

**CALIFORNIA RED-LEGGED FROG,  
CALIFORNIA TIGER SALAMANDER AND  
WESTERN POND TURTLE SURVEYS,  
ALAMEDA COUNTY APN 099B-7010002-09**

**Prepared for:**

Gruen, Gruen and Associates  
546 Howard Street  
San Francisco, CA 94105

**Prepared by:**

Biosearch Wildlife Surveys  
P.O. Box 8043  
Santa Cruz, CA 95061  
(831) 662-3938

21 July 1999

**CALIFORNIA RED-LEGGED FROG,  
CALIFORNIA TIGER SALAMANDER AND  
WESTERN POND TURTLE SURVEYS,  
ALAMEDA COUNTY APN 099B-7010002-09**

**SUMMARY**

A field study and habitat assessment for two special-status amphibians and one special-status reptile were performed at an undeveloped 140-acre parcel (Alameda Co. APN 099B-7010002-09) located approximately five miles south of the town of Byron in Alameda County, California. The primary wildlife habitat on the site is non-native grassland. Two drainage courses that cross the site have been impounded to form thirteen permanent ponds. A seasonal pond is present in the southeast corner of the site. The site is currently used to graze cattle.

California red-legged frogs (*Rana aurora draytonii*) inhabit both drainage systems on the site, and close to 100 individuals were observed. California red-legged frog tadpoles were found in six of the ponds, and breeding is suspected in four other ponds. Suitable upland habitat occurs adjacent to occupied ponds. California tiger salamander (*Ambystoma californiense*) larvae were located in the seasonal pond in the southeast corner of the study site, and suitable upland habitat is present throughout most of the parcel. Ten western pond turtles (*Clemmys marmorata*) were present, and both drainage courses provide suitable aquatic habitat. The presence of a juvenile pond turtle confirms that the species breeds in the vicinity. Suitable nesting habitat is present throughout most of the parcel.

**INTRODUCTION**

This report provides the results of focused surveys and habitat assessments for special-status amphibians and aquatic reptiles on a 140-acre parcel located in northeastern Alameda County, California. Diurnal surveys were conducted for California red-legged frog and western pond turtle and nocturnal surveys were carried out for red-legged frog. Aquatic surveys were carried out for California red-legged frog and California tiger salamander, although surveys were conducted outside the optimal survey period to detect the latter species.

The parcel is being acquired to mitigate for loss of special-status species habitat resulting from proposed development projects elsewhere in the Bay Area Region. The purpose of this study was to locate the target species and determine if the site provides breeding habitat to support the species over time. Locality records for each species in the region are presented. Estimates of the acreage of aquatic habitat and potential upland habitat are generated for each species. General management recommendations are provided.

## SITE DESCRIPTION

The subject parcel (Alameda Co. APN 099B-7010002-09) covers 140 acres situated in the SE ¼ of Section 35 (T1S; R3E). It is bordered by Bruns Avenue on the east and by portions of Kelso Road on the south and west. The primary wildlife habitat on the site is annual grassland dominated by *Bromus* and *Avena*. Two low ridges cross the parcel from southwest to northeast. Three drainage courses flow towards the northeast across the site, two of which have been impounded into a series of permanent ponds. The central drainage contains eight ponds (Ponds 1-7; Figures 2-5). Pond 1 has an island in its center. Ponds 1, 2, 3, 4, 5a and 6 are greater than three feet deep. Pond 5b is relatively small and no more than two feet deep. Pond 7 is filled with sediment and is no more than a few inches deep (Figure 5). All the ponds have a deep layer of sediment. As the result of cattle grazing, little emergent vegetation is present in any of these ponds with the exception of Pond 7. The western drainage contains five ponds (Ponds 9-13; Figures 2, 7-8). Ponds 9, 10, 11 and 13 are greater than three feet deep and support small patches of emergent vegetation. Pond 12 is mostly filled with sediment and is no more than a few inches deep. There was once a pond situated between Ponds 12 and 13, but the berm has been breached. The creek between these ponds supports freshwater marsh vegetation. The easternmost drainage has a single pond (Pond 8; Figure 6) that holds water into mid-summer. There is very little emergent vegetation at this pond.

Elevations on the site range from 80 feet along Bruns Road to 160 feet along the central ridge. The site is currently used for grazing cattle. California ground squirrels (*Spermophilus beecheyi*) are distributed throughout the site. A wood pole transmission line and two underground pipelines pass through the site. A warehouse is situated in the southeastern corner. An old quarry is present in the southwestern portion of the site. Surrounding lands are used primarily for cattle grazing, wind energy production and agriculture. A substation is present across Bruns Road to the east and the Delta Pumping Plant is situated to the northwest. The main drainage courses appear to receive water from seepage from the Bethany Reservoir located less than 1½ miles to the south.

## BACKGROUND INFORMATION - SPECIES ACCOUNTS

### California red-legged frog (*Rana aurora draytonii*)

The California red-legged frog is the largest native frog in California and can reach a body length of 5½". It historically occupied many of the Pacific drainage basins in California, but has been eliminated from 70-75% of its range (Jennings & Hayes 1994; Miller, *et al.* 1996). The species requires still or slow-moving water during the breeding season, where it deposits large egg masses, usually attached to submergent or emergent vegetation. Breeding typically occurs between December and April, depending on annual environmental conditions. Eggs require 6 to 12 days before hatching and metamorphosis occurs 3.5 to 7 months after hatching (Stebbins 1985), normally between July and September. Radio-telemetry data indicates that during the breeding season, adults engage in straight-line movements irrespective of riparian corridors, and may move up to two miles between non-breeding and breeding sites (Bulger 1999). They may take refuge in

small mammal burrows, leaf litter or other moist areas in order to avoid desiccation (Rathbun, *et al.* 1993; Jennings and Hayes 1994). California red-legged frogs emerge to forage after dark, and may move up to 300 feet into surrounding uplands, especially following rains, when individuals may spend days or weeks in upland habitats (Bulger 1999). During the non-breeding season, a wider variety of aquatic habitats are used, including small pools in coastal streams (Bulger, pers. comm.; Allaback and Laabs, pers. observ.). Occurrence of this frog has shown to be negatively correlated with presence of introduced bullfrogs (Moyle 1973; Hayes & Jennings 1986, 1988), although both species may be able to persist at certain locations (pers. observ.; Jennings, pers. comm.). On 23 May 1996, the California red-legged frog was listed as Threatened under the federal Endangered Species Act (USFWS 1973; Miller, *et al.* 1996).

### **California tiger salamander (*Ambystoma californiense*)**

The California tiger salamander inhabits grassland and oak savanna habitats in the valleys and low hills of central and coastal California. Adults spend most of their lives underground, typically in burrows of ground squirrels and other animals. During winter rains between November and March, adults emerge from underground retreats to breed (Jennings & Hayes 1994; Loredo and Van Vuren 1996). Vernal pool and semi-permanent, quiet waters provide sites for egg-laying. After hatching in two to three weeks, larvae are 10-15 mm in length. They continue to develop in the pools for three to four months until they metamorphose at about 100-125mm (50-70mm snout-vent length). Annual recruitment is variable and appears to be related to the timing and amount of rainfall (Loredo and Van Vuren 1996). Following transformation, juvenile salamanders seek refugia, typically mammal burrows, in which they may remain until the next winter rains (Stebbins 1985; Jennings 1996). However, movements of juveniles are unpredictable and mass migrations have been observed in the summer months and during the first fall rains (Holland *et al.* 1990). Habitat conversion has eliminated the species from much of its former range (Shaffer *et al.* 1993; Fisher and Shaffer 1996). The California tiger salamander is currently listed as a federal Candidate species following a ruling by the USFWS (Sorensen 1994), which found Endangered status "warranted but precluded" by higher priority species. A ruling is supposed to be published annually by USFWS regarding the species' status.

### **Western pond turtle (*Clemmys marmorata*)**

The western pond turtle ranges from western Washington to northern Baja California, mostly west of the Sierra Nevada-Cascade crest (Stebbins 1985). It can reach a length of just over 8 inches (21cm) with a low carapace that is generally olive, brownish or blackish (Stebbins 1985; Jennings and Hayes 1994). It primarily inhabits permanent water sources including ponds, streams and rivers. It is often seen basking on logs, mud banks or mats of vegetation. The species can be difficult to detect, particularly if no obvious basking sites are present or if the environmental conditions are not favorable. Pond turtles can move across terrestrial habitats in response to fluctuating water level, an apparent adaptation to the variable rainfall and unpredictable flows that occur in many

coastal California drainage basins (Rathbun, *et al.* 1992). In addition, it can over-winter on land or in water or remain active in the winter, depending on environmental conditions (Rathbun, *et al.* 1993; Jennings and Hayes 1994). Females travel from aquatic sites into open, grassy areas to lay eggs in shallow nests (Holland 1992; Rathbun, *et al.* 1992). Nests have been reported from 2-400 meters or more away from water bodies (Jennings and Hayes 1994). It appears that most hatchlings over-winter in the nest (Holland 1992; Jennings and Hayes 1994), and placing nests away from watercourses makes young less susceptible to death by flood events that commonly occur during the winter weather year (Rathbun, *et al.* 1992). Pond turtles may live for 40 years or more (Jennings and Hayes 1994), and are therefore able to persist in certain degraded areas even without successful reproduction. The western pond turtle has been separated into two subspecies (*C. m. marmorata* is the northwestern subspecies and *C. m. pallida* is the southwestern subspecies), both of which are listed as Species of Special Concern by the CDFG. Current research suggests, however, that the taxon may be represented by three distinct populations throughout its range in California and may therefore require a taxonomic revision (Jennings and Hayes 1994).

## METHODS

Field surveys were conducted by wildlife biologists David Laabs, Mark Allaback and field assistant Sara Higgins. Field surveys for California red-legged frogs followed survey guidelines provided by the U.S. Fish and Wildlife Service (USFWS 1997), with the addition of a third nocturnal survey. Nocturnal surveys were conducted on 1 June, 7 June and 22 June 1999. The perimeter of each pond was walked slowly with headlamps and binoculars. The shoreline, water surface and adjacent upland areas were inspected. All amphibians were identified to species (if possible) and recorded by pond number. Environmental conditions (air temperature, cloud cover and wind speed) were recorded.

Diurnal visual surveys were conducted for California red-legged frogs and western pond turtles on 1 June and 16 June 1999. Each pond was surveyed with binoculars at a distance, then the edge of each pond was walked slowly. All vertebrates observed or detected by sign were recorded. Environmental conditions were recorded.

Aquatic sampling was performed for California red-legged frog and California tiger salamander larvae on 1 June and 16 June using a combination of seines, dip-nets and minnow traps. Surveys for California tiger salamanders followed the Aquatic Surveys portion of the CDFG survey protocol for the species, with the exception that surveys were conducted later in the season than is optimal (CDFG 1996). Sampling for red-legged frog larvae was conducted under authority of a federal Fish and Wildlife Permit (PRT-768-251). Pond bottoms were covered in a deep layer of sediment, which made seining difficult or impractical in most of the ponds. Minnow traps were placed along the shoreline of each pond in which larvae had not been detected by other methods. Floats were placed inside each trap to provide an air space for any air-breathing vertebrates that might be captured. Traps were staked to the shoreline with nylon rope. Traps were kept in place between three and six hours before checking.

The results of previous biological surveys in the vicinity were reviewed (JSA 1990; Stromberg 1991, 1994, 1997; Contra Costa County Water District 1993; Environmental Sciences Associates 1993; Skenfeld 1993; Biosearch Wildlife Surveys 1995, 1996, 1997, 1998a, 1998b, 1998c). A record search of the California Natural Diversity Data Base was performed for the Byron Hot Springs and Clifton Court Forebay quadrangles.

## **RESULTS**

### **Previous Observations in Vicinity**

All records of California red-legged frog, California tiger salamander and western pond turtle within one mile of each parcel are included in the following descriptions, while all observations within five miles are presented in Figure 1.

California red-legged frogs are known from numerous localities to the north, west and south of the property (Figure 1), and observations have been recorded over the past 20 years. Red-legged frogs are known from the Brushy Creek, Mountain House and Kellogg Creek drainage basins and can be found in stock ponds and slow-moving creeks throughout much of the region. In 1982, California red-legged frogs were recorded near Christensen Road, 0.7 miles S of the site. In 1997, the species was documented near the end of Byron Hot Springs Road, 0.7 miles W of the site, and along Christensen Road near the California Aqueduct, 0.8 miles SW of the site. This latter record is further upstream one of the drainage courses that cross the subject property.

California tiger salamanders have been recorded in several locations to the north, west and south of the property (Figure 1). California tiger salamanders are known from the Brushy Creek, Mountain House and Kellogg Creek drainage basins, and can be found in stock ponds and vernal pools throughout much of the region. In 1981, an adult was seen on the parcel just west of Bruns Avenue. In 1982, juvenile tiger salamanders were observed at a stock pond near the California Aqueduct 0.8 miles north of the parcel. In 1986, tiger salamander larvae were observed at two locations near the intersection of Christensen Road and Bruns Avenue, one mile south of the parcel.

Western pond turtles are known from scattered localities in the Brushy Creek, Mountain House and Kellogg Creek drainage basins (Figure 1). In March 1996, four adult pond turtles were observed in a pond 0.5 miles to the northeast, along the same drainage that crosses the study site (Laabs, pers. obs.).

### **Field Surveys**

#### Results of Nocturnal Surveys

Nocturnal surveys were conducted on 1 June, 7 June and 22 June 1999. Air temperatures were 58°, 55° and 78° F at the beginning of each survey, respectively. Surveys on 1 and

22 June were performed in relatively poor conditions due to strong winds ranging from an estimated 10 to 25 miles per hour. The nocturnal survey on 7 June was conducted under extreme conditions with winds estimated to be over 30 miles per hour, and numbers were correspondingly lower. California red-legged frog adults were observed in twelve ponds (all except Ponds 7 and 8). Ninety-nine red-legged frogs were observed on 22 June 1999. An estimated 60-75% of these individuals were considered to be of reproductive age based on size (greater than or equal to approximately 80mm, snout-vent length). Large frogs that could not be identified to species were observed on 2 and 6 occasions on 7 June and 22 June, respectively. A single adult bullfrog (*Rana catesbeiana*) was observed at Pond 9 on 22 June. Pacific tree frog adults were observed and heard in several locations. Muskrats (*Ondatra zibethica*) or their sign were observed in all ponds except Ponds 7, 8 and 12.

### Results of Diurnal Surveys

Diurnal surveys were conducted on 1 June and 16 June 1999. Temperatures were 72° and 76° F at the beginning of each survey, respectively. Western pond turtles were observed in six ponds (Ponds 1, 2, 3, 5a, 6 and 11). Ten turtles were observed on 1 June, while eight were observed on 16 June. All individuals except one were adults (>140 mm). A single juvenile turtle was observed in Pond 1 on 16 June 1999. Two California red-legged frogs, one bullfrog and two unidentified frogs were observed on 1 June, while 19 California red-legged frogs and three unidentified frogs were observed on 16 June 1999. Because diurnal surveys are much less reliable for locating red-legged frogs, only results of nocturnal visits are given in Table 1.

Three bird species with young were observed on the site. American avocets (*Recurvirostra americana*) were observed in Pond 2, mallards (*Anas platyrhynchos*) in Pond 3 and cinnamon teal (*Anas cyanoptera*) in Pond 4.

### Results of Aquatic Surveys

Aquatic sampling was performed at twelve of the fourteen ponds. Ponds 7 and 12 are filled with sediment, and are not currently deep enough to support red-legged frog tadpoles. Red-legged frog tadpoles were captured in six ponds (Ponds 1, 2, 3, 5a, 10 and 11). All tadpoles appeared healthy, and within the expected range of development for the time of year. Pacific tree frog (*Hyla regilla*) tadpoles were present in all permanent ponds. Two non-native species were captured in both permanent drainages: mosquitofish (*Gambusia affinis*) and red swamp crayfish (*Procambarus clarkii*).

California tiger salamander larvae were captured in a single pond (Pond 8). This is the only pond that dries during the summer on the study site. All tiger salamander larvae appeared healthy and within the expected stage of development for the time of year. No other vertebrates were detected in Pond 8.

Pond #	WPT 6/1/99 Diurnal	WPT 6/16/99 Diurnal	RLF 6/1/99 Nocturnal	RLF 6/7/99 Nocturnal	RLF 6/22/99 Nocturnal	RLF/CTS Larvae 6/1/99; 6/22/99 Aquatic
1	2	1	2	1	2	RLF
2	4	4	6	0	3	RLF
3	2	1	19	2	9	RLF
4	0	0	12	2	8	
5a	1	0	8	0	6	RLF
5b	0	0	0	0	7	
6	0	1	6	0	8	
7	0	0	0	0	0	
8	0	0	0	0	0	CTS
9	0	0	3	0	1	
10	0	0	6	4	5	RLF
11	1	1	2	1	24	RLF
12	0	0	0	0	3	
13	0	0	6	5	23	
Total	10	8	70	15	99	6 RLF/1 CTS

**Table 1.** Results of nocturnal surveys for California red-legged frog (RLF), diurnal surveys for western pond turtles (WPT) and aquatic surveys for California red-legged frogs and California tiger salamanders (CTS) at parcel APN 099B-7010002-09, Alameda County.

### Other Special-status Species

Several other special-status species were observed on Parcel F. Two loggerhead shrikes (*Lanius ludovicianus*) were present along the western edge of the parcel on 1 June and 16 June. A northern harrier (*Circus cyaneus*) was observed foraging near Pond 11. A group of four burrowing owls (*Athene cunicularia*) was observed in the southwest portion of the site on 16 June. Burrowing owl calls were heard during every night survey in the vicinity of Pond 6. During previous field surveys on the site in October 1998, ten burrowing owls and 24 owl burrows with sign were identified (Biosearch Wildlife Surveys and 1998). Potential San Joaquin kit fox burrows were also seen, as well as fox-sized scat, and the species has been recorded on numerous occasions in the vicinity. American badgers are active on the site, based on the presence of recent diggings and fresh burrows. A white-tailed kite and a northern harrier were observed on 29 October 1998. An immature golden eagle was found dead near the southwestern corner of the site last year (Biosearch Wildlife Surveys 1998).



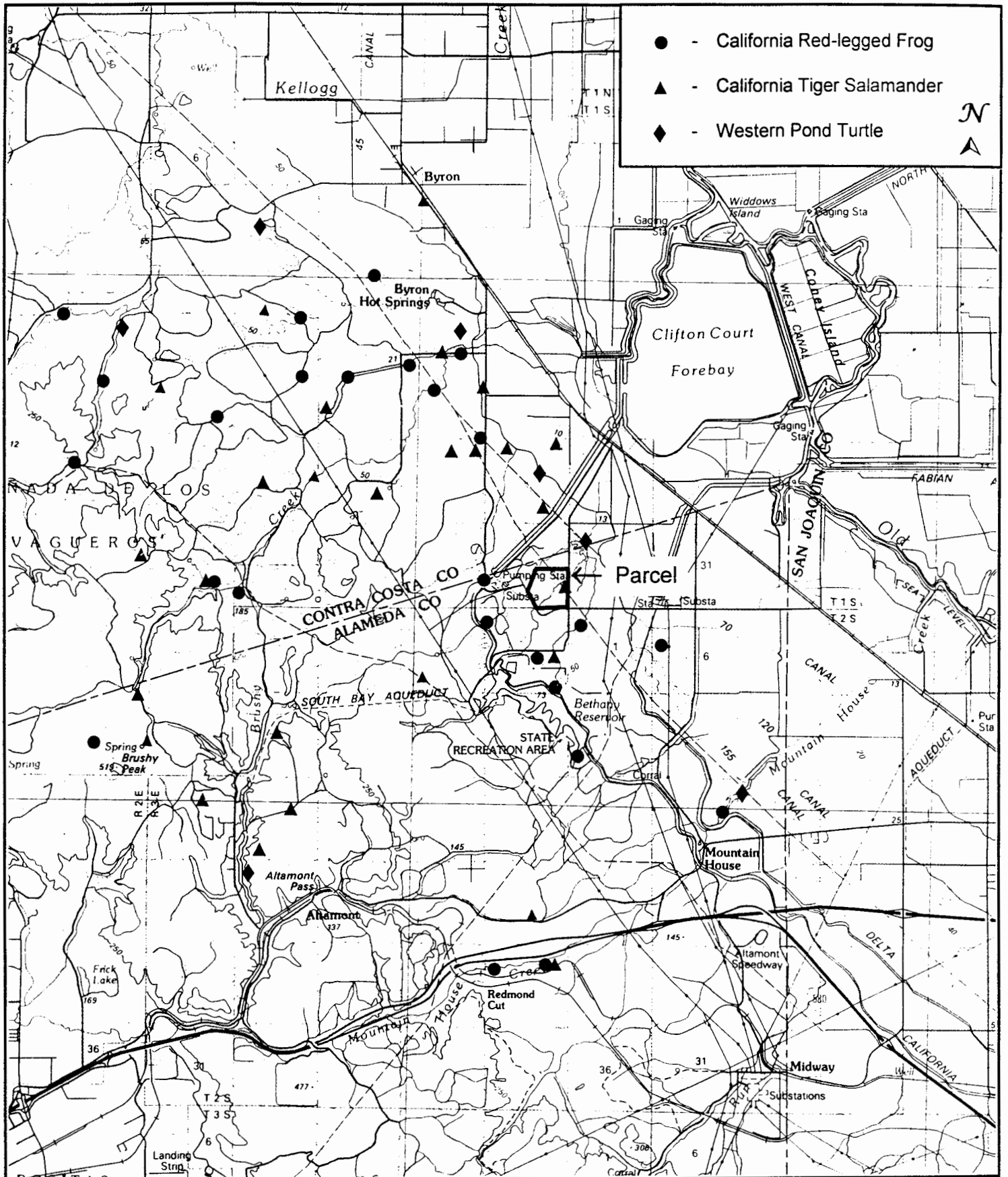
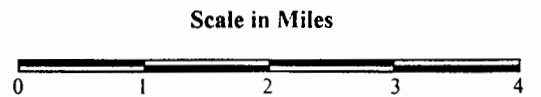


Figure 1. Red-legged Frog, Tiger Salamander & Pond Turtle – Regional Observations

Biosearch Wildlife Surveys  
 PO Box 8043  
 Santa Cruz CA 95061



Source: USGS Stockton 1:100,000 Scale

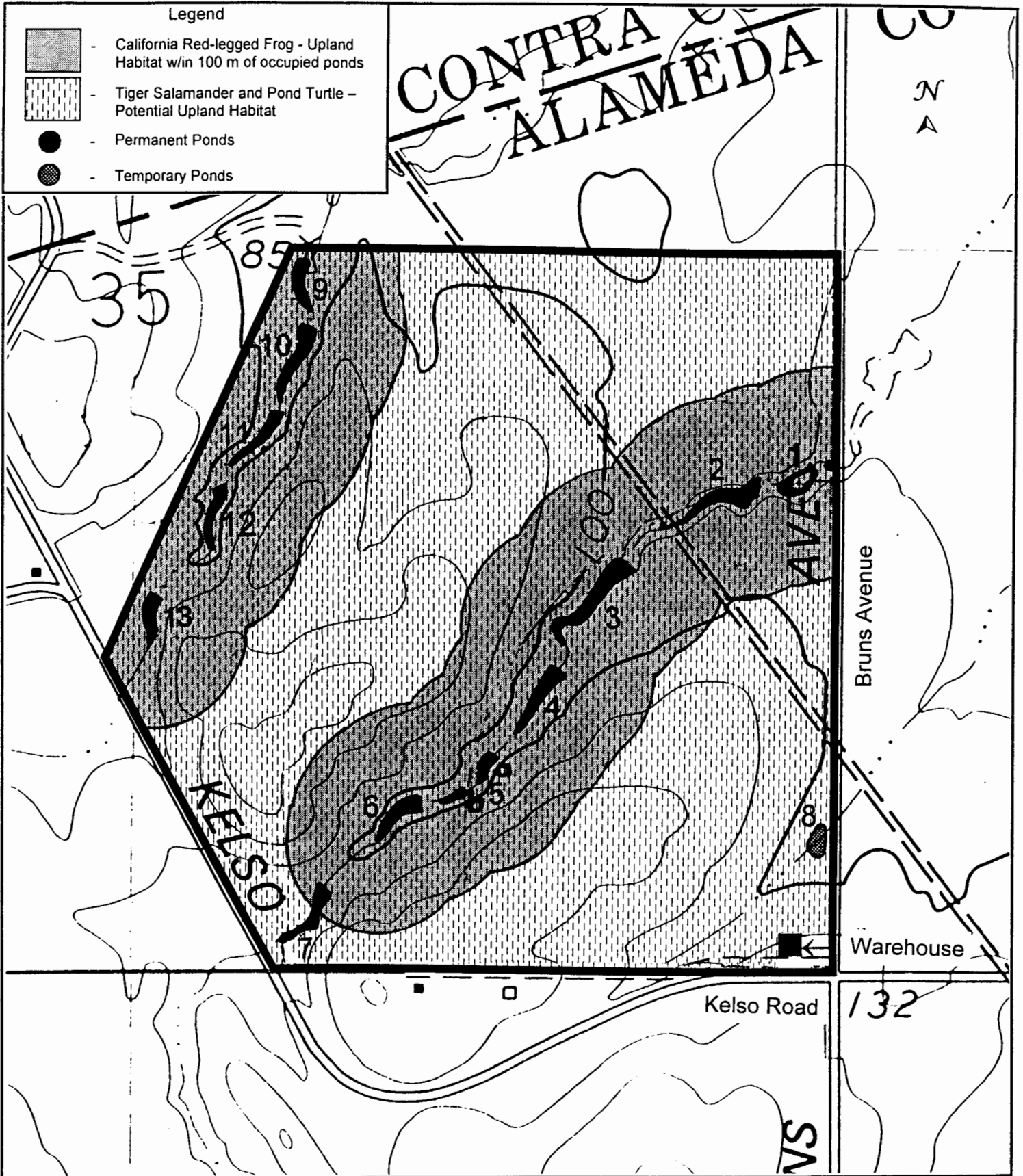


Figure 2. Red-legged Frog, Tiger Salamander & Pond Turtle - Potential Habitat

Biosearch Wildlife Surveys  
 PO Box 8043  
 Santa Cruz CA 95061

Scale in Feet  
 0 200 400 600 800 1000  
 Source: Clifton Court Forebay USGS Quad

## DISCUSSION

The study site currently provides suitable habitat for California red-legged frogs based on the presence of nearly 100 adults, six breeding sites, and undeveloped upland habitat. Due to the windy conditions encountered during surveys, the numbers of frogs are probably higher than were counted. Introduced bullfrogs are present in both drainage courses, but only two individuals were observed (one at Pond 2 and one at Pond 9). Even taking into account the possibility that the unidentified frogs were bullfrogs, the relative frequency of bullfrogs is very low compared to that of red-legged frogs. However, since the drainage systems contain water year-round, bullfrog abundance could increase rapidly. Two other species implicated in declines of native amphibians, red swamp crayfish and mosquitofish, are also present. A full inventory of fishes was not performed, and if larger predatory fishes are present or become established in the future, they could have a profound negative effect on red-legged frog reproduction. Red-legged frogs inhabited twelve of the fourteen ponds surveyed (Ponds 1, 2, 3, 4, 5a, 5b, 6, 9, 10, 11, 12 and 13). These ponds occupy ~2.5 acres of the site. Red-legged frogs were confirmed to be breeding in six ponds (Ponds 1, 2, 3, 5a, 10, and 11). Breeding in Ponds 4, 6, 9 and 13 is suspected, given the similarities to confirmed breeding sites, and the difficulties in sampling the ponds effectively. Therefore, breeding is confirmed or suspected in ponds that occupy ~2.3 acres of the site. The acreage calculations are approximations made in the field and checked with aerial photographs. A formal wetland delineation has not been conducted.

California red-legged frogs make use of upland habitats in the vicinity of occupied aquatic habitats (Rathbun, *et al.* 1993; Miller, *et al.*, 1996; Bulger, 1999). The use of such habitats varies seasonally. Data on the use of upland habitats in the relatively arid region that includes the subject parcel are lacking. Recent radio-telemetry data collected in northern Santa Cruz County indicates that red-legged frogs frequently spent days or weeks in upland areas away from breeding sites (Bulger 1999). Use of uplands increased following rain events. These data showed that 50% of all non-dispersing activity was within 25 m of occupied aquatic sites, while 90% was within 60 meters. Virtually all non-dispersing activity occurred within 100 meters of occupied aquatic habitats. Uplands within 100 meters of occupied ponds on the study parcel make up ~60.9 acres of the site. During dispersal behaviors (e.g. during winter when red-legged frogs migrate between non-breeding and breeding habitat), long-range movements of up to two miles have been documented. This indicates that during the winter months, virtually the entire site could be utilized by red-legged frogs dispersing to or from breeding ponds on and off the study site.

The site provides suitable habitat for California tiger salamander based on the presence of a known breeding pond and suitable upland habitat. It is estimated that Pond 8 supported hundreds of tiger salamander larvae on 1 June, and the pond continued to hold water in mid-June. Although the aquatic sampling effort was performed late in the year, it is unlikely that the other ponds are used for breeding, since they all contain year-round water, and are atypical of native tiger salamander breeding sites in the vicinity. Additional

sampling earlier in the season would be necessary to confirm this. The breeding pond on the parcel covers 0.1 acres.

California tiger salamanders occupy uplands for most of the year. Data on the distances traveled between upland aestivation sites and breeding sites is limited. CDFG considers all suitable habitat within one kilometer of breeding sites to be potential upland habitat. During a complete ground survey of the site conducted in the fall of 1998, 1,993 California ground squirrel burrows were counted on the site, for an average of 14.2 burrows/acre (Biosearch Wildlife Surveys 1998c). Ground squirrel burrows were scattered throughout the site. Burrows of Botta's pocket gopher (*Thomomys bottae*) and California vole (*Microtus californicus*) were also observed, indicating that the site has an abundance of potential aestivation sites. Therefore, 136.9 acres of the site (excluding the ponds, the channels between the ponds and the warehouse) represents suitable upland habitat for the species.

The site provides appropriate habitat for western pond turtle based on the presence of ten individuals, permanent aquatic habitat and adjacent undeveloped upland habitat. The presence of a juvenile turtle suggests that the species is successfully breeding in the area. Western pond turtles were observed in five of the ponds in the central drainage and a single pond in the western drainage. However, all of the deeper ponds on the site provide appropriate conditions for the species. Only Ponds 5b, 7 and 12 are too shallow to provide escape cover for pond turtles. Therefore, ~2.3 acres of the site is appropriate aquatic habitat. Upland habitat in the vicinity of occupied aquatic habitat is likely used by western pond turtles for egg-laying as well as during periods of dormancy, although the use of upland habitats by the species is still poorly understood. A radio-telemetry study from Monterey County documented that pond turtles will nest up to 400 meters from aquatic habitats. Therefore, ~136.9 acres of the site (excluding the ponds, drainage courses and the warehouse) represents potential upland habitat for the species.



A management plan should be prepared to ensure that mitigation lands continue to provide suitable habitat for California red-legged frogs, California tiger salamanders and western pond turtles as well as burrowing owls. Management should center on the continuation of cattle grazing and maintenance of current ground squirrel abundance. Keeping grass height relatively low by regular cattle grazing appears to be an effective means of optimizing conditions for both ground squirrels and burrowing owls in annual grassland habitat. Ground squirrel burrows also provide important cover-sites for both California tiger salamanders and California red-legged frogs. If grazing were to cease habitat suitability for these species could decrease dramatically and ground squirrels could abandon the site. The current level of grazing appears to benefit resident special-status species. Leasing the lands for grazing would provide income that could be used for low-level management of the parcel. Several items should be written into the cattle operator's lease including a prohibition on ground squirrel poisoning, hunting and trespass.

The relative abundance of bullfrogs on the site is currently low, and control measures are not warranted at this time. Although a fish inventory was not part of this study, it seems unlikely that large predatory fishes such as bass are present, since red-legged frogs and tadpoles are numerous. However, if relative abundance of bullfrogs or exotic fishes increases significantly, control measures should be considered. Since the site contains permanent waters and introduction of exotic aquatic predators and competitors are a constant threat, a biological monitoring program is justifiable. Monitoring methods should compare with those used in the present study. A management plan for the parcel should provide various options to control or reduce abundance of exotic species.

Ensuring the integrity of the man-made berms that form the ponds should also be included in the management plan. This is particularly important for Pond 8, which represents the only breeding site for California tiger salamanders on the site.

The ponds on the site are used to water cattle, although not all the ponds are necessary for this purpose. Excluding cattle from some of the ponds may increase habitat quality for California red-legged frogs and western pond turtles by increasing emergent vegetation. However, such a change could also result in an increase in the numbers of bullfrogs on the site. Experimental exclosures of some of the ponds should be attempted and the results assessed prior to any large-scale exclusion of cattle. Western pond turtles could benefit from introduction of floating basking sites, which are not currently present.

## CITATIONS

- Biosearch Wildlife Surveys. 1995. San Joaquin kit fox survey and first year monitoring of Habitat Management Lands (1994) Byron Airport, Contra Costa County, California. Prepared for: Manager of Airports, Contra Costa County.
- \_\_\_\_\_. 1996. Red-legged frog survey, Armstrong Road, Contra Costa County, California. Santa Cruz, California. Prepared for: Contra Costa County Public Works Department, Martinez, California. 26 September.
- \_\_\_\_\_. 1997. San Joaquin kit fox survey and third year monitoring of Habitat Management Lands (1996) Byron Airport, Contra Costa County, California. Prepared for: Manager of Airports, Contra Costa County.
- \_\_\_\_\_. 1998a. Burrowing owl survey, Armstrong Road Reconstruction Project. Prepared for: Contra Costa County Public Works Department, Martinez, California.
- \_\_\_\_\_. 1998b. Burrowing owl, San Joaquin kit fox and Swainson's hawk assessment along a proposed water pipeline in Contra Costa County. Prepared for: Byron-Bethany Irrigation District, Byron, California.
- \_\_\_\_\_. 1998c. Burrowing owl habitat assessment, Contra Costa Co. APN 002-200-01 (Portion), Alameda Co. APN 099B-7020-1-8, APN 099B-7010-002-07 & APN 099B-7010002-09. Prepared for: Gruen, Gruen Associates.
- Bulger, J. B. 1999. Terrestrial activity and conservation of California red-legged frogs (*Rana aurora draytonii*) in forested habitats of Santa Cruz County, California. Prepared for Land Trust of Santa Cruz County.
- California Department of Fish and Game. 1996. Survey protocol for California tiger salamander (*Ambystoma Californiense*). Inland Fisheries Informational Leaflet # 44. Contra Costa Water District and U.S. Department of Interior, Bureau of Reclamation.
1993. Final Stage 2 Environmental Impact Report/ Environmental Impact Statement for the Los Vaqueros Project.
- Environmental Science Associates. 1993. State Route 4 Bypass Project Environmental Impact Report. Submitted to: State 4 Bypass Authority.
- Fisher, R. N., and H. B. Shaffer. 1996. The Decline of Amphibians in California's Great Central Valley. Conservation Biology, Pages 1387-1397, Volume 10, No. 5.
- Hayes, M.P. and M.R. Jennings. 1986. Decline of Ranid Frog Species in Western North America: are Bullfrogs (*Rana catesbeiana*) Responsible? Journal of Herpetology 20:490-509.
- Hayes, M.P. and M.R. Jennings. 1988. Habitat Correlates of Distribution of the California Red-legged Frog (*Rana aurora draytonii*) and the Foothill Yellow-legged Frog (*Rana boylei*): Implications for Management. In R.C. Szaro, K.E. Severson, and D.R. Patton tech. Corr., Management of Amphibians, Reptiles and Small Mammals in North America. USDA, Forest Service, Rocky Mountain Forest and Range Experiment Station. Gen. Tech. Rpt. RM-166.
- Holland, D. C., M. P. Hayes and E. McMillan. 1990. Late summer movement and mass mortality in the California tiger salamander (*Ambystoma californiense*). Southwestern Naturalist. 35:217-220.
- Holland, D.C. 1992. A Synopsis of the Distribution and Current Status of the Western Pond Turtle in (*Clemmys marmorata*) Oregon. Report prepared for Nongame Division

- Oregon Department of Fish and Wildlife.
- Jennings, M. R. 1996. *Ambystoma californiense* (California tiger salamander). Burrowing ability. *Herpetological Review* 27(4).
- Jennings, M. R. and M. P. Hayes. 1994. Amphibian and Reptile Species of Special Concern in California. California Department of Fish and Game Contract # 8023. Inland Fisheries Division, Rancho Cordova, California.
- Jones & Stokes. 1990. Draft Environmental Impact Report Vasco Road and Utility Relocation Project. Prepared for: Contra Costa Water District.
- Loredo, I. and D. Van Vuren. 1996. Reproductive Ecology of a Population of the California Tiger Salamander. *Copeia*, 1996 (4), pages 895-901.
- Miller, K. J., A. Willy, S. Larsen, and S. Morey. 1996. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the California Red-legged Frog. *Federal Register*: Vol. 61, No. 101.
- Moyle, P.B. 1973. Effects of introduced bullfrogs, *Rana catesbeiana*, on the native frogs of the San Joaquin Valley, California. *Copeia*, 1973: 18-22.
- Shaffer, H.B, R. N. Fisher and S. E. Stanley. 1993. Status Report: the California Tiger Salamander (*Ambystoma californiense*). Final report for California Department of Fish and Game, Inland Fisheries Division Contracts FG 9422 and FG 1383.
- Skenfield, M.W. 1993. Vernal pool survey, Byron Hot Springs project, Contra Costa County. Murphys, CA. Prepared for: PDM Soils, Inc., Byron, CA.
- Sorensen, P.C. 1994. Endangered and Threatened Wildlife and Plants; 12-month Petition Finding for the California Tiger Salamander. *Federal Register*, 59: 18353-18354.
- Stebbins, R.C. 1985. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston MA.
- Stromberg, L.P. 1991. Biological Assessment. Byron Airport Expansion Project, Contra Costa County California. San Rafael, CA. Submitted to Sacramento Field Office, United States Fish and Wildlife Service, Sacramento, CA.
- Stromberg, L.P. 1994. Biological Constraints Analysis, Byron Planning area, Contra Costa County, California. San Rafael, CA. Prepared for Comprehensive Planning Community Development Department, Martinez, CA.
- Stromberg, L. P. 1997. Results of 1996-97 wetland monitoring surveys, Byron Airport and Byron Boy's Ranch, Contra Costa County, California. Prepared for: Manager of Airports, Contra Costa County.
- Rathbun, G.B., N. Siepel, and D. Holland. 1992. Nesting Behavior and Movements of Western Pond Turtles (*Clemmys marmorata*). *The Southwestern Naturalist*, Vol. 37, No. 3, September.
- Rathbun, G.B., M.R. Jennings, T.G. Murphey, and N.R. Siepel. 1993. Status and Ecology of Sensitive Aquatic Vertebrates in Lower San Simeon and Pico Creeks, San Luis Obispo County, California. Unpublished report, National Ecology Research Center, Piedras Blancas Research Station, San Simeon, California, 93452-0070. Cooperative Agreement 14-16-009-91-1909.
- USFWS. 1997. Guidance of Site Assessment and Field Surveys for California Red-legged Frogs.



**Figure 3.** Pond 1 looking east towards Kelso Avenue.



**Figure 4.** Pond 3 from berm looking southwest.





Figure 5. Pond 7 from berm looking southwest.



Figure 6. Pond 8 from berm looking south.



Figure 7. Pond 11 from berm looking south.



Figure 8. Pond 13 from berm looking south.