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Distribution, Abundance, and Breeding Activities of the Southwestern Willow Flycatcher at Marine Corps Base Camp Pendleton, California

2008 Annual Report

Prepared for:

Assistant Chief of Staff, Environmental Security
U.S. Marine Corps Base Camp Pendleton

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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By Scarlett L. Howell and Barbara E. Kus

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EXECUTIVE SUMMARY

Surveys for the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) were conducted at Marine Corps Base Camp Pendleton, California, between 13 May and 1 August 2008. Fifty-five transient flycatchers of unknown sub-species were observed during Base-wide surveys. Transients occurred on 10 of the 16 drainages surveyed in 2008. No willow flycatchers were detected at Cockleburr, Cristianitos, French, Newton, Roblar, or Windmill Creeks. Transients occurred in a range of habitat types including mixed willow riparian, willow-sycamore dominated riparian, oak-sycamore dominated riparian, riparian scrub, and upland scrub. The distance from transient locations to the nearest surface water averaged 363 ± 472 m (std, n = 55).

In 2008, the resident southwestern willow flycatcher population on Base consisted of seven females, seven males, and one non-territorial "floater" bird. Nine territories were established, consisting of seven pairs and two single males. In total, seven females formed pair bonds with five male willow flycatchers. Two of the five paired males were polygynous with two females each. All territories were located in mixed willow riparian habitat. Poison hemlock (*Conium maculatum*) was present in all territories. Distance to surface water averaged 73 ± 39 m (std, n = 10), with 70% (7/10) of resident flycatchers located within 100 m of water.

Eight nesting attempts by willow flycatchers were documented during the 2008 breeding season. Nesting was initiated in late May and continued into August. Eighty-eight percent (7/8) of nests successfully fledged at least one flycatcher young. Predation accounted for the one nest failure. Of the seven pairs whose nests were monitored, 100% (7/7) fledged young. Twenty fledglings were produced, yielding an estimated seasonal productivity of 2.9 young per pair (20 young/7 pairs). No instances of brown-headed cowbird (*Molothrus ater*) parasitism were observed. Pairs placed nests in five species of plants, including black willow *(Salix gooddingii*), arroyo willow (*S. lasiolepis*), sandbar willow (*S. exigua*), mule fat (*Baccharis salicifolia*), and poison hemlock. Eighty-eight percent of nests were placed in native species.

Seven resident females and five males that were banded in previous years were present at Camp Pendleton in 2008. Of the banded adult flycatchers present during the 2007 breeding season, 67% (4/6) of males and 13% (1/8) of females returned to Camp Pendleton in 2008. Sixty percent of those moved to different breeding areas. Twenty percent (2/10) of nestlings banded in 2007 returned to the Base as adults in 2008; both were female (Table 4). All returning second-year birds paired and nested in 2008. Twenty-four nestlings from eight nests were banded in 2008. None of the transients observed during surveys were seen to carry bands.

INTRODUCTION

The southwestern willow flycatcher (*Empidonax traillii extimus*) is one of four subspecies of willow flycatcher in the United States, with a breeding range including southern California, Arizona, New Mexico, extreme southern portions of Nevada and Utah, and western Texas (Hubbard 1987, Unitt 1987). Restricted to riparian habitat for breeding, the southwestern willow flycatcher has declined in recent decades in response to widespread habitat loss throughout its range and, possibly, cowbird parasitism (Wheelock 1912; Willett 1912, 1933; Grinnell and Miller 1944; Remson 1978; Garrett and Dunn 1981; Unitt 1984, 1987; Gaines 1988; Schlorff 1990; Whitfield and Sogge 1999). By 1993, the species was believed to number approximately 70 pairs in California (USFWS 1993) in small disjunct populations. The southwestern willow flycatcher was listed as endangered by the State of California in 1992 and by the U.S. Fish and Wildlife Service in 1995.

Willow flycatchers in southern California co-occur with the least Bell's vireo (*Vireo bellii pusillus*), another riparian obligate endangered by habitat loss and cowbird parasitism. However, unlike the vireo, which has increased six-fold since the mid-1980's in response to management alleviating these threats (USGS Western Ecological Research Center, San Diego Field Station unpubl. data), willow flycatcher numbers have remained low. Currently, the majority of southwestern willow flycatchers in California are concentrated in three sites: the South Fork of the Kern River in Kern County (Schuetz and Whitfield 2007), the Upper San Luis Rey River, including a portion of the Cleveland National Forest in San Diego County (Varanus Biological Services 2001), and Marine Corps Base Camp Pendleton in San Diego County (Kenwood and Kus 2007). Outside of these sites, southwestern willow flycatchers occur as small, isolated populations of one to half a dozen pairs. Data on the distribution and demography of the flycatcher, as well as identification of factors limiting the species, are critical information needs during the current stage of recovery planning (Kus *et al.* 2003, Kus and Whitfield 2005).

Male southwestern willow flycatchers typically arrive in southern California at the end of April while females arrive approximately one week later. Males sing repeatedly from exposed perches while on the breeding grounds. Once the pair bond is established, the female builds an open-cup nest usually placed in a branch fork of a willow or plant with a similar branching structure approximately 1-3 meters above the ground. The typical clutch of 3-4 eggs is laid in May-June. Females incubate for approximately 12 days and nestlings fledge within 12-15 days in early July. Adults usually depart from their breeding territory in mid-August/early September to their wintering grounds in central Mexico and northern South America.

The purpose of this study was to document the status of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in San Diego County, California. Specifically, our goals were to (1) determine the size and composition of the willow flycatcher population at the Base, (2) document survivorship and movement of resident flycatchers, (3) document nesting activities, and (4) characterize habitat used by flycatchers. These data, when combined with data from other years, will inform natural resource managers about the status of this endangered species at Camp Pendleton, and guide modification of land use and management practices as appropriate to ensure the species' continued existence.

This work was funded by the Assistant Chief of Staff, Environmental Security, Resources Management Division, Marine Corps Base Camp Pendleton, California.

STUDY AREAS AND METHODS

Field Surveys

All of Camp Pendleton's major drainages, and several minor ones supporting riparian habitat, were surveyed for flycatchers between 13 May and 1 August (Fig. 1, Appendix A, Figs. 5-10). Field work was conducted by Ursula Carliss, Aaron Gallagher, Scarlett Howell, Barbara Kus, Suellen Lynn, Melanie Madden-Smith, Eric Nolte, Michelle Rogne, Jennifer Scott, and Mike Wellik. The specific areas surveyed are as follows:

Santa Margarita River: between Stuart Mesa Road and the Base boundary, including Ysidora Basin and Stagecoach Canyon (Appendix A, Figs. 5, 6).

De Luz Creek: between the confluence with the Santa Margarita River and the Base boundary (Appendix A, Fig. 5).

Roblar Creek: from the confluence with De Luz Creek to a point approximately 1.5 km upstream (Appendix A, Fig. 5).

Fallbrook Creek: around Lake O'Neill as well as along the creek between the lake and the Base boundary (Appendix A, Fig. 5).

Las Flores Creek: between the Pacific Ocean and a point approximately 800 m upstream of Basilone Road (Appendix A, Fig. 9).

Cockleburr Canyon: between the Pacific Ocean and 0.25 km upstream of Interstate 5 (Appendix A, Fig. 6).

Horno Canyon: between Old Highway 101 and the upstream limit of riparian habitat (Appendix A, Fig. 9).

Piedra de Lumbre Canyon: between the confluence with Las Flores Creek and the upstream limit of riparian habitat (Appendix A, Fig. 9).

French Creek: between the Pacific Ocean and the Edson Range Impact Area (Appendix A, Fig. 6).

Aliso Creek: between the Pacific Ocean and 0.5 km upstream of the electrical transmission lines (Appendix A, Fig. 6).

Newton Canyon: between the confluence with the Santa Margarita River and the upstream limit of riparian habitat (Appendix A, Fig. 6).

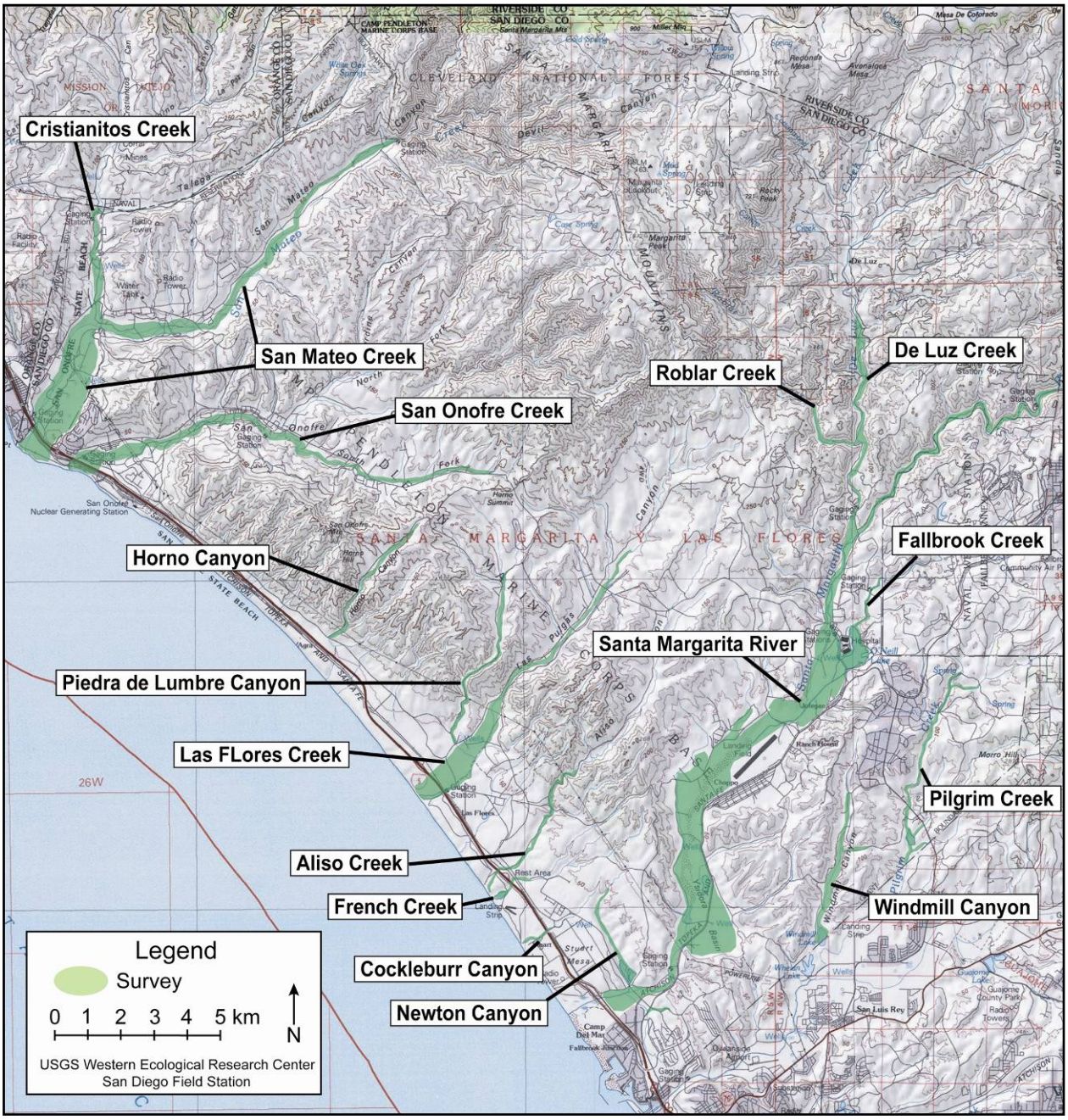

Fig. 1. Southwestern willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2008.

San Onofre Creek: between the Pacific Ocean and the access road to Range 219 (Appendix A, Figs. 7, 9).

San Mateo Creek: between the Pacific Ocean and the Base boundary, including habitat south of the creek and south of the agricultural fields (Appendix A, Figs. 7, 8).

Cristianitos Creek: between the confluence with San Mateo Creek and the Base boundary (Appendix A, Fig. 7).

Pilgrim Creek: between the Base boundary and the limit of habitat upstream of Sewage Treatment Plant 1, including two side drainages between Pilgrim Creek and the southern Base boundary (Appendix A, Fig. 10).

Windmill Canyon: from the Base boundary to the golf course entrance (Appendix A, Fig. 10).

Drainages were surveyed at least once during each of four consecutive survey periods between 13 May and 1 August. The first period extended from 13 May through 31 May, the second period from 1 June through 21 June, the third from 22 June through 12 July, and the fourth from 13 July through 1 August.

Investigators followed standard survey protocol (Sogge *et al*. 1997), moving slowly (approximately 2 km per hour) through the riparian habitat while searching and listening for willow flycatchers. Observers walked along the edge(s) of the riparian corridor on the upland and/or river side where habitat was narrow enough to detect a bird on the opposite edge. In wider stands, observers traversed the habitat, choosing routes that permitted detection of all birds throughout its extent. Surveys were conducted between dawn and early afternoon, depending on wind and weather conditions.

For each bird encountered, investigators recorded age (adult or juvenile), breeding status (paired, unpaired or transient), and whether the bird was banded. Flycatcher locations were mapped on 1":12,000" aerial photographs as well as 1":24,000" USGS topographic maps, using a Garmin 12 Global Positioning System (GPS) unit with 1-15 m positioning accuracy to determine geographic coordinates (WSG84). Distance to the nearest surface water was recorded for each location, and habitat type was specified according to the following categories based on dominant vegetation:

Mixed willow riparian: Habitat dominated by one or more willow species including black willow, arroyo willow, and red willow (*S. laevigata*), with mule fat as a frequent co-dominant.

Willow-cottonwood: Willow riparian habitat in which cottonwood (*Populus fremontii*) is a co-dominant.

Willow-sycamore: Willow riparian habitat in which sycamore (*Platanus racemosa*) is a co-dominant.

Sycamore-oak: Woodlands in which sycamore and oak (*Quercus agrifolia*) occur as co-dominants.

Riparian scrub: Dry and/or sandy habitat dominated by sandbar willow or mule fat, with few other woody species.

Upland scrub: Coastal sage scrub adjacent to riparian habitat.

Non-native: Sites vegetated exclusively with non-native species such as giant reed (*Arundo donax*) and salt-cedar (*Tamarix ramosissima*).

Percent cover of exotic vegetation at each location was estimated using cover categories of <5%, 5-50%, 51-95% and > 95%, and the dominant exotic species recorded.

Nest Monitoring

Pairs were observed for evidence of nesting, and nests located and monitored following standard protocol (Rourke *et al*. 1999). Nests were visited as infrequently as possible to minimize the chances of leading predators or brown-headed cowbirds to nest sites; typically, there were 3-4 visits per nest. The first visit was timed to determine the number of eggs laid, the next to determine hatching and age of young, and the last to band nestlings. After a nest became inactive, six possible nest fates were assigned based on the following parameters:

(SUC) Successful: Nest fledged at least one young. Fledging was confirmed by detection of young outside the nest.

(PRE) Nest failed as a result of predation: This includes 1) nests seen in the process of ant or other predation, 2) nests found with evidence such as eggshell fragments, feathers, or partially consumed nestlings in or below the nest, 3) nests with eggs or nestlings later found empty and torn from supporting branch, either partially or completely, typically indicative of mammal predation (Peterson et al. 2004), and 4) nests with eggs or nestlings later found intact but empty before the expected fledge date with no evidence of eggs or nestlings on the ground, consistent with snake and bird predation which typically leaves no sign (Peterson et al. 2004).

(PAR) Nest failed as a result of parasitism: This includes 1) nests that were abandoned with one or more cowbird eggs in the nest, and 2) nests that were tended by the host, but contained only cowbird eggs.

(OTH) Nest failed for other reasons that are known: This includes nests that failed for reasons such as host plant failure, surrounding vegetation falling and crushing a nest, inviable eggs that did not hatch after more than two weeks, and human disturbance such as mowing or weed-whacking. Nests that appeared to have failed as a result of cowbird "predation" such as 1) abandoned nests containing punctured eggs in or below the nest, 2) nests where nestlings were killed by a puncture wound to the skull, or 3) nests where nestlings were ejected from the nest and found on the ground were also given this nest fate.

(INC) Incomplete: Nests that were seen under construction, but were never completed.

(UNK) Nest failed for unknown reasons: This designation is used when no other reason could be confirmed. In many instances, the fate "UNK" was assigned to nests that were likely depredated, but because we could not confirm egg-laying did not fit the criteria of the "PRE" fate (above). These are explained more fully in results.

Nest characteristics including height, host species, and host height were recorded following the abandonment or fledging of nests.

Precipitation Data

Precipitation has been associated with bird population dynamics, especially in arid environments (Boag and Grant 1984; Rotenberry and Wiens 1989, 1991; Chase *et al*. 2005), primarily through its influence on primary productivity (Cody 1981, Grant and Grant 1987). We investigated potential effects of annual precipitation on total number of flycatcher territories, average clutch size, and number of young fledged per pair. We examined precipitation data from three weather stations on Camp Pendleton: Las Flores, Target Range, and Ammo Dump (WRCC 2008). We chose to use precipitation data from the Target Range weather station because 1) the Target Range weather station presented the most complete set of precipitation data and 2) data from the other two weather stations correlated well with the Target Range data set (Las Flores x Target Range $r = 0.87$, $P = 0.001$, $n = 11$; Ammo Dump x Target Range $r = 0.88$, $P = 0.02$, $n = 6$). Annual precipitation was compiled for each rainfall year (July through June), which measures precipitation during the winter prior to the year of associated flycatcher demographic data (e.g., precipitation from July 2004 through June 2005 is associated with flycatcher data from 2005). Tests were considered significant if $P<0.10$.

Banding

Nestlings were banded at 7-10 days of age. Each bird received a silver aluminum federal numbered band on the left leg. Unbanded adults were captured in mist nets within their territories, and were banded with a numbered federal band on one leg and a solid or bi-colored metal band on the other. Returning second-year birds banded as nestlings in 2007, with a single silver aluminum federal numbered band on the right leg, were recaptured in their territories and banded with a colored metal band on the left leg to yield a full, unique combination.

RESULTS

Population Size and Distribution

Transients

Fifty-five willow flycatchers of unknown sub-species were observed during Base-wide surveys (Appendix B, Figs. 11-21). All transients located during surveys were detected between 15 May and 10 June. Transients occurred on 10 of the 16 drainages surveyed in 2008. No willow flycatchers were detected at Cockleburr, Cristianitos, French, Newton, Roblar, or Windmill Creeks.

Residents

Seven females, seven males, and one non-territorial "floater" bird were detected throughout the 2008 breeding season (Appendix B, Fig. 19; Appendix C, Figs. 24-27). Five of the males were paired while two of the males remained single. Two of the five paired males were polygynous with two females each (Appendix C, Figs. 22, 25). The floater bird was detected for a few days in late July within the ARC territory (Appendix C, Fig. 22). Overall, nine territories (i.e., two unpaired males and seven female nesting locations) were established in 2008, with seven females forming pair bonds with five male willow flycatchers.

Resident flycatchers were restricted to the Santa Margarita River (Appendix B, Fig. 19; Appendix C, Figs. 22-25). Flycatcher distribution on the Santa Margarita River contracted relative to previous years. Distribution of resident flycatchers within two of the core breeding areas (those annually supporting multiple flycatcher territories) increased, with both the Air Station and Pueblitos sites supporting more birds than in 2007. Two resident pairs, one single male, and one floater were documented within the Air Station site. Historically, this area supported breeding flycatchers from 2000 to 2002 (Kus 2001, Kus and Ferree 2002, Kus and Kenwood 2003), was devoid of breeding flycatchers from 2003 to 2006 (Kus and Kenwood 2005, 2006a, 2006b; Kenwood and Kus 2007), was occupied by a single male for a short period in 2005 (Kus and Kenwood 2006b), and was re-colonized by two breeding pairs in 2007 (Rourke *et al.* 2008). The Pueblitos area rebounded from a historic low of one breeding pair in 2007 (Rourke *et al.* 2008), to three breeding pairs in 2008. Within the core breeding areas, the Pump Road location experienced the most dramatic decline. In 2008, the Pump Road area supported a single nesting pair and one single male, four fewer pairs than in the 2007 breeding season. This area had previously supported between 4-7 pairs annually since 2004 (Kus and Kenwood 2006a, 2006b; Kenwood and Kus 2007, Rourke *et al.* 2008). The Treatment Ponds area declined from three territories in 2007 (Rourke *et al.* 2008) to one breeding pair in 2008. No resident birds were detected in the Rifle Range breeding area, which was colonized during the 2007 breeding season (Rourke *et al.* 2008). Portions of the Santa Margarita River that historically supported resident flycatchers (Vine, Bell, Ysidora Ponds, the southern portion of Pueblitos, Rifle Range, and the Hospital breeding areas) were devoid of flycatcher territories in 2008. It appears that flycatchers may be favoring breeding areas with past giant reed treatment (Fig. 2), as all breeding areas south of Pueblitos no longer contain flycatcher territories. Bell and Ysidora Ponds breeding areas, both of which have steadily declined over the past few years, supported no flycatcher territories in 2008.

No resident flycatchers were detected away from the Santa Margarita River, including on San Mateo Creek, which was colonized by a nesting pair in 2007 (Rourke *et al.* 2008). For the second year in a row, no resident flycatchers were detected at Lake O'Neill on Fallbrook Creek, which had historically supported at least one territory since 2000 (Kus 2001; Kus and Ferree 2002; Kus and Kenwood 2003, 2005, 2006a, 2006b; Kenwood and Kus 2007; Rourke *et al.* 2008).

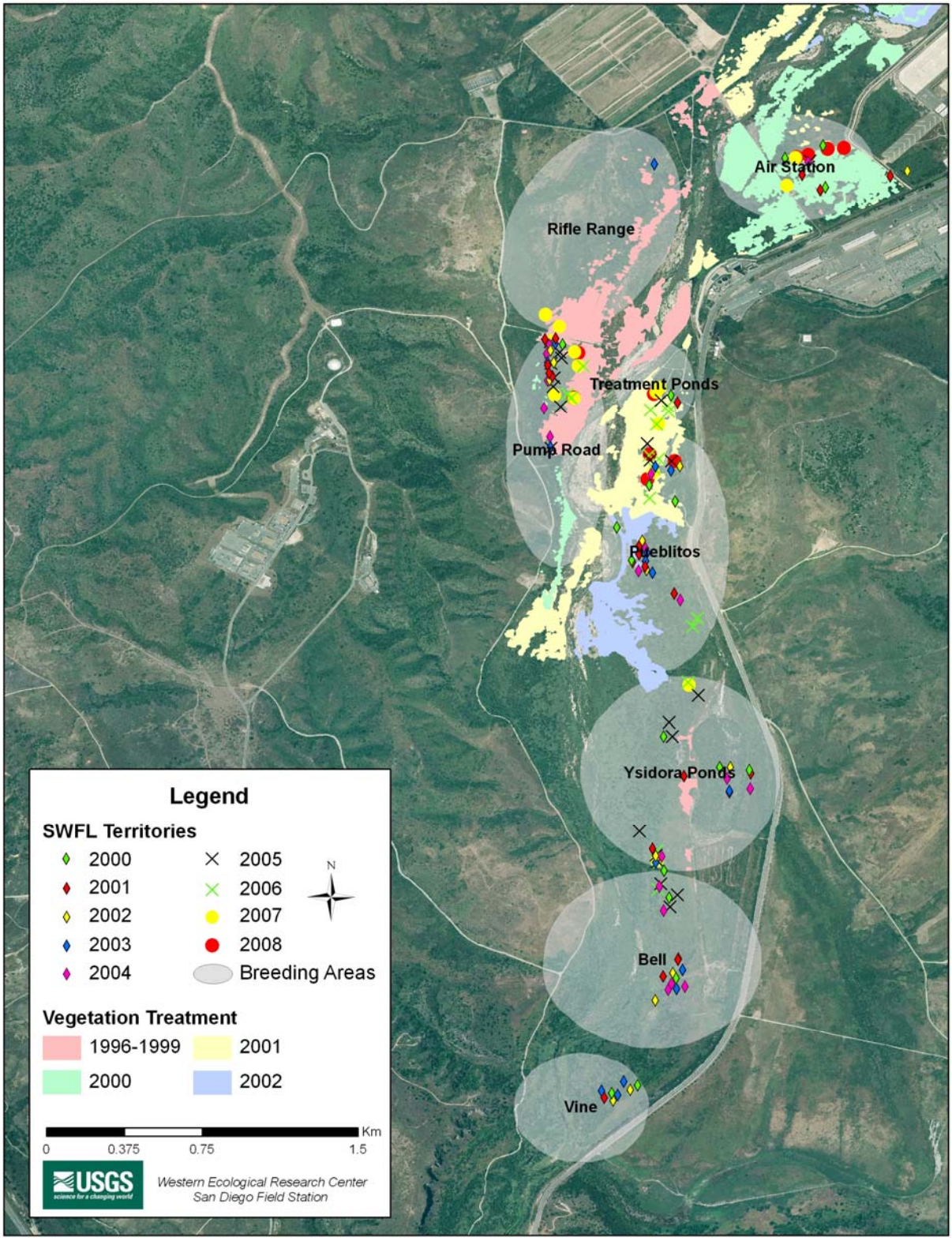

Fig. 2. Historical southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton in relation to giant reed treatment.

Habitat Characteristics

Fifty-five percent (36/65) of all flycatcher sightings occurred in habitat classified as mixed willow riparian, 64% (23/36) of which occurred along the Santa Margarita River (Table 1). Nine percent (6/65) of locations were in riparian scrub, dominated by mule fat and/or sandbar willow. An additional 11% (7/65) of birds occupied willow habitat co-dominated by cottonwoods or sycamores. The remaining 25% of the flycatcher detections were in more arid habitats including areas dominated by a mix of sycamores and oaks (6%, 4/65) or upland vegetation (19%, 12/65). No flycatchers were documented in habitats consisting solely of non-native vegetation. While transients used all habitat types, resident flycatchers were found exclusively (10/10) in mixed willow riparian.

Table 1. Habitat characteristics of willow flycatcher locations at Marine Corps Base Camp Pendleton in 2008.

Bird ID	Drainage	Status[a]	Habitat Type[b]	% Cover Exotics[c]	Dominant Exotics[d]	Distance to Surface Water (m)
ALW01A	Aliso Creek	T	Upland Scrub	2	BRA	1500
ALW01B	Aliso Creek	T	Upland Scrub	2	BRA	1500
ALW02	Aliso Creek	T	Willow/Sycamore	2	BRA	1500
ALW03	Aliso Creek	T	Upland Scrub	3	BRA, CON	2000
ALW04	Aliso Creek	T	Willow/Sycamore	2	CON	100
178	De Luz Creek	T	Mixed Willow	2	CON	130
179	De Luz Creek	T	Mixed Willow	1	-	610
96	Fallbrook Creek	T	Mixed Willow	2	ARU	5
HO01F	Horno Canyon	T	Upland Scrub	3	BRA	50
HO02F	Horno Canyon	T	Upland Scrub	3	BRA, SIL	800
HO03F	Horno Canyon	T	Upland Scrub	3	BRA, SIL	860
HO04F	Horno Canyon	T	Oak/Sycamore	3	BRA	1100
HO05F	Horno Canyon	T	Oak/Sycamore	3	BRA	1160
HO06F	Horno Canyon	T	Oak/Sycamore	3	BRA, SIL	580
97	Las Flores Creek	T	Upland Scrub	1	-	250
L02	Las Flores Creek	T	Mixed Willow	2	CON	20
L01	Las Flores Creek	T	Riparian Scrub	3	BRA	450
LN03F	Las Flores Creek	T	Mixed Willow	3	CON	3
LN04F	Las Flores Creek	T	Willow/Sycamore	3	BRA, RAP	1200
LN05F	Las Flores Creek	T	Willow/Sycamore	3	BRA, CON	380
PD01F	Piedra de Lumbre	T	Upland Scrub	3	BRA	150
PD02F	Piedra de Lumbre	T	Mixed Willow	3	BRA	150
PSF01	Pilgrim Creek	T	Mixed Willow	2	-	5
92A	San Mateo Canyon	T	Mixed Willow	1	-	50
92B	San Mateo Canyon	T	Mixed Willow	1	-	50
93A	San Mateo Canyon	T	Mixed Willow	2	CON	210
93B	San Mateo Canyon	T	Mixed Willow	2	CON	210
MTF01	San Mateo Canyon	T	Riparian Scrub	2	BRA	0
MTF02	San Mateo Canyon	T	Riparian Scrub	3	BRA	400
MTF03	San Mateo Canyon	T	Riparian Scrub	3	CON	300
MTF04	San Mateo Canyon	T	Oak/Sycamore	2	BRA	400

Table 1 (*continued*). Habitat characteristics of willow flycatcher locations at Marine Corps Base Camp Pendleton in 2008.

Bird ID	Drainage	Status[a]	Habitat Type[b]	% Cover Exotics[c]	Dominant Exotics[d]	Distance to Surface Water (m)
MTF05	San Mateo Canyon	T	Willow/Cottonwood	3	CON	400
91	San Mateo Canyon	T	Mixed Willow	1	-	250
94	San Mateo Canyon	T	Upland Scrub	3	CON	80
95	San Mateo Canyon	T	Mixed Willow	3	CON	130
126	San Onofre Creek	T	Upland Scrub	2	BRA	350
127	San Onofre Creek	T	Willow/Sycamore	3	BRA	0
FWF01	San Onofre Creek	T	Willow/Sycamore	2	FOE	10
SGW01	Santa Margarita River	T	Upland Scrub	2	BRA	800
SGW02	Santa Margarita River	T	Mixed Willow	3	BRA, CON	200
SE01WA	Santa Margarita River	T	Mixed Willow	2	CON	30
SE01WB	Santa Margarita River	T	Mixed Willow	2	CON	30
31	Santa Margarita River	T	Upland Scrub	1	BRA	20
PRM	Santa Margarita River	S	Mixed Willow	3	CON	75
PRN	Santa Margarita River	P	Mixed Willow	3	CON	120
RRWF01	Santa Margarita River	T	Mixed Willow	2	CON	100
RRWF02	Santa Margarita River	T	Mixed Willow	2	SIL	450
RRWF03	Santa Margarita River	T	Mixed Willow	2	CON	300
RRWF04	Santa Margarita River	T	Mixed Willow	2	BRA	0
RRWF05	Santa Margarita River	T	Mixed Willow	2	CON	200
RRWF06	Santa Margarita River	T	Mixed Willow	2	CON	150
ASA	Santa Margarita River	P	Mixed Willow	2	CON	100
ESF04	Santa Margarita River	T	Mixed Willow	2	CON	60
AEF05	Santa Margarita River	F	Mixed Willow	2	CON	110
TAR	Santa Margarita River	P	Mixed Willow	2	CON	15
ETA	Santa Margarita River	P	Mixed Willow	2	CON	20
ESF03	Santa Margarita River	T	Mixed Willow	2	ARU, CON	100
ESF01	Santa Margarita River	T	Mixed Willow	2	CON	15
ESF02	Santa Margarita River	T	Mixed Willow	2	CON	15
AWF01	Santa Margarita River	T	Riparian Scrub	2	-	10
EWN	Santa Margarita River	P	Mixed Willow	2	CON	35
ETC	Santa Margarita River	P	Mixed Willow	2	CON	60
ANG	Santa Margarita River	P	Mixed Willow	1	CON	80
AEF02	Santa Margarita River	T	Riparian Scrub	2	CON	175
ARC	Santa Margarita River	S	Mixed Willow	2	CON	110

[a] F= floater resident bird, P = breeding pair, S = single resident male, T = transient.
[b] For paired birds, habitat type is assessed within the male's territory boundary, except for those pairs that include polygynous males, in which case habitat type is assessed within the females' use areas.
[c] 1 = <5%, 2 = 5-50%, 3 = 51-95%.
[d] ARU = giant reed, BRA = black mustard (*Brassica nigra*), CON = poison hemlock, FOE = fennel (*Foeniculum vulgare*), RAP = wild radish (*Raphanus raphanistrum*), SIL = milk thistle (*Silybum* sp.), TAM = salt cedar.

Exotic vegetation was recorded in 100% (65/65) of flycatcher locations, and was considered the dominant vegetation (percent cover of exotics >50; Table 1) in 34% (22/65) of the sites. The majority of exotic-dominated sites were occupied by transient flycatchers (91%, 20/22). Within resident flycatcher territories, 70% (7/10) were composed of 25-50% poison

hemlock. The most common exotic plants in habitat used by transient flycatchers in 2008 were poison hemlock, black mustard, and thistle.

Flycatcher locations differed in their proximity to surface water (Table 1). On average, transients were nearly five times as far from surface water (363 ± 472 m [std]), as were resident flycatchers (73 ± 39 m [std]). The majority (70%, 7/10) of resident detections were within 100 m of water, and all resident flycatchers were located within 200 m of water. In contrast, just 55% (30/55) of transient birds were located within 200 m of water. This is similar to previous years (excluding the wet year of 2005), when transients were typically 2-4 times as far from water as were residents (Kus and Kenwood 2003, 2005, 2006a, 2006b; Kenwood and Kus 2007; Rourke *et al.* 2008).

Breeding Activities

Eight nesting attempts by willow flycatchers were documented during the 2008 breeding season (Table 2). Nesting was initiated in late May. The earliest confirmed lay date was 27 May and the latest was 13 July. Only one pair attempted more than one nest, following an unsuccessful initial attempt. Nesting continued into August, with the last young fledging on 9 August. Of the seven pairs whose nests were monitored, 100% (7/7) fledged young during the 2008 breeding season.

Table 2. Nesting activity of southwestern willow flycatcher pairs at Marine Corps Base Camp Pendleton in 2008.

Pair ID	Lay Date	# Eggs	# Nestlings	# Fledglings	Nest Fate[a]	Comments
ANG	24-Jun-08	3	2	2	SUC	One egg did not hatch and was removed when nestlings were banded.
ASA	04-Jun-08	4	4	3	SUC	One underdeveloped nestling found dead hanging from side of nest.
ETC	29-Jun-08	3	3	3	SUC	
ETA	30-May-08	4	3	3	SUC	One egg did not hatch and was removed when nestlings were banded.
EWN	07-Jun-08	4	4	0	PRE	Nest was intact but empty on fledge day, however, no fledglings were detected in the area. Failure confirmed by timing of re-nest.
	13-Jul-08	3	3	3	SUC	
PRN	07-Jun-08	3	2	2	SUC	One egg did not hatch and was removed when nestlings were banded.
TAR	27-May-08	4	4	4	SUC	

[a] PRE = Nest failed due to predation, SUC = Nest fledged at least one young.

In 2008, 88% (7/8) of nests successfully fledged at least one flycatcher young. Predation was believed to be the cause of the one nest failure, although no predation events were directly witnessed. The first nest of the EWN pair was intact but empty on or near the predicted fledge date; however no fledglings were detected in the area and both parents were seen foraging and preening. Failure was confirmed based on the timing of the EWN pair's second nesting attempt, which was successful.

Mean clutch size, estimated from eight nests known to have full clutches, was 3.5 ± 0.5 eggs. Three nests contained an infertile egg that did not hatch. Mean brood size, estimated from eight nests containing full broods, was 3.1 ± 0.8 nestlings/nest. One nestling from the ASA nest was found dead, hanging from the side of the nest. This nestling had appeared to be approximately two days younger than the rest of the brood earlier at the time of banding, and therefore was not banded. The cause of death was unknown. Twenty fledglings were produced, yielding an estimate of seasonal productivity of 2.9 young per pair (20 young/7 pairs).

Annual Effects of Precipitation on Productivity and Population Size

Although there were some indications that annual precipitation may be related to flycatcher productivity, especially during years with low annual precipitation, we did not find any significant relationships between precipitation and the total number of flycatcher territories on Camp Pendleton ($r = 0.33$, $P = 0.39$) or young/pair ($r = 0.45$, $P = 0.22$). However, we found that average clutch size was positively correlated with annual precipitation ($r = 0.66$; $P = 0.06$; Fig. 3).

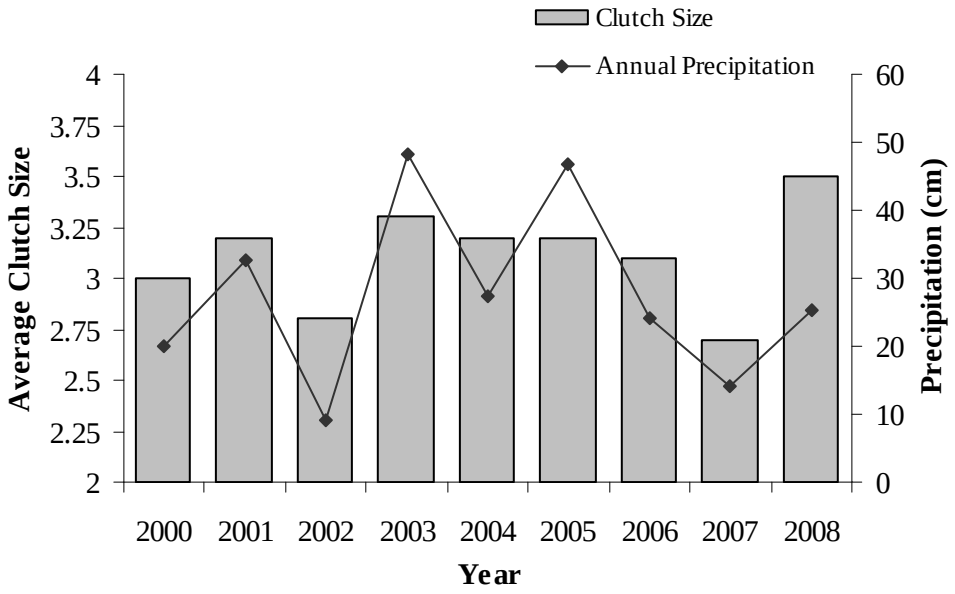

Fig. 3. Average clutch size of southwestern willow flycatchers in relation to total precipitation in the preceding rainfall year (July – June), 2000-2008.

Nest Site Characteristics

Flycatchers placed nests in five species of plants (Table 3), including arroyo willow, black willow, sandbar willow, mule fat, and poison hemlock. Eighty-eight percent of nests were placed in native species: 75% (6/8) in willow and 12.5% (1/8) in mule fat. Only one nest (12.5%, 1/8) was placed in the exotic species poison hemlock. Nest height averaged 1.7 ± 0.3 m, while host height averaged 4.8 ± 2.9m.

Table 3. Nest site characteristics of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2008. All measurements are in meters.

					Distance to the edge of:	
Pair ID	**Nest ID**	**Host Species**	**Host Height**	**Nest Height**	**Host Plant**	**Clump**
ANG	1	Sandbar willow	5.2	2.2	2.3	2.1
ASA	1	Arroyo willow	9.5	1.7	0.5	3.2
ETC	1	Black willow	7.9	1.6	1.2	1.5
ETA	1	Black willow	2.1	1.4	1.8	2.5
EWN	1	Poison hemlock	2.2	1.6	0.5	7.5
EWN	2	Arroyo willow	6.2	2.2	0.5	0.5
PRN	1	Mule fat	1.7	1.4	0.6	3.1
TAR	1	Arroyo willow	3.8	1.7	0.9	1.0

Cowbird Parasitism

All nests were checked for the presence of cowbird eggs. No nest parasitism of southwestern willow flycatcher nests by brown-headed cowbirds was documented in 2008.

Banded Birds

All of the resident willow flycatchers were observed closely enough to determine with confidence whether they were banded (Table 4). One hundred percent (7/7) of females and 63% (5/8) of males were banded in previous years. Of these, two second-year females and one third-year female that were banded with a single federal band as nestlings in 2007 and 2006, respectively, were recaptured and banded with a second band to provide unique combinations. Five females and four males were originally banded on Camp Pendleton. The remaining two females and one male were originally banded on the San Luis Rey River.

One unbanded adult male was captured and banded with a single silver aluminum federal numbered band on the left leg. Twenty-four nestlings from eight nests were banded (Appendix D). All, except four nestlings from one nest (EWN), are believed to have fledged. No banded transients were detected during surveys.

Table 4. Band status of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2008.

Territory / Bird ID	Status[a]	Male Banded?[b]	Female Banded?[b]	Nestlings Banded?	Comments[c]
AEF05	F	Unbanded	NA		
ARC	S	Msi : yere	NA		Male banded in 2004 as a nestling at Ysidora Ponds.
ANG	P	Msi : rere	dgye : Msi	2	Male banded in 2005 as an adult at Air Station. Female banded in 2007 as a nestling at Pump Road and color-banded in 2008. Male polygynous with female at ASA territory.
ASA	P	Msi : rere	Msi : yeor	3	Female banded in 2006 as a nestling at Ysidora Ponds and color-banded in 2008. Male polygynous with female at ANG territory.
ETA	P	Msi : -	Msi : sisi	3	Male banded in 2008. Female banded in 2005 as an adult at Guajome Lake on the San Luis Rey River. The female's band was peeling, originally banded Msi : dbdb.
ETC	P	orye : Msi	redg : Msi	3	Male banded in 2006 as an adult at Ysidora Ponds. Female banded in 2007 as a nestling at Air Station and color-banded in 2008. Male polygynous with female at EWN territory.
EWN	P	orye : Msi	whsi : Msi	7	Female banded in 2005 as an adult at Whelan Lake on the San Luis Rey River. The female's band was peeling, originally banded Msi : whdb. Male polygynous with female at ETC territory.
PRM	S	Unbanded	NA		
PRN	P	dbdb : Msi	Msi : sire	2	Male banded in 2005 as a nestling at Whelan Lake on the San Luis Rey River and color-banded in 2008. Female banded in 2004 as a nestling at Bell. The female's band was peeling, originally banded Msi : dgre.
TAR	P	Mdg : reye	Msi : dgsi	4	Male banded in 2004 as an adult at Pueblitos. Female banded in 2004 as a nestling at Bell. The female's band was peeling, originally banded Msi : dgdg.

[a] F = floater resident bird, P = breeding pair, S = single resident male.
[b] Band combinations: left leg : right leg; Msi = federal aluminum band, Mdg = anodized green federal band. *Metal bands:* dbdb = dark blue, dgsi = dark green-silver split, dgye = dark green-yellow split, orye = orange-yellow split, redg = red-dark green split, rere = red, reye = red-yellow split, sire = silver-red split, sisi = silver, whsi = white-silver split, yeor = yellow-orange split, yere = yellow-red split.
[c] See Fig. 4; Appendix B, Fig. 19; Appendix C, Figs. 22-25 for breeding area and territory locations

Four females in 2008 were observed with peeled or partially peeled color bands, complicating identification (ETA, EWN, PRN, and TAR). Three of the four females (ETA, EWN, and PRN) were captured to confirm their identities and to inspect the bands. We found that the epoxy and all or a portion of the pin-striping employed in making the color-bands used to uniquely identify individual flycatchers had peeled off. When the birds were resighted, depending on the lighting conditions, the exposed silver portion of the band appeared either white or silver. Because the "new" color combinations were unique, the bands were not changed. The TAR female was recognized as the PIC female from 2007, and since her band was identifiable and she had been captured in 2007, she was not captured again. In 2007, the females from both the RIF and PRN territories were undetermined based on resight data, and it was believed that the pin-striping on their bands had peeled off (Rourke *et al.* 2008). Efforts to recapture the two birds were unsuccessful. The female occupying the 2008 ETA territory was not detected in 2007 and is believed to be the same individual that occupied the 2007 RIF territory. However, without having recaptured both of the birds, we cannot confirm that the two birds are the same individual. The female occupying the 2008 PRN territory was also not confirmed on Base in 2007 but is believed to be the same individual that occupied the 2007 PRN territory. Lastly, the 2008 PRN female is the same female that nested at PRN in 2005 and 2006, further increasing the likelihood that she also nested at PRN in 2007, although we cannot confirm this.

Survivorship, Site Fidelity, and Movement

The recapture and resighting of banded birds allowed us to determine the rate at which flycatchers previously documented on Base returned to hold territories in 2008. Although this is the minimum number of flycatchers known to survive, and does not include birds that dispersed off Base or that we may have failed to detect/resight, it can be used as an inference to calculate minimum annual survivorship for the flycatcher population on Base. Of the uniquely banded adult flycatchers present during the 2007 breeding season, 67% (4/6) of males and 13% (1/8) of females returned to Camp Pendleton in 2008. Overall, adult survivorship from 2007 on Camp Pendleton was 36% (5/14). Three adult females last seen in 2006 reappeared in 2008, one last seen as a nestling (ASA), and two last seen as adults (ETA and PRN), increasing the survivorship estimate of the 2007 population. It is possible that these birds were present during the 2007 breeding season; therefore, if these birds are incorporated into calculations of return rate, a revised estimate of the total adult return rate is 47% (8/17), with a revised female return rate of 36% (4/11). Survivorship was calculated from the banded population seen on Camp Pendleton, and does not include two additional birds, one female and one male, that were detected on Base in 2008 that were banded in 2005 at Guajome Regional Park and Whelan Lake on the San Luis Rey River.

Two of the 10 nestlings banded in 2007 that survived to fledge were resighted and re-captured at Camp Pendleton in 2008, yielding an estimate of first-year survivorship of 20%. Both returning second-year birds were female and each one paired and nested successfully in 2008 (Table 4).

Willow flycatchers at Camp Pendleton generally settle into breeding concentrations or areas where groups of birds establish territories (Fig. 4). Resighting banded birds allowed us to identify individuals that returned to the same area they used the previous year. In 2008, two of

the five banded returning adults (40%; excluding birds last seen in 2006) returned to the breeding area they had occupied in 2007 (Table 5). Both adult flycatchers were male, and either returned to the same territories they previously occupied, or occupied a territory that encompassed a portion of the area they defended previously. The other three returning adults (60%; excluding birds last seen in 2006) moved to different breeding areas within the Santa Margarita River in 2008 (Table 5, Fig. 4). Of these three, two were male and one was female, and all three were the same individuals that moved the previous year. All three moved from the west to the east side of the Santa Margarita River in 2008, after moving to the west side of the river in 2007. The two male flycatchers moved from the Pueblitos area to the Pump Road and Rifle Range areas in 2007, and in 2008, both moved to the Air Station area, approximately 1.6 and 1.3 km away, respectively. The female flycatcher that moved from the Treatment Ponds area to the Pump Road site in 2007, moved back to the Treatment Ponds area in 2008, approximately 0.4 km away. This female has moved back and forth between Pump Road (PIC 2005, 2007) and Treatment Ponds (TOR 2006, TAR 2008) areas since dispersing from her natal area (Bell) in 2004. The average distance moved by adult flycatchers between the 2007 and 2008 breeding seasons was 1.9 $\pm$ 2.4 km. If the three females last seen in 2006 (ASA, ETA, PRN) are included in the calculations, the proportion of birds that moved to different breeding areas between years decreases to 50% (4/8), and those exhibiting site fidelity increases to 50% (4/8).

In contrast to returning adults, neither of the two returning second-year birds banded as nestlings in 2007 returned to their natal areas to breed. One female, banded as a nestling at Pump Road, dispersed to the Air Station, approximately 1.5 km away (Table 5, Fig. 4). The other female was banded in the Air Station area and dispersed to the Pueblitos area, approximately 1.6 km away (Table 5, Fig. 4). The average distance that second-year birds dispersed from their natal areas was 1.5 $\pm$ 0.1 km.

No instances of within-season movement by banded southwestern willow flycatchers were observed during the 2008 breeding season.

Two birds in the 2008 Camp Pendleton flycatcher population were immigrants from Whelan Lake (Table 5). These birds, a female and her male offspring, were both banded in the same territory on the San Luis Rey River in 2005 (Kus and Rourke 2005). The female nested at Whelan Lake from 2005 to 2007. The male was banded as a nestling in the 2005 Wilson nest and has not been detected since fledging.

Table 5. Between-year, between-area movement of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2008.

Year Last Detected	Area (Territory) Last Detected[a]	Area (Territory in 2008)	Dispersal Distance (km)	Band Combination[b]	Age in 2008	Sex[c]
2007	Rifle Range (RIF)	Air Station (ARC)	1.3	Msi : yere	4 yrs	M
2007	Pump Road (PRN)	Air Station (ANG/ASA)	1.6	Msi : rere	≥ 4 yrs	M
2007	Pueblitos (ETA)	Pueblitos (ETC/EWN)	0.1	orye : Msi	≥ 3 yrs	M
2005	Whelan Lake, San Luis Rey River	Pump Road (PRN)	6.1	dbdb : Msi	3 yrs	M
2007	Treatment Ponds (TAR)	Treatment Ponds (TAR)	0	Mdg : reye	≥ 5 yrs	M
2007	Pump Road (PNB)	Air Station (ANG)	1.5	dgye : Msi	1 yr	F
2006	Ysidora Ponds (MSL)	Air Station (ASA)	3.5	Msi : yeor	2 yrs	F
2006	Pueblitos (EDY)	Pueblitos (ETA)	0.1	Msi : sisi	≥ 4 yrs	F
2007	Air Station (ARC)	Pueblitos (ETC)	1.6	redg : Msi	1 yr	F
2007	Whelan Lake, San Luis Rey River	Pueblitos (EWN)	5.6	whsi : Msi	≥ 4 yrs	F
2006	Pump Road (PRN)	Pump Road (PRN)	0	Msi :sire	4 yrs	F
2007	Pump Road (PIC)	Treatment Ponds (TAR)	0.4	Msi : dgsi	4 yrs	F

[a] See Fig. 4, Appendix B, Fig. 19; Appendix C, Fig. 22-25 for breeding area and territory locations.

[b] Band combinations: left leg : right leg; Msi = federal aluminum band, Mdg = anodized green federal band. *Metal bands:* dbdb = dark blue, dgsi = dark green-silver split, dgye = dark green-yellow split, orye = orange-yellow split, redg = red-dark green split, rere = red, reye = red-yellow split, sire = silver-red split, sisi = silver, whsi = white-silver split, yeor = yellow-orange split, yere = yellow-red split.

[c] Sex: M = male, F = female.

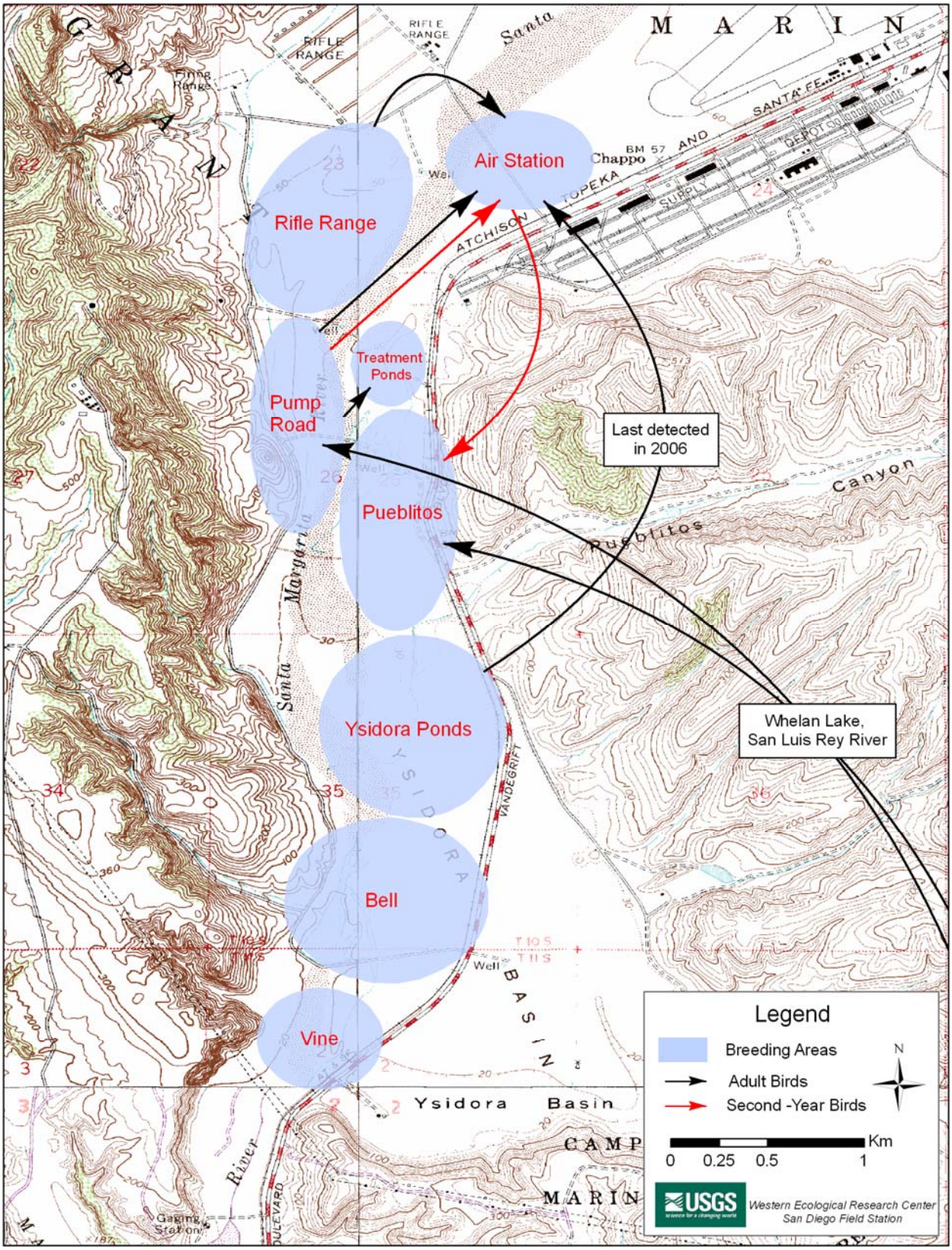

Fig. 4. Between-year, between-area movement by adult and second-year southwestern willow flycatchers at Marine Corps Base Camp Pendleton, 2008.

DISCUSSION

The southwestern willow flycatcher population on Camp Pendleton in 2008 (15 individuals) declined to nearly half the numbers observed in the 2007 (26) breeding season. However, because of the polygynous nature of flycatchers, where males can mate with up to four females in a season, a more meaningful estimate of flycatcher effective population size is derived from the annual number of breeding females. Only seven resident female willow flycatchers were detected on Base in 2008, a 50% decline compared to 2007, and the lowest number of females observed since monitoring began in 2001. Prior to the 2008 breeding season, the number of female willow flycatchers has fluctuated between a low of 14 in 2007 and a high of 22 in 2004 (Kus and Ferree 2002; Kus and Kenwood 2003, 2005, 2006a, 2006b; Kenwood and Kus 2007; Rourke *et al.* 2008). In 2005 and 2006, the total number of females documented on Base was 17 and 19, respectively, with the mean number of female flycatchers averaging 18.0 ± 2.3 (std) per year from 2001 to 2006. Of the nine banded flycatchers present in 2007 that did not return to Camp Pendleton in 2008, seven were female and two were male. The cause of the decline in females on Base in 2008 is unknown; however, this does not appear to be a localized phenomenon. The Kern River population, once the largest population in California, experienced an almost identical decline between 2006 and 2007, dropping from 15 females to nine females (Schuetz *et al.* 2008). Additionally, there were no breeding willow flycatchers documented in 2008 on the lower San Luis Rey River for the first time since it was colonized and monitoring began in 2000 (Kus and Rourke 2005, Ferree and Kus, in prep). Despite the decline, nest success (number of nests fledging at least one young/total number of nests found) of flycatchers was the highest observed in the past eight years; seven of eight nests fledged young during 2008.

The number of transient willow flycatchers detected annually on Base can vary greatly despite consistent survey scope and effort. The number detected in 2008 (55) was within the range of numbers observed between 2003 and 2007 (35-85) (Kus and Kenwood 2005, 2006a, 2006b; Kenwood and Kus 2007; Rourke *et al.* 2008). Presumably the majority of the transient/migrating birds are of a different sub-species of willow flycatcher, most likely *E. t. brewsteri* or possibly *E. t. adastus*, and not the southwestern sub-species (*E. t. extimus*) that breeds on Base. Variation in the annual number of transients therefore is most likely a result of anthropogenic or ecological factors that are possibly different from those influencing *E. t. extimus* distribution and abundance.

Despite the reduction in the number of females documented on Base, the degree of polygyny in the population remained high with 40% (2/5) of paired males polygynous, and 57% (4/7) of females sharing mates. As in 2005, 2006, and 2007, single males were present during the breeding season, but the majority of females chose instead to pair with polygynous birds. Continued monitoring at Camp Pendleton, combined with information from other polygynous populations of willow flycatchers (Davidson and Allison 2003; Pearson *et al.* 2006), should enhance our understanding of the basis for polygyny in this species, and its implications for genetic viability of the population.

As in previous years, resident flycatchers were largely distributed among historic breeding locations, although the number of territories each location supported differed compared

to previous years. Three of the four core flycatcher breeding sites on the Santa Margarita River (Treatment Ponds, Ysidora Ponds, Pueblitos, and Pump Road) were occupied in 2008; however Ysidora Ponds was unoccupied for the first time since monitoring began. Three of the sites decreased in flycatcher numbers, while one increased. The number of breeding pairs/females decreased at Treatment Ponds (-2), Ysidora Ponds (-1), and Pump Road (-4), while Pueblitos increased by two territories in 2008. The Air Station site continued to support multiple territories (two pairs, a single male, and a floater), after two pairs re-colonized the site in 2007 (Rourke *et al.* 2008). No flycatcher territories were documented outside of the core matrix of flycatcher breeding locations on the Santa Margarita River.

Because of their semi-colonial nature, flycatchers within each of these locations can be expected to interact frequently. However, the proximity of the sites on the Santa Margarita River is such that movement between locations occurs annually, and often occurs within breeding seasons. In 2008, three adult flycatchers were documented nesting in areas that were different from their last documented breeding location, and they were also the same three individuals that moved to different breeding areas from 2006 to 2007. In 2005 and 2006, seven adult flycatchers (per year) were documented moving to different breeding locations. Habitat conditions and suitability may be an important factor in annual flycatcher movement between breeding sites since there has been no correlation between productivity and/or nest success at the original breeding location and the likelihood that a flycatcher will disperse to a new location the following year (USGS Western Ecological Research Center, San Diego Field Station unpubl. data). One adult flycatcher that shifted breeding areas in 2008 was noted to have moved between Treatment Ponds and Pump Road every year since dispersing from her natal territory. Thus flycatchers may be evaluating the habitat within the matrix of breeding sites on the Santa Margarita River each year in an attempt to maximize their fitness.

Overall, nest success and productivity increased in 2008 compared to previous years. Eighty-eight percent (7/8) of nests fledged young in 2008, compared to 42% (8/19) in 2007, 52% (13/25) in 2006, and 60% (15/25) in 2005. Twenty young were fledged in 2008, double the number fledged in 2007 (10). At 2.9 young per pair, average productivity per pair was comparable to 2003 (3.0) and double the productivity rate in 2007 (1.4). Average clutch size was the highest since monitoring began in 2000, at 3.5 eggs per nest, well above the 2007 average clutch size (2.7), and comparable to 2003 (3.3 eggs per nest). Three eggs were infertile and failed to hatch. Overall, 11% (3/28) of eggs that survived to the expected hatch date failed to hatch in 2008, compared to 15% (4/26) in 2007, 13% (7/52) in 2005 and 2% (1/48) in 2006.

Although the population of banded birds was reduced, the return rate of banded adults between 2007 and 2008 (36%) was identical to that observed in 2007 (36%), and slightly higher than in 2005 (31%). Return of second year birds was the highest documented (20%, 2/10) since 2003 (27%), compared to 11% (3/27) in 2007, 15% in 2004 (5/34) and 2006 (4/26) and 17% (7/42) in 2005. Averaged across years (2001-2008), approximately 14% of birds banded the previous year return the following year to breed, suggesting that at least three second year birds will return in 2009. The total percentage of adults within the breeding population that were banded as nestlings tends to increase annually. In 2008, 40% (6/15) of the total adult flycatcher population on Base were originally banded as nestlings, compared to 31% (8/26) in 2007. The presence of such a large percentage of natal banded birds creates the opportunity to collect life-

time reproductive data for a growing segment of the population, which will facilitate identification of age- and sex-specific patterns in life history characteristics that influence population size, productivity, and genetic structure.

One possible reason for the population decline on Camp Pendleton may be that the turnover of older birds is outpacing the rate of return of second year birds. Of the nine banded birds present in 2007 that did not return in 2008, 55% (5/9) would have been at least three years old in 2008. The current population on Camp Pendleton contains a high proportion of older birds; 75% of the returning banded birds in 2008 (9/12; Table 5) were at least three years old. Of the willow flycatchers banded by USGS in San Diego County between 1995 and 2008, only 31% (26/84) were known to be at least four years old (USGS unpublished data). Of the thirty-four birds originally banded as nestlings and were detected at least one additional year after banding, only 20% (7/34) survived to the age of four. Fifty adults were banded and were detected at least one additional year after banding; 38% (19/50) were detected for more than three years after their initial banding and were therefore at least four years old. With a minimum of three second year birds estimated to enter the 2009 population to replace multiple aging adults, there is potential for more declines.

As the flycatcher population on Camp Pendleton decreases, the risk of inbreeding will likely increase (Meffe and Carrol1 1997). At least one case of inbreeding has been documented on Base; in 2006, a male bred with one of his offspring from the prior year (Kenwood and Kus 2007). However, the potential for inbreeding is reduced through immigration and emigration, which has been documented on Base six times since 2002, with all individuals immigrating from the nearby population on the San Luis Rey River (9-24 km distance; Kus and Kenwood 2003, 2005, 2006a, 2006b, Kenwood and Kus 2007). Once again in 2008, flycatchers from the San Luis Rey River moved into the population on Camp Pendleton: a female that had nested on the San Luis Rey River from 2005 to 2007, and one of her offspring from 2005, a male that had not been detected since fledging (Ferree and Kus 2007, 2008, Kus and Rourke 2005). In addition to the banded birds that immigrate onto Camp Pendleton, each year unbanded flycatchers are detected on Base. These unbanded flycatchers could be moving onto base from other nearby populations, such as the population on the upper San Luis Rey River. Movement between the drainages is an encouraging sign that regional flycatcher populations are connected through dispersal over a large area. Further banding and resighting of flycatchers throughout their range will allow a better determination of the extent of movement between populations and the role such movement plays in maintaining genetic diversity and persistence in these populations.

CONCLUSIONS

The southwestern willow flycatcher population in California appears to be experiencing a statewide decline, rather than one isolated to Camp Pendleton. Populations on the Kern River and the lower San Luis Rey River have experienced steep declines or been eradicated in recent years. It is encouraging that two flycatchers immigrated onto the Base in 2008, suggesting that the habitat on Camp Pendleton may be more suitable to flycatchers than that in nearby riparian drainages. This may be in part a result of management actions on Base, specifically the restoration of riparian habitat, including the removal and treatment of invasive exotics such as

giant reed. The flycatcher population on Base has contracted to the midstream portions of the Santa Margarita River, bypassing areas further south that were historically occupied, but still contain giant reed. Prioritizing the opportunity to focus on exotic removal, treatment, and habitat restoration to ready these areas for re-colonization by southwestern willow flycatchers in the future will likely enhance recovery of flycatchers on Base.

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APPENDIX A

SOUTHWESTERN WILLOW FLYCATCHER SURVEY AREAS AT MARINE CORPS BASE CAMP PENDLETON, 2008

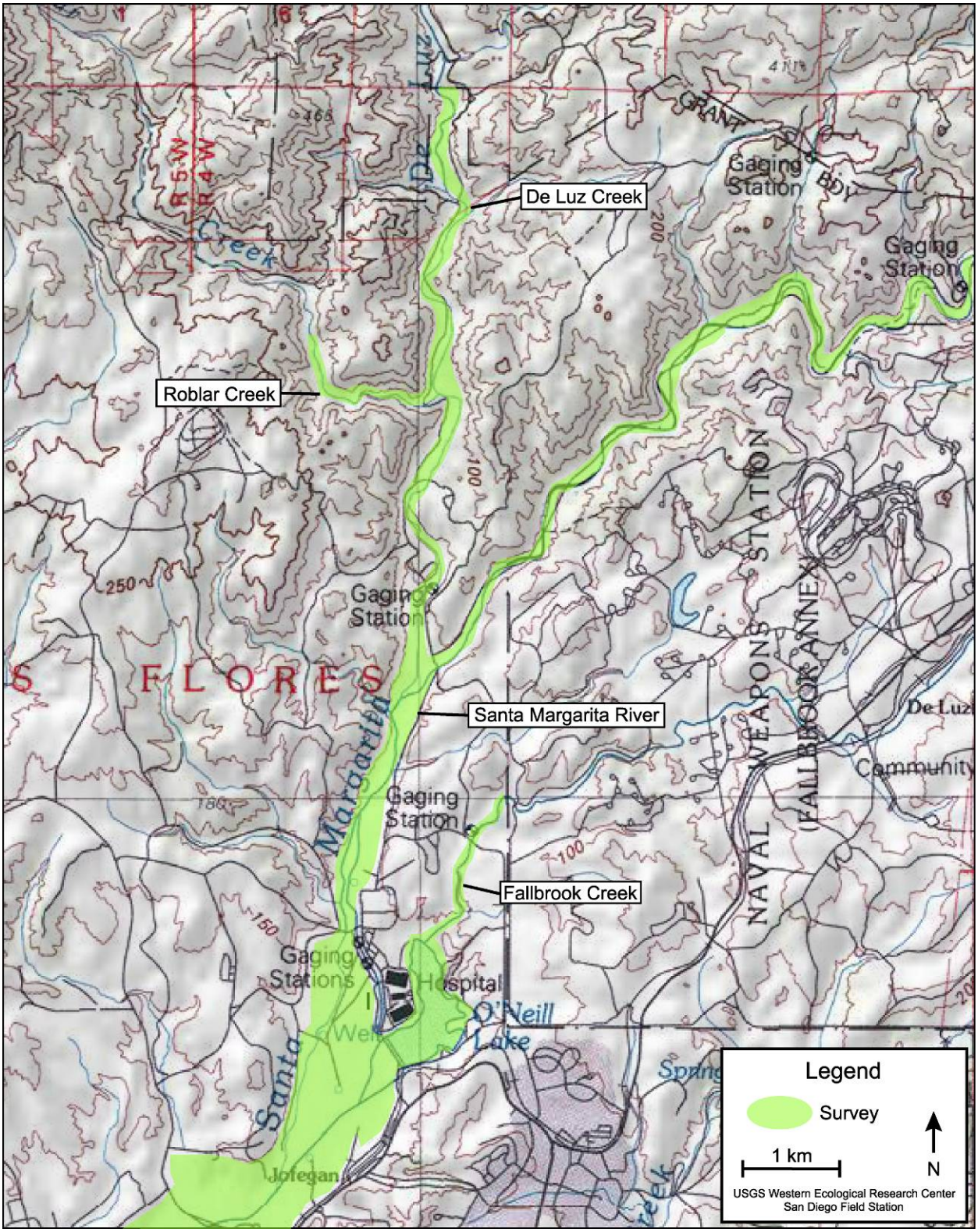

Fig. 5. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2008: Santa Margarita River, Fallbrook Creek, De Luz Creek and Roblar Creek.

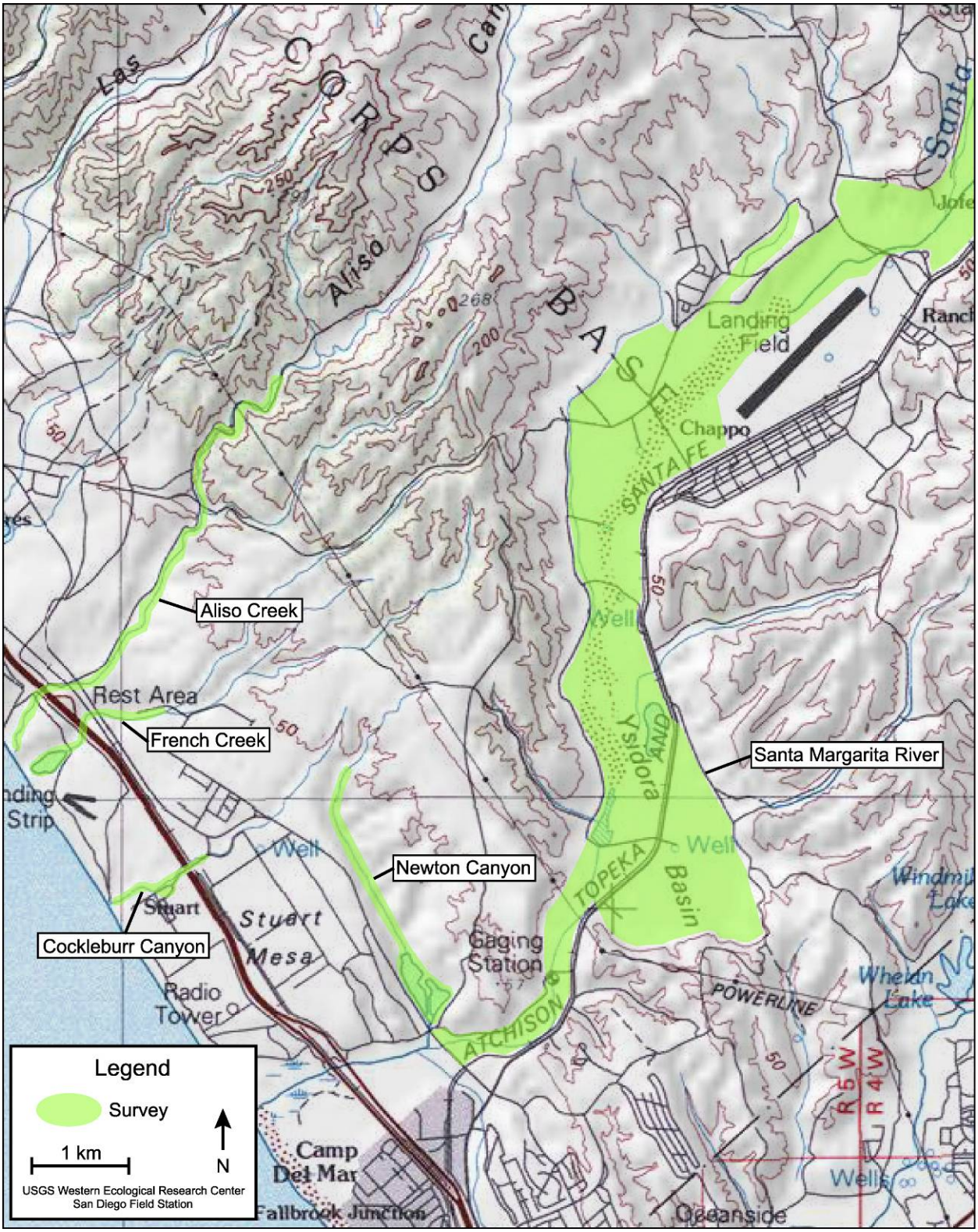

Fig. 6. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2008: Santa Margarita River, Newton Canyon, Cockleburr Canyon, French Creek, and Aliso Creek.

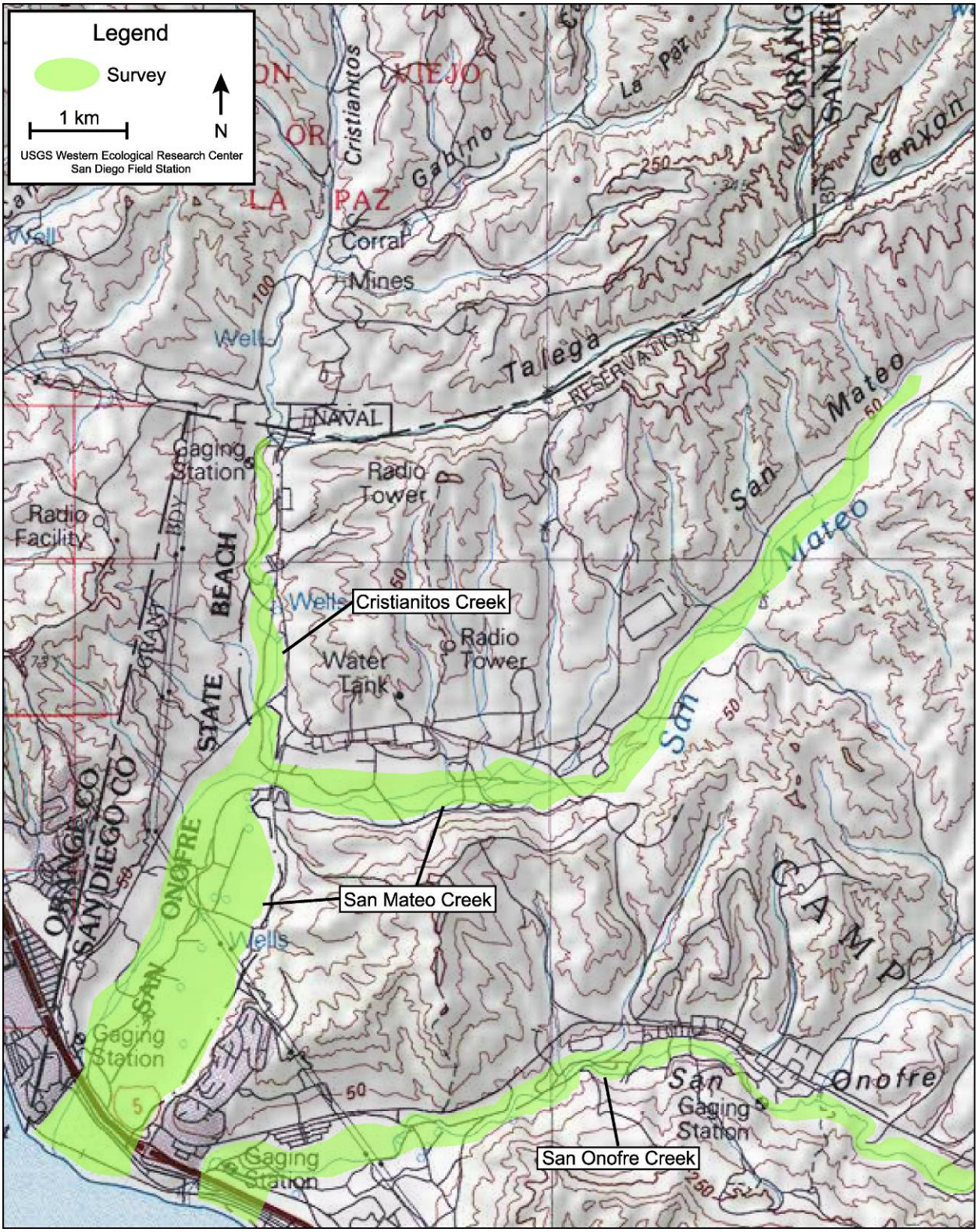

Fig. 7. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2008: Cristianitos Creek, San Mateo Creek and San Onofre Creek.

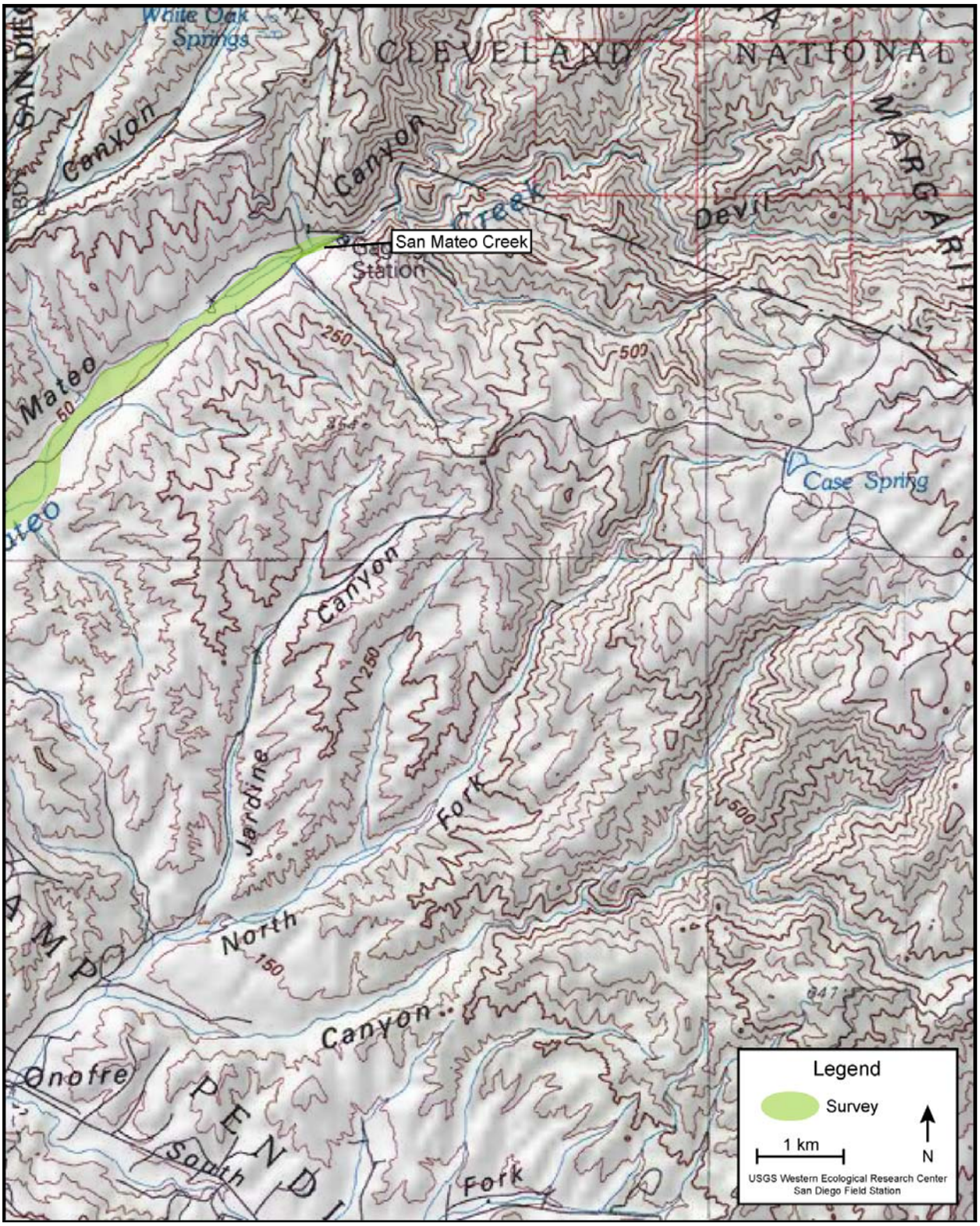

Fig. 8. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2008: San Mateo Creek.

Fig. 9. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2008: Las Flores Creek, Piedra de Lumbre Canyon, Horno Canyon, and San Onofre Creek.

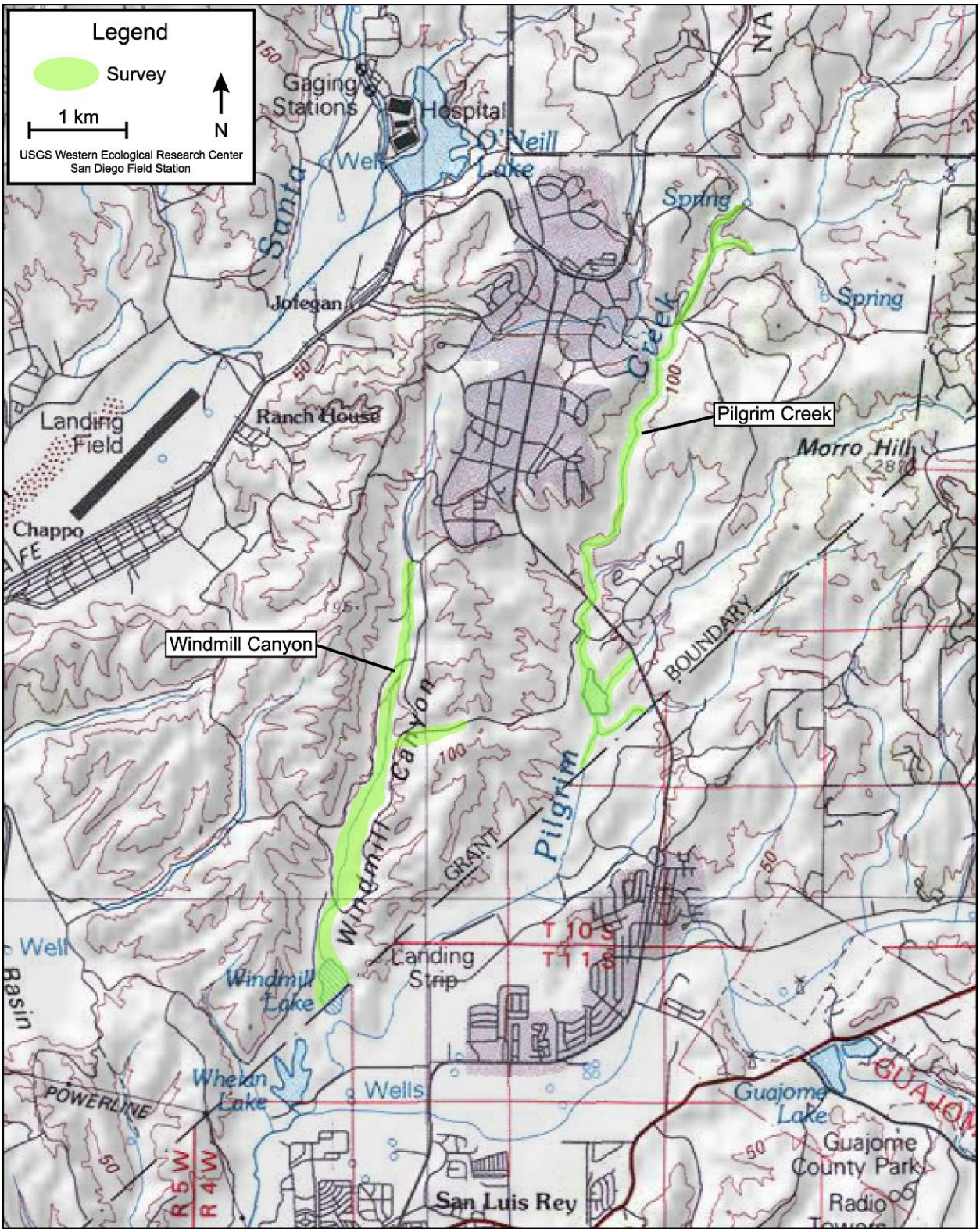

Fig. 10. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2008: Windmill Canyon and Pilgrim Creek.

APPENDIX B

LOCATIONS OF SOUTHWESTERN WILLOW FLYCATCHERS AT MARINE CORPS BASE CAMP PENDLETON, 2008

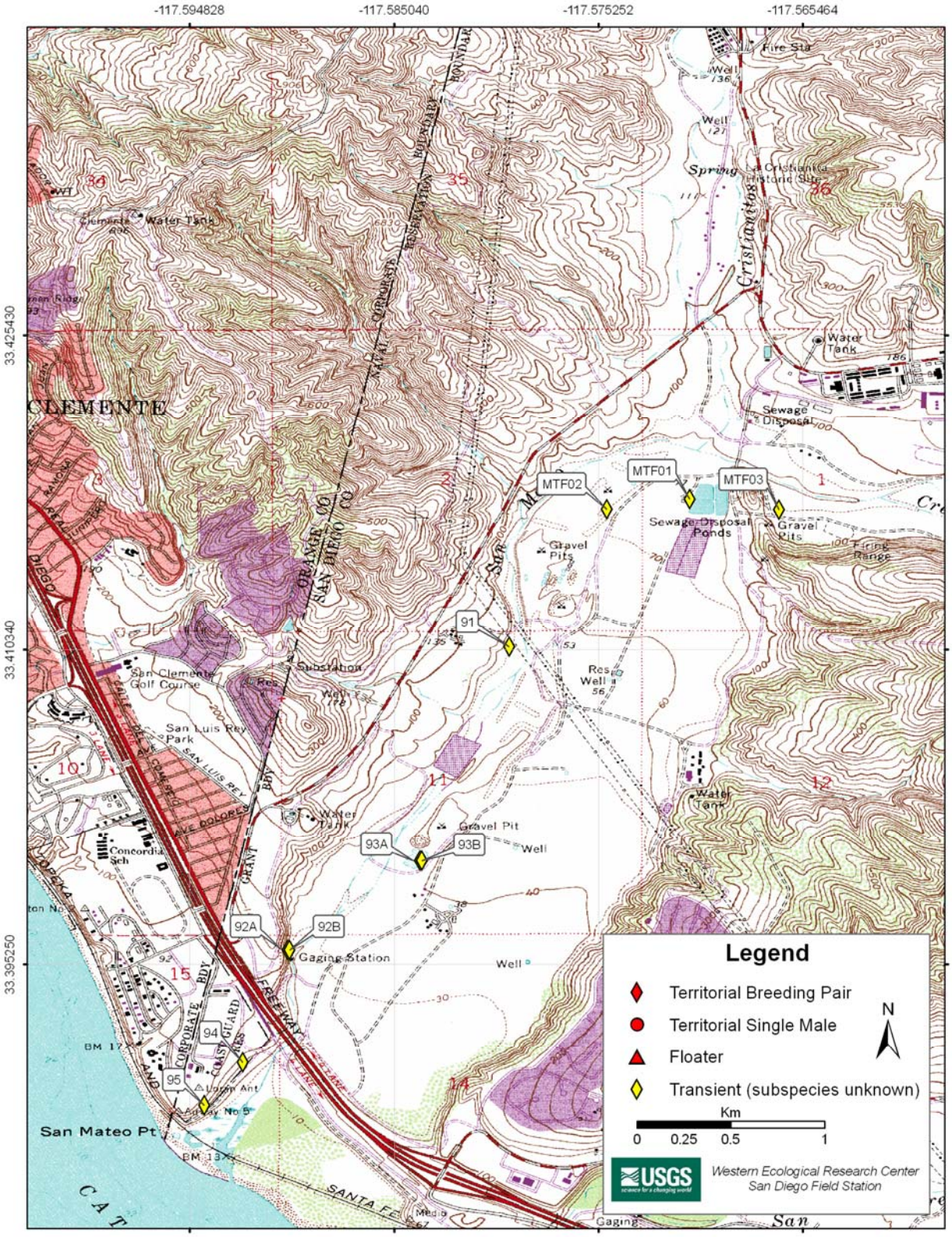

Fig. 11. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2008: Cristianitos Creek and San Mateo Creek.

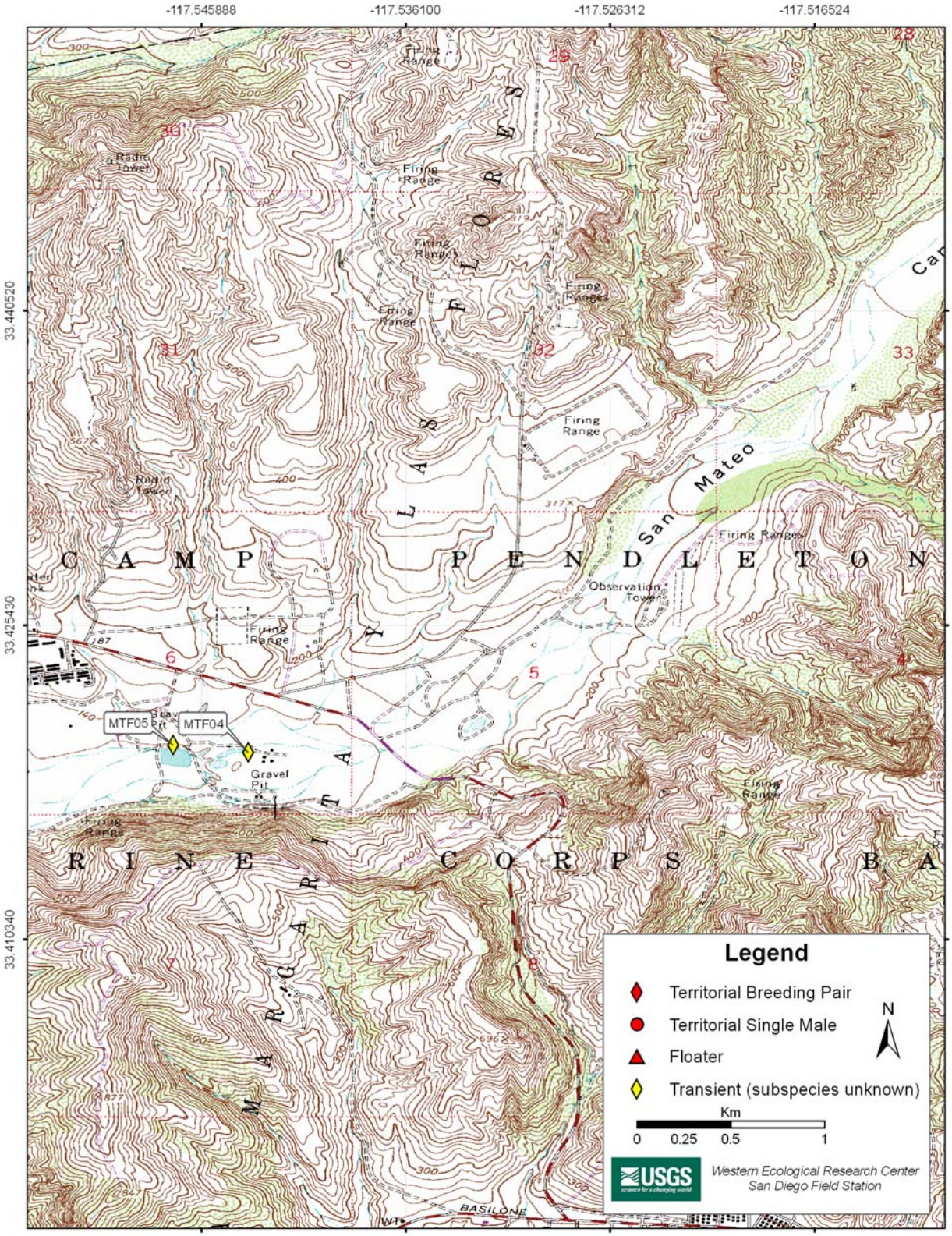

Fig. 12. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2008: San Mateo Creek (upstream).

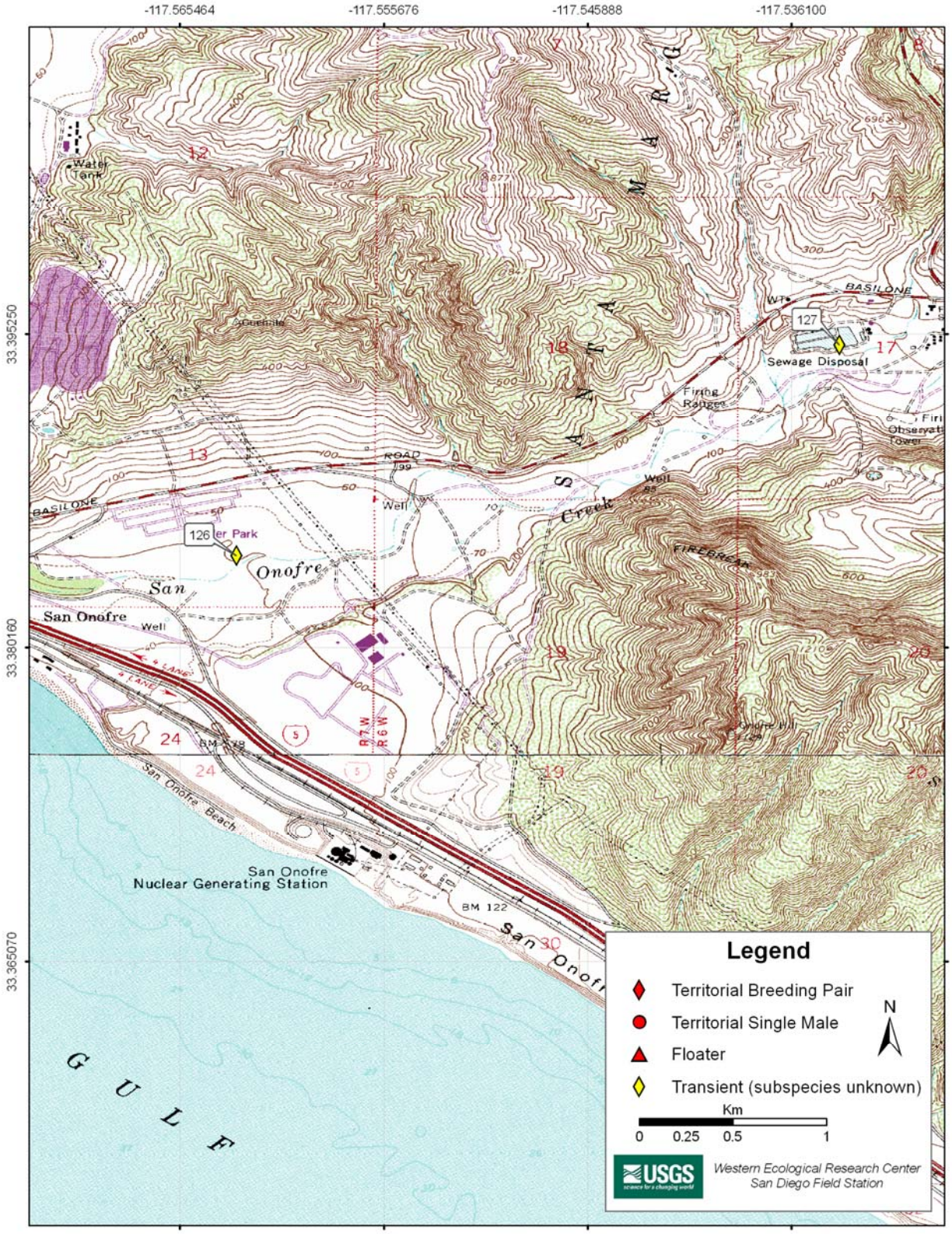

Fig. 13. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2008: San Onofre Creek (downstream).

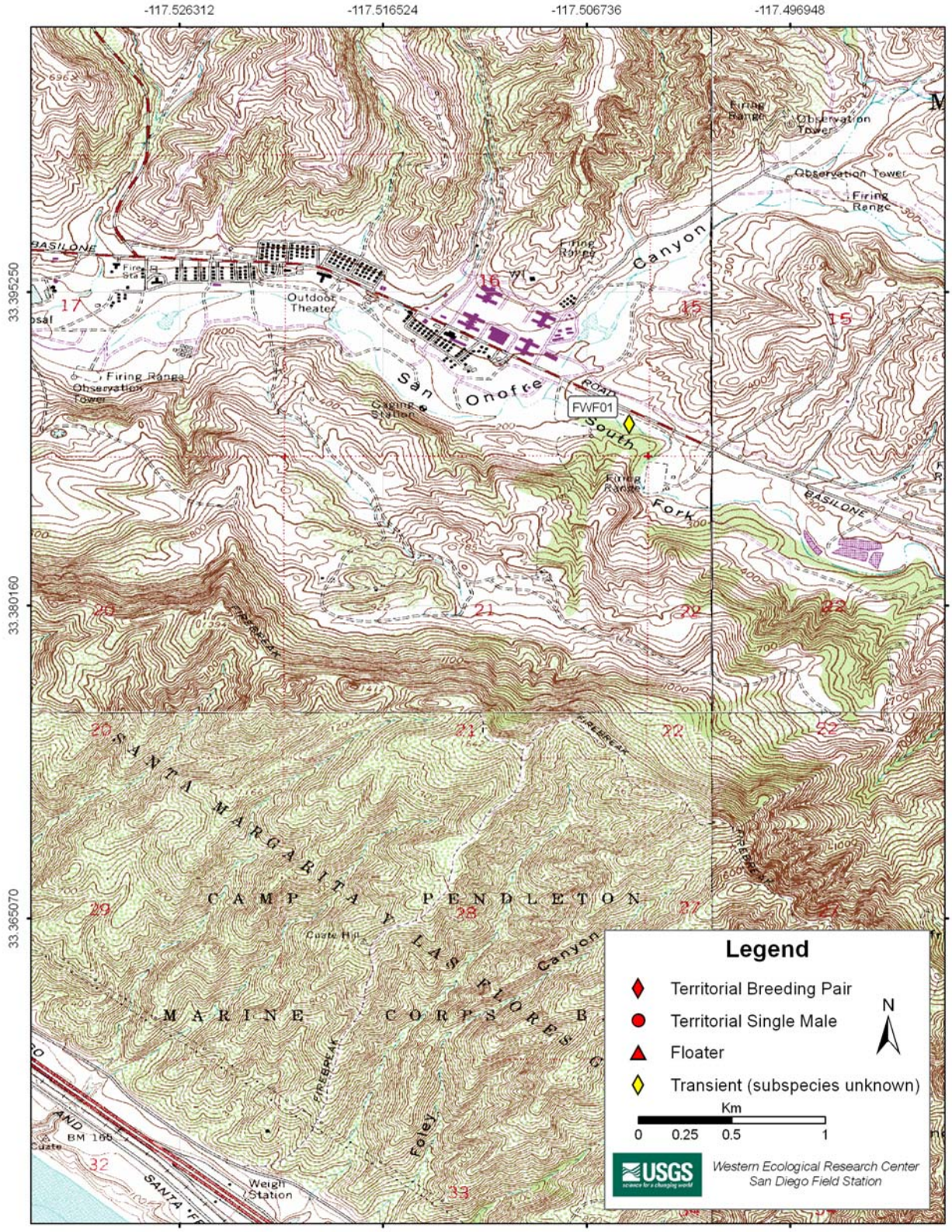

Fig. 14. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2008: San Onofre Creek (upstream).

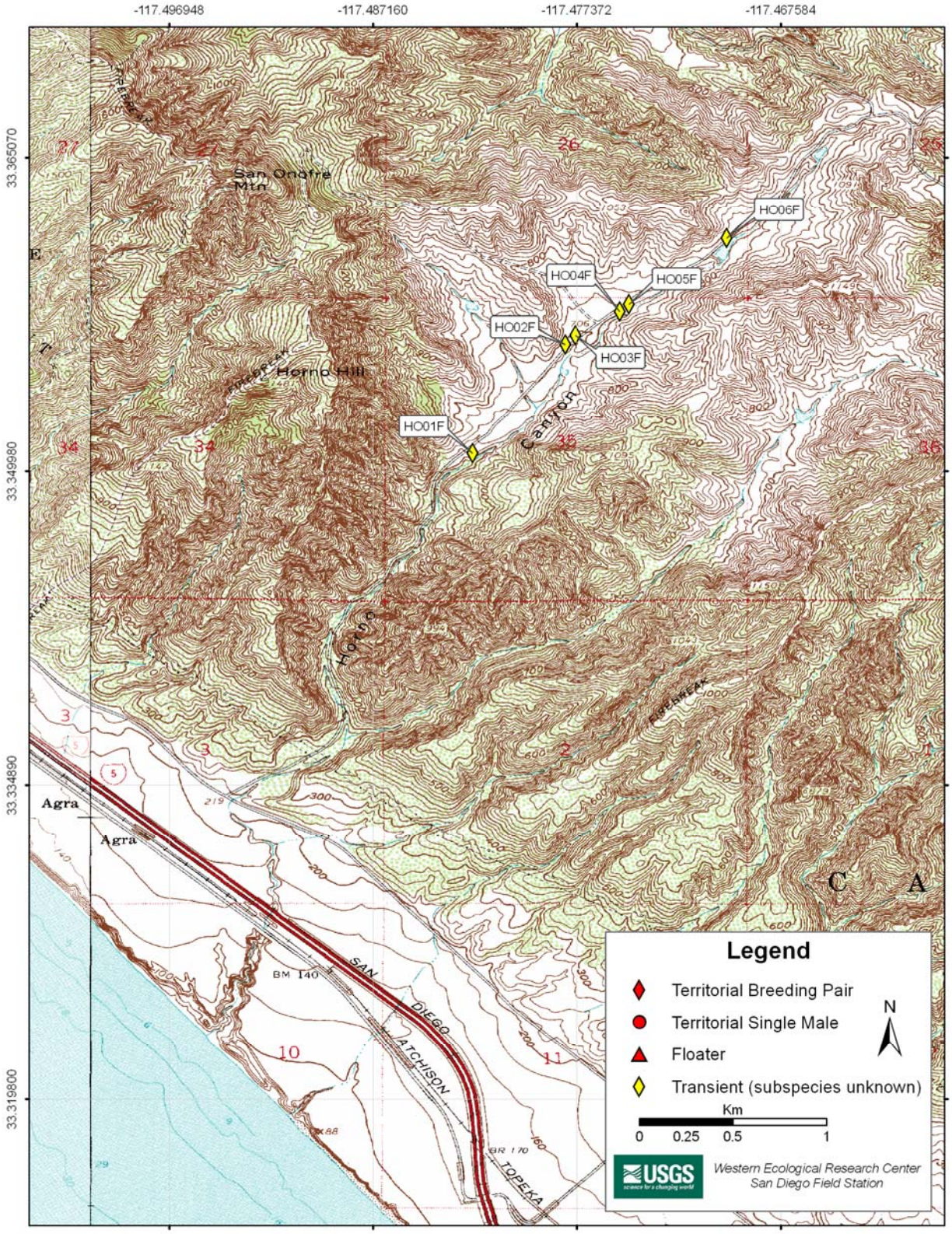

Fig. 15. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2008: Horno Canyon.

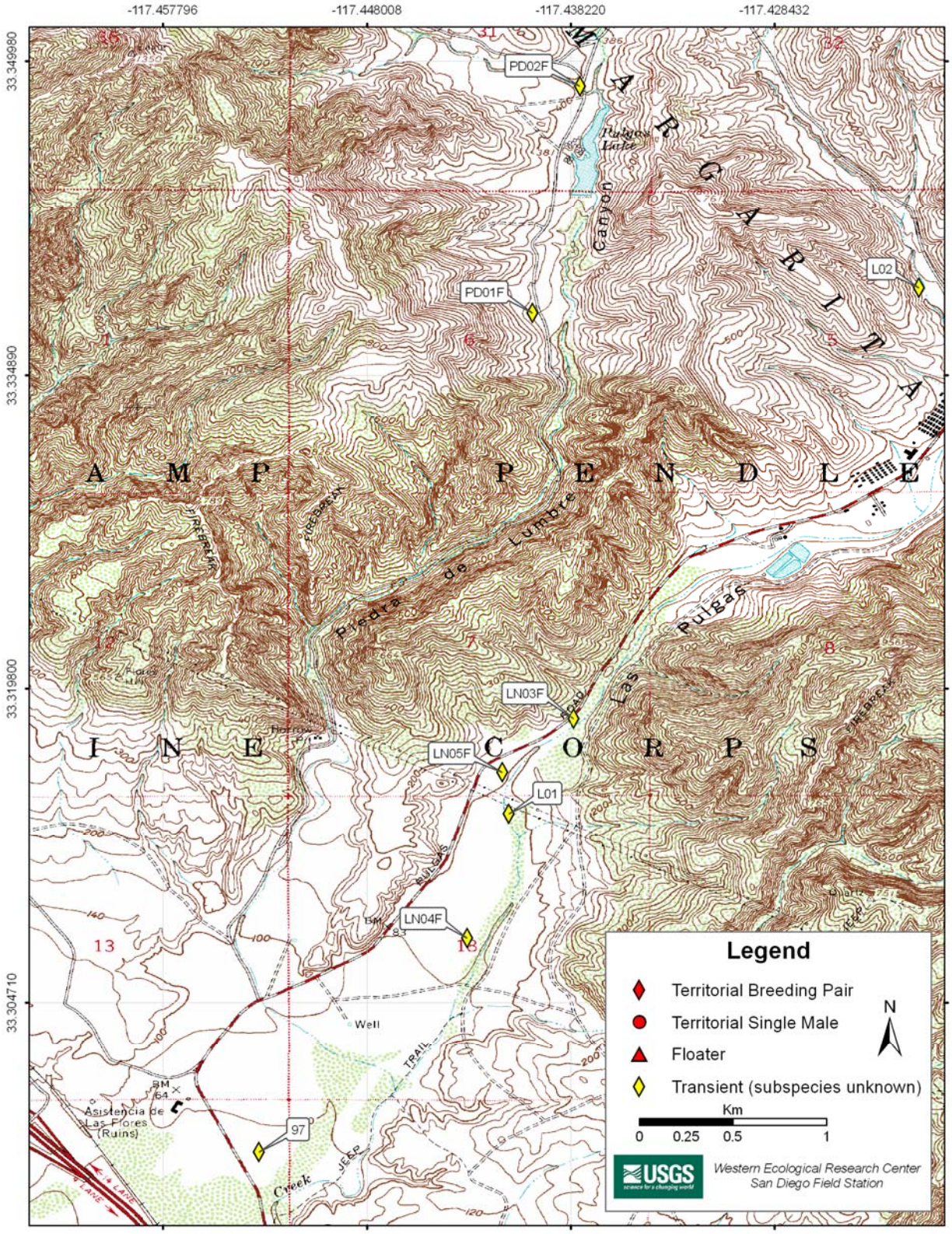

Fig. 16. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2008: Las Flores Creek and Piedra de Lumbre Canyon..

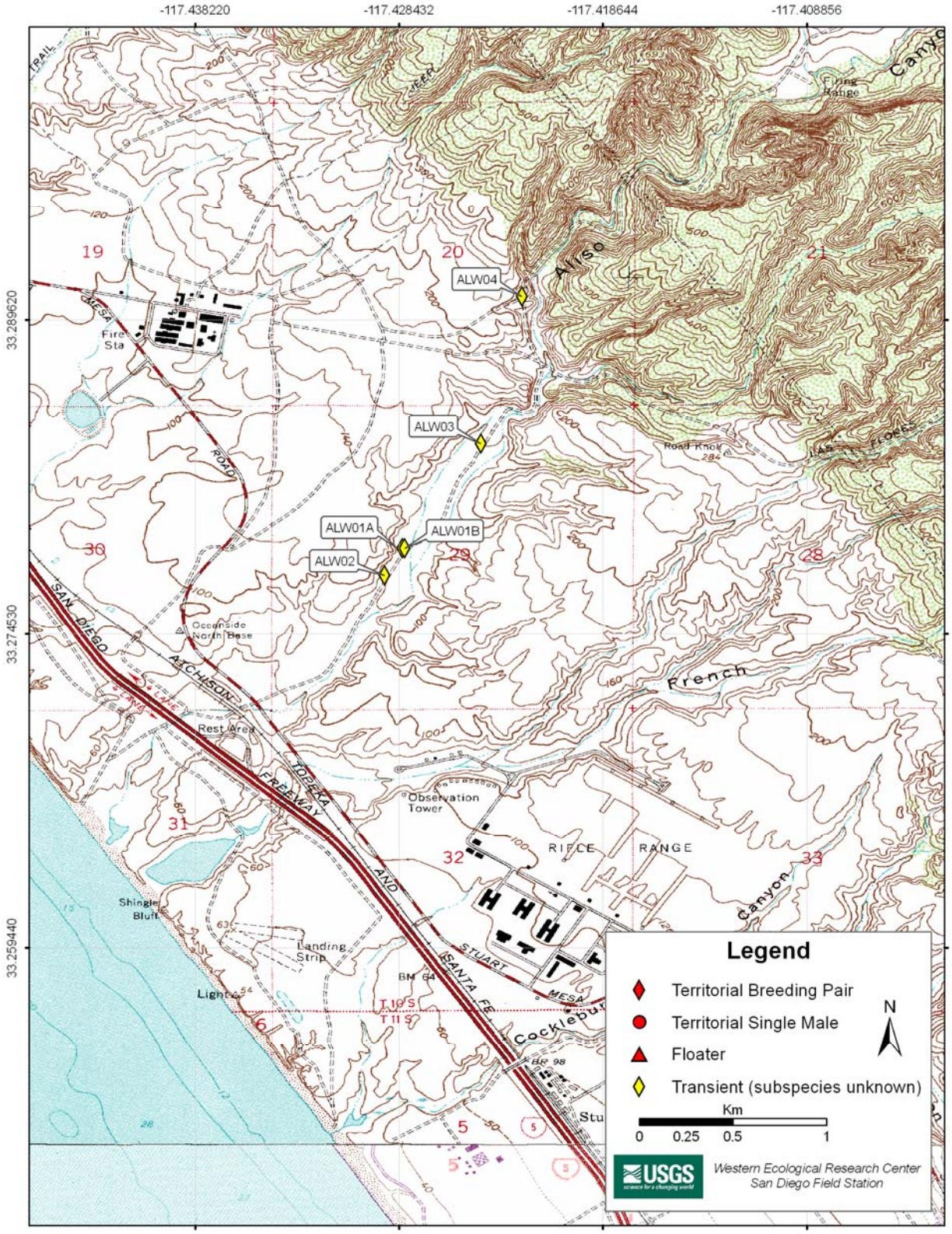

Fig. 17. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2008: Aliso Creek.

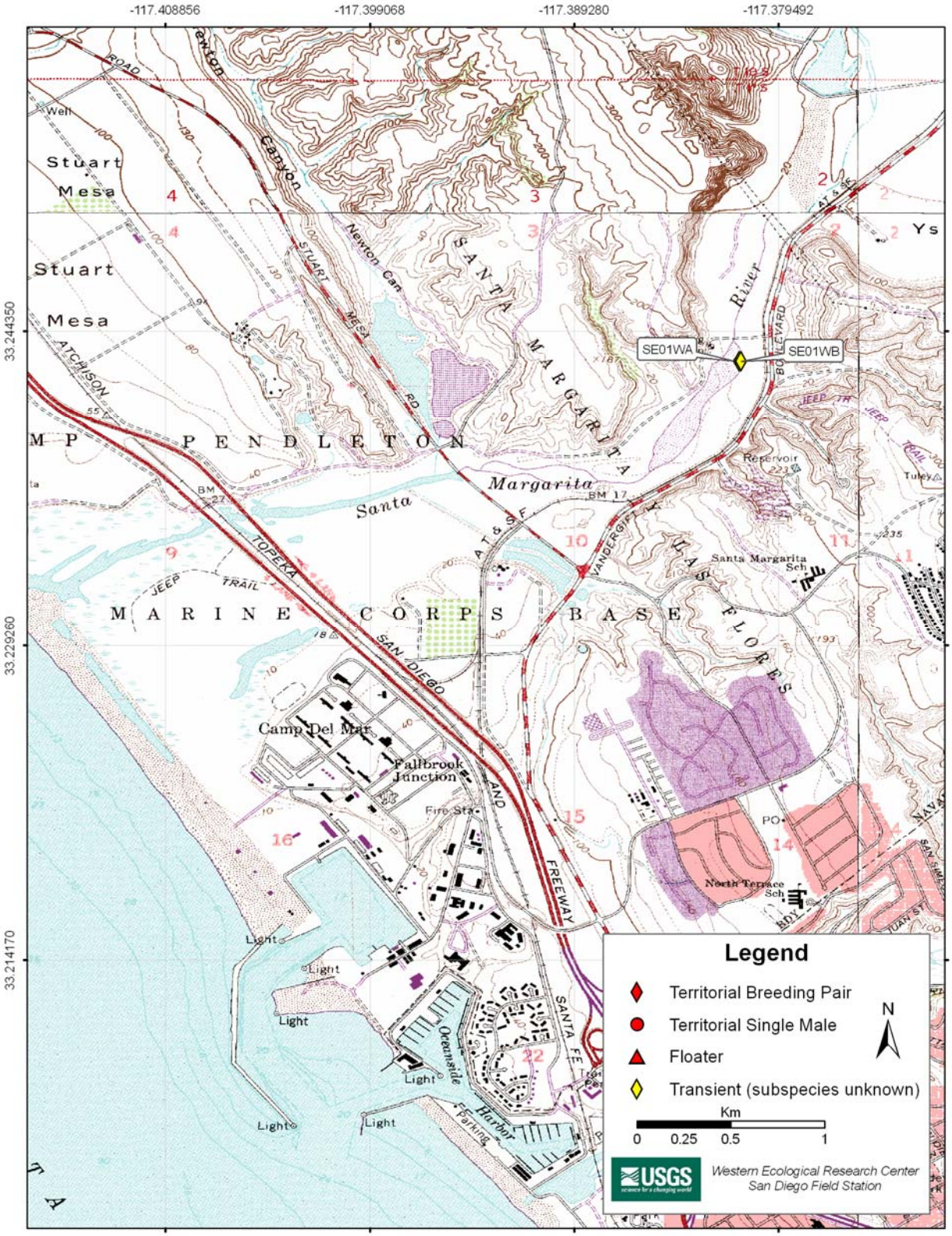

Fig. 18. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 200: Santa Margarita River (downstream).

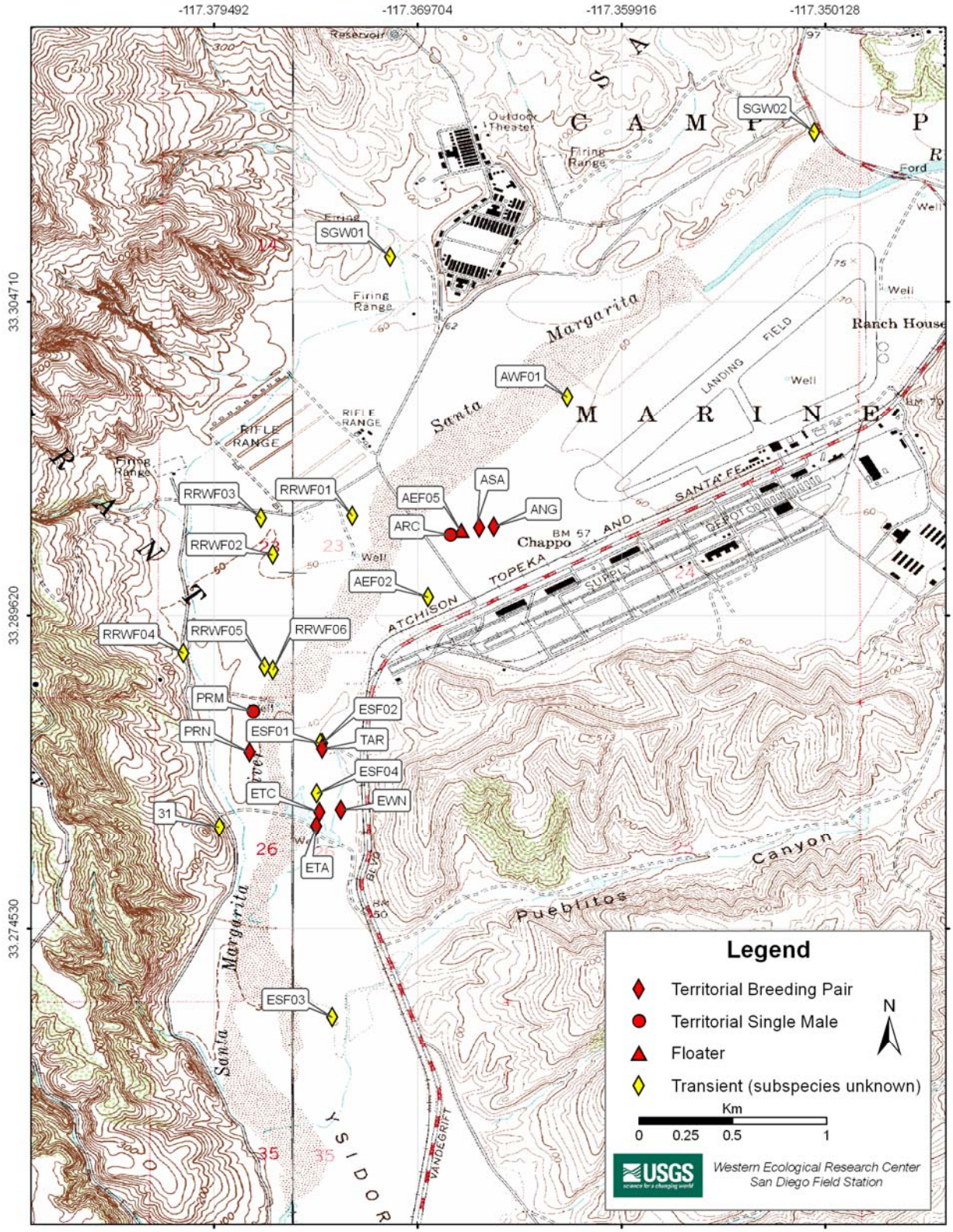

Fig. 19. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2008: Santa Margarita River (midstream).

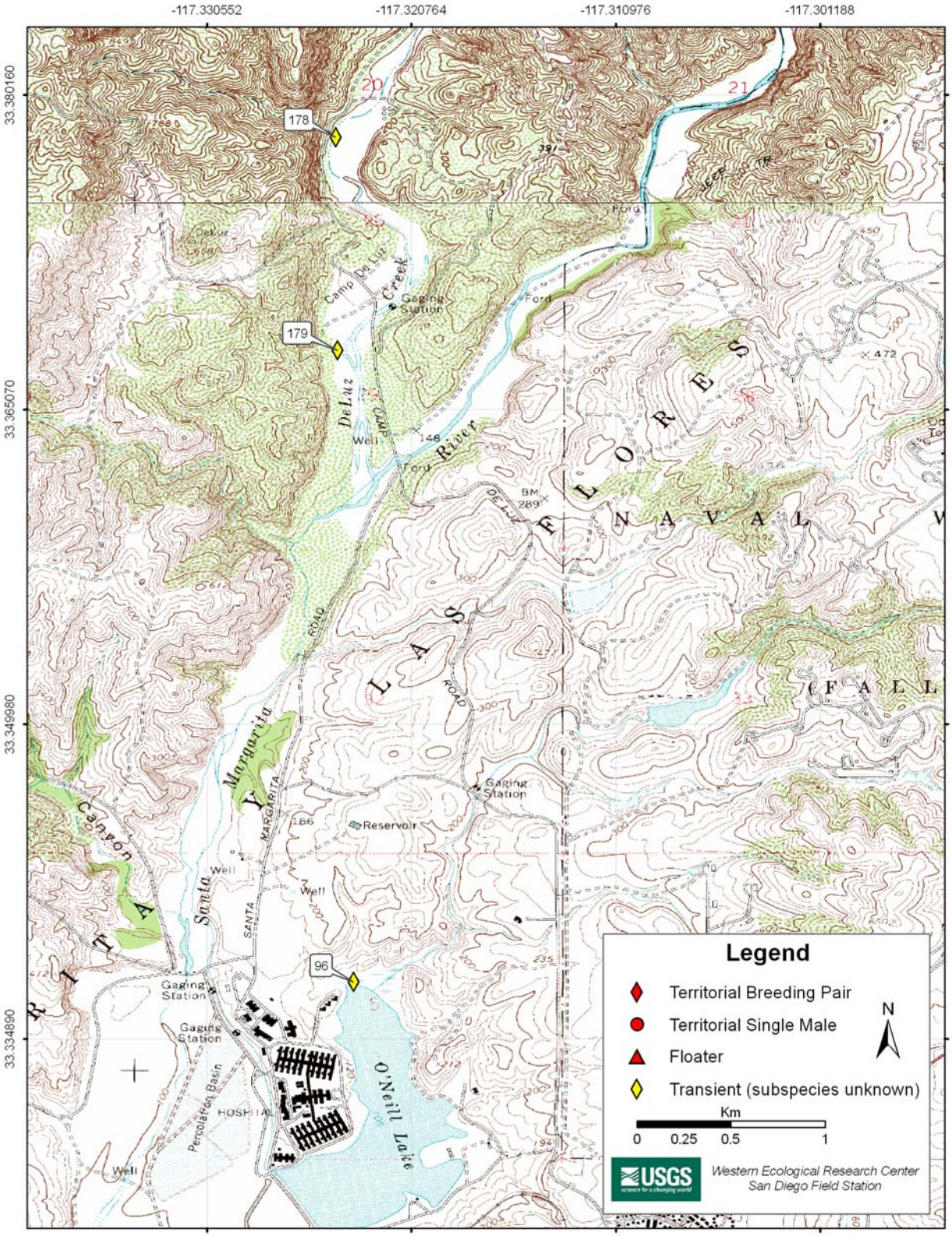

Fig. 20. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2008: Santa Margarita River (upstream), De Luz Creek and Fallbrook Creek.

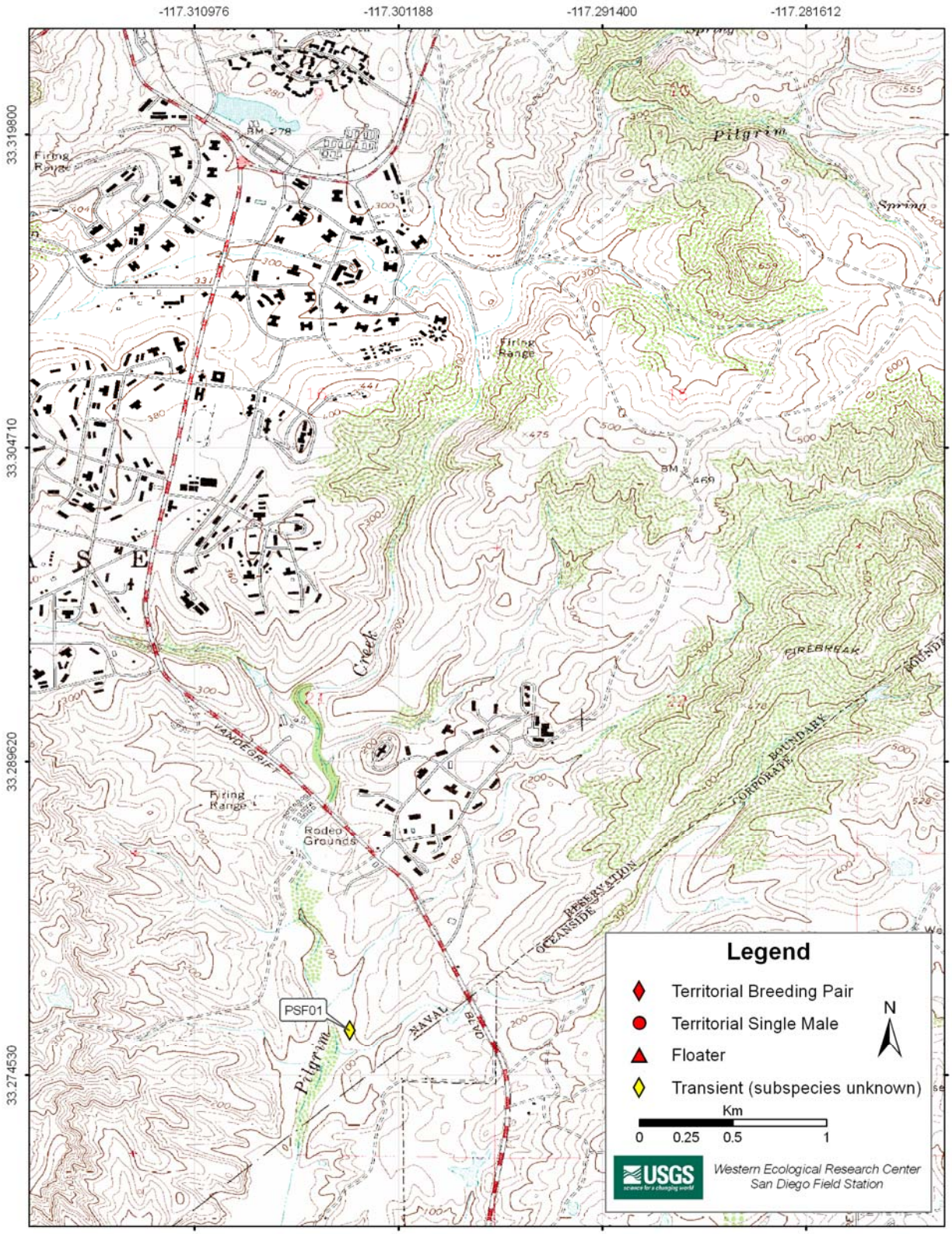

Fig. 21. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2008: Pilgrim Creek.

APPENDIX C

SOUTHWESTERN WILLOW FLYCATCHER BREEDING LOCATIONS AT MARINE CORPS BASE CAMP PENDLETON, 2008

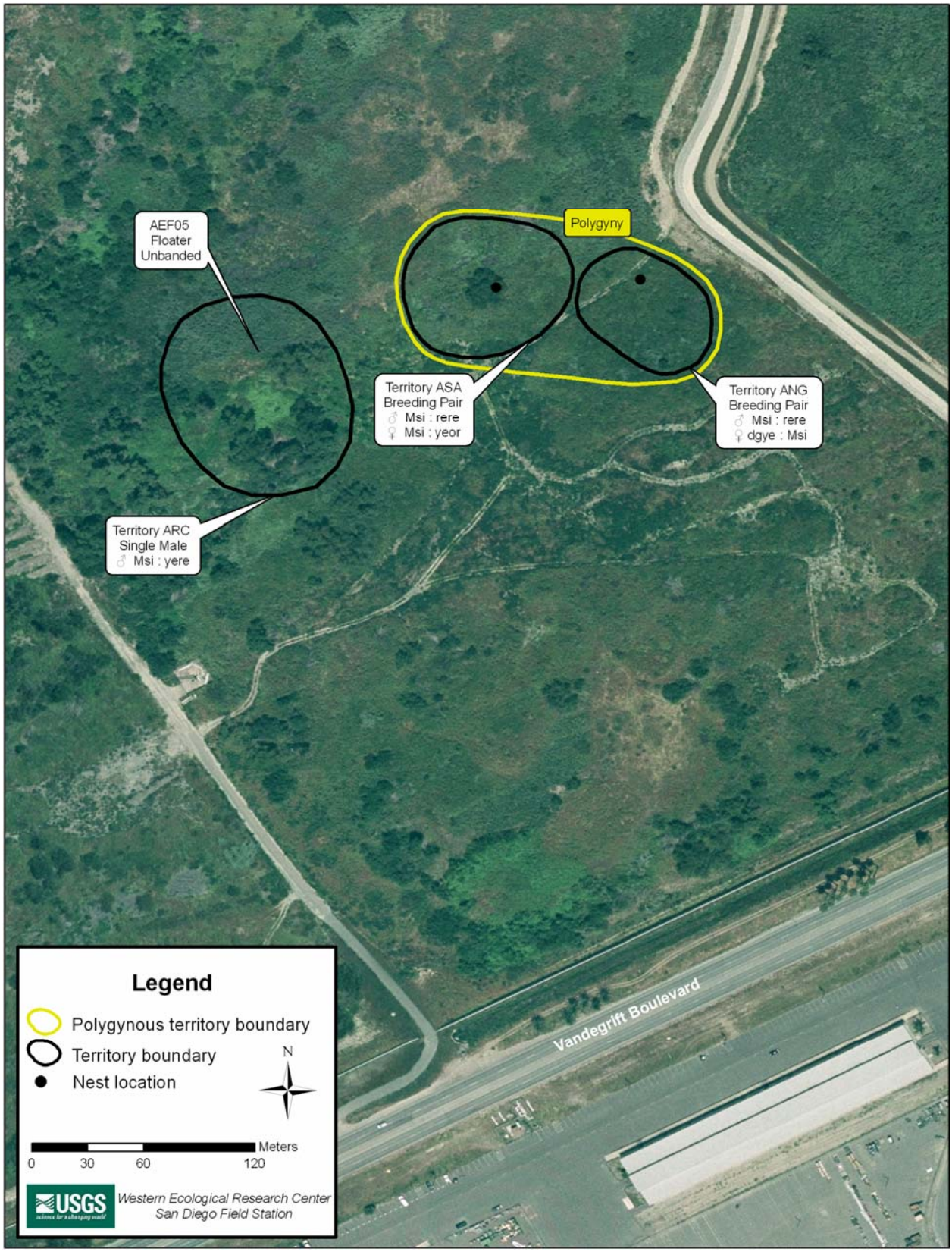

Fig. 22. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2008: Air Station Breeding Area, Santa Margarita River.

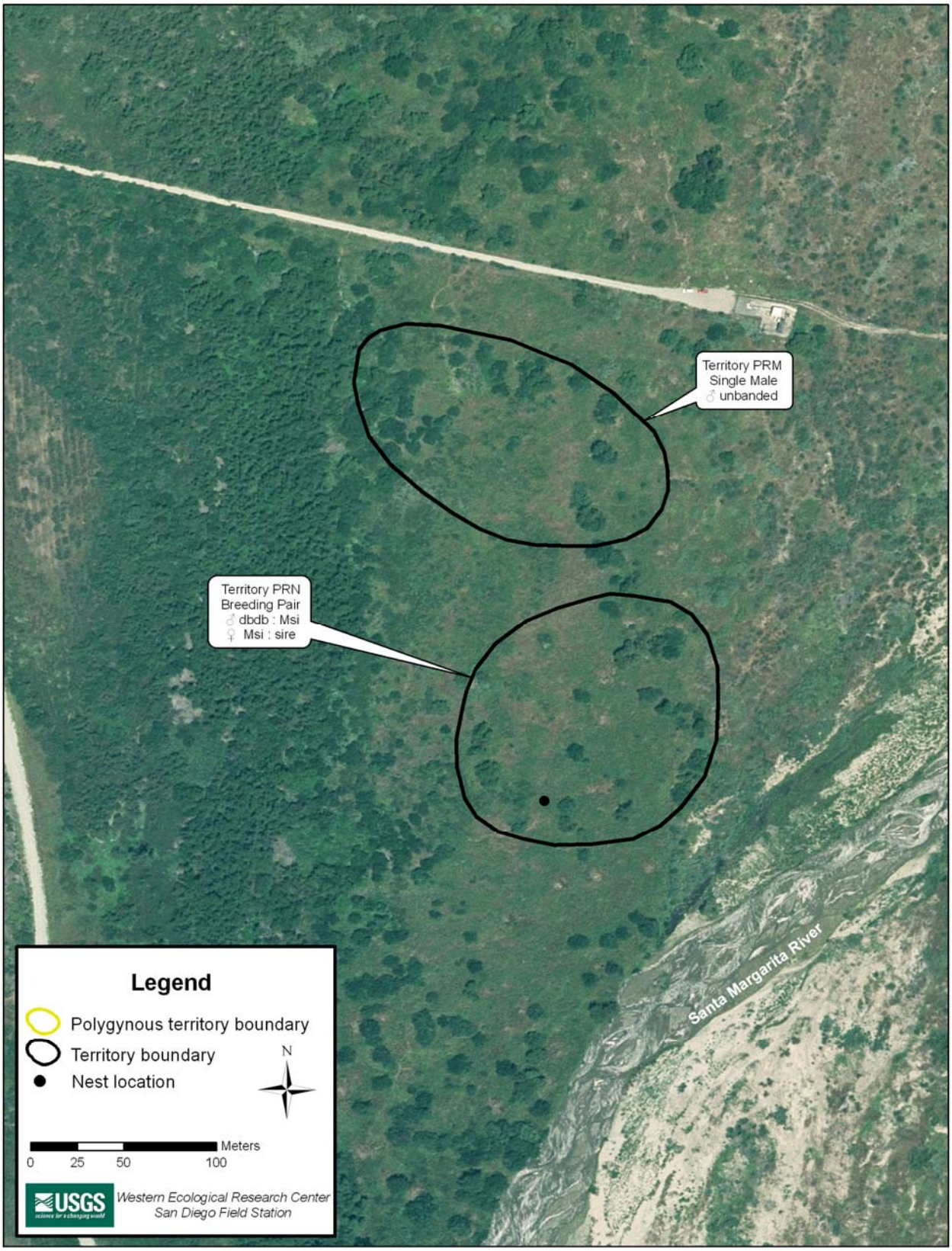

Fig. 23. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2008: Pump Road Breeding Area, Santa Margarita River.

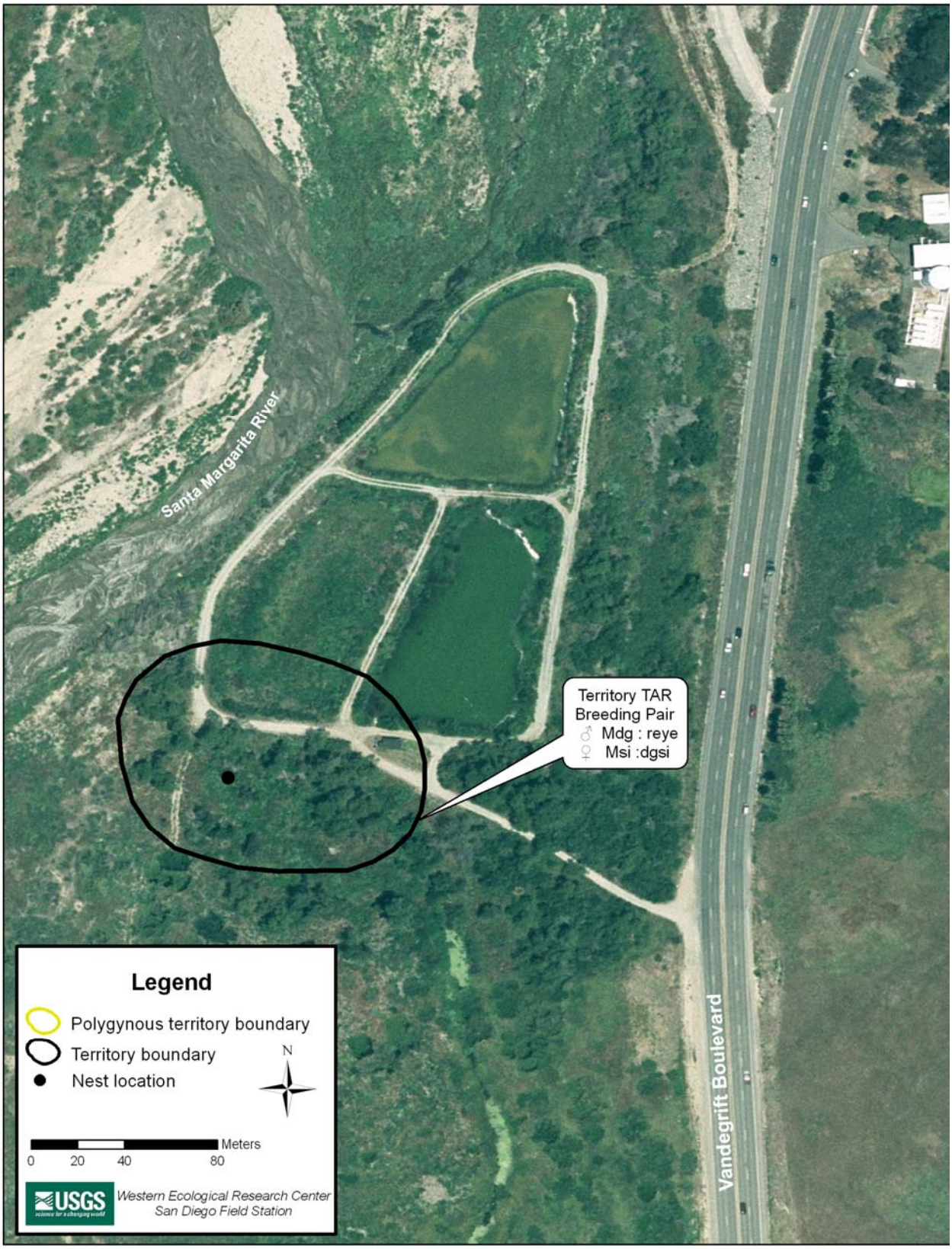

Fig. 24. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2008: Treatment Ponds Breeding Area, Santa Margarita River.

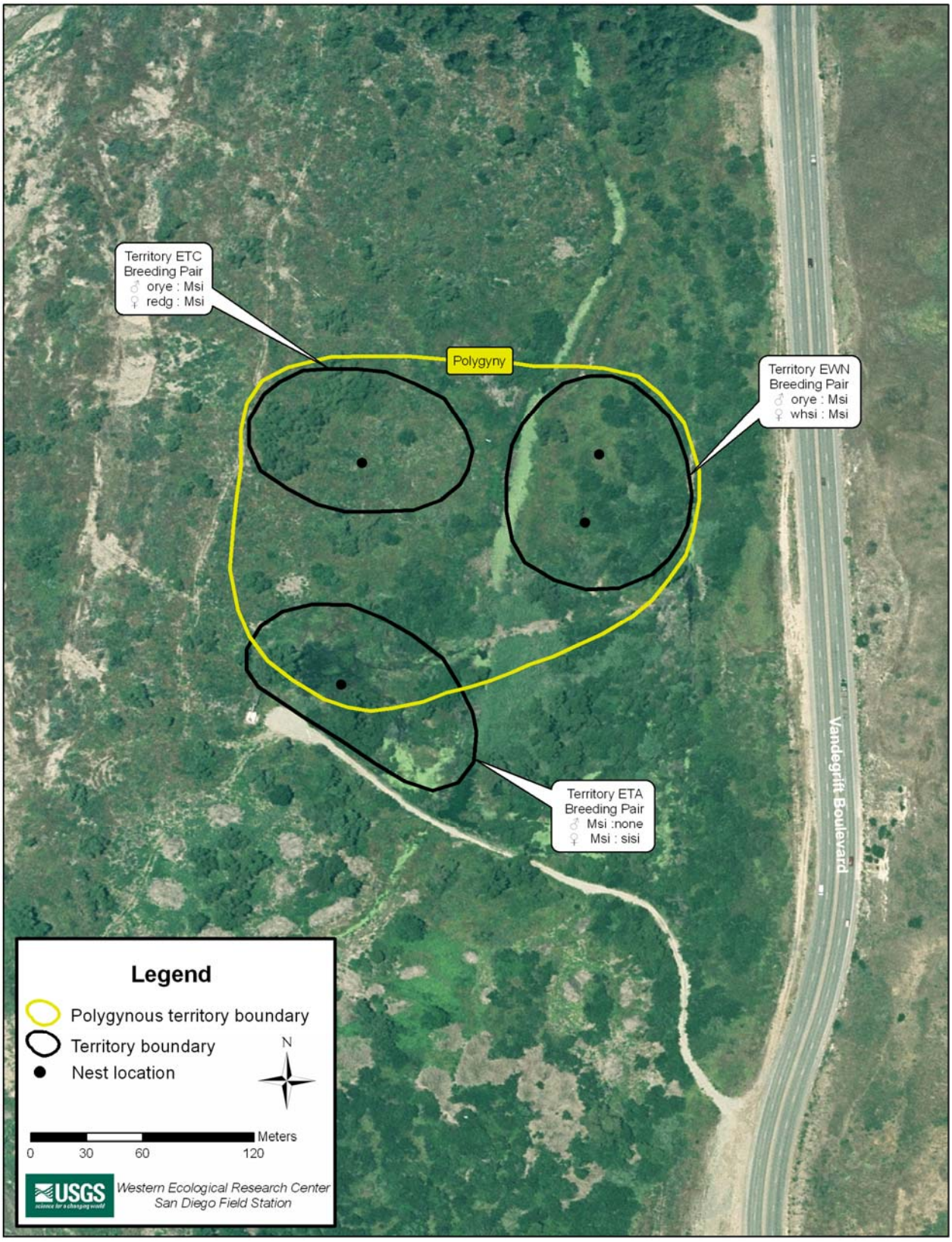

Fig. 25. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2008: Pueblitos Breeding Area, Santa Margarita River.

APPENDIX D

BAND COMBINATIONS AND IDENTIFICATION OF SOUTHWESTERN WILLOW FLYCATCHER NESTLINGS BANDED ON MARINE CORPS BASE CAMP PENDLETON, 2008

Band combinations and identification of southwestern willow flycatcher nestlings banded on Marine Corps Base Camp Pendleton in 2008.

Territory ID	Nest ID	Nestling Band Combination[a]	Federal Band Number
ANG	1	Msi : none	228058474
ETC	1	Msi : none	228058475
ETC	1	Msi : none	228058476
ETC	1	Msi : none	228058477
EWN	2	Msi : none	228058478
EWN	2	Msi : none	228058479
EWN	2	Msi : none	228058483
TAR	1	Msi : none	237003282
TAR	1	Msi : none	237003283
TAR	1	Msi : none	237003284
TAR	1	Msi : none	237003285
ETA	1	Msi : none	237003286
ETA	1	Msi : none	237003288
ETA	1	Msi : none	237003289
ASA	1	Msi : none	237003290
ASA	1	Msi : none	237003291
ASA	1	Msi : none	237003292
EWN	1	Msi : none	237003293
EWN	1	Msi : none	237003294
EWN	1	Msi : none	237003295
EWN	1	Msi : none	237003296
PRN	1	Msi : none	237003297
PRN	1	Msi : none	237003298
ANG	1	Msi : none	237003299

[a] Band combinations: left leg : right leg, Msi = federal aluminum band, none = no bands present.