ENTRIX, Inc., "Focused Special-Status Aquatic Species Assessment—Santa Clara River, Landmark Village Project, Newhall Ranch, California" (2006; 2006B)

FOCUSED SPECIAL-STATUS AQUATIC SPECIES ASSESSMENT - SANTA CLARA RIVER

LANDMARK VILLAGE PROJECT NEWHALL RANCH, CALIFORNIA

Prepared for: Newhall Land Valencia, CA

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Project No. 3109002

April 5, 2006

Focused Special Status Aquatic Species Assessment Santa Clara River

Landmark Village Project Newhall Ranch, California

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1. INTRODUCTION

This report summarizes the focused assessment of potential effects of the Landmark Village (Project) on threatened or endangered aquatic species inhabiting the Newhall Ranch reach of the Santa Clara River, from the Castaic Creek confluence through the boundary of the proposed Landmark Project. Specifically, this report focused on potential impacts to unarmored threespine stickleback, arroyo toad, and California red-legged frog as these species are listed as threatened or endangered by the State and Federal Endangered Species Act. In addition, this assessment includes discussion of potential impacts to southwestern pond turtle and two-stripe garter snake designated by the State as "Species of Concern." The primary focus of this assessment is to examine potential impacts to the habitat of the above species resulting from alterations to local hydrology and corresponding habitat areas through implementation of the Project.

1.1 LANDMARK VILLAGE PROJECT (LANDMARK)

Newhall Land (Newhall) plans to develop approximately 291 acres of property west of Castaic Creek adjacent to the north bank of the Santa Clara River. The Project site is currently used for agricultural production, and is within the approved Newhall Ranch Specific Plan boundaries. Newhall retained ENTRIX to assess the potential effects of the Project on selected special-status aquatic species, including unarmored threespine stickleback, arroyo toad, California red-legged frog, southwestern pond turtle, and two-stripe garter snake. The primary features related to the Project examined in this assessment focus on buried soil cement bank stabilization along both the north and south banks of the Santa Clara River, construction of Long Canyon Road bridge over the river, which would include bridge abutments and piers, and exposed rock rip rap flanking the SR-126 bridge at Castaic Creek. The footprint of the buried bank stabilization is set back from the Santa Clara and the existing riparian corridor, and the exposed protection along Castaic Creek is along the margin of the active channel. This assessment addresses both the construction footprint of the bank protection as well as the anticipated hydrologic and water quality influences of the Project on in-stream habitat utilization.

1.2 BACKGROUND

Unarmored Threespine Stickleback

The unarmored threespine stickleback, *Gasterosteus aculeatus williamsoni*, was designated a federally endangered species in 1970 (U. S. Fish and Wildlife Service 1985) and a state endangered species in 1971. Populations are restricted to three sections of the upper Santa Clara River including the Newhall Ranch reach, which represents the downstream demarcation of the unarmored subspecies. Currently, Critical Habitat for unarmored threespine stickleback

has not been designated under the Endangered Species Act. The fish is a small, largely annual fish that requires shallow, slow, marginal stream flows with abundant aquatic vegetation for cover. The male guards territories and builds a small nest of decaying vegetation where he guards the eggs until they hatch. Large numbers of stickleback can exist in the summer and fall with the long breeding season in southern California, and breeding can be almost all year in dry years when a stream is minimally disrupted by storm flows. Up to a few hundred stickleback per 10 meters of stream can exist under optimum conditions. Strong storm flows usually severely decimate the population until the streams stabilize in spring and the numbers can build up again.

Other populations within the Santa Clara River watershed occur upstream of the Project site both in Soledad Canyon above Lang Station (about 12 miles upstream) and in San Francisquito Canyon from just below Drinkwater Reservoir upstream to the vicinity of the old St. Francis Dam location (about 11..5 miles upstream of the river). San Francisquito Creek actually enters the Santa Clara River about three miles upstream of the Project site near the upper end of the downstream unarmored population. Recently, a population was discovered in upper Bouquet Canyon (Jonathan Baskin, pers. comm.) about 11 miles above its mouth at the Santa Clara River. Perennial flows occur in the Santa Clara River downstream of the Saugus Water Reclamation Plant, which discharges tertiary treated effluent immediately downstream of the Bouquet Canyon Road bridge over the Santa Clara River. These populations are located upstream of the Project site and the hydrology and habitat where these populations are situated are clearly not affected by the Project.

Arroyo Toad

Arroyo toads (*Bufo californicus*) occupy the margins of permanent and seasonal streams in coastal foothill canyons and valleys and to a limited extent in the desert, but they require extremely specialized and limited microhabitat within that general habitat type. Most spawning occurs in shallow overflow pools adjacent to inflow channels of third and higher-order streams. During the remainder of the year, adults occupy adjacent sand bars and sandy terraces, nearly always within 100 meters of suitable spawning pools. Suitable spawning pools lack suspended silt, aquatic predators, and dense woody bordering vegetation (Sweet 1993). Suitable bordering sandbars are usually dampened by capillarity and often include sparse emergent vegetation. The moist substratum keeps metamorphosing juveniles from desiccating during warm summer weather (Sweet 1993; Jennings and Hayes 1994). Suitable terrace habitat includes at least some dense overgrowth, such as California sycamore (*Platanus racemosa*), Fremont cottonwood (*Populus fremontii*), and willows (*Salix* sp.), but the understory is usually barren except for layers of dead leaves (Sweet 1993). Adult and metamorphosed juvenile arroyo toads are known to forage for various invertebrates around the drip line of large oaks (*Quercus*). They also forage extensively on ants (Sweet 1992, 1993). Little is known of arroyo toad winter

hibernaculum requirements, but these toads are believed to hibernate exclusively in the riverine terrace, above the level of frequent winter floods (USFWS 1999).

On April 13, 2005, the U.S. Fish and Wildlife Service issued its Final Designation of Critical Habitat for the Arroyo Toad. Unit 6, covering a portion of the Newhall Ranch reach of the Santa Clara River and once considered for inclusion in the Critical Habitat Area, has been removed from the Final Designation of Critical Habitat.

California Red-legged Frog

California red-legged frog (Rana aurora draytonii) habitat components include spawning pools and their terrestrial borders, spring/summer refuges, and subterranean hibernation sites. These may be combined at single sites or they may be separated by aquatic or terrestrial "dispersal corridors" (Hayes & Jennings 1989; Jennings & Hayes 1994). Spawning pools are the ecologically central components of California red-legged frog habitat, because they support all elements of the species' reproductive biology and also provide forage for all red-legged frog life stages. Spawning pools are typically permanent or extended seasonal ponds (through August), or stream/spring pools of 0.7-1.2 meters in depth, with dense bordering, emergent, and surface vegetation. Such pools may be as small as 1m² in surface area, with no known upper area limit. Always present at spawning habitat is a large complex invertebrate fauna for juvenile forage, extensive submerged herbaceous and algal vegetation for tadpole forage, and small terrestrial mammals such as voles (Microtus) that are an important component of adult frog forage (Jennings & Hayes 1994). Most suitable ponds are also partially to fully sunlit with mud or silt substrata, environmental factors essential to promote dense floating and emergent vegetation. Large populations of exotic predators such as bullfrogs and exotic centrarchid fish are usually absent from California red-legged frog spawning pools.

Newly constructed or impounded ponds rarely support California red-legged frog populations most spawning sites have existed in stable, relatively undisturbed form for decades (Barry unpbl; Hayes & Jennings 1989). Likewise, red-legged frog spawning habitat is usually absent from river bottomland, presumably because high springtime flows would disrupt spawning success by scouring spawning pools and discouraging long-term aquatic vegetative growth. California red-legged frogs are vulnerable to early season floods because they spawn in early to mid-winter.

Adult California red-legged frogs may move in late spring and summer to shaded pools along streams where undercut banks and exposed root masses offer secure refuges. However, an isolated summer refuge component appears not to be critical to population survival because many adult frogs may be found throughout the summer at spawning pools. Hibernaculum preferences probably include lentic substrata (pond bottoms) or any secure subterranean site

near spawning or summer refuge habitat, such as rodent burrows, vegetation mats, and root channels.

California red-legged frog "dispersal habitat" refers usually to stream courses that do not offer spawning or summer habitat but could be dispersal corridors between populations (USFWS 2002). Such corridors probably pertain more to populations in xeric localities; preliminary data from Marin County, California populations indicate that in mesic regions California red-legged frogs can disperse across any non-saline vegetated habitat (Gary Fellers, USGS, pers. comm.). "Dispersal habitat" as discussed in this report refers to any habitat that could be occupied temporarily by California red-legged frogs; it does not necessarily imply that California red-legged frogs might use such habitat to disperse or move among spawning pool habitats.

The 2001 Critical Habitat designation for the California red-legged frog was vacated by court order, but the U.S. Fish and Wildlife Service (2004a) reproposed Critical Habitat with substantially the same boundaries on 13 April 2004. A Final Rule is expected in spring 2005. Neither Critical Habitat designation included any part of the Santa Clara River or tributaries in the Landmark Project Area.

Southwestern Pond Turtle

Southwestern pond turtles (Clemmys (Emys) marmorata pallida), a California Species of Concern, require exposed permanent or extended seasonal (through August) slow or still water, bordered by or in the vicinity of suitable upland oviposition (egg deposition) habitat. Suitable oviposition areas are usually gently sloping treeless hillsides well above floodplains, with southern or southwestern exposure and clay or possibly sandy soil (Holland 1991). Eggs are deposited in flask-shaped vertical excavations from late spring through summer, and hatchlings apparently remain in the nest until the following spring (Holland 1991). All life history stages of post-emergent pond turtles are highly aquatic. Suitable aquatic habitat for adult pond turtles usually includes relatively deep water (at least 0.5 meter) with secure basking sites (logs, exposed banks, etc) within reach of secure subsurface concealment. The aquatic substratum may be silty, muddy, or rocky. Juveniles are generally more secretive than adults and may favor more secure basking habitat such as densely vegetated sections of ponds and stream pools (Barry unpbl. obs.). A complex invertebrate fauna and relatively high primary productivity typically also characterize southwestern pond turtle aquatic habitat (Jennings and Hayes 1994). The most important forage for hatchlings is nektonic plankton, but adults utilize a variety of plant and animal forage sources (Bury 1986).

Two-striped Garter Snake

The two-striped garter snake (*Thamnophis hammondii*) occurs from southern Baja California north to central Monterey and western Fresno Counties (Rossman and Stewart 1987). These snakes are found most frequently along the margins of rocky and sandy streams with fairly fast water, and they were formerly ubiquitous and abundant in association with such habitat throughout coastal southern California (Jennings and Hayes 1994). The two-striped garter snake is a California Species of Concern because most of its characteristic habitat in the lowlands of Southern California has been severely degraded and consequently this species has disappeared from substantial portions of its range (Stewart 1968; Jennings and Hayes 1994). Two striped garter snakes are believed to feed almost exclusively on fish and tadpoles, which they catch in shallow water by stalking, ambushing, or by cornering against submerged rocks or root masses (Jennings and Hayes 1994; Barry unpbl. obs). Thus, even though they are fundamentally terrestrial, they depend entirely on aquatic habitat for forage.

Although the preferred microhabitat for this species is poorly understood, the greatest numbers seemingly occur in areas along stream courses where the combination of in-stream rocky or other cover, terrestrial vegetative or other cover, and easy access to aquatic forage species of the appropriate size range exists (Barry unpbl obs.). For example, along relatively undisturbed reaches of the San Gabriel River in the San Gabriel Mountains these snakes are frequently found along relatively shallow rocky pools that laterally border somewhat deeper reaches, and they also frequent exposed root masses associated with pools created by the fallen trees. Smaller fish and tadpoles are typically abundant and easy for the snakes to capture in the shallow sections and the root mass pools, and larger fish occur in the adjacent deeper sections (Barry unpbl. obs.). Shoreline rocks, burrows, and dense vegetation (including root masses) offer excellent terrestrial cover, and submerged rocky aggregations offer aquatic refugia. Thus, although these wary snakes are often abundant and easily observed in such habitat, they are difficult to capture because they rarely stray far from secure cover and they flee rapidly into the water when approached (Barry unpbl. obs.).

Two-striped garter snakes are active nearly year-round in the Southern California lowlands, but in higher elevations they hibernate for a variable time span during the winter, and emerge as early as February. They usually mate soon after emergence, but females of this species can become gravid with sperm stored from matings that occurred as long as two years previously (Stewart 1972). Two-striped garter snakes bear live young in litters that average 8-10, usually in late July (Rossman and Stewart 1987). Mortality in newborns is probably fairly high, in particular because newborns may have difficulty securing small amphibian or fish prey in disturbed waterways (Jennings and Hayes 1994; Barry unpbl. obs.).

1.3 STUDY SCOPE

The scope of this assessment is on the potential effects of the Project on the target aquatic species described above. The assessment is based on a review of technical and regulatory documents provided by Newhall Land (Section 2.1) and a field reconnaissance survey of the Project site. Additionally, the preparers of this assessment have relied upon their extensive knowledge and experience on this subject. See Section 5, below, for a list of the preparers of this assessment. In addition, please refer to Appendix B for copies of the resumes of the preparers. No new quantitative surveys or analyses were conducted as part of this study.

1.4 ORGANIZATION OF DOCUMENT

The remainder of this report is organized as follows:

- Section 2 describes the methods used in the development of the assessment.
- Section 3 discusses the results of this assessment.
- **Section 4** cites literature and technical references used in the preparation of this assessment. These reference documents are incorporated herein by this reference.
- Section 5 is the list of preparers of this assessment.

2. METHODS

The methods used to conduct this assessment are based on review of technical and regulatory documentation provided by Newhall, and field reconnaissance surveys of the Project area. The methods are described in greater detail below.

2.1 REVIEW OF EXISTING PROJECT REPORTS AND DOCUMENTATION

The following technical reports and supporting documentation were reviewed in assessing the potential effects of the Landmark Village Project on sensitive aquatic species inhabiting the Santa Clara River and their habitat:

- Biological Resources Assessment of the Proposed Santa Clara River Significant Ecological Area. Los Angeles County Department of Regional Planning. PCR Services Corporation, Frank Hovore and Associates, FORMA Systems, November 2000.
- Final EIS/EIR: 404 Permit and 1603 Streambed Alteration Agreement for Portions of the Santa Clara River and its Tributaries, Los Angeles County. Valencia Company, August 1998.
- Results of Focused Surveys for Arroyo Toad and Special-Status Aquatic Reptiles and Amphibians, River Village Project; Newhall Ranch, Valencia, California. Newhall Ranch Company, Compliance Biology, Inc, Camarillo, CA, October, 2004.
- Biological Resources of the Upland Areas of the West Ranch. Newhall Land and Farming Company, Valencia, California, Dames and Moore, Santa Barbara, California, July 1993.
- *Natural River Management Plan: Permitted Projects and Activities.* Santa Clara River and tributaries. Valencia Company, November 1998.
- Results of Focused Surveys for Arroyo Toad and Special-Status Aquatic Reptiles and Amphibians within the Natural River Management Plan Area, Valencia, California. Impact Sciences, September 2001.
- Aquatic Surveys Along the Santa Clara River Part I: Castaic Junction Project Area, Los Angeles County, California. Aquatic Consulting Services, Inc., April 2002.
- Aquatic Surveys Along the Santa Clara River Part III: West of Commerce Center Bridge to the Ventura County Line, California. Aquatic Consulting Services, Inc., June 2002.

- Biological Opinion for the Natural River Management Plan, Santa Clarita, Los Angeles County, California (1-8-02-F-4R) (File No. 940050400-BAH). U.S. Fish and Wildlife Service, November 2002.
- Results of Focused Surveys for Unarmored Threespine Stickleback and Other Special-Status Fish Species, Newhall Ranch, Valencia California. Impact Sciences, Inc., January 2003.
- Results of Focused Surveys for Arroyo Toad and Special-Status Aquatic Reptiles and Amphibians within the Newhall Ranch Area, Los Angeles County, California. Newhall Land and Farming, Impact Sciences, Inc., September 19, 2001.
- Letter from Scott Cameron (Ecological Sciences, Oxnard, CA) to Rick Farris, U.S. Fish and Wildlife Service, Ventura, CA, Subject: Permit submittal requirements, TE 808242, arroyo toad surveys, Los Angeles County, California, August 2, 2001.
- Letter from Scott Cameron (Ecological Sciences, Oxnard, CA) to Mark Subbotin, Newhall Ranch Co, Valencia, CA, Subject: Results of focused arroyo toad surveys, Auto Center Expansion Project and Hart Baseball and Softball Complex (Hart Complex Area), Santa Clarita, California.
- Letter from David Crawford (Impact Science, Inc, Agoura Hills, CA) to Mark Subbotin, Newhall Land and Farming, Subject: Brief summary of arroyo toad survey results in NRMP area, June 18, 2001.
- Biota Report, Newhall Ranch Specific Plan, Los Angeles County Department of Regional Planning, Los Angeles, California, September 7, 1995, July 1996 revision.
- SEATAC Biota Report, Combined San Francisquito Canyon Projects (West Creek (VTTM 52455) and East Creek (VTTM 44831, 52667), Newhall Land and Farming Company, Significant Ecological Area 19, San Francisquito Canyon, Los Angeles County, California, Los Angeles County Department of Regional Planning, Frank Hovore & Associates, San Marino Environmental Associates, Planning Consultants Research, August 19, 1998.
- Amended 404 Permit (No. 940050400-BAH) for Natural River Management Plan. U.S. Army Corps of Engineers, June 2003.
- Proposed Designation of Critical Habitat for the California red-legged frog (Rana aurora draytonii), U.S. Fish and Wildlife Service, April 13, 2004, 69 FR 19620-19642.

- Proposed Designation of Critical Habitat for the Arroyo Toad, U.S. Fish and Wildlife Service, April 28, 2004, 69 FR 23254-23328.
- Final Designation of Critical Habitat for the Arroyo Toad, Final Rule. U.S. Fish and Wildlife Service, April 13, 2005, 50CFR Part 17 (RIN 1018-AT42).
- Revised Additional Analysis to the Newhall Ranch Specific Plan and Water Reclamation Plant Final Program EIR, Volume VIII (May 2003), Section 2.3, Floodplain Modifications.
- Flood Technical Report for the Landmark Village Project (2005). Pacific Advanced Civil Engineering, Inc. (PACE)
- Landmark Village Water Quality Technical Report. (GeoSyntec Consultants April 2005).

2.2 REVIEW OF RECORDS AND LITERATURE

Information on the special-status wildlife of the proposed Landmark Project Area was obtained through a search of the *California Natural Diversity Database* (CNDDB; CDFG, 2004); from searches of the specimen catalogues of the major California vertebrate museum collections (detailed below); from the U.S. Fish and Wildlife Service (USFWS), Ventura Office, Endangered Species Division's species list (USFWS 2003); and from reports on biological studies completed in the Project vicinity. Preliminary identification of potential habitat for sensitive aquatic species within the Project site was determined by reviewing aerial photography provided by Newhall Land. Site visits on 31 March and 10 November 2004 identified other potential habitat.

The first step to evaluate Project effects on potential populations of the target special-status aquatic species is to determine the historical presence of these species within the Project area. ENTRIX biologists queried the California Natural Diversity Database (CDFG 2004), the collection catalogue of the Los Angeles County Museum of Natural History (LACM), and the online collection databases of the Museum of Vertebrate Zoology, University of California, Berkeley (UC Berkeley 2004); and the California Academy of Sciences (CAS 2004), to obtain this information. Various literature sources were also used. (Disclaimer: CNDDB and museum records always carry some degree of uncertainty because of potential misidentifications or incorrect locality data. Further, the absence of species records from any given site does not imply that the species is absent from the site).

The ENTRIX biologists then examined maps and aerial photographs to locate aquatic habitat within and near the banks of the Santa Clara River within the Project site. Aquatic habitat suitability for any of the reptile and amphibian species was determined by comparison with

previously published assessments (e.g., Holland 1991; Jennings and Hayes 1994; Sweet 1992, 1993; USFWS 1999, 2002), as well as by the ENTRIX biologists' extensive experience with the species in various parts of California. To assess the potential effects of the proposed Project on unarmored threespine stickleback, arroyo toad, California red-legged frogs, southwestern pond turtles, and two-striped garter snakes, ENTRIX biologists consulted the USFWS Biological Opinion for the Natural River Management Plan (NRMP), Santa Clarita, Los Angeles County, California (1-8-02-F-4R), dated 15 November 2002; various natural history accounts for these species (e.g., Jennings and Hayes 1994; Holland 1991; Sweet 1992; Swift et al. 1993; Stebbins 1951); Newhall Ranch Specific Plan Final Program EIR (March 1999); Revised Additional Analysis to the Newhall Ranch Specific Plan and Water Reclamation Plant Final Program EIR, Volume VIII (May 2003), Section 2.3, Floodplain Modifications; *Landmark Village Water Quality Technical Report. (GeoSyntec Consultants April 2005);* and the PACE Flood Technical Report for the Landmark Village Project (2005).

2.3 FIELD RECONNAISSANCE SURVEYS

Several herpetological and ichthyological reconnaissance surveys were conducted in the spring and late fall of 2004 to document habitat conditions within the Project area (Figure 1). An additional reconnaissance was performed in February 2005 following a severe January flood event (Figure 2). The survey activities are more fully described in the following sections.

Herpetological Reconnaissance Surveys

ENTRIX biologists, Sean Barry and Matt Carpenter, conducted reconnaissance-level field surveys, focused on the following sensitive aquatic vertebrate species and their associated habitat within the Santa Clara River floodplain: 1) southwestern arroyo toad; 2) California red-legged frog; 3) southwestern pond turtle; and 4) two-striped garter snake. The purpose of field surveys was to analyze the potential effects of the Landmark Village Project on these species and their habitat.

The surveys were conducted on March 31 and November 10, 2004 in and along the Santa Clara River, within the boundaries of the Landmark Project site (Castaic Creek west to Chiquito Creek). The Project site was examined for aquatic habitat, such as flowing or standing water, emergent vegetation, and associated aquatic species. During the November survey, the ENTRIX biologist photographed the Santa Clara River channel within the Project area every 100-200 feet, and also photographed other areas of potential aquatic species habitat, to document the stream cross-sections and to document any potential bordering and other associated cover, pool, and channel habitat. See Appendix A for photographs.

Potential habitat for arroyo toads, California red-legged frogs, western pond turtles, and twostriped garter snakes was noted, along with other features relevant to life history, such as the presence of prey or predators. Habitat factors noted for arroyo toads included the presence of clear, standing water (required for egg deposition), sandy banks, and the presence of willows, cottonwood, and sycamore trees. Habitat factors noted for California red-legged frogs included relatively deep and vegetated sunlit pools. Habitat factors noted for southwestern pond turtles included permanent or nearly permanent water, depth of water, basking sites such as partially submerged logs, rocks, mats of floating vegetation or open mud banks, and suitable terrestrial sites for egg-laying. Habitat factors noted for two-striped garter snakes included isolated stream channels with adjacent shallow and deep moving water with bordering vegetative (including root masses) or rocky cover, in-stream cover, and evidence of fish.

Ichthyological Reconnaissance Surveys

ENTRIX biologists, Dr. Camm Swift and Steve Howard, conducted reconnaissance-level field surveys, focused on unarmored threespine stickleback. The purpose of these field surveys was to analyze the potential effects of the Landmark Project on this species and its associated habitat. The entire reach of the Santa Clara River from the mouth of Salt Creek to the Castaic Junction was surveyed on March 31 and April 1, 2004. An additional survey was conducted on November 8, 2004 in the Santa Clara River and Castaic Creek from the mouth to the State Route 126 (SR-126) Bridge within the Landmark Village Project area. The surveys focused mainly on evaluating habitat conditions within these reaches and in establishing the relative proximity from the stream side Project boundary to in-stream habitats. Most of these efforts were visual habitat assessments documented by field photographs with special reference to unarmored threespine stickleback and other fishes. Some collecting was conducted with a small seine (1.8 X 1.2 m, 3 mm mesh/6 X 3 feet, one eighth inch mesh) and aquarium dip nets in habitats that could potentially contain sticklebacks. Further upstream, the Santa Clara River at the Commerce Center Drive Bridge area and Castaic Creek near the Interstate 5 Bridge, was examined on December 16, 2004.

Winter 2005 Post-Flooding Reconnaissance Surveys

Camm Swift and Sean Barry conducted an additional survey within the Landmark Village Project reach of the Santa Clara River on February 1, 2005 to document and evaluate habitat changes due to the recent large storm flows that disturbed much of the habitat that was previously examined.

3. RESULTS

This section discusses the results of the assessment and addresses potential impacts of the Project on the target special-status aquatic species. Based on the review of hydraulic modeling documents provided, it appears that very little or no physical in-stream changes will result from the Project. This assessment focuses on the effect of bank stabilization on those species and does not address other terrestrial features of the Project. Much of the existing terrestrial habitat is currently in a disturbed (agricultural) state and is poorly suited for the target species. The hydraulic models reviewed suggest that the in-stream conditions will not be affected by the bank protection features except in extreme flood event years.

The results of the assessment for each species is described further below:

3.1 UNARMORED THREESPINE STICKLEBACK

Historical and Recent Vicinity Records

Unarmored threespine stickleback collections have been few and widely scattered in the Del Valle Zone of the Santa Clara River with a few notable exceptions. One exception is the refuge area identified during the surveys for the Mobil and Arco 1994 oil spill investigations. This is an area of marshy habitat just north northeast of Magic Mountain that apparently is always wetted and contains numerous stickleback. During the oil spill, this refuge area was apparently not affected since the main river flow directed the contamination away from this sensitive area.

Thus, it was also considered a site for relocating rescued stickleback that could not be returned to the main river immediately because of the oil contamination.

Results of ENTRIX Field Reconnaissance

The March 31 and April 1, 2004 surveys were during relatively high spring flows and the river had recently been scoured and fresh sediments were present. Also virtually all marginal herbaceous vegetation and other cover was washed out along much of the river. Due to an unusual set of strong October rain storms, the river was also scoured out during the visits in November and December 2004. Typically, the November and December collections would precede any high flows, marginal herbaceous vegetation would be well developed, and fishes would be abundant. Due to the early storms, the habitat conditions noted during our surveys were comparable to those normally associated with early spring conditions. In some drought years, the river goes without being substantially scoured out and fishes can remain abundant all year. For our spring 2004 surveys, the habitat was more or less in early spring scoured conditions.

During the spring 2004 survey, the river was running a visually estimated 30 to 40 cubic feet per second (cfs) and was turbid with visibility to about 50 cm. Some small spring tributaries and isolated pools were clear. The water temperature ranged from 22-26 degrees and at least four areas of upwelling with water at 18 to 20 degrees C. The substrate was variously sand, gravel, and cobble and 10-40% of the margins of the river had some vegetative cover such as herbaceous vegetation, debris, or overhanging trees or bushes. This marginal vegetation was just beginning to develop, as was green algae in the water. About 30-40% of the habitat was low to high gradient riffles with the remaining being runs. Eight to ten deeper, standing or backwater pools, more than 1 m deep, were seen near large obstructions. In the area of the mouth or delta of Castaic Creek in the Santa Clara River, a small flow entered the main river with a few associated pools and backwaters. However, it was emerging from the stream bed a few hundred meters upstream since the main Castaic Creek was dry farther upstream. In about 30 seine hauls and 140 dips with aquarium dip nets, throughout the stretch examined over the two days, no stickleback were taken or seen. Arroyo chubs were abundant, and one Santa Ana sucker was taken. Larval arroyo chubs were commonly seen and up to about 15 sucker larvae were observed. Some backwater areas had clawed frogs and about 25 were taken. In addition, several clawed frog larvae were seen in isolated floodplain pools.

The survey on November 8, 2004 was restricted specifically to the Landmark Village Project area and the well scoured channel with an estimated 25-30 cfs of flow and sand was about 75% of the substrate and gravel, cobble, and rock the other 25% in the main river. Visibility was about 50 cm in the main river and some isolated ponds were clearer. Several isolated or spring fed pools existed in the riparian areas on the north side of the floodplain and were choked with cattails, willows, and Arundo. The shores of the main river channel where almost entirely scoured off by the October storms. Ten seine hauls took six half grown to adult unarmored threespine stickleback in backwater areas of the main river that serve as small refuges during scouring flows. Arroyo chubs were common in the river with over 150 taken, and in the oxbow ponds crayfish (about 20 taken) were common. One large arroyo chub was taken in the oxbow ponds, along with one small clawed frog. A few mosquitofish were collected and other seen in the protected oxbows. Even though some fish were common or very locally abundant, these were in occasional oxbow and marginal areas with most areas of faster flow devoid of fishes.

On the December 16, 2004 visit, Castaic Creek was dry all the way to the SR-126 Bridge, and the only wetted areas were near storm drains that were surveyed earlier this year and found to be fishless. The Commerce Center Drive Bridge area was similar to the river downstream examined by Swift and Howard, but no fish collections were made and no fish were seen. The Commerce Center Drive Bridge is upstream of the Landmark Village Project.

Following a severe flood event in January 2005, ENTRIX biologists conducted a one-day reconnaissance survey of the Project reach to evaluate the response of habitat conditions.

Generally, plant and animal life had been flushed from the active stream channel. Riparian and aquatic vegetation along the stream margins had been scoured. Few or no aquatic insects were observed during numerous spot inspections. The streambed also aggraded in many areas, particularly in backwater pools where significant shallowing or complete filling had occurred. Significant deposition of sand and gravel was also observed in the forms of lateral and mid-channel bars. Most exotic aquatic species appeared to have been flushed out by the flooding events. Based on this survey, the observed flood event would have flushed out most aquatic species due to its size and severity, with or without the proposed Project improvements. Figure 2 illustrates the state of channel conditions in the Santa Clara River along the Project area following the January 2005 flood.

Project Impacts

The potential impacts to unarmored threespine stickleback due to the construction and persistence of the Project's bank stabilization features and the bridge construction are expected to be less than significant. Stickleback are known to inhabit the Newhall Ranch reach of the Santa Clara River adjacent to the Landmark Village Project area. The location of the proposed stabilization features is set back beyond the existing riparian corridor in a majority of the Project and construction would not interface with the active stream channel. The hydrologic influence of the bank stabilization on fish is likely to be essentially transparent when viewed in conjunction with flood flow conditions. Based on reconnaissance surveys conducted following recent flood events (January and February 2005), high flow conditions appear to have dislocated and dispersed aquatic organisms downstream.

The Flood Technical Report for the River Village Project (PACE 2005) found that there would be no significant impacts in water flows, velocities, depth, sedimentation, or floodplain and channel conditions adjacent to and downstream of the Project site as a result of the proposed Project improvements. These hydraulic effects were also found to be insufficient to alter the amount, location and nature of aquatic and riparian habitats in the Project area and downstream into Ventura County. The technical analysis further determined that the river would still retain sufficient width to allow natural fluvial processes to continue; and, as a result, the mosaic of habitats in the river that support various sensitive species would be maintained, and the population of the species within and immediately adjacent to the river corridor would not be significantly affected. Based on that technical assessment, no impacts to adjacent or downstream populations of the unarmored threespine stickleback are expected.

The Landmark Village Water Quality Technical Report (GeoSyntec 2005) indicates that the modeled concentrations in runoff from developed areas with Project Design Features (PDFs) are below all benchmark water quality objectives and criteria and TMDL waste load allocations for the Santa Clara River and are addressed by a comprehensive site design, source control,

and treatment control strategy. These water quality objectives are established to protect various beneficial uses including general wildlife, sensitive, rare and endangered species. Therefore, potential impacts from the Project on receiving water quality <u>and beneficial uses</u> in the Santa Clara River are not significant. Based upon that Report, no impacts to adjacent or downstream populations of unarmored threespine stickleback are expected.

3.2 ARROYO TOAD

Historical and Recent Vicinity Records

Neither of the museum database gueries (CAS 2004; UC Berkeley 2004) yielded records of the arroyo toad from the main channel of the Santa Clara River. However, mainstem Santa Clara River CNDDB records for the arroyo toad exist from the "Santa Clara River, just east of Interstate 5" (1994), which is about two miles east of the River Village Project site, and from "Bear Canyon at the Santa Clara River, six miles upstream of Solemint" (2001), which is about eleven miles east of the Project site. Arroyo toads were also found recently at the confluence of San Francisquito Creek and the Santa Clara River, about 2.3 miles east of the River Village Project (Impact Sciences 2001). Further, the Aquatic Consulting surveys (2002a) reported arroyo toad tadpoles from pools adjacent to the Valencia Water Treatment Plant and from a pool just upstream of the River Village Project area (site 26). Among north tributaries to the Santa Clara River, arroyo toads are well-known from the Blue Point area along Piru Creek (CNDDB, LACM, and CAS records); from several sites along Sespe Creek (Ventura County) (CNDDB and LACM records and Sweet (1992)); and from at least one location along Castaic Creek north of Castaic Lake (CNDDB 2004; Compliance Biology 2004; U.S. Fish and Wildlife Service 2004). The existence of tributary records upstream and downstream of the Project area, as well as the in-channel Santa Clara River records west of Interstate 5 place the Project site within the probable distribution of the arroyo toad in the Santa Clara River channel. The recent origin of many of the records indicates that the arroyo toad still inhabits suitable habitat within the Santa Clara River basin, including the main channel. However, although standardized USFWS "protocol" surveys conducted recently within the Landmark Village Project site (Impact Sciences 2001; Compliance Biology 2004) showed that all of the components of arroyo toad habitat exist within the Landmark Village Project boundaries, these studies failed to document the occurrence of arroyo toads within such boundaries. Non-protocol surveys by Aquatic Consulting Services (2002b) also identified arroyo toad habitat in the Santa Clara River from the Landmark Village Project downstream to the Ventura County line.

Results of ENTRIX Field Reconnaissance

The March 31, 2004 survey was conducted during daylight hours from just northwest of the Travel Village trailer park along Castaic Creek downstream to the Wolcott Road crossing, with particular attention to the braided Castaic Creek channel complex just upstream of the confluence with the Santa Clara River. A spot survey was also conducted at the Long Canyon crossing downstream of Wolcott Road. Potential arroyo toad spawning habitat in the form of overflow pools with stable gravel or sandbars and nearby terrace vegetation was noted throughout the braided channel, and in the main stem of the Santa Clara River just downstream of the Wolcott Road crossing on the north and in places on the south sides of the river. Although the water level was fairly high because of winter storm runoff, overflow pools were visible but submerged upstream of the Long Canyon crossing, on the north bank of the river mainstem. No arroyo toads were observed during this reconnaissance surveys, but none would be expected because of the early season and the time of day of the survey.

The November 10, 2004 survey was conducted during daylight hours from the junction of Chiquito Creek and SR-126 downstream to the Santa Clara River, then upstream along the mainstem Santa Clara River to the confluence with Castaic Creek, then upstream along Castaic Creek nearly to SR-126. Flows in the mainstem river were lower than they had been the previous March, although they were undoubtedly recently augmented by heavy autumn rains. However, Chiquito Creek was dry between SR-126 and the Santa Clara River, and the Chiquito Creek channel was not incised or otherwise well defined close to the confluence. This suggests that Chiquito Creek flows downstream of SR-126 tend to be very episodic, short term, and sediment-loaded. A long overflow channel was visible along the north side of the Santa Clara River between the Long Canyon crossing and Wolcott Road, but this channel was choked with several generations of emergent vegetation (especially cattails (Typha)) and may not be suited to arroyo toad spawning. This is probably the same channel that was submerged but visible during the March 31, 2004 survey. The braided complex at the Castaic Creek confluence was mostly dry, but the main channel of Castaic Creek where it parallels and eventually flows into the Santa Clara River just upstream of the Wolcott Road crossing still held substantial water (to about 18 inches depth). How much of this had resulted from the recent rains was not clear. Castaic Creek itself from the braided complex upstream to SR-126 was essentially dry, and overflow channels of the type preferred by arroyo toads as spawning habitat were not evident upstream of the braided complex. However, bordering terrace habitat on the south side of the Santa Clara River and along much of Castaic Creek was clearly well suited to arroyo toads. No arroyo toads were observed during this survey, but none would be expected because of the lateness of the season, the time of day of the survey, and the prevailing cool weather.

Following a severe flood event in January 2005, ENTRIX biologists conducted a brief one-day reconnaissance survey of the Project reach to evaluate the response of habitat conditions. Generally, plant and animal life had been flushed from the active stream channel. Riparian and aquatic vegetation along the stream margins had been scoured. Few or no aquatic insects were

observed during numerous spot inspections. The streambed also aggraded in many areas, particularly in backwater pools where significant shallowing or complete filling had occurred. Significant deposition of sand and gravel was also observed in the forms of lateral and midchannel bars. Most exotic aquatic species appeared to have been flushed out by the flooding events. Based on this survey, the observed flood event would have flushed out most aquatic species due to its size and severity, with or without the proposed Project improvements. Figure 2 illustrates the state of channel conditions in the Santa Clara River along the Project area following the January 2005 flood.

The early 2005 flood events severely altered riparian habitat conditions which may take up to several years to finally reach pre-flood condition equilibrium. Overall, the surveys confirmed that limited potential arroyo toad spawning and foraging habitat typically exists along the Santa Clara River and possibly Castaic Creek within the Landmark Village Project Area boundaries. However, the results of the focused USFWS protocol surveys cited above indicate that arroyo toads are very scarce or absent along these reaches, and along the Santa Clara River downstream to the Los Angeles-Ventura County line (Aquatic Consulting Services 2002). The following discussion of Project impacts pertains only to available arroyo toad foraging and spawning habitat within the Landmark Village Project Area.

Project Impacts

Although the arroyo toad has not been recorded from within the Project area, seemingly suitable, but limited, habitat exists within the Project boundaries in the reach from Castaic Creek downstream at least to Wolcott Road and possibly to the Long Canyon crossing. It is not anticipated that the proposed Project's bank stabilization features will substantially alter the local sediment transport regime or otherwise affect in-stream habitat (spawning, foraging) for arroyo toad. The Project area falls within an extremely dynamic reach of the Santa Clara River where high disturbance flood events occur every 5 to 10 years and change the existing stream structure. The EIR/EIS for the NRMP area, located directly east of the Landmark site, stated that the widening of the river channels within the areas of bank protection (i.e., stabilization) would not cause system-wide channel or bed erosion, or aggradation. In its 1998 and 2002 Biological Opinions on the NRMP (p. 30), the U.S. Fish and Wildlife Service accepted the NRMP's findings, and stated further that the NRMP would not affect arroyo toad habitat negatively within the Santa Clara River mainstem. Utilization of these same methods of bank protection in Landmark are anticipated to lead to the same result – no affect of arroyo toad habitat.

The Flood Technical Report for the Landmark Village Project (PACE 2005) found that there would be no significant impacts in water flows, velocities, depth, sedimentation, or floodplain and channel conditions downstream of the Project site as a result of the proposed Project

improvements. These hydraulic effects were also found to be insufficient to alter the amount, location and nature of aquatic and riparian habitats in the Project area and downstream into Ventura County. The technical analysis further determined that the river would still retain sufficient width to allow natural fluvial processes to continue; and, as a result, the mosaic of habitats in the river that support various sensitive species would be maintained, and the population of the species within and immediately adjacent to the river corridor would not be significantly affected. Based on that technical assessment, no impacts to downstream populations of the arroyo toad are expected.

The Landmark Village Water Quality Technical Report (GeoSyntec 2005) indicates that the modeled concentrations in runoff from developed areas with Project Design Features (PDFs) are below all benchmark water quality objectives and criteria and TMDL waste load allocations for the Santa Clara River and are addressed by a comprehensive site design, source control, and treatment control strategy. These water quality objectives are established to protect various beneficial uses including general wildlife, sensitive, rare and endangered species.

Therefore, potential impacts from the Project on receiving water quality <u>and beneficial uses</u> in the Santa Clara River are not significant. Based upon that Report, no impacts to downstream populations of arroyo toad are expected.

3.3 CALIFORNIA RED-LEGGED FROG

Historical and Recent Vicinity Records

There are no California Natural Diversity Database records for the California red-legged frog from the Santa Clara River watershed, Los Angeles and Ventura Counties. However, the Museum of Vertebrate Zoology (UC Berkeley 2003) lists 17 specimens from Soledad Canyon (Santa Clara River channel) in its collection, from as recently as 1953. More precise locality data are unavailable. The California Academy of Sciences (CAS 2003) also lists a Soledad Canyon specimen, from 1950. The nearest specific locality to the Project site is some 15 miles upstream near the confluence with Agua Dulce Creek. Jennings and Hayes (1994) and the CNDDB indicate that this species still occurs in the Santa Clara River watershed, in sites along San Francisquito Creek 5-10 miles northeast of the Project site, and in tributaries to the Santa Clara River in Ventura County. The closest documented Ventura County occurrence is in Piru Creek 4.5 miles north of Piru, about 10 airline miles west to north-west of the Project site (USFWS 2002). Potential spawning habitat for California red-legged frogs also exists in some

of the small tributaries that flow north into the Santa Clara River, within and near the Project boundaries. Further, the verified records upstream and downstream of the Project site place the Project site within the distribution of the California red-legged frog along the Santa Clara River.

Results of ENTRIX Field Reconnaissance

The field evaluations indicate that potential spawning or summer habitat for the California redlegged frog is absent from the main channel of the Santa Clara River within the Project site. Further, the various USFWS protocol surveys for arroyo toads conducted along the Santa Clara River from Santa Clarita to the Ventura County line during the past few years would probably have found California red-legged frogs if they occurred in the mainstem of the Santa Clara River, but none were reported during these surveys. California red-legged frogs generally avoid large river channels with widely fluctuating flows, because such habitat usually does not permit reproductive activity (Hayes and Jennings 1989). For example, episodic winter flooding (typical of the Santa Clara River stream channel) may dislodge egg masses, and subsequent desiccation before the summer (also typical of the Santa Clara River) would kill tadpoles before they could metamorphose. Conversely, during the late winter and autumn, when California redlegged frogs may be most likely to move randomly (USFWS 2002), the mainstem Santa Clara River channel can be considered potential "dispersal habitat," primarily because adult frogs can survive in the main channel during that season.

Following a severe flood event in January 2005, ENTRIX biologists conducted a one-day reconnaissance survey of the Project reach to evaluate the response of habitat conditions. Generally, plant and animal life had been flushed from the active stream channel. Riparian and aquatic vegetation along the stream margins had been scoured. Few or no aquatic insects were observed during numerous spot inspections. The streambed also aggraded in many areas, particularly in backwater pools where significant shallowing or complete filling had occurred. Significant deposition of sand and gravel was also observed in the forms of lateral and midchannel bars. Most exotic aquatic species appeared to have been flushed out by the flooding events. Based on this survey, the observed flood event would have flushed out most aquatic species due to its size and severity, with or without the proposed Project improvements. Figure 2 illustrates the state of channel conditions in the Santa Clara River along the Project area following the January 2005 flood.

Project Impacts

As indicated above, field evaluations indicate that potential spawning or summer habitat for the California red-legged frog is absent from the main channel of the Santa Clara River within the Project site. Within the Project site boundaries, impacts to California red-legged frogs would probably result only from construction activity effects on the unlikely presence of dispersing red-

legged frogs during the construction process. On that basis, implementation of Project improvements would not significantly affect California red-legged frog populations.

The Flood Technical Report for the Landmark Village Project (PACE 2005) found that there would be no significant impacts in water flows, velocities, depth, sedimentation, or floodplain and channel conditions downstream of the Project site as a result of the proposed Project improvements. These hydraulic effects were also found to be insufficient to alter the amount, location and nature of aquatic and riparian habitats in the Project area and downstream into Ventura County. The technical analysis further determined that the river would still retain sufficient width to allow natural fluvial processes to continue; and, as a result, the mosaic of habitats in the river that support various sensitive species would be maintained, and the population of the species within and immediately adjacent to the river corridor would not be significantly affected. Based on that technical assessment, no impacts to downstream populations of the California red-legged frog are expected.

The Landmark Village Water Quality Technical Report (GeoSyntec 2005) indicates that the modeled concentrations in runoff from developed areas with Project Design Features (PDFs) are below all benchmark water quality objectives and criteria and TMDL waste load allocations for the Santa Clara River and are addressed by a comprehensive site design, source control, and treatment control strategy. These water quality objectives are established to protect various beneficial uses including general wildlife, sensitive, rare and endangered species.

Therefore, potential impacts from the Project on receiving water quality and beneficial uses in the Santa Clara River are not significant. Based upon that Report, no impacts to existing populations of Red-legged Frog are expected.

3.4 SOUTHWESTERN POND TURTLE

Historical and Recent Vicinity Records

Southwestern pond turtles are probably distributed throughout the Santa Clara River watershed, wherever there is sufficient permanent or near-permanent water and oviposition sites to support populations. However, the CNDDB includes only two Santa Clara River records of southwestern pond turtles, from near Castaic Junction (2000) and from downstream near the Ventura County line (1998). Neither of the museum databases includes any Santa Clara River watershed southwestern pond turtle records. Conversely, the Impact Sciences (2001) report states that during those surveys pond turtles were observed numerous times at unspecified sites within the NRMP reaches, presumably where sufficient water existed to satisfy the aquatic habitat requirements discussed previously.

Results of ENTRIX Field Reconnaissance

During the March 31, 2004 field reconnaissance survey, ENTRIX biologists observed pond turtles at the confluence of Castaic Creek and the Santa Clara River and at the Long Canyon crossing. The November survey revealed that suitable aquatic habitat remains in the mainstem late in the year (presumably augmented by autumn rains). Neither survey identified specific terrestrial oviposition habitat, but moderate west- and south-facing meadowland slopes in the canyon openings appear to supply oviposition habitat requirements. Some potentially suitable oviposition habitat may also occur along the Castaic Creek embankment between the confluence with the Santa Clara River and Interstate 5. However, firm claylike soils, a possible oviposition site requirement (Holland 1991), seem to be absent from the mainstem channel, including the terrace on the north river bank.

Following a severe flood event in January 2005, ENTRIX biologists conducted a one-day reconnaissance survey of the Project reach to evaluate the response of habitat conditions. Generally, plant and animal life had been flushed from the active stream channel. Riparian and aquatic vegetation along the stream margins had been scoured. Few or no aquatic insects were observed during numerous spot inspections. The streambed also aggraded in many areas, particularly in backwater pools where significant shallowing or complete filling had occurred. Significant deposition of sand and gravel was also observed in the forms of lateral and midchannel bars. Most exotic aquatic species appeared to have been flushed out by the flooding events. Based on this survey, the observed flood event would have flushed out most aquatic species due to its size and severity, with or without the proposed Project improvements. Figure

2 illustrates the state of channel conditions in the Santa Clara River along the Project area following the January 2005 flood.

Project Impacts

Project impacts on southwestern pond turtles will probably include temporary or permanent alteration of aquatic channel foraging habitat consequent to construction activities, possible loss of basking areas, but probably no long-term effects from bank stabilization as long as adjacent braids and overflow channels continue to exist. Oviposition habitat on the south bank and downstream will probably not be affected by bank stabilization, but may be temporarily disturbed during future road and bridge development.

The Flood Technical Report for the Landmark Village Project (PACE 2005) found that there would be no significant impacts in water flows, velocities, depth, sedimentation, or floodplain and channel conditions downstream of the Project site as a result of the proposed Project improvements. These hydraulic effects were also found to be insufficient to alter the amount, location and nature of aquatic and riparian habitats in the Project area and downstream into Ventura County. The technical analysis further determined that the river would still retain sufficient width to allow natural fluvial processes to continue; and, as a result, the mosaic of habitats in the river that support various sensitive species would be maintained, and the population of the species within and immediately adjacent to the river corridor would not be significantly affected. Based on that technical assessment, no impacts to adjacent or downstream populations of the southwestern pond turtle are expected.

The Landmark Village Water Quality Technical Report (GeoSyntec 2005) indicates that the modeled concentrations in runoff from developed areas with Project Design Features (PDFs) are below all benchmark water quality objectives and criteria and TMDL waste load allocations for the Santa Clara River and are addressed by a comprehensive site design, source control, and treatment control strategy. These water quality objectives are established to protect various beneficial uses including general wildlife, sensitive, rare and endangered species.

Therefore, potential impacts from the Project on receiving water quality and beneficial uses in the Santa Clara River are not significant. Based upon that Report, no impacts to adjacent or downstream populations of southwestern pond turtle are expected.

3.5 TWO-STRIPED GARTER SNAKE

Historical and Recent Vicinity Records

Santa Clara River records for the two-striped garter snake in the Newhall Ranch region are absent from the CNDDB and the museum collections, yet the various reports reviewed for this document and personal communications with local biologists indicate that this species occurs somewhat commonly along this reach of the river.

Results of ENTRIX Field Reconnaissance

During the March 31, 2004 survey, the ENTRIX biologists observed one two-striped garter snake near an exposed root mass along the braided confluence of Castaic Creek and the Santa Clara River. Exposed root masses are particularly favored by these snakes because they offer secure shelter and they tend to form small shallow backwater pools where small fish congregate and are easy for the snakes to capture (Barry unpbl. obs.). The November 10, 2004 survey revealed that such isolated complex refugia are very limited along the reach from Castaic Creek to Chiquito Creek, but the survey also revealed that low dense bankside vegetation, another type of favored retreat, occurs almost continuously along the north side of the river from Chiquito Creek upstream nearly to the Wolcott Road crossing. Much of this vegetation is associated with overflow pools that entrap fish during the late spring and early summer, which undoubtedly attracts two-striped garter snakes in greater than typical numbers to exploit this resource. However, subsequent pool drying eliminates this resource and garter snakes consequently disperse, to return during the following spring when the forage resource is renewed (Barry unpbl. obs.).

Following a severe flood event in January 2005, ENTRIX biologists conducted a one-day reconnaissance survey of the Project reach to evaluate the response of habitat conditions. Generally, plant and animal life had been flushed from the active stream channel. Riparian and aquatic vegetation along the stream margins had been scoured. Few or no aquatic insects were observed during numerous spot inspections. The streambed also aggraded in many areas, particularly in backwater pools where significant shallowing or complete filling had occurred. Significant deposition of sand and gravel was also observed in the forms of lateral and midchannel bars. Most exotic aquatic species appeared to have been flushed out by the flooding events. Based on this survey, the observed flood event would have flushed out most aquatic species due to its size and severity, with or without the proposed Project improvements. Figure 2 illustrates the state of channel conditions in the Santa Clara River along the Project area following the January 2005 flood.

Project Impacts

Project impacts on two-stripe garter snake will be less than significant since the proposed Project's bank stabilization features are set back from the active channel and existing snake habitat. No adverse change to foraging habitat is expected from implementation of the Project.

The Flood Technical Report for the Landmark Village Project (PACE 2005) found that there would be no significant impacts in water flows, velocities, depth, sedimentation, or floodplain and channel conditions downstream of the Project site as a result of the proposed Project improvements. These hydraulic effects were also found to be insufficient to alter the amount, location and nature of aquatic and riparian habitats in the Project area and downstream into Ventura County. The technical analysis further determined that the river would still retain sufficient width to allow natural fluvial processes to continue; and, as a result, the mosaic of habitats in the river that support various sensitive species would be maintained, and the population of the species within and immediately adjacent to the river corridor would not be significantly affected. Based on that technical assessment, no impacts to adjacent or downstream populations of the two-striped garter snake are expected.

The Landmark Village Water Quality Technical Report (GeoSyntec 2005) indicates that the modeled concentrations in runoff from developed areas with Project Design Features (PDFs) are below all benchmark water quality objectives and criteria and TMDL waste load allocations for the Santa Clara River and are addressed by a comprehensive site design, source control, and treatment control strategy. These water quality objectives are established to protect various beneficial uses including general wildlife, sensitive, rare and endangered species.

Therefore, potential impacts from the Project on receiving water quality and beneficial uses in the Santa Clara River are not significant. Based upon that Report, no impacts to adjacent or downstream populations of two-striped garter snake are expected.

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5. LIST OF PREPARERS

ENTRIX, Inc.

- Matt Carpenter, Senior Project Manager: coordination and management of ENTRIX technical staff through the background document review, field reconnaissance and document preparation phases.
- Camm Swift, Ph.D., Senior Fisheries Scientist: conducted field reconnaissance survey and background document review; prepared technical discussion of issues related to stickleback and fish.
- Sean Barry, M.S., Senior Herpetologist: conducted field reconnaissance surveys and reviewed background documents, site photos and field reconnaissance documentation; prepared technical discussion of issues related to amphibians and reptiles.
- Steve Howard, Senior Staff Fisheries Scientist: assisted field reconnaissance survey and background document review; supported technical discussion of issues related to stickleback and fish.
- Resumes for these preparers are included in Appendix B.

APPENDIX A

FIGURES AND FIELD PHOTOGRAPHS





Figure 1. Landmark Village Study Area (Santa Clara River) – Newhall Ranch, California

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Figure 2 . Landmark Village Study Area Aerial Photograph (following January 2005 Flooding)

Focused Special-Status Aquatic Species Assessment Landmark Village Project - Santa Clara River Newhall Land





Castaic Creek / Santa Clara River Confluence photographed in November 2004 prior to winter 2005 floods.



Castaic Creek upstream of confluence following January 2005 flood (note vegetation scoured throughout).





Spring 2004 channel conditions at the Landmark Village Project site (facing upstream)



Isolated pool seined for fish and other aquatic vertebrates during the Spring 2004 reconnaissance.

APPENDIX B

RESUMES OF PREPARERS



Camm Churchill Swift, Ph.D.

Senior Project Biologist

Discipline/Specialty

- Ichthyology
- Fishery Biology
- Estuarine Biology

Education

- Ph.D., Department of Biology, Florida State University, Tallahassee, 1970
- M.A., Department of Zoology, University of Michigan, Ann Arbor, 1965
- A.B., Department of Zoology, University of California, Berkeley, 1963

Training/Certifications

- California Department of Fish and Game. Resident
 Scientific Collecting Permit
 No. 801056-01 with
 Memoranda of Understanding covering federally listed tidewater goby, Santa ana sucker, unarmored threespine stickleback, southern
 steelhead & incidental take of redlegged frog and Species of special concern arroyo chub and speckled dace.
- USFWS U. S. Fish and Wildlife Service Scientific Collecting Permit (10A) No. TE793644-5 for tidewater goby, Santa Ana sucker and unarmored threespined stickleback
- NOAA Fisheries project specific southern steelhead handling permit

Summary of Qualifications

Dr. Swift is one of the leading authorities on the biology, management, and conservation of the fresh and brackish water fishes of coastal southern California. He served on the Recovery Teams for the unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) and tidewater goby (*Eucyclogobius newberryi*), both feder1ally endangered species, and was an author for the recovery plans for both fish. He currently serves on the Technical Recovery Teams for tidewater goby (U. S. Fish and Wildlife Service) and southern steelhead (National Marine Fisheries Service). Dr. Swift is a member of the Desert Fishes Council.

With over 20 years of experience working in the field, Dr. Swift is one of the most knowledgeable persons in the state on the status and distribution of freshwater fishes of coastal southern California. He has a strong understanding of their biology, requirements for recovery, and habitat restoration needs to improve their conservation status. He has worked with a wide variety of public and private agencies to conserve these species and advise on habitat restoration for their benefit.

Dr. Swift also has major expeditionary experience in the fresh and estuarine waters of the southeastern United States, marine shore fishes of Pacific coastal Mexico and Costa Rica (including Cocos Island), the Indus River Delta, Pakistan, and Amazonian Peru. He has done extensive field work, led field crews, conducted literature searches, and written several comprehensive reports and peer reviewed publications. He serves as an expert witness in fishery conservation issues. He also has considerable experience in identification and analysis of archaeological and fossil fish bones from the southeastern United States, southern California, and coastal Pakistan.

Relevant Experience Research Expertise

Dr. Swift is a recognized expert in the biology, conservation, and paleontology of freshwater and estuarine fishes in coastal southern California, including the federally endangered brackish water species, the tidewater goby, *Eucyclogobius newberryi*, the migratory (anadromous) and federally listed steelhead (*Oncorhynchus mykiss*), and the federally threatened Santa Ana sucker (*Catostomus santaanae*). Of approximately eight species of freshwater fishes native to the Los Angeles Basin, the Santa Ana sucker, Santa Ana speckled dace (*Rhinichthys csculus ssp.*), and arroyo chub (*Gila orcutti*) are endemic in this region and have been highly impacted by man. The severe alteration of freshwater and estuarine habitat in much of California has led to most of the freshwater and brackish water species having special conservation status.

Newhall Land and Farming - Special Status Aquatic Species EIR Assessment, Los Angeles County, California

Performed habitat surveys in the upper Santa Clara River for sensitve aquatic species with an emphasis on the federally listed endangered unarmoured threespine stickleback. Surveyed tributary habitat potential, mapped refugia areas and analyzed instream flow velocity model alternatives for project impacts on stickleback habitat.

Wastewater Impacts on Native and Sensitive Fish Species

Provide assessment of impacts of changes in water flow from San Bernardino Infiltration and Extraction Wastewater Treatment Facility (RIX) on populations of Santa Ana sucker, City of San Bernardino.

Environmental Compliance and Monitoring/Terrestrial Biology - The Old Road Outlet Project - Valencia, California

ENTRIX continues to provide environmental compliance assistance to Newhall Land and Farming Company and the City of Santa Clarita. ENTRIX provided environmental compliance via a Verification Request Letter submittal to ACOE and CDFG. Other services included a biological assessment of the project area, impact assessment and pre-construction surveys. ENTRIX continues to support The Old Road Outlet Project by providing environmental compliance work (i.e., environmental monitoring) for sensitive species, paticularly the federally listed endangered unarmored threespine stickleback. Monitoring efforts also include weekly nesting bird and preconstruction monitoring.

City of Santa Clarita - Special Staus Species Survey and Unarmored Threespine Stickleback Relocation, City of Santa Clarita, California

Conducted weekley pre-construction surveys for nesting special status and migratory birds for the Old Road Outlet Project. Conducted weekly surveys for sensitive upland reptile and mammal species. Conducted sensitive aquatic species surveys. Performed capture and relocation of federally endangered unarmored threespine stickleback during river diversion activites. Provided consulting for design, construction and implementation of a temporary river diversion channel.

Biological Assessment Santa Paula Creek Maintenance Project - Santa Paula, Ventura County, CA

In winter-spring of 2007, ENTRIX surveyed a 2+ mile reach of lower Santa Paula Creek to assess impacts of instream flood control measures that were placed in lower Santa Paula Creek just above the city of Santa Paula. Field surveys included vegetation mapping, general habitat assessment, wildlife observations, nesting bird surveys and bird monitoring, benthic macro-invertebrate sampling and fish sampling.

Owen's Lake Native Fishes Survey, Lone Pine, California

In late 2002 and early 2003, Dr. Swift directed and carried out surveys for the Owens pupfish and other native and non-native fishes in the lower Owens River and its delta in northern Owens dry lake bed. All of the known springs around the delta and dry lake beds (riverine, marsh, and hot spring environments) were sampled. This work was conducted for the Great Basin Unified Air Pollution Control District as a revision of their Environmental Impact Report.

Estuarine Fishes of Ballona Marsh, Los Angeles County, California

Dr. Swift is coauthor of "Estuarine Fish Communities of Ballona Marsh [Los Angeles County]", In: Ralph Schrieber, Ed., Biota of the Ballona Region, Los Angeles County. Suppl. No. 1, Marina del Rey/Ballona Local



Coastal Plan, Los Angeles Co. Dept. Regional Planning. This one year study sampled fishes monthly at 13 staions in the marsh and provided the most comprehensive study of the fish communities of the marsh to date. It continues to be followed to monitor changes to the fish community. Currently Dr. Swift serves on the Scientific Advisory Committee for the Ballona Marsh Restoration.

Santa Clara River Estuary Tidewater Goby Surveys and Expert Witness Testimony, Ventura, California

For over five years Dr. Swift has been conducting biannual sampling of the tidewater goby population in the Santa Clara River Estuary as an element of the compliance monitoring program for the City of San Buenaventura's National Pollutant Discharge Elimination System (NPDES) Permit. He participated in permit renewal workshops and provided expert witness testimony on the impacts of they City's discharge and estuarine hydrodynamics on tidewater goby and steelhead populations at Regional Water Quality Control Board hearings for the permit renewal.

Study of Santa Ana Sucker Biology on the Middle Santa Ana River, Riverside, California

As part of the Santa Ana Sucker Conservation program on the Santa Ana River, Dr. Swift participated in a long-term study to assess the population size and distribution of Santa Ana Suckers in the Santa Ana River near the city of Riverside, California. The program was administered by the multi agency Santa Ana Water Projects Authority (SAWPA) in Riverside. Survey protocols included annual summer surveys employing electrofishing using three pass depletion transects at locations in the mainstem Santa Ana River near the city of Riverside. Santa Ana suckers were measured, weighed, and tagged with PIT tags if over about 80 mm standard length. Dr. Swift holds federal permits for capture, handling and PIT tagging of the suckers. In addition to the mainstem river sites, electrofishing efforts were conducted at sites in the mainstem and tributaries of the river to detect tagged suckers. Dr. Swift participated in the program from 1999-2003, which formed the beginning of a long term annual survey of population size, movements and distribution of the Santa Ana sucker in the river.

U.S. Geological Survey, National Water-Quality Assessment Program, Santa Ana River, California

Dr. Swift participated in the USGS NAWQA program, a nationwide river monitoring and quality assessment designed to assess the status and trends in the quality of freshwater streams and aquifers, and to provide a sound understanding of the natural and human factors that affect the quality of these resources. The program included a three year survey of Santa Ana suckers on the Santa Ana River. Survey protocols required electrofishing of a total of one kilometer of river in 100 meter increments at two localities on the Santa Ana River. The goal of this assessment was to characterize, in a nationally consistent manner, the broad-scale geographic and seasonal variations of water-quality related to major contaminant sources and background conditions.

California Department of Fish and Game Native Fish Surveys, San Gabriel River, California

The California Department of Fish and Game periodically assesses the status of wild trout, Santa Ana sucker, speckled dace, and arroyo chubs in the San Gabriel River system. Dr. Swift participated in four of these sampling efforts in the early 1990s. Survey protocols included electrofishing with three pass depletion of 100 meter transects in the West Fork of the San Gabriel River and its tributary Bear Creek. Fish were identified, measured and released back to the stream.

Restoration of the Santa Maria River Estuary, Santa Barbara County, California

Dr. Swift prepared a historical analysis of coastal estuaries, habitat change, and restoration options for the estuary at the mouth of the Santa Maria River, Santa Barbara County, CA for California Department of Fish and Game Oil Response Team, for its contribution to the Trustees of Guadalupe Site, through Hagler-Bailly Inc., Boulder, Co. Field work. In addition Swift collaborated with ENTRIX biologists in surveying the estuary for tidewater gobies and preparing a report on their current status at the site.

Big Tujunga Mitigation and Restoration, Sunland, CA

On behalf of the Los Angeles County Department of Public works, Dr. Camm Swift, with Dan Holland, designed and implemented the exotic removal program at Big Tujunga Wash from from 2000 to 2004. Work included extensive trapping for crayfish, gill netting and snorkeling for bass, removal of bullfrog egg masses, and monitoring of the three native fish species in Haines Creek. Dr. Swift was instrumental in making recommendations with respect to the refinement of methods, equipment needs and sampling design and strategy. Effectiveness monitoring of the eradication efforts included periodic surveys of the native fishes in the streams at randomly selected transects along the 1.7 km of stream in the mitigation area.

Expert Witness Testimony Big Tujunga Wash, CA

In support of the California Department of Fish and Game's Community Arbitration with Foothill Golf and Development in California State Superior Court, Los Angeles, Dr. Swift provided extensive and detailed information on the biology of Southern California Coastal Minnow and Santa Ana Sucker to support the Department's position of the extreme importance of the wash habitat for the continued existence of the native fishes and other native species in this surviving remnant fish community consisting of the Santa Ana sucker (federally threatened) and Santa Ana speckled dace and arroyo chub, both California species of special concern.

Exotic Predators on Tidewater Gobies on Marine Corps Base Camp Pendleton

Dr. Swift, working with Mr. Holland, used their extensive experience on the Base to prepare a management plan for exotic fishes and other species on Marine Corps Base Camp Pendleton. Many of these prey on tidewater gobies and this plan included methods for removal of exotics and for prevention or minimizing their impact on native aquatic species. Since 1998, Dr. Swift has led teams of biologists to implement the exotic species removal plan at San Mateo Lagoon on the Base.

San Juan Creek Native Fish Survey - La Novia Bridge, San Juan Capistrano, California

Dr. Swift provided biological support and pre-construction monitoring for a project involving widening of the La Novia Street Bridge over San Juan Creek. The project included field surveys and monitoring, developing best management practices for fish avoidance and developing mitigation measures for post-construction planning. Species of concern included migrating southern steelhead, unarmored three-spine stickleback and arroyo chub.

Tidewater Gobies on Vandenberg Air Force Base

Cooperative Agreement between National Biological Service (now part of USGS) and Loyola Marymount University for study of the biology of the federally endangered tidewater goby on Vandenberg Air Force Base, Santa Barbara County. Included three to four paid undergraduate research assistants at Loyola Marymount University. This contract extended for two years and comprehensively studied the biology and distribution of



the tidewater gobies at five sites on Vandenberg Air Force Base. A comprehensive report detailed many aspects of needs for restoration of habitats on the Base.

Bixby Ranch Steelhead, Tidewater Goby and California Red-Legged Frog Baseline Habitat Assessment, Santa Barbara, California

Dr. Swift conducted a baseline biological assessment of the Bixby Ranch in Santa Barbara, California. The focus of this assessment was to assess aquatic habitat conditions as it pertains to steelhead, tidewater goby, California red-legged frog, and southwestern pond turtle. Terrestrail habitat was also assessed but was limited by access constraints. New poulations of tidewater gobies were discovered during this assessment.

Tidewater Gobies on Marine Corps Base Camp Pendleton

Dr. Swift, working with Mr. Dan Holland, did multiple surveys from 1991 to 2000 for the tidewater gobies and other members of the estuarine fish community at seven estuaries and lagoons on Marine Corps Base Camp Pendleton, coastal southern California. They provided the first descriptions of the estuarine fish communities for several of these sites and provided recommendations for maintenance and improvement of habitat for the species on the Base. With Dan Holland, Camp Pendleton Amphibian and Reptile Survey, Fallbrook, CA for Marine Corps Base Camp Pendleton

Surveys of Freshwater Fishes of Southern California

Dr. Swift has extensive experience surveying, researching and studying freshwater species of special concern. A representative sample of these surveys includes:

- Advised a Six Agency committee of southern California water and power purveyors, including Metropolitan Water District of Southern California] on the quality and rationale for U.S. Fish and Wildlife Service Critical Habitat designations for endangered big river fishes of the Colorado River, southwestern United States. Responsibilities included expert testimony, literature research and report writing.
- Supervised crews of three to six graduate students surveying the estuarine and freshwaters of southern California for fishes for four months and prepared report for the California Department of Fish and Game on the status and distribution of these fishes, at Natural History Museum of Los Angeles County.
- Evaluated the status of the native freshwater fishes of southern California, including the status of the estuarine tidewater goby, *Eucyclogobius newberryi*, with recommendations for preserves to maintain their existence. California Department of Fish and Game Contract FG-7455, one year. Compiled data bases on fish records collaborating with Peter Moyle, U. C. Davis, to incorporate data into the California Department of Fish and Games, at Natural History Museum of Los Angeles County.
- Participated in a Cooperative Agreement between National Biological Service (now part of USGS) and Loyola Marymount University for study of the biology of the federally endangered tidewater goby on Vandenberg Air Force Base, Santa Barbara County. Included three to four paid undergraduate research assistants at Loyola Marymount University.
- Analyzed bottom samples from Delta Mendota Canal, central California, for invertebrate densities of the Asiatic clam, *Corbicula fluminea*, as a research assistant Zoology Department, University of California, Berkeley.
- Identified freshwater and coastal fish habitats to determine Significant Ecological Areas for Regional Planning Department, Los Angeles County, via contract to Natural History Museum of Los Angeles County.



 Co-author, U.S. Fish and Wildlife Service Recovery Plan for Endangered Unarmored Threespine Stickleback, as member of Unarmored Threespine Stickleback Endangered Species Recovery Team.

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- Author, Estuarine Fish Communities of Ballona Marsh [Los Angeles County], In: Ralph Schrieber, Ed., Biota of the Ballona Region, Los Angeles County. Suppl. No. 1, Marina del Rey/Ballona Local Coastal Plan, Los Angeles Co. Dept. Regional Planning.
- Served on an expert panel, habitat suitability criteria and curves for three native cyprinoid fishes (state species of special concern) of the Santa Ana River, southern Calif., EA Engineering and Technology (Lafayette, CA) for Southern California Edison Company.
- Surveyed for freshwater fishes of the Los Angeles River. Field work and report writing, as part of contract from the California Department of Fish and Game to the Natural History Museum of Los Angeles County, to assess the fauna and flora of the river.
- Monitored populations of native federally endangered fish species during streambed alterations in the Santa Clara River, southern. Performed both field work and report writing.
- Surveyed for the proposed endangered fish, the tidewater goby, in coastal estuaries of Camp Pendleton Marine Base, southern California. Performed both field work and report preparation.
- Surveyed for the federally endangered tidewater goby in the estuarine Shuman Lagoon, Vandenberg Air Force Base, Santa Barbara County, CA for U.S. Fish and Wildlife Service, Ventura Field Office,
- Analyzed diet of the endangered bird, the least tern, with Patricia Baird, Department of Biology, California State University, Long Beach. Under U.S. Navy contract (to P. Baird) at Long Beach, with three undergraduate research participants at Loyola Marymount University.
- Prepared draft recovery plan for tidewater goby as a member of the Tidewater Goby Technical Recovery Team, with U. S. Fish and Wildlife Service, Ecological Services, Ventura California.
- Prepared historical analysis of coastal estuaries, habitat change, and restoration options for the estuary at the mouth of the Santa Maria River, Santa Barbara County, CA for California Department of Fish and Game Oil Response Team, for its contribution to the Trustees of Guadalupe Site. Performed field work, research and report writing in collaboration with Entrix Inc., retained by UNOCAL Corporation.
- Surveyed for the endangered fish species, the tidewater goby on Marine Corps Base Camp Pendleton, coastal southern California, and provide recommendations for maintenance and improvement of habitat for the species on the Base. With Dan Holland, Camp Pendleton Amphibian and Reptile Survey, Fallbrook, CA for Marine Corps Base Camp Pendleton.
- Prepared management plan for exotic fishes on Marine Corps Base Camp Pendleton, including methods for removal of exotics and for prevention or minimizing their impact on native aquatic species. With Dan Holland (Principal Investigator), Camp Pendleton Amphibian and Reptile Survey, Fallbrook, CA.
- Surveyed for native and introduced freshwater fishes in the middle Santa Ana River in the Prado Dam vicinity with special reference to Santa Ana sucker and arroyo chub. For U. S. Army Corps of Engineers, Los Angeles CA.
- Surveyed, downstream trapping, and analysis of habitat quality for the three endangered fishes (southern steelhead, tidewater goby, and unarmored threespine stickleback) in San Antonio Creek, Santa Barbara County for Vandenberg Air Force Base.

 Surveyed, downstream trapping, and food habit studies of Santa Ana suckers in the Santa Ana River to document movements into diversions and impact of exotic species on suckers. Phase II for Santa Ana Water Project Authority, Riverside, CA.

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- Expert witness on Southern California Minnow/sucker community for California Department of Fish and Game in their arbitration with Foothill Golf and Development, State Superior Court, Los Angeles, No. 99-0600-DW (This fish community consists of Santa Ana sucker, Santa Ana speckled dace, and arroyo chub).
- Prepared preliminary assessment of impacts of shore dredging on the fisheries of Big Bear Lake, for Big Bear Municipal Water District.
- Surveyed and estimate population sizes of endangered unarmored threespine stickleback and tidewater goby, and analyze steelhead habitat on several drainages on Vandenberg Air Force.
- Monitored population of tidewater goby in San Luis Obispo Creek Lagoon in relation to Avila Beach clean up site. For Unocal through Essex Environmental, San Luis Obispo.
- Surveyed for tidewater gobies in Santa Clara River Lagoon, Ventura County. For City of Ventura CA.
- Surveyed for populations of sensitive native freshwater fish in the Santa Ana River near Colton and Loma Linda, CA.
- Surveyed for populations of native fishes in the Santa Ana River in the vicinity of the Interstate 210 crossing, for Cal Trans, CA.
- Monitored for Santa Ana suckers and assess effects of bridge maintenance, sand mining, and alternative bridge design on this fish. For Riverside County Transportation Department.
- Surveyed for the federally endangered tidewater goby in lower San Luis Rey River, CA. with Camp Pendleton Amphibian and Reptile Survey, Fallbrook, CA.
- Surveyed and monitored for the federally endangered tidewater goby in San Mateo Lagoon, Camp Pendleton Marine Corps Base with recommendations for restoration and recovery.
- Interaction of native and exotic freshwater fishes during El Nino disturbance in the Santa Margarita River, southern California. With USGS Laboratory, San Diego State University with partial support of the Nature Conservancy.
- Determined possible effects on steelhead of UNOCAL remediation of soil contamination in the vicinity of the lower Santa Maria River.
- Reviewed and assessed mitigation features for Seven Oaks Dam on the Santa Ana River in relation to populations of Santa Ana sucker downstream. For the U. S. Army Corps of Engineers.
- Review and assess mitigation plans and Biological Assessments for tidewater goby and steelhead in relation to Lower Mission Flood Control Project of U. S. Army Corps of Engineers. For City of Santa Barbara, CA.
- Survey for fishes and assess possible impacts of the construction of a pipeline crossing over Dominguez Channel in Wilmington.
- Directed surveys for Santa Ana speckled dace in lower Fremont, Blackstar, and Silverado canyons, Orange County.



- Survey for native freshwater fishes and advise on mitigation for quarry operations at the mouth of Fish Canyon, near Azusa, CA.
- Implement eradication plan for exotic fishes in Los Angeles County Public Works mitigation area of lower Big Tujunga Canyon-Haines Creek area. With Camp Pendleton Amphibian and Reptile Survey, Fallbrook, CA, for Los Angeles County Department of Public Works.
- Identify freshwater fossil fish remains from a variety of late Pleistocene freshwater sites in Riverside County.
- Monitor, rescue, and transfer federally threatened Santa Ana suckers from diversion of Santa Ana River, Orange County. For U. S. Corps of Engineers
- Provide assessment of impacts of changes in water flow from San Bernardino Infiltration and Extraction Wastewater Treatment Facility (RIX) on populations of Santa Ana sucker. For City of San Bernardino.
- Survey for native fishes in relation to highway crossing of streams at Temecula Creek, San Diego County and Chino Creek, San Bernardino County. For CalTrans.
- Provide assessment of impacts and mitigation possibilities for native sensitive fish species in lower San Juan Capistrano Creek, Orange County and lower San Mateo Creek, northern San Diego County for various alternatives of the proposed new highways. For Foothill/Eastern Transportation Corridor Agency.
- Provide expertise and field work to study steelhead in Topanga Creek including snorkel surveys, habitat assessment, and up and downstream migrant trapping. With Resource Conservation District of the Santa Monica Mountains, Topanga, CA.
- Prepare draft Recovery Plan for combined South Central Coast Steelhead (federally threatened) and South Coast Steelhead (federally endangered) as member of NOAA Technical Recovery Team for Southern Steelhead.

Professional Affiliations and Honors

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Dr Swift has held various elected and appointive positions in the California-Nevada Chapter of the American Fisheries Society, Southern California Academy of Sciences, and American Society of Ichthyologists and Herpetologists. Secretary, Vice-president, and President of the Academy; elected President-elect, and proceeded to President, and past President of California Nevada Chapter, 1997-1999. Served on host committees for Los Angeles meetings of the American Society of Ichthyologists and Herpetologists (twice), Society of Vertebrate Paleontology, California-Nevada Chapter of the AFS, and the Southern California Academy of Sciences (three times).

Dr. Swift served as a member of the Unarmored Threespine Stickleback Endangered Species Recovery Team (1972-1995). He currently serves on the Technical Recovery Team for the Tidewater Goby (2003-present), both for U.S. Fish and Wildlife Service, and is a member of the Southern Steelhead Technical Recovery Team (2003-present) for the National Marine Fisheries Service.

Dr. Swift was elected Fellow of the Southern California Academy of Sciences in 1991 and Emeritus Associate Curator of Fishes, Natural History Museum of Los Angeles County in 1993. He received the Award of Excellence from California Nevada Chapter of the American Fisheries Society in 1997.



Dr. Swift is an active member in numerous professional associations including: American Fisheries Society, including California Nevada Chapter, Estuarine Research Foundation, American Society of Ichthyologists and Herpetologists, Desert Fishes Council, Southeastern Fishes Council, Society of Vertebrate Paleontology, Sigma Xi (Loyola Marymount University Chapter), American Association for the Advancement of Science, Southern California Academy of Sciences, Society for Conservation Biology, Society of Systematic Biology, Biological Society of Washington, Japanese Ichthyological Society, Western Field Ornithologists, and California Native Plant Society

Publication, presentation and grant list available

Publications: 1989-present

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- 1993. Swift, T. H. Haglund, M. Ruiz, and R. Fisher. Status and distribution of the freshwater fishes of southern California. Bull. S. Calif. Acad. Sci., 92(3):101-168.
- 1996. Chapter 30. Distribution and migration. Pp. 595-630. (excluding literature cited in single collection at end of book). In: Carl Bond. Biology of Fishes, (textbook) Second Edition. Harcort, Brace, and Co., Philadelphia.
- 1996. Lafferty, K., R. Swenson, and C. C. Swift. Tidewater goby; endangered species profile. Environmental Biology of Fishes, 46:254.
- 1998. The fish fauna of Ballona Marsh, an urban estuary on the western of the Los Angeles Basin. p. 1427 (Abst). In: Orville T. Magoon, et al. Eds, California and the World Ocean '97. 2 vols. American Society Civil Engineers, Reston, VA
- 1999. K. Lafferty, C. C. Swift and R. Ambrose. Postflood persistence and recolonization of endangered tidewater goby populations. North American Journal of Fisheries Management, 19(2):618-622.
- 1999. ______. Extirpation and recolonization in a metapopulation of an endangered fish, the tidewater goby. Conservation Biology, 13(6):1447-1453.
- 2002. Swift, K. Hieb, and R. Swenson. Family Gobiidae. pp. 7-9. IN: William S. Leet, Christopher M. Dewees, Richard Klingbeil, and Eric J. Larson (editors), California's Living Marine Resources: A status report. The Errata. California Department of Fish and Game, Sacramento, CA (December, 2001) (www.dfg.ca.gov/mrd) [The larger work appeared in hard copy in earliest 2002 minus this Gobies article later added to an electronic Errata on the web site for inclusion in the Section on Bay and Estuarine Finfish Resources]
- 2002. M. N. Dawson, K. D. Louie, M. Barlow, D. K. Jacobs, and C. C. Swift. Comparative phylogeography of sympatric sister species, Clevelandia ios and Eucyclogobius newberryi (Teleostei, Gobiidae), across the California transition zone. Molecular Ecology, 11, 1065-1075.
- 2002. Swift and D. C. Holland. Exotic Fish species and their impacts on small costal lagoons in southern California. (Abst.) Bull. S. Calif. Acad. Sci., 101(2), Supplement, p. 32
- 2002. Interaction between native fish, habitat, and exotic fish species in the middle Santa Ana River, southern California. (Abst.) Bull. S. Calif. Acad. Sci., 101(2), Supplement, p. 32.

2006. Chapter 29. Distribution. Pp. 601-638. IN: Michael Barton, Bond's Biology of Fishes, 3rd Edition, Thompson Brooks/Cole, Belmont, CA.

Presentations: (1999 to present)

- The disappearing fishes of southern California. In: Swimming Upstream: Restoring California's rivers and streams for salmon, steelhead and other species. Educational Workshop sponsored by the Sierra Club and California Trout, 12 June 1999, Los Angeles Zoo, Los Angeles, CA
- Biodiversity and conservation of the freshwater fishes of southern California. (with Jonathan Baskin) In: Planning for Biodiversity: Bringing research and management together. A symposium sponsored by the USDA Forest Service and USGS Western Ecological Research Center. California State Polytechnic University, Pomona, 29 February-2 March 2000.
- Dramatic effects of rainfall on species distributions in the Santa Margarita River. (with Manna Warburton [presenter] and Robert N. Fisher), California-Nevada Chapter, American Fisheries Society, 34th Annual Meeting, Ventura, CA 31 March-1 April 2000.
- Freshwater fishes of the Los Angeles River, southern California. (with Jeffrey Seigel and Dan Holland), and
 Fish population fluctuations 1997-2000 in small lagoons on Marine Corps Base Camp Pendleton.
 (with Dan Holland), Annual Meeting, Southern California Academy of Sciences, University of
 Southern California, Los Angeles, CA 19-20 May 2000.
- El Nino effects on the native and exotic fish populations of the Santa Margarita River southern California. (with Robert N. Fisher [presenter] and Manna Warburton). Society for Conservation Biology Annual Meeting, Hilo Hawaii, 29 July-Aug. 1, 2001.
- El Nino effects on estuarine fish populations associated with the southernmost populations of tidewater goby, 1990-2001 (with Dan Holland), and The federally threatened Santa Ana sucker in the Santa Ana River-Distribution, habitat, and exotic predators. Ann. Meeting, California Nevada Chapter American Fisheries Society, Tahoe City, CA April 19-20, 2002
- Exotic fish species and their impacts on small coastal lagoons in southern California (with Dan Holland, presenter), and Interaction between native fish, habitat, and exotic fish species in the middle Santa Ana River, southern California. Annual. Meeting, Southern California Academy of Sciences, Claremont, CA June 7-8, 2002.
- Fish populations of small coastal lagoons in southern California. California Estuarine Research Society, Inaugural Meeting, Hubbs Sea World Research Institute, San Diego, CA, April 14, 2003
- Status of and prognosis for the freshwater fishes of coastal southern California. Swift [presenter], Jonathan N.
 Baskin, Robert Fisher, and Thomas Haglund; Status, Habitat, and restoration of southern Steelhead in Topanga Creek and State Park, just south of Malibu Creek. Rosi Dagit [presenter] and Swift; Visual Display of stream habitat survey profiles using GIS: An example from Topanga Creek, coastal Southern California. Kevin Reagan [presenter], Rosi Dagit, and Swift; and a Poster: Genetic structure in the staghorn sculpin from Alaska to southern California. Kristina D. Louie [presenter], K. P. Kloepfli, D. K. Jacobs, and Swift. Western Division/Cal-Neva Chapter of American Fisheries Society,

Joint Annual Meeting, San Diego, April 14-17, 2003. In addition Swift organized two days of symposia on the freshwater fish, amphibian, and aquatic reptile fauna of coastal southern California.

- Organized one day Symposium for California Nevada Chapter of the American Fisheries Society Meeting, San Luis Obispo, March 30, 2006. Chaired session and presented "Annual and seasonal variations in fish populations of San Mateo Lagoon, San Diego County, CA" with Dan Holland, Melissa Booker, Brian Lohstroh, and Eric Bailey.
- Status and distribution of freshwater fishes of coastal southern California. In symposium on Aquatic Vertebrates of Southern California. Southern California Academy of Sciences Meeting, Pepperdine University, Malibu, 13,14 May 2006.
- Expanding distributions of invasive fishes in coastal southern California estuaries and freshwaters. Presentation at the California Nevada Chapter of the American Fisheries Society Meeting, Lake Tahoe, Nevada, April 2008.

Employment History

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- ENTRIX, Inc., Senior Project Scientist, September, 2003 present
- Emeritus Associate Curator, Natural History Museum of Los Angeles County, January, 1993 present
- Part-time instructor, Mount San Antonio College, 1993 1994
- Visiting Assistant Professor of Biology, Loyola Marymount University, Los Angeles, 1994 1998
- Part-time instructor, East Los Angeles, Rio Hondo, and Valley colleges, 1993-1994, 1998 1999
- Associate Curator of Fishes, Natural History Museum of Los Angles County; and Adjunct Assistant Professor of Biology, University of Southern California, 1970 - 1993



Discipline/Specialty

- Terrestrial Ecology
- ESA compliance and Consultation
- Herpetology/Mammalogy
- Molecular Biology

Education

- M.S., Zoology, University of California, Davis
- B.S., Zoology, University of California, Davis

Registrations

- California Department of Fish and Game scientific collecting permit #000131 and associated MOU's: mammals, fish, reptiles, amphibians, invertebrates, California species of special concern
- Section 10A US Fish and Wildlife Service Endangered Species Recovery Permit, #TE 827500, for distribution-wide studies of the California redlegged frog (Rana aurora draytonii), the giant garter snake (Thamnophis gigas), and the San Francisco garter snake (Thamnophis sirtalis tetrataenia). Expires 12/31/2006

Summary of Qualifications

Mr. Barry has over thirty year's experience consulting with agencies and environmental consulting firms to plan and conduct investigations on State and federally listed (threatened/endangered) California reptiles and amphibians, for refuge development, urban impact assessments, and evaluation of conservation status of individual populations. He is a nationally recognized authority on the endangered San Francisco garter snake (Thamnophis sirtalis tetrataenia) and has also recently completed studies of special-status (e.g., Sierra Nevada) California red-legged frog populations (Rana aurora draytonii). Mr. Barry has also conducted numerous contract and scientific studies of the giant garter snake (Thamnophis gigas), and he holds a Federal Endangered Species Recovery permit that covers work with the giant garter snake, the San Francisco garter snake, and the California red-legged frog. Mr. Barry has also worked with reptile and amphibian populations in Oregon, Nevada, Arizona, New Mexico, Texas, Nebraska, Missouri, Michigan, Tennessee, Pennsylvania, and New Jersey. Mr. Barry' experience in mammalogy studies include work with total mammal diversity across much of California, and specialized studies of bats, insectivores, and rodents in the Sierra Nevada, Central Valley, Basin and Range province, Transverse and Peninsular ranges (southern California), and California deserts. Mr. Barry's scientific background also includes projects related to molecular evolution and systematics (microsatellite and single nucleotide polymorphism analysis) and molecular biology of regulated genes (targeted gene studies, gene expression analysis). Responsibilities in University of California research programs have included project and safety management, budget planning, scheduling, all aspects of field and laboratory technical work, grant and proposal preparation, and teaching/mentorship.

Relevant Experience Regulatory Compliance

Calistoga Ranch - Napa County, CA

Mr. Barry worked as part of the ENTRIX team to prepare a comprehensive Section 404 (U.S. Army Corps of Engineers), Section 401 (California Regional Water Resources Control Board), and 1603 (California Department of Fish and Game) permit package for streambed and drainage basin modifications along Biter Creek at Calistoga Ranch. The project involved extensive modification and restoration of the creek between Biter Lake and the property boundary neaer the Napa River, and the permit package covered streambed alteration, sediment discharge, endangered species impacts, anadromous fisheries impacts, storm runoff pollution prevention planning, and streambed restoration.

Laguna Creek Sedimentation Basin Habitat Management Plan preparation, San Francisco Public Utilities Commission - San Mateo County



Mr. Barry developed a comprehensive take avoidance plan to protect federally listed Threastened and Endangered species and California Fully Protected species (San Francisco garter snake, California red-legged frog during reconstruction and restoration of a sedimentation basin at the mouth of Laguna Creek near Upper Crystal Springs Reservoir. Mr. Barry also consulted on hydrologically and ecologically favorable designs for the sedimentation basin restoration, and helped to plan the post-construction vegetation restoration program. Mr. Barry also devised a series of success criteria to measure the efficacy of the restored sedimentation basin as listed species habitat.

Stanford University Linear Accelerator Center, Positron-Electron Facility Construction Project (PEP) – San Mateo and Santa Clara Counties, CA

Mr. Barry surveyed the entire Linear Accelerator property for federally-listed endangered reptiles and amphibians and worked with Center planners and operations personnel to devise a management strategy for riparian-associated wildlife during and after the PEP construction.

Land Use and Resource Management Planning

Natomas Basin Habitat Conservation Plan - Sacramento County, CA

Mr. Barry worked with several stakeholders in the Natomas HCP region to identify and protect western pond turtle and federally-listed giant garter snake populations during the initial stages of Natomas Basin development and mitigation. He prepared several comprehensive evaluations for various agencies and clients that delineated affected garter snake populations and reconciled protection plans with HCP requirements. An important part of this work was to devise strategies to facilitate consultations among the US Fish and Wildlife Service, the City of Sacramento, landownders, consultants, and other stakeholders so that issues of primary importance were highlighted. For example, he showed that development issues in upland sites east of the basin impacted listed and special status species far less than they might along tributary creeks in the same region.

South Sacramento County Habitat Conservation Plan - Sacramento County, CA

Mr. Barry evaluated the entire HCP region as potential or actual habitat for giant garter snakes and western spadefoot toads, and prepared extensive documentation for the HCP to identify the most critically important sites for the conservation of both species.

Santa Cruz Habitat Conservation Plan - Santa Cruz County, CA

Mr. Barry assisted in preparation of a ESA Section 10 Habitat Conservation Plan to cover Santa Cruz City activities that affect several federally-listed and potentially-listed species. He also presented part of the Plan to the Scientific Advisory Committee and participated in strategic and administrative meetings with City, legal, consultant, and agency personnel.

Plumas National Forest/Soper Wheeler parcel exchange - Butte, Plumas, Sierra, and Yuba Counties, CA

Mr. Barry evaluated the reptile and amphibian populations of several thousand acres of National Forest and private holdings in support of a proposed land exchange, and worked with USFS and other stakeholders to ensure that the exchange would impact special status species populations minimally. During this work Mr. Barry also discovered the largest California red-legged frog population ever documented in the Sierra Nevada, which is regarded as one of the most significant discoveries ever in California conservation biology.



Golden Gate National Recreation Area - San Mateo and San Francisco Counties, CA

Mr. Barry evaluated several historical sites within the GGNRA to determine their current ability to support San Francisco garter snake and California red-legged frog populations. The recommendations in his report were incorporated into the proposed GGNRA management plan, currently under study by NPS.

Electric Power

Big Creek Strategic Alternative Licensing Project - Central Sierra Nevada

Mr. Barry mentored ENTRIX biologists on specialized identification methods for special status and federallylisted amphibian species at various sites in the Big Creek Project (San Joaquin River Basin). This project will submit applications to the Federal Energy Regulatory Commission (FERC) for four projects: Big Creek Nos. 1 & 2 (FERC No. 2175), Big Creek Nos. 2A, 8 and Eastwood (FERC No. 67), Big Creek No. 3 (FERC No. 120) and Mammoth Pool (FERC No. 2085).

Kilarc/Cow Creek Licensing Project - Shasta County, CA

Mr. Barry surveyed much of the Cow Creek basin to determine its suitability for special status amphibians, and he mentored ENTRIX biologists in survey and census techniques. This project has submitted hydroelectric relicensing applications to FERC, and the environmental data submitted during the relicensing process will be used in future management programs.

Oil and Gas

Chevron San Ardo-Coalinga pipeline - Monterey and Fresno Counties, CA

Mr. Barry provided project leadership in special status reptile and amphibian surveys for the pipeline project, and mentored ENTRIX subcontractors in effective survey and identification techniques for several species. The petroleum pipeline will extend from San Ardo in the Salinas River Valley 50 miles east to Coalinga at the western edge of the San Joaquin Valley, and will intersect habitats of several special status species.

Water Resource Management

Madera Ranch-Mendota Pool pipeline - Madera County, CA

Mr. Barry evaluated the 30-mile pipeline route between Madera Ranch and Mendota Pool to assess its potential impact on giant garter snake and western pond turtle populations, and demonstrated by analysis of seasonal stream flow and accompanying faunal population shifts on the ranch property that the pipeline installation could be timed easily to avert any potential impacts.

San Francisco Peninsula Watershed San Francisco Garter Snake Management (San Francisco Public Utilities Commission) — San Mateo County, CA

Mr. Barry discovered and studied over 20 San Francisco garter snake and California red-legged frog populations on the San Francisco Peninsula Watershed for the San Francisco Water Department, the California Department of Fish and Game, and the University of California, Davis, and prepared a comprehensive management proposal to reconcile watershed management and biological conservation interests on SFPUC properties.

Denniston Creek Reservoir expansion - San Mateo County, CA

Mr. Barry performed several comprehensive surveys of the Dennistorn Creek basin near Half Moon Bay for listed and special status reptile and amphibian species, and worked with the Coastside County Water District to plan the proposed Denniston Reservoir expansion to mimimize its impact on these species.



Wilder Creek dam removal, Wilder Ranch State Park - Santa Cruz County, CA

Mr. Barry assessed the size and habitat use of the California red-legged frog population downstream of the dam, and worked with the US Fish and Wildlife Service and California Department of Parks and Recreation to devise a plan to minimize the impact to the population when the dam was removed.

Mammalogy Research

Diversity study of California bats - California

Mr. Barry conducted mist net and roost studies over three years to assess the distribution of several species of California bats. These studies were conducted statewide and included species of particular conservation concern, such as the big-eared bat of southeastern California.

Heteromyid rodent ecology studies - San Joaquin Valley, Mohave and Colorado Deserts

Mr. Barry conducted trapping studies and burrow assessments to study diversity and foraging ecology of several species of kangaroo rats and pocket mice.

Molecular Biology

Molecular biology of regulated genes - University of California, Davis Rowe Program in Genetics

Mr. Barry managed and executed a NIH-funded program to study the expression and regulation of various consitutive genes in lipid metabolic pathways, and became an authority on the regulation, isolation, and characterization of rare messenger ribonucleic acid sequences in mammalian tissues.

Employment History

- ENTRIX Inc, Project Scientist/Herpetologist, 2003 to date
- Independent Consultant/Herpetologist, 1974 to 2003
- Staff Research Associate, University of California, Davis, 1983 to 2003
- Curator of the Vertebrate Museum, Department of Zoology, University of California, Davis, 1972 to 1975
- Biologist, California Department of Fish and Game, Endangered Species Program Reptiles and Amphibians office, 1972 to 1975

Reviewer

- San Francisco Garter Snake Recovery Plan, US Fish and Wildlife Service, 1983-85.
- California Red-Legged Frog Recovery Plan, US Fish and Wildlife Service, 2000-2002.
- Check-list of Amphibians, Reptiles, Birds, and Mammals of California, California Department of Fish and Game
- "Measuring and Monitoring Biological Diversity" book series (mammals, amphibians, reptiles), Smithsonian Institution Press. February 2000-present

Journal Referee

Journal of Herpetology, 1998 to date



Publications

ENVIRONMENTAL CONSULTANTS

- Barry, S.J. 1976. Investigations on the occurrence of the San Francisco garter snake at the Stanford Linear Accelerator Center. SLAC Tech. Note 76-2.
- Barry, S. J. 1978. The status of the San Francisco garter snake. California Department of Fish and Game Endangered Species Special Publ. 78-2.
- Barry, S. 1993. The San Francisco garter snake: protection is the key to recovery. Tideline 13:1-3,15.
- Barry, S. J. and H. B. Shaffer. 1994. The California tiger salamander at Lagunita: a 50-year update. Journal of Herpetology 28:159-164.
- Barry, S. J. and M. Mangel, 1994. Review of Harrison, L. Kinetic Theory of Living Pattern. Mathematical Biosciences. 124:237-241.
- Barry, S. 1996. The San Francisco garter snake and the San Francisco Watershed. Prepared for City of San Francisco, Public Utilities Commission, San Francisco Water Department. 143p.
- Barry, S. J., M. R. Jennings, and Hobart M. Smith. 1996. Current subspecific names for western Thamnophis sirtalis. Herpetological Review, 27:172-173.
- Barry, S. J. 1997. Museum and Anatomical Preparation of Reptile Specimens. in Ackerman, L., ed. The Biology, Husbandry, and Medicine of Captive Reptiles. TFH, Neptune, NJ, 3 vols.
- Barry, S. J. and M. R. Jennings. 1998. Eutaenia sirtalis tetrataenia Cope in Yarrow, 1875 and Coluber infernalis Blainville, 1835 (Currently Thamnophis s. tetrataenia and T. s. infernalis): proposed conservation of usage of the subspecific names by the designation of a neotype for T. s. infernalis. Bulletin of Zoological Nomenclature 55:224-228.
- Barry, S. J. 1999. A study of the California red-legged frog (Rana aurora draytonii) of Butte County, California. Par Environmental Services, Sacramento, CA, Tech. Rept. No.3, 16p.

In Press

- Barry, S. J., in press. Preparing Reptiles as Scientific Specimens. in Foster, M., and McDiarmid, R., eds Measuring and Monitoring Biological Diversity: Standard Methods for Reptiles. Spring 2004, Smithsonian Institution Press.
- Barry, S. J., in press. Masticophis flagellum piceus (Red racer), carrion feeding. Herpetological Review, in press.

Submitted

 Barry, S. J. and M. R. Jennings. Nomenclature of western Thamnophis sirtalis resolved by designation of a neotype for T. s. infernalis. Herpetological Review

In Preparation

Barry, S. J. and G. M. Fellers. The history and status of the California red-legged frog (Rana aurora draytonii) in the Sierra Nevada

Professional Affiliations

• Ecological Society of America



- The Wildlife Society
- American Society of Mammalogists
- American Society of Ichthyologists and Herpetologists
- Society for the Study of Amphibians and Reptiles
- Herpetologists' League
- Society of Systematic Biologists
- Southwestern Society of Naturalists
- Society for the Preservation of Society for the Preservation of Natural History Collections



Discipline/Specialty

- Aquatic Invertebrate Ecology
- Fisheries Biology
- Habitat Assessments and Mapping
- IFIM/PHABSIM
- Limnology
- Salmonid Biology
- Stream and Estuarine Ecology
- Water Quality Assessment
- Environmental Monitoring

Education

 B.S., Fisheries: Humboldt State University, Arcata, CA, 1999

Training/Certifications

- California Department of Fish and Game. Resident Scientific Collecting Permit No. 801293-01
- USFWS Project Permitted Tidewater Goby Specialist in Ventura and Santa Cruz Counties
- Theory and Application of the Physical Habitat Simulation System, Utah State University, May 2002
- Sampling Theory and Design Workshop, Humboldt State University, March 2002
- Aquatic Ecological Assessment Workshop, CDFG, March 2002
- Electrofishing Workshop, AFS and Smith-Root, March 2006

Affiliations

 American Fisheries Society, Oregon and Cal-Neva Chapters since 1998

Summary of Qualifications

Mr. Howard is an interdisciplinary scientist with an emphasis on aquatic studies including fishery habitat assessment and population surveys, fish species identification, fisheries techniques, fish passage assessment, fish and aquatic invertebrate population analysis, water quality assessment, and wildlife population and escapement surveys. Mr. Howard has preformed numerous projects in aquatic habitats ranging from high elevation lakes and streams to coastal estuaries. Mr. Howard has also conducted projects including subsurface soil and groundwater investigations, environmental impact studies, environmental monitoring, and site closure and remediation. Mr. Howard has been involved in permitting large power projects and smaller instream projects throughout California.

Mr. Howard has conducted numerous fish population studies throughout many of the western states. Representative projects include chinook, steelhead and bull trout studies in northern California and Oregon, steelhead studies in central and southern California, various trout species studies in California, Oregon and Idaho, and native fish studies in Oregon and southern California. Mr. Howard has also conducted fish population surveys in southern and central California estuaries for the endangered tidewater goby.

Mr. Howard manages the majority of the aquatic projects in southern California. Proven management skills along with technical expertise with special status aquatic species, instream flow studies and mitigation compliance has been a key factor in the retention of on-call services contracts with several clients in southern California.

Relevant Experience Fish and Wildlife Studies

McKenzie River Watershed Spring Chinook Population Study - Lane County, Oregon

Mr. Howard conducted chinook salmon spawning surveys, obtained biological samples from spawned-out salmon, collected downstream migrants, monitored fish passage though leaburg dam, and monitored bull trout migration under the Western Oregon Research and Monitoring Program. Mr. Howard conducted these projects for the Oregon Department of Fish and Wildlife.

Oregon State Elk Population Study - Lane County, Oregon

Mr. Howard managed an initial statewide effort to obtain elk teeth and tissue samples throughout the state of Oregon. This effort was successful and set precedent for future Oregon Department of Fish and Wildlife elk tissue collection efforts.

United Water Conservation District FERC Relicensing Project - Ventura County, California



ENTRIX, Inc. designed multiple studies under agency consultation during the FERC application process. Mr. Howard conducted fish population studies and identified fish species present in Piru Creek below Santa Felecia Dam, within Piru Lake and above the lake in Piru Creek.

United Water Conservation District Steelhead Migration Project - Ventura County, California

ENTRIX, Inc. directed fish passage monitoring and fish rescue consultation involving steelhead on the lower Santa Clara River. Mr. Howard was the lead fisheries biologist for the project. The Vern Freeman Diversion fish passage facility includes a fish ladder, fish screens, and a downstream migrant fish trap. During steelhead migration, facilities at the diversion were inspected for stranded steelhead and resident rainbow trout for relocation to the appropriate habitat. These operations were interim mitigation measures for section 10 incidental steelhead take.

PacifiCorp FERC Relicensing Project - Jackson County, Oregon

ENTRIX, Inc. conducted numerous aquatic studies under agency consultation during the FERC reliscencing application process. Mr. Howard analyzed fish population data in the upper Rogue River watershed to estimate salmonid population densities above and below dams.

Moyie River Fish Population Study - Bonner County, Idaho

ENTRIX, Inc. conducted a salmonid relative abundance survey in the Moyie River in Idaho. The survey was performed utilizing four divers at several gas pipeline river crossings. This was conducted in conjunction with past monitoring and a proposed expansion of the pipeline at the crossings in the Moyie River. Mitigation for each crossing consisted of installing Riprap wings to prevent bank Scour and rock-drop structures to form rearing and holding pools.

Ventura County Flood Control Tidewater Goby Project - Ventura County, California

ENTRIX, Inc. served as fisheries professional to the Ventura County Flood Control District during pipe maintenance in the Hueneme drain. A temporary impoundment was placed around the work area which trapped numerous fish including tidewater gobies. Mr. Howard identified fish species within the impoundment and relocated all fish away from the work area.

Ventura County Flood Control Bank Stabilization Project - Ventura County, California

ENTRIX, Inc. served as fisheries professional for Ventura County Flood Control District during a bank stabilization and habitat restoration project on the Sespe River. Mr. Howard was in charge of identifying fish species for relocation outside of the project boundary.

San Clemente Dam Retrofit Drawdown Project - Monterey County, California

ENTRIX, Inc. is conducting annual fish rescues upstream of San Clemente Dam and fish trapping and relocation activities to appropriate habitats downstream of San Clemente Dam for California-American Water Company. Water quality monitoring was also an important part of this project during the drawdown activities. Dissolved oxygen can drop dramatically during these types of projects. Aerators were installed throughout the reservoir to maintain adequate DO levels during the project. A low percentage of steelhead mortalities occurred during this project. Mr. Howard conducted fish rescues and relocations and water quality monitoring during this project. Mr. Howard was one of a few biologists permitted by NOAA Fisheries to conduct electrofishing and fish relocation activities during this project.



Haines Creek Native Fish Population Monitoring and Exotic Species Removal Project - Los Angeles County, California

ENTRIX, Inc. is involved in a multi-year fish population monitoring project on Haines Creek. Haines Creek is one of a few creeks that has sustaining populations of Santa Ana suckers and Santa Ana speckled dace. Numerous exotic species are also found in Haines Creek such as largemouth bass, green sunfish, mosquito fish and crawfish. Sampling is conducted by a 2-pass seining method in 200-meter sample sites.

San Lorenzo River Steelhead and Tidewater Goby Relocation Project - Santa Cruz County, California

ENTRIX, Inc. conducted steelhead and tidewater goby rescue and relocation activities during a bank stabilization project in the tidally influenced reach of the San Lorenzo River. A portadam was constructed around the work area and water was pumped out the impoundment. During fish rescue operations, Mr. Howard discovered the first known tidewater goby in the San Lorenzo River, which prompted further consultation to complete the project. Entrix, Inc. assisted in expediting this consultation process with the USFWS and NOAA Fisheries by monitoring water quality within the impoundment and describing tidewater goby habitat and in the San Lorenzo River.

Habitat Assessment Studies

Habitat Typing Projects - California and Oregon

ENTRIX, Inc. performs numerous habitat typing investigations for multiple clients throughout the United States. Mr. Howard has performed habitat typing field projects in northern California coastal rivers and in mountain streams in southern California and Oregon.

Steelhead Habitat and Passage Assessment - Ventura County, California

ENTRIX, Inc. conducted a steelhead habitat and passage assessment for the City of Ventura to be included in the Ventura River Habitat Conservation Plan. Mr. Howard was the lead fisheries biologist in charge of assessing steelhead habitat on North Fork Matilija Creek. A diversion facility on the Ventura River currently blocks access to headwater steelhead habitat in North Fork Matilija Creek and its tributaries. A fish passage facility is planned for construction in the near future allowing upstream migration to important steelhead habitat in the North Fork Matilija. This habitat assessment quantified spawning and rearing habitat for southern California steelhead trout.

Matilija Creek Steelhead Habitat Evaluation - Ventura County, California

ENTRIX, Inc. conducted a steelhead habitat evaluation for the Matilija Dam Ecosystem Restoration Project. Mr. Howard assisted a project team during this evaluation. The report supplemented the F3 Feasibility Study prepared by the US Army Corps of Engineers and Ventura County Flood Control District. The Matilija Dam project is the largest dam removal and restoration activity ever proposed in California. Restoration will connect endangered southern California ESU steelhead with nearly 50 percent of its historic Ventura River basin spawning and rearing habitat.

Salsipuedes Creek Fish Passage Project - Santa Barbara County, California

ENTRIX, Inc. modified an existing concrete apron to provide for fish passage along Salsipuedes Creek near Lompoc, California. Responsibilities included surveying, conducting site reconnaissance studies, preparing design drawings, permit information, and a grant application, and construction oversight. Mr. Howard assisted the project engineer on anadromous fish passage criteria for the project.



Bioassessment and Invertebrate Studies

Olympic View Sanitary Landfill Wetland Evaluation - Kitsap County, Washington

ENTRIX, Inc. conducted statistical analysis of previously collected data to evaluate relationships between chemical and physical water parameters and the abundance and diversity of macroinvertebrates in a wetland adjacent to the landfill. Stepwise regression analysis attempted to correlate species abundance and richness with water quality and chemistry to assess localized impacts. Mr. Howard conducted this statistical analysis and assisted the project team with the final report.

Santa Clara River Estuary Bioassessment - Ventura County, California

ENTRIX, Inc. designed and conducted this bioassessment study which involved stratified sampling of several estuarine habitats for benthic macroinvertebrates in the Santa Clara River Estuary. Mr. Howard was the lead field biologist on this project. The macroinvertebrate data characterized the assemblage diversity and develops relationships between species abundance, density, richness and microhabitat preferences (grain size, salinity tolerances, etc.). The objective of this study was to support the City and LAWRQCB in the development of defensible site-specific NPDES limits for metals discharged to the estuary.

Big Creek FERC Relicensing Bioassessment Project - Sierra National Forest, California

ENTRIX, Inc. performed this study under agency consultation for the SCE Big Creek FERC relicensing application process. Mr. Howard was a lead biologist on this bioassessment project. The project was conducted in a large portion of the South Fork San Joaquin River watershed. Macroinvertebrate sampling occurred above and below large dams and small diversions to assess Southern California Edison project impacts.

Instream Flow Studies/PHABSIM Modeling

United Water Conservation District FERC Relicensing IFIM Project - Ventura County, California

ENTRIX, Inc. conducted an instream flow study to determine the impacts of Santa Felicia Dam on the steelhead habitat in Piru Creek. Mr. Howard lead a crew comprised of client staff and sub-contractors.

United Water Conservation District FERC Relicensing Steelhead Migration Project- Ventura County, California

ENTRIX, Inc. conducted a migration study on the Santa Clara River downstream of Piru Creek to determine adequate flow releases that would facilitate steelhead upstream migration to Piru Creek.

Ventura River IFIM Project - Ventura County, California

ENTRIX, Inc. conducted this instream flow study to determine the impacts of dams and diversions on the steelhead habitat in the Ventura River. The results of this study will assist in the identification of factors potentially limiting fish populations in the effected reaches of the Ventura River and to determine appropriate minimum instream flows. Mr. Howard conducted the field investigation, PHABSIM Modeling and produced the final report. Instream Flow Incremental Methodology (IFIM) studies in Oregon and California including the Ventura River. These projects use multiple flow regimes in determining fish habitat suitability downstream from dams and diversions.

Matilija Creek IFIM Project - Ventura County, California

ENTRIX, Inc. conducted this instream flow study to determine the impacts of releases from Matilija Dam on Steelhead rearing and spawning habitat from the dam to the Robles Diversion on the Ventura River. The

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results of this study will assist in the identification of factors potentially limiting fish populations in the effected reach and to determine appropriate release flows and ramping rates. Mr. Howard conducted the field investigation, data collection, and modeling setup.

PacifiCorp FERC IFIM Project - Jackson County, Oregon

ENTRIX, Inc. conducted this instream flow study to determine the impacts of dams and diversions on fisheries habitat in the upper Rogue River watershed. Mr. Howard assisted in the field investigation and data collection.

Water Quality Studies

Santa Clara River Estuary Metals Translator Study - Ventura County, California

ENTRIX, Inc. conducted a yearlong investigation focused on determining the metals translators for copper, nickel, zinc, and lead in the Santa Clara River Estuary. There are chemical differences between the Ventura Water Reclamation Facilities (VWRF) discharged effluent and the receiving Santa Clara River water. The Metals Translator Study determined what fraction of metals in the VWRF effluent were dissolved in the receiving water, and therefore bioavailable. Mr. Howard was the lead investigator on the Santa Clara River Estuary Metals Translator Study for the City of San Buenaventura.

Big Creek FERC Relicensing Water Quality Project - Sierra national Forest, California

ENTRIX, Inc. conducted a water quality study related to the hydroelectric relicensing of Southern California Edison's Big Creek system in the San Joaquin River watershed. Study sites were selected by ENTRIX and a combined agency working group targeting large reservoirs, small impoundments, and streams below project facilities. Mr. Howard was in charge of multiple sampling teams working throughout the San Joaquin watershed.

Environmental Monitoring

360 Networks Fiber Optics Project - Modoc, Lassen, Tehama, Glenn, Butte, Yuba, and Sutter Counties, California

ENTRIX, Inc. monitored fiber optic installation that occurred within a variety of sensitive habitats including rivers, wetlands, vernal pools, caves, and cultural resource areas. Many species listed under the California and Federal endangered species acts were of special concern on this project. Mr. Howard was the lead environmental monitor on this fiber optics project for the California Public Utilities Commission. No significant environmental impacts, under the adopted environmental mitigation measures, occurred on this project.

Southern Trails Gas Pipeline Project - Riverside County, California

ENTRIX, Inc. monitored fiber optic installation that occurred within a variety of sensitive dessert habitats including rivers, washes, reptile and bird habitats, and cultural resource areas in the Mojave Dessert near Palm Springs, California. Mr. Howard was the Lead Field Coordinator for the California State Lands Commission on this project. The pipeline right-of-way was 8 miles long which crossed numerous washes including the San Gorgonio River. No significant environmental impacts, under the adopted environmental mitigation measures, occurred on this project.



Ventura County Water Protection District Sediment Removal- Ventura County, California

ENTRIX, Inc. monitored a sediment removal and channel maintenance project on Pole Creek in Fillmore, California. Mr. Howard served as fisheries professional and Environmental Monitor to the Ventura County Flood Control District on this project. This creek is a tributary to the Santa Clara River which supports a small population of endangered southern California steelhead trout. Mr. Howard assessed steelhead habitat quality and steelhead migration barriers. Additionally, Mr. Howard monitored construction to eliminate the possibility of project related steelhead impacts.

Ventura County Water Protection District Emergency Instream Restoration Projects- Ventura County, California

ENTRIX, Inc. assisted the County of Ventura during and following the floods events that caused extensive damage to private property, flood control and fish passage facilities, and the agricultural communities throughout Ventura County in 2004 and 2005. Mr. Howard managed 15 projects for the county following the flood events. Mr Howard, along with other ENTRIX biologists permitted to work with local endangered fish species including steelhead and tidewater gobies captured and relocated fish species prior to instream construction activities. Construction monitoring was also conducted to ensure emergency permit compliance and to minimise potential take of endangered species and their habitat.

El Paso Natural Gas Conversion Project- San Berbardino County, California

ENTRIX, Inc. monitored pipeline installation that occurred within a variety of sensitive desert habitats including rivers, washes, reptile and bird habitats, and cultural resource areas near Blythe, California. Mr. Howard was the Lead Field Coordinator for the California State Lands Commission and the BLM on this project. The pipeline right-of-way was 80 miles long. This project had multiple compliance challenges that were identified and managed onsite with oversite by the Lead Field Coordinator and Project Manager. No significant environmental impacts, under the adopted environmental mitigation measures, occurred on this project.