhancement actions consist of the 7<sup>th</sup> Avenue Ditch enhancement, wetland deepening (central and south), non-native plant removal, creation of vegetation debris piles, fuel abatement, and access road restoration. The potential biological effects and anticipated take resulting from these enhancements are discussed below.

#### *Potential Biological Effects*

- Adverse: harassment, injury, or mortality of SFGS and CRLF from vehicle strikes or being struck by hand tools during vegetation clearing activities; grading/excavation associated with the proposed enhancements; alteration of breeding and foraging behavior due to increased noise levels and human activity, potentially resulting in increased predation and stress; permanent loss of upland habitat (*i.e.*, rodent burrows) during restoration of access roads.
- Beneficial: increased aquatic habitat for CRLF and Pacific treefrog breeding; reduced mortality risk from establishment of permanent travel routes discouraging off-road incursions into upland habitat and increased visibility of road surface; reduced risk of significant wildfire from fuel abatement and associated reduced mortality risk to SFGS and CRLF; increased suitable upland habitat for CRLF and SFGS from removal of non-native plants (*e.g.*, iceplant and pampas grass).

#### *Anticipated Take*

- The planned enhancements are anticipated to result in temporary adverse effects to approximately 6.9 acres of suitable habitat. The projected acreage associated with each activity is specifically broken down as follows.
  - 7<sup>th</sup> Ave Ditch Enhancement = 1.33 acres  
(Excavation Area = 0.32 acre; Temp. Construction Area = 1.01 acres)
  - Wetland Deepening Central = 0.25 acre  
(Excavation Area = 0.05 acre; Temp. Construction Area = 0.20 acre)
  - Wetland Deepening South = 0.25 acre  
(Excavation Area = 0.05 acre; Temp. Construction Area = 0.20 acre)
  - Upland Habitat Enhancement = 1.0 acre
  - Fuel Abatement = 2.55 acres
  - Access Road Restoration = 1.52 acres

### **3.2 PHASE 2 AND 3 HABITAT ENHANCEMENT AND MANAGEMENT ACTIVITIES**

Because future enhancement and management activities for Phases 2 and 3 are currently undefined and will be determined in conjunction with USFWS and CDFG based on the results of the Phase 1 enhancement activities, accurately assessing the level of impact of these future activities is not feasible. Therefore, to provide the greatest degree of flexibility for future Plan enhancement and management actions and to conservatively estimate the level of impact resulting from these actions, it is assumed that future enhancement and management actions will collectively have effects (beneficial and adverse) on the entire 180-acre WOB property during the life of the Plan.

### **3.3 CUMULATIVE EFFECTS**

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the area covered by this Plan. Future federal actions that are unrelated to the proposed actions are not considered in this section because they will be subject to separate consultation pursuant to Section 7 of the ESA.

No further actions or development in addition to the above-described habitat enhancements and long-term maintenance and monitoring are anticipated.

## 4.0 AVOIDANCE AND MINIMIZATION MEASURES

The avoidance and minimization measures described below will be implemented to reduce the potential for adverse impacts to SFGS and/or CRLF resulting from activities described above in Section 2.0. Many of these measures are adapted from those that have been successfully implemented for previous flood control maintenance projects on the WOB property and previous Biological Opinions issued by the USFWS (1996a, 1998, 2003, 2005a, 2007). In addition, the monitoring programs for major activities (*e.g.*, aquatic habitat creation in Cupid Row and South Lomita Canals) will be based, in part, on an acknowledgement of the net conservation benefit of implementing habitat enhancements throughout the WOB property.

Because the disturbance levels associated with the activities described above in Section 2.0 vary in both intensity and spatial extent, avoidance and minimization measures presented below in this section have correspondingly been grouped into the following categories:

- General Protection Measures. These measures will be implemented for all Plan activities, regardless of frequency or disturbance level.
- Major Ground Disturbance Protection Measures. These measures will be implemented for major ground disturbance activities that involve significant grading and/or excavation on the property and where installation of snake exclusion fencing is not practicable (*e.g.*, across canal bottoms, *etc.*). Specifically, these measures will be implemented for the following activity:
  - Cupid Row Canal Widening (east-west segment)
- Moderate Ground Disturbance Protection Measures. These measures will be implemented for those enhancement activities that will involve minor to moderate grading in upland and seasonal wetland areas, and for which the work area can be completely enclosed in snake exclusion fencing. Specifically, these measures will be implemented for the following activities:
  - South Lomita Canal Channel Openings
  - South Lomita Canal Channel Widening
  - 7th Avenue Ditch Enhancement
  - Wetland Deepening Central
  - Wetland Deepening South
- Minor Ground Disturbance Protection Measures. These measures will be implemented for those activities that will not involve mechanized grading and/or excavation of wetland or upland habitats. Each activity in this category has its own set of protection measures since they vary somewhat in their level of disturbance. Minor ground disturbance protection measures will be implemented for the following activities:
  - Upland Habitat Enhancement – Vegetation Debris Piles
  - Upland Habitat Enhancement – Invasive Plant Removal

- Fuel Abatement
- Access Road Restoration

#### 4.1 GENERAL PROTECTION MEASURES

- A pre-activity meeting will be held immediately prior to the initiation of work for all persons directly involved with implementation of the proposed activities in the Plan area (*i.e.*, WOB property). All conditions included in agency approval documents (*i.e.*, USFWS Biological Opinion, CDFG Streambed Alteration Agreement) will be reviewed and discussed. As part of the pre-activity meeting, a site visit will be held to address and clarify any outstanding issues pertaining to activity implementation according to the prescribed conditions.
- Prior to the start of work, an educational program regarding the sensitivity of SFGS, CRLF, and their habitat will be conducted for all personnel. The educational program will include visual materials on species identification, procedures to follow when encountering any snake or frog species in the work area, penalties for take, and all work restrictions within the WOB property. In addition, pocket-sized photo cards depicting SFGS and CRLF will be distributed to all personnel.
- A chain-of-command for field crews and other on-site personnel will be established prior to commencement of all activities. This program will establish the biological monitors as the persons in charge of, and responsible for, all facets of project implementation. The specific chain-of-command will be defined at the pre-activity meeting (described above) to be held immediately prior to the initiation of work.
- Biological monitors will have full responsibility and authority of stopping work activities, if any crews or personnel are not complying with the provisions outlined in this document and/or conditions in any other authorization from the USFWS and/or CDFG.
- Prior to the start of work, areas will be identified by the biological monitor-in-charge and approved by the USFWS and CDFG as acceptable locations to which SFGS and CRLF may be relocated if these species are encountered within a work area. Relocation areas will be a minimum of 500 feet from the boundary of any work area and will not include staging areas or roads. No SFGS or CRLF will be removed from the WOB property or maintained in captivity overnight without prior notification and written approval by the USFWS and CDFG unless the animal is in need of emergency medical assistance. Medical assistance will be provided to injured animals by a certified wildlife veterinarian familiar with amphibian and reptile care.
- Only biological monitors specifically authorized by the USFWS and CDFG to handle SFGS or CRLF will be allowed to handle, transport, and relocate individuals of these species.
- Biological monitors will check for any reptiles or amphibians under vehicles and equipment parked for more than 30 minutes.
- To maintain safety and limit any chance of take or habitat disturbance, a simple system of hand signals will be established for the monitors, truck drivers, equipment operators, and field personnel to use during habitat enhancement and related activities.
- Both the USFWS and CDFG will be notified immediately if any SFGS or CRLF are injured or killed during the course of any enhancement or management activities. All other incidental observations will be reported in the daily field monitoring forms (see below).

- A written and photographic record of all habitat enhancement activities will be maintained. Daily field monitoring forms will be prepared by the biological monitors to document project implementation and compliance. Monitoring forms will describe the progress of work, any difficulties encountered, observations of SFGS or CRLF, and any other pertinent information regarding activities on the site. A photographic record of the project will also be maintained. This record will be provided to the USFWS and CDFG upon completion of the activity upon request.
- All entry gates to the WOB property not used for equipment access will be locked at all times and gates used for project-related access will be locked during non-work hours. All gates must be closed after entering or leaving the property.
- Trucking/hauling of excavated material will be conducted to ensure careful and unhurried removal of material from the WOB property. To facilitate this, all contracts for the trucking/hauling will be established on a time and materials basis, thereby eliminating any incentive for expediting the hauling activity.
- All motorized vehicles traveling on existing roads within the site will not exceed 5 miles per hour.
- All project-related parking will be located off of the WOB property. The only vehicles allowed on site will be the Gradall excavator, haul trucks, and other necessary equipment service/maintenance vehicles.
- Refueling of equipment will be conducted using heavy-gauge tarps made of chemically resistant polypropylene or other impervious material with vertical sides for spill containment. These containment tarps will be set up under the equipment prior to servicing or refueling. Once the work is completed, the tarp and its contents must be immediately removed from the property and all contaminants properly disposed of off site. Standard operating procedures will be implemented immediately in case of fuel spillage.
- All work-related trash and debris will be removed daily from the WOB property.
- No pesticides or burrow fumigants will be used on or adjacent to the WOB property.
- Smoking will not be permitted on the WOB property.
- All vehicles entering the site will carry a functional fire extinguisher.
- No dogs or other pets will be allowed on the WOB property.
- USFWS and CDFG personnel will be given complete access to the WOB property at all times and will not be required to provide prior notice.

## **4.2 MAJOR GROUND DISTURBANCE PROTECTION MEASURES**

### **4.2.1 Biological Monitoring**

- All work will be continuously monitored by two qualified biologists. At least one monitor will be named on or possess a valid 10(a)(1)(A) recovery permit from the USFWS that allows them to handle SFGS and CRLF. This person will be present on site at all times during project activities. The non-permitted biological monitor will be approved by the USFWS and CDFG prior to the commencement of any work. In addition, approved, non-permitted biological monitors may seek authority from the USFWS and CDFG to handle SFGS and CRLF, provided that the monitor has

prior experience with or receive training from a permitted biologist in the proper handling of these species prior to project commencement.

- The biological monitors will be equipped with two-way radios at all times and at least two cellular phones will be on site during habitat enhancement activities. The communication equipment will ensure that the biological monitors are in close verbal contact and able to direct, as well as to halt, if necessary, any and all project operations and activities.
- The biological monitors will have a pillow case available in which to place captured SFGS and CRLF. Pillow cases used to hold CRLF will be wetted prior to inserting CRLF. SFGS will be turned over to the 10(a)(1)(A)-permitted biological monitor within 10 minutes of capture. The age and class (young of year, juvenile, adult) of all captured SFGS and CRLF will be noted on the daily field monitoring forms.
- Every morning prior to commencement of work, a biological monitor will survey the work area for SFGS and CRLF.

#### **4.2.2 Vehicle and Equipment Access**

- To minimize ground disturbance, access points closest to the activity will be used by all equipment and vehicles.
- Prior to the commencement of work, all travel routes and work areas (where equipment will operate) will be manually cleared of vegetation. If necessary, the travel routes will be delineated with nylon rope tied to T-stakes on either side to establish defined corridors for vehicles and prevent unnecessary off-road travel. Travel routes will be cleared to a standard 15-foot width and widened an additional 5 to 10 feet in the vicinity of corners and junctions to allow equipment and vehicles to negotiate these areas.
- Prior to commencement of work, the work area will be cleared of vegetation under the direct supervision of the monitoring biologist. Grasses and other herbaceous vegetation will be cut with string trimmers to approximately 4–6 inches in height. All cut vegetation generated from the clearing activities will be hauled off-site and disposed of properly.
- Operation of all vehicles and heavy equipment will be limited to clearly defined areas. Backhoes and other heavy equipment used to excavate channel openings will operate from the adjacent canal banks, as opposed to within the canals themselves.

### **4.3 MODERATE GROUND DISTURBANCE PROTECTION MEASURES**

#### **4.3.1 Biological Monitoring**

- All work will be monitored on a full-time basis and documented by a qualified, non-permitted biological monitor who is familiar with both SFGS and CRLF. The monitoring biologist will continually monitor the site during all excavation and site preparation work.
- A qualified biological monitor who holds or is named on a 10(a)(1)(A) recovery permit for SFGS and CRLF, will be available on-call throughout the duration of each activity. If any SFGS or CRLF are observed within the work area, the monitoring biologist will have the authority to stop all work and will immediately contact a permitted biologist to relocate the animal(s).

- The biological monitor will inspect the work area each morning prior to the commencement of work to ensure that no SFGS or CRLF are present.

#### **4.3.2 Vehicle and Equipment Access**

- All work areas will be clearly marked in the field and all access routes clearly delineated. Access routes will be delineated with brightly colored plastic flagging tied to the tops of wooden lathe stakes along each side of the access route. The most direct route to and from work areas will be established to minimize disturbance to the existing habitat.
- Prior to project implementation, the access route and proposed enhancement work area will be cleared under the direct supervision of the monitoring biologist. Following installation of the snake exclusion fencing (described below), grasses and other herbaceous vegetation within the work areas will be cut with string trimmers to approximately 4–6 inches in height. All cut vegetation generated from the clearing activities will be hauled off-site and disposed of properly. The access route will be cleared to a maximum width of 15 feet.

#### **4.3.3 Snake Exclusion Fencing**

- An exclusion fence will be installed around the work area for a two-week period prior to the commencement of the habitat enhancement activity.
- Exclusion fences will be constructed in accordance with agency-approved methods that have previously been used on the WOB property.
- Immediately after installation of the fence and vegetation clearing described above, the area within the snake exclusion fence will be either trapped for a period of two weeks or subject to a thorough rodent burrow excavation effort.
- For projects that require repeated entry and exit by construction equipment, the exclusion fence will include a wooden gate with gaps along the margins no larger than 0.25 inch wide. Otherwise, the construction equipment will be moved into the work area after trapping/burrow excavation is complete by temporarily opening a section of fence under supervision of the biological monitor.
- Once fencing is in place, it will be maintained until all work within the enclosure has been completed. The fencing will be inspected on a daily basis, and any damaged areas will be repaired immediately upon discovery.

#### **4.4 MINOR GROUND DISTURBANCE PROTECTION MEASURES**

Each of the following activities will be subject to the following protection measures in addition to the activity-specific protection measures described below:

- All activities will be supervised/monitored on a full time basis by a qualified non-permitted biological monitor.
- Only existing access roads on the property will be used for equipment access.

- Prior to the initiation of vegetation clearing/removal, the biological monitor will search ground vegetation for SFGS and CRLF using a probing stick and/or bare hands.
- No trapping, handling, or translocation of SFGS or CRLF will be allowed. If a SFGS is observed, all work in the immediate vicinity will stop and the biologist will observe the animal. Work may resume only if and when the biological monitor has determined that the animal has left the work area.

#### **4.4.1 Fuel Abatement**

- Fuel abatement activities will be limited to the month of April, unless a site inspection is conducted by the USFWS and CDFG and authorization is given to conduct work outside the month of April.
- Fuel abatement will be conducted with hand tools or by using goats. No mechanized equipment, with the exception of weed-eaters, will be allowed to conduct fuel abatement.
- All cut vegetation from fuel abatement activities will be consolidated and loaded onto a truck for removal from the site. No stockpiling of cut vegetation will occur during fuel abatement activities.

#### **4.4.2 Upland Habitat Enhancement – Vegetation Debris Piles**

- Prior to the placement of vegetation debris in designated enhancement areas, such areas will be cleared of all vegetation by hand to 4–6 inches in height under the direction of a monitoring biologist.
- Cattail cuttings will be transported from the canal to the designated enhancement areas by hand using tarps. No machinery or vehicles will be used to transport vegetation cuttings/debris.

#### **4.4.3 Upland Habitat Enhancement – Invasive Plant Removal**

- All invasive plant removal will be conducted by hand. Iceplant, in particular, is easily removed by hand pulling (Bossard *et. al.*, 2000).
- When removing large (*i.e.*, greater than 300 square feet) patches of vegetation (*e.g.*, iceplant patch near Millbrae Pump Station), workers will concentrate in a designated “work area” rather than spreading out to different parts of the patch. This approach will allow more focused monitoring of plant removal by the biologist, thus minimizing potential take of SFGS. Work areas will be no larger than 300 square feet in size.

#### **4.4.4 Access Road Restoration**

- Prior to the commencement of work, the road alignment will be manually cleared of vegetation using hand tools and string trimmers only.
- The road alignment will be delineated with nylon rope tied to T-stakes on either side to establish a defined work area and prevent unnecessary off-road travel.
- All cut vegetation will be consolidated and loaded onto a truck for removal from the site. No stockpiling of cut vegetation will occur during access road restoration activities.

## 5.0 MONITORING PLAN

### 5.1 RECOVERY GOALS AND MONITORING OBJECTIVES

The ultimate goal of this Plan is to ensure the long-term viability of the SFGS population on the WOB property. The following objectives have been identified as being essential elements to achieve the stated recovery goal; these project objectives are also considered benchmarks to assist in tracking the overall success of the Plan:

- (1) create aquatic habitat conditions that will result in increased amphibian prey availability (specifically CRLF and Pacific treefrog by increasing the hydroperiod of existing seasonal wetlands and expanding existing aquatic habitat areas);
- (2) reduce sediment input into Cupid Row Canal to maintain suitable breeding habitat and reduce significant disturbance resulting from maintenance activities;
- (3) enhance upland habitat for SFGS and CRLF through the removal of invasive non-native species (iceplant and pampas grass) and creation of upland retreats using cut vegetation/debris;
- (4) conduct annual monitoring of habitat conditions on the WOB property, with a particular emphasis on monitoring the specific areas where the habitat enhancement activities have been implemented; and
- (5) as part of the amphibian monitoring program, ensure that American bullfrogs (*Lithobates catesbeiana*) and African clawed frogs (*Xenophis laevis*) do not become established on the WOB property.

### 5.2 CRITERIA FOR SUCCESS

In addition to determining the overall success of the Plan, the success criteria will provide a basis for determining the need for changes to the Plan, as well as additional enhancement and management actions. It should be noted that failure to attain either of the success criteria within the 10-year implementation period will not necessarily imply that the Plan has failed. Rather, the entire set of monitoring results will provide a basis for determining whether changes to the Plan (with agency input) are warranted. The following success criteria have been developed for the Plan:

- (1) The Plan will result in a measurable increase in suitable breeding habitat for amphibians (CRLF and Pacific treefrog) on the WOB property.
- (2) The SFGS population on the WOB property will either remain stable or increase as determined by comparing the population estimates of future trapping surveys to the baseline population estimate as described below in Section 5.4.1.

### 5.3 ADAPTIVE MANAGEMENT APPROACH

Adaptive management is an emerging approach to natural resource management that openly acknowledges uncertainty about how ecological systems function and how they respond to management actions (Atkinson *et al.* 2004). In general, management is adaptive when management actions are measured and evaluated before and after they occur, with the resulting information used to refine the next round of management actions (USGS, undated). As discussed above, results of the monitoring effort will focus on identifying successful habitat enhancement activities to incorporate into future phases of the Recovery Plan. In addition, results of successful enhancement activities identified through the adaptive management program can be applied to other recovery efforts planned or occurring in the SFGS range.

USFWS (1996b) defines adaptive management as a method for examining alternative strategies for meeting measurable biological goals and objectives, and adjusting future conservation management actions as necessary according to what has been learned. The key component in making the adaptive management process meaningful includes careful planning through identification of uncertainties, incorporating a range of alternatives, implementing a sufficient monitoring program to determine success of the alternatives, and a feedback loop from the results of the monitoring program that allows for change in the management strategies. The purpose of the adaptive management feedback loop is to ensure that the goals and objectives of the Plan are being met.

### 5.4 WILDLIFE MONITORING

#### 5.4.1 San Francisco Garter Snake

**5.4.1.1 Baseline Population Study.** From March 28 through July 1, 2007, Swaim Biological, Inc. (SBI) conducted a comprehensive mark-recapture trapping survey of SFGS throughout the WOB property. The specific purpose of this survey was to establish a baseline SFGS population estimate prior to implementation of the Plan.

Snakes were captured using a standard drift-fence, funnel-trap protocol, currently employed by SBI at other SFGS study sites (*e.g.*, Año Nuevo State Reserve) and approved under USFWS permit TE-815537 and a Memorandum of Understanding issued by the CDFG. Traplines consisted of a drift fence (14-inch-high by 22-foot-long flexible hardboard or particle board) with two funnel traps (wood and wire mesh-paneled) located at each end. Each trapline was set at least 2 inches into the ground to deter animals from crawling under the hardboard and to guide animals toward funnel traps.

A total of 88 traplines were installed on the WOB property. Trapline layout was based on a stratified random sample of habitat classes. Prior to sampling, the WOB parcel was divided into five geographic areas to ensure coverage of the entire site. These five areas were then stratified by habitat (marsh, upland, and canal) and trapline placement selected randomly within each habitat class. Habitat classifications follow delineations of Wharton (1989) and Larsen (1994). Trap allocation was based on the proportion of available habitat except for the upland category, where trapping effort was reduced based on observations from trapping and radio telemetry studies conducted in the 1980's and 1990's, in which SFGS activity was centered around WOB wetland areas (Wharton 1989, Larsen 1994).

Traplines were checked by a permitted biologist once or twice per day. Upon capture, any SFGS individual greater than 150 mm snout-vent length (SVL) was PIT tagged, marked by a ventral scale clip, measured (length and weight), probed for presence of hemipenes (to determine sex), and photographed to chronicle morphological variation on the site. Genetic samples (tail clips less than 3 mm) were taken from no more than 30 SFGS. Ventral scutes and tails of SFGS smaller than 150 mm SVL were not clipped. All other snake species were PIT tagged and marked with a ventral scale clip.

Based on the trapping work described above, a total of 458 individual SFGS were recorded a total of 548 times during the three month trapping effort on the WOB property. The SFGS population at WOB is estimated to be 534 individuals (478 – 678, 95% CI) based on the 2007 capture/recapture data. Results of the 2007 baseline SFGS population study are described in more detail in the *San Francisco Garter Snake Monitoring Report, West of Bayshore Property, San Francisco International Airport: 2007 Baseline Survey Results* (Swaim 2008).

**5.4.1.2 Additional Population Studies.** The above-described SFGS trapping survey will be repeated in Years 5 and 10. Results of these follow-up surveys will be compared to the baseline population estimate, providing information on approximate population trends and whether the SFGS population is responding to Plan habitat enhancements.

**5.4.1.3 Semi-Annual Surveys.** The results of the baseline trapping survey will be used to identify areas of high SFGS activity at which semi-annual focused surveys using cover boards or other methods will be conducted. In addition, focused SFGS trapping surveys will be conducted in the immediate vicinity of the completed enhancement activities to collect data on SFGS use of the habitat enhancement areas.

**5.4.1.4 Annual Qualitative Monitoring.** As part of the late-summer juvenile CRLF survey associated with the amphibian species monitoring as discussed below, incidental observations of SFGS will continue to be recorded. These observations, while not quantitatively comparable among years, will provide qualitative information on SFGS occurrence patterns and habitat use.

## **5.4.2 California Red-legged Frog**

From 1998-2005, LSA and Ibis Environmental, Inc. conducted CRLF surveys at the WOB property as an element of the RMP (LSA 1998). These surveys and associated field methods will be incorporated into the Plan monitoring program and slightly modified to provide information on the relative abundance of CRLF at the habitat enhancement locations, as well as at randomly selected wetlands in other portions of the WOB property. Specific methods for the two types of CRLF surveys are summarized below.

**5.4.2.1 Spring Adult Survey.** The spring adult survey will consist of four nocturnal (*i.e.*, no earlier than one hour after sunset) site visits during the breeding season (November through April) in which two biologists search canal segments and wetlands for CRLF using the visual encounter method (Crump and Scott Jr. 1994). Each feature (*i.e.*, canal segment or wetland) will be surveyed twice over the four-night sampling period. Specific habitat features to be surveyed will be identified during a preliminary site visit and clearly delineated on aerial photos of the site and in the field using

permanent (*i.e.*, steel rebar) stakes and flagging. Surveyors will become familiar with the specific locations of each survey area prior to conducting the first nocturnal survey.

In South Lomita Canal, surveys will be conducted at the habitat enhancement locations (concrete bend and four channel openings). Given the limited extent of naturally occurring open-water areas in remaining portions of the canal that would be visible to surveyors, it may not be possible to survey additional “control” areas to which enhanced areas can be compared. In Cupid Row Canal, surveys will be conducted at each of the enhancement areas (*i.e.*, canal widening) along the east-west segment, as well as at randomly selected open-water areas in the north-south segment, if any are present. Such a sampling scheme (*i.e.*, termed “accessibility sampling” by Krebs [1989]) will not enable statistical comparisons of CRLF abundance among different portions of the canals, but will at least provide qualitative information on CRLF use of the various habitat enhancement sites over the 10-year period in which the Plan is in effect. In addition to the canals, six seasonal wetlands that were surveyed between 1998 and 2005, as part of SFO’s RMP, will be surveyed for CRLF (Figure 11). Surveys will also be conducted at the three proposed wetland deepening/enhancement sites, as well as at three randomly selected wetlands (or portions of wetlands) of similar size in other portions of the WOB property (Figure 11).

Canal segments will be surveyed by scanning the open water, bank (up to 6.5 feet from water’s edge), and emergent or floating vegetation for frog eye shine using a USFWS-approved light (*e.g.*, Wheat Lamp, 6-volt Nite-Lite halogen lamp, or sealed-beam light that produces less than 100,000 candle watts) and binoculars. When scanning for eye shine, surveyors will rest the binoculars on top of the light, line up the field of view with the light beam, and move the two in unison to maximize the potential for detecting frogs (Corben and Fellers 2001). Wetlands will be surveyed by using the above technique from as many fixed points around the wetland perimeter as necessary to ensure 100 percent visual coverage, with great care taken to avoid damage or disturbance of sediments and shoreline vegetation. Surveys will only be conducted under the following weather conditions:

- Air temperature will be at least 10 degrees Celsius (50 degrees Fahrenheit), since frogs are less likely to be active at lower temperatures (USFWS 2005b).
- Wind speed will not exceed 8 kilometers/hour (5 miles/hour), since high wind speeds affect temperatures and the surveyors’ ability to hear frogs calling.
- Surveys will be conducted under clear to partly cloudy skies (high clouds are okay) but not under dense fog or heavy rain. Surveys may be conducted during light rains.

Visual encounter survey results will be expressed as the number of CRLF detected per person-hour of searching.

**5.4.2.2 Late Spring Tadpole Survey.** In June of each monitoring year, LSA biologists will sample CRLF tadpoles at the same locations surveyed for CRLF adults in the spring. Tadpoles will be trapped using a modified funnel trap design, which enhances the ability to capture tadpoles while ensuring their safety. Each trap will consist of a 5-gallon plastic bucket pierced with small holes and a larger 4-inch hole in the side that is fitted with a wire mesh funnel (1/8-inch mesh, 1.5 feet long). A styrofoam float will be placed in each bucket and the bucket placed about 4 inches above the water level so any inadvertently captured adult frogs can breathe. Two buckets will then be attached to either end of an approximately 10-foot-long drift screen that is anchored in shallow water along the edge of the canal or wetland. The drift screen funnels tadpoles into the buckets at both ends.

Traps will be installed in June and checked for three consecutive days. Captured tadpoles will be immediately released in approximately the same location as they were captured. Tadpole abundance will be expressed as the *average number of tadpoles captured per trap night*, since the total number of tadpoles collected would likely include multiple captures of the same individuals. Sampling sites will be selected based on accessibility and water depth, and will be located in areas of relatively open water that also contained a shallow submerged shelf. Since the amount of water at a given site (*i.e.*, canal segment or wetland) will likely vary from year to year, trap sites may need to be slightly re-located in some years to maintain accessibility and suitable water depth.

### 5.4.3 Pacific Treefrog

Pacific treefrogs are an important food source for newborn and juvenile SFGS, which may prefer the species so strongly that they are unable to switch to other available prey (Larsen 1994). At the WOB property, newborn and juvenile SFGS often face limited feeding opportunities due to the lack of juvenile treefrogs, which are abundant in late May through early June but disappear from most seasonal wetlands during the summer. As a result, Larsen (1994) emphasized that habitat management at WOB should implement “strategies that will increase the number of the preferred prey items available in late summer and fall, particularly Pacific treefrogs.” Larsen specifically recommended the creation and maintenance of wetlands with dense cattails and cocklebur (*Xanthium strumarium*), which support treefrogs into the summer after the wetlands have dried due to the abundance of vegetative cover. Because treefrogs play such an integral role in the survival of newborn and juvenile SFGS, they are included in this monitoring program.

**5.4.3.1 Spring Calling Surveys.** Calling surveys for Pacific treefrogs will be conducted concurrently with the spring adult CRLF surveys. Upon arriving at a given site, observers will wait one minute, then begin a three-minute listening period. At the end of the listening period, the observer(s) will record a simple index value based on one developed for the Wisconsin Frog and Toad Survey (Mossman *et. al.*, 1998, cited in USGS, undated):

- 0 = no frogs heard calling
- 1 = individual calls, overlapping
- 2 = calls are overlapping, but individuals are still distinguishable
- 3 = numerous frogs can be heard; chorus is constant and overlapping

For the purposes of this monitoring program, the above index is better suited to monitoring Pacific treefrog use of the various enhancement sites than counts of individual treefrogs, which are difficult to detect due to their small size.

### 5.4.4 Invasive Frogs

Although American bullfrogs and African clawed frogs have not been observed at the WOB property, they have been found at nearby locations (USFWS, pers. comm.). Ensuring that these two non-native, invasive species do not become established on the WOB property is an important component of the recovery actions identified in this Plan. Any observations of these species during the above-described wildlife monitoring efforts will be reported to the USFWS and CDFG. Depending on the number of non-native frogs observed, SFO and the regulatory agencies will ascertain the appropriate level of control/eradication efforts necessary.

## 5.5 VEGETATION MONITORING

To monitor the efficacy of the above-proposed habitat enhancements in maintaining open-water conditions, permanent vegetation transects will be established across each of the habitat enhancement areas. This component of the Plan monitoring program will entail the installation of vegetation transects at the following Phase 1 improvement locations: each of the four channel openings in South Lomita Canal, the realigned concrete bend in South Lomita Canal, Cupid Row Canal widening areas, 7<sup>th</sup> Avenue Ditch, and the two wetland deepening locations.

Transect end points will be permanently marked with steel rebar stakes and placed approximately 5 feet outside the canal or wetland boundary. Vegetation data will be collected by fixing a nylon tape across each transect and recording the cover type (*i.e.*, plant species, bare ground, or open water) at 2-foot intervals along the tape. In areas where more than one cover type is present at a single sampling point (*e.g.*, within willow stands), the dominant overhead cover or rooted plant will be recorded. Recorded plant species will be noted as either upland or wetland species as per Reed (1988).

## 5.6 WATER QUALITY/HYDROLOGY

### 5.6.1 Water Quality

Increased salinity in the Cupid Row Canal during the early 1990s was attributed to failure of the North Channel tide gate near San Francisco Bay (Larsen 1994). Since increased salinity is considered a threat to amphibians and hence, to SFGS, a critical component of this Plan is to determine if salinity levels within the on-site wetlands are below 4.0 ppt (*i.e.*, the level above which CRLF embryos are unable to survive [Jennings and Hayes 1990]) by incorporating property-wide salinity monitoring into the monitoring program. To measure salinity in the canals, 10 permanent sampling stations will be established along the entire length of each canal (four in Cupid Row, six in South Lomita) (Figure 12). Salinity and water quality will also be measured at 10 groundwater monitoring stations previously established in various wetlands throughout the entire property. Salinity will be measured four times each year (at approximately three-month intervals) in conjunction with other monitoring visits. Other standard water quality parameters (*e.g.*, temperature, dissolved oxygen, pH) will also be measured at each station. The first year of data collection will provide baseline salinity levels for the various aquatic features (*e.g.*, Cupid Row Canal, South Lomita Canal, seasonal wetlands/ponds) to which future data can be compared.

In addition to the water quality monitoring described above, focused sediment monitoring will be conducted in South Lomita Canal in an effort to determine whether sediment input is a significant problem in this canal. To better quantify sediment input and deposition, flow monitoring and total suspended solids (TSS) sampling will be conducted at four locations within South Lomita Canal two times per year (at appropriate times based on winter storm events) as part of the monitoring program for Phase 1 activities. TSS sampling will be conducted at each of the following locations: (1) at the upstream end of the canal in the vicinity of the concrete bridge; (2) immediately downstream of the concrete bend; (3) in the vicinity of Station MA; and (4) at the Millbrae Pump Station at the downstream end of the canal. This focused sediment monitoring will provide the data and information necessary

Figure 12: Location of Groundwater and Canal Salinity Monitoring Stations

to better understand the extent of sediment input and the need for future management actions (*i.e.*, installation of a sediment trap).

### **5.6.2 Wetland Hydrology**

The hydrological regime for the wetland enhancement sites will be influenced by several factors, including direct precipitation, watershed contribution, and proximity to subsurface groundwater. The target hydroperiod will be from the start of the rainy season through September in a year with average rainfall. This target is intended to provide the necessary habitat conditions to allow adequate CRLF and Pacific treefrog larval development.

Permanent staff gauges will be installed in the deepest portion of each wetland immediately after construction, and each wetland will be visited monthly from the first rain event in a given year through the late spring/early summer of the following year when all surface water has disappeared. Site visits will be scheduled to coincide with other monitoring visits (*e.g.*, CRLF surveys, vegetation monitoring) as much as possible to ensure maximum efficiency of time and resources. For example, prior to conducting nighttime CRLF surveys in the spring (March–May), biologists will spend the day collecting hydrology and salinity data. Hydrology variables recorded during each visit will include water depth and percent cover of each feature by open water. In addition, any incidental observations of native amphibians within each wetland will be noted during each visit.

### **5.6.3 Tide Gate Inspections**

As part of their on-going flood control maintenance responsibilities, SBCFCZ will increase their attention towards the monitoring and maintenance of the tide gate at the downstream end of the North Channel, which could assist with improving habitat conditions at the downstream end of Cupid Row Canal through a reduction in saltwater intrusion. Specifically, SBCFCZ staff will inspect the tide gate on a quarterly basis to ensure that it is functioning properly.

## **5.7 DATA MANAGEMENT**

SFO and their consultants, as well as SBCFCZ staff, will be the central repository for all monitoring data and reports. To maximize data utility and organization, a single mid- to upper-level staff person will be assigned the role of data manager and will be responsible for ensuring that all Plan data, both qualitative and quantitative, is collected and archived properly.

## **5.8 REPORTING REQUIREMENTS**

LSA will prepare an annual monitoring report describing the progress/results of Plan activities. The annual report will be submitted by December 31 of each year during the 10-year Plan period. The report will summarize results of the previous year's monitoring, as well as the results of any habitat improvement activities. The report will also detail specific enhancement and management recommendations to be implemented in future phases. The reports will include figures and maps, as needed, and will contain a list of names of all persons who prepared the reports and who participated in the monitoring. In addition, at the end of Years 3 and 7, the annual monitoring report will include

a summary of Phase 1 and 2 activities, respectively, and proposed habitat enhancement activities for the next phase. Reports will be submitted to the following agencies: USFWS, CDFG, Corps, and RWQCB.

## 6.0 ANNUAL MAINTENANCE

This section describes annual maintenance actions necessary for keeping the Cupid Row Canal sediment trap free of excess sediment and certain portions of the canals free of excess vegetation after initial habitat improvements and construction have been completed. Since none of these actions will involve machinery, the probability of SFGS and CRLF take is considered to be very low.

### 6.1 CUPID ROW SEDIMENT TRAP

Regular maintenance of the sediment trap will consist of periodic (as needed) excavation of accumulated sediment using a vacuum truck and hand tools, if necessary. The sediment trap will be inspected prior to beginning of the rainy season to ensure that the structure is clear of debris and ready for winter storm flows. In addition, SFO staff will inspect the sediment trap once a month during the rainy season to ensure that the trap is functioning as intended. If the periodic inspections reveal that sediment levels have filled or are compromising the function of the sediment trap, additional sediment excavation will be conducted. In their sediment generation study of Cupid Row Canal (see Appendix B), Hydroconsult Engineers, Inc. (HCE) recommend that, as a guide, the sediment trap be cleaned out approximately three times per year during the rainy season. As discussed above, SFO and SBCFCZ will work proactively with cities and community groups to identify potential sediment inputs in the upstream watershed to reduce long-term input of sediment.

### 6.2 CANAL VEGETATION MANAGEMENT

Maintaining the two canals of excess in-stream vegetation is critical to the long-term success of the habitat enhancements described above in Sections 2.1 and 2.2. Following the initial habitat creation work in Year 1, SBCFCZ and SFO staff will visit Cupid Row Canal several times per year to monitor cattail and willow re-establishment and assess whether additional vegetation clearing is needed, based on a threshold amount of cattail cover (*e.g.*, if cattail cover exceeds 50 percent of the channel width in any locations, additional clearing will be conducted on an as-needed basis). Emphasis will be placed on clearing vegetation by hand during the initial stages of re-growth before dense root mats form across the low-flow channel.

At South Lomita Canal, portions of the canal that contain substantial amounts of vegetation will be cleared immediately after the initial habitat enhancement activities to provide maximum water flow at the outset of Phase 1. Vegetation removal efforts will focus on the northern portion of the canal between the upstream end to the downstream limit of the concrete bend realignment and canal widening segment. To further reduce sediment input into South Lomita Canal, an agreement between SFO and the City of Millbrae has been established to maintain the existing concrete apron near Landing Lane (west of the BART/Caltrain tracks).

### 6.3 AVOIDANCE AND MINIMIZATION MEASURES

The following measures will be implemented for any maintenance action conducted at the above locations subsequent to initial construction and/or habitat enhancement work. Although some of the measures below refer to “sediment or vegetation removal,” no sediment will be removed during annual vegetation management of the two canals. Any references to “sediment” or “sediment removal” strictly refer to annual maintenance of the Cupid Row Canal sediment trap.

- All of the applicable general protection measures identified above in Section 4.1 will apply to annual maintenance actions.
- All actions will be continuously and thoroughly monitored by a qualified biologist experienced with monitoring for SFGS and CRLF. For the Cupid Row Canal sediment trap work, the biological monitor must possess a 10(a)(1)(A) recovery permit from the USFWS that allows them to handle SFGS and CRLF.
- A chain-of-command for field crews and other on-site personnel will be established prior to each maintenance action. This will establish the biological monitor as the person in charge of, and responsible for, all facets of project implementation. The specific chain-of-command will be established at the pre-project meeting to be held immediately prior to the commencement of work.
- The biological monitor and foreman working on the project will be equipped with two-way radios at all times and at least two cellular phones will be on site during sediment or vegetation removal activities.
- The biological monitor will have the responsibility and authority of stopping work if any crews or personnel are not complying with the avoidance and minimization outlined herein.
- Daily field monitoring forms will be maintained by the biological monitor to document activity implementation. Monitoring forms will describe the progress of work, any difficulties encountered, observations of SFGS or CRLF, and any other pertinent information.
- Prior to sediment removal from the Cupid Row Canal sediment trap, the biological monitor will probe existing sediment and vegetation (if present) for SFGS and CRLF using a probing stick and/or bare hands. Any SFGS or CRLF found during this initial survey will be moved to a suitable relocation area as defined above in Section 4.2.1 (see fifth bullet).
- Prior to any vegetation removal within the canals, the biological monitor(s) will thoroughly survey the immediate area for the presence of SFGS and CRLF using a probing stick and/or bare hands. Following this initial survey, the in-channel vegetation will be modified as follows: only new willow growth, designated as that which is less than or equal to 1 inch diameter-at-breast-height (DBH), or that in which the sum of all branches is less than or equal to 1 inch DBH, may be removed by hand. Cattails will be removed by hand; larger cattails may require cutting below the water surface due to their size and root structure.
- No trapping, handling, or translocation of SFGS will be allowed during canal vegetation management activities. If a SFGS is observed, all work in the immediate vicinity will stop, and the biological monitor will observe the animal. Work may resume only if and when the monitor has determined that the animal has left the work area.

- If any SFGS or CRLF are harmed as a result of sediment or vegetation removal, work will cease immediately and the USFWS and CDFG will be contacted. Work will not re-commence until both agencies are satisfied that all reasonable precautions have been implemented to ensure that no further take will occur.

## 7.0 IMPLEMENTATION

### 7.1 FUNDING

Funding for the habitat improvement and maintenance activities will be identified in advance of each phase of Plan implementation to ensure that adequate budget is available. A typical line item budget will be developed prior to each phase detailing the budget allocated for specific actions to be implemented, including monitoring, minimization measures, reporting, and administration. This budget will be based in part on SFO's and SBCFCZ's prior experience with maintenance activities on the property. SFO and SBCFCZ have a shared responsibility for the maintenance of Cupid Row Canal. Therefore, for Cupid Row Canal habitat enhancements, SFO will work closely with SBCFCZ to determine the projected budget needs for maintenance and management actions for Phase 1 and future phases of the Plan.

The needs of the monitoring program are dynamic due to the adaptive management framework. Consequently, the budget must have flexibility to respond to these needs. Funding for the monitoring program will be provided by SFO on an annual basis and will include a guaranteed base-level allocation. The monitoring program will use these funds to conduct annual data collection, analysis, and reporting. In addition to the base-level funding allocation, a contingency allowance will be established to provide additional flexibility to respond to short-term needs and/or unanticipated management actions that are necessary.

### 7.2 PROJECT TIMELINE AND PHASED APPROACH

The Plan will be in effect for an initial period of 10 years, commencing with the issuance of USFWS and CDFG approvals. Prior to the end of the 10-year period, SFO, SBCFCZ, USFWS, and CDFG will review the success of the Plan and collectively determine whether to continue with enhancement and management actions. If desired by SFO, the Plan may be renewed in increments of 5 or 10 years.

The Plan will be based on a phased approach for implementing the habitat improvement activities, consistent with an adaptive management monitoring strategy as described above. This Plan prescribes enhancement and management actions to be implemented in Phase 1 (*i.e.*, years 1–3). Specific habitat enhancement and management activities to be implemented in future phases (*i.e.*, Phases 2 and 3) will be determined in based on the results of monitoring and data collection following the implementation of Phase 1, in conjunction with input from the agencies. Potential Phase 2 and 3 habitat enhancements may include additional non-native vegetation removal, deepening of existing seasonal wetlands or other habitat enhancements that meet the objectives of this Plan. As discussed above, Phase 2 and 3 habitat improvement activities will be based, in part, on successful enhancement projects that were implemented during the Phase 1 and 2 programs, respectively. At the end of each phase, an interim Plan report summarizing the monitoring results to date, acres of SFGS and CRLF habitat temporarily impacted by the enhancement activities, and proposed habitat enhancement/management measures for the subsequent phase will be submitted to USFWS and CDFG for review and approval.

### **7.3 UNFORESEEN CIRCUMSTANCES**

In the event of unforeseen circumstances that affect implementation of this Plan, SFO will coordinate with USFWS and CDFG to modify the overall project approach, enhancement and management actions, take avoidance/minimization measures, and/or monitoring and reporting requirements, as needed, to address the unforeseen circumstances. If necessary, the Plan will be revised to reflect any significant changes to the elements described above.

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## **APPENDIX A**

# **SOUTH LOMITA CANAL - SFIA WEST OF BAYSHORE SEDIMENT GENERATION STUDY**

## **APPENDIX B**

# **CUPID ROW CANAL - SFIA WEST OF BAYSHORE SEDIMENT GENERATION STUDY**