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

2009 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 15 May and 28 July 2009. Thirty-five transient flycatchers of unknown sub-species were observed during Base-wide surveys. Transients occurred on 10 of the 16 drainages surveyed in 2009. No Willow Flycatchers were detected at Aliso Creek, Cristianitos Creek, Fallbrook Creek, Horno Canyon, Piedra de Lumbre Canyon, or Roblar Creek. Transients occurred in a range of habitat types including mixed willow (*Salix* spp.) riparian, willow-sycamore (*Platanus racemosa*) dominated riparian, oak (*Quercus* sp.)-sycamore dominated riparian, riparian scrub, and upland scrub. The distance from transient locations to the nearest surface water averaged 451 ± 593 m (std, $n = 35$).

In 2009, the resident Southwestern Willow Flycatcher population on Base consisted of eight females, eight males, and one non-territorial "floater" bird. Twelve territories were established, consisting of eight pairs (four consisting of a single male pairing with a single female and four consisting of a single male pairing polygynously with four different females) and three single males (one single male held two separate territories). In total, eight females formed pair bonds with five male Willow Flycatchers. With the exception of one territory in riparian scrub along San Mateo Creek, all territories were located in mixed willow riparian along the Santa Margarita River. Poison hemlock (*Conium maculatum*) was present in all territories. Distance to surface water averaged 67 ± 47 m (std, $n = 13$), with 69% (9/13; 12 territories and one floater) of resident flycatchers located within 100 m of water.

Seventy-five percent (6/8) of Willow Flycatcher pairs successfully fledged at least one young during the 2009 breeding season. Nesting was initiated in early June and continued into August. Nine nesting attempts were documented, 67% (6/9) were successful. Predation accounted for 67% (2/3) of nest failures. Eleven fledglings were produced, yielding an estimated seasonal productivity of 1.4 young per pair (11 young/8 pairs). No instances of Brown-headed Cowbird (*Molothrus ater*) parasitism were observed. Pairs placed nests in five species of plants, including black willow *(S. gooddingii*), arroyo willow (*S. lasiolepis*), sandbar willow (*S. exigua*), California black walnut (*Juglans californica*), and poison hemlock. Seventy-eight percent (7/9) of nests were placed in native species.

Sixteen birds (eight males, seven females, and one unknown sex "floater") that were banded in previous years were present at Camp Pendleton in 2009. Of the banded adult flycatchers present during the 2008 breeding season, 100% (6/6) of males and 29% (2/7) of females returned to Camp Pendleton in 2009. Eighty-eight percent (7/8) of those returned to the same breeding area. Twenty percent (4/20) of nestlings banded in 2008 returned to the Base as adults in 2009, including three females and one male (Table 5). All returning second-year females paired and nested in 2009. Fifteen nestlings from seven nests were banded in 2009. 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, Brown-headed 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 (USGS Western Ecological Research Center, San Diego Field Station unpubl. data), and Marine Corps Base Camp Pendleton in San Diego County (Howell and Kus 2009). 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 m 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 15 May and 28 July (Fig. 1, Appendix A, Figs. 5-10). Field work was conducted by Travis Cooper, Aaron Gallagher, Scarlett Howell, Barbara Kus, Melanie Madden-Smith, Eric Nolte, Ryan Pottinger, Michelle Rogne, Mike Wellik, and David Wilamowski. 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).

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

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

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).

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

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).

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

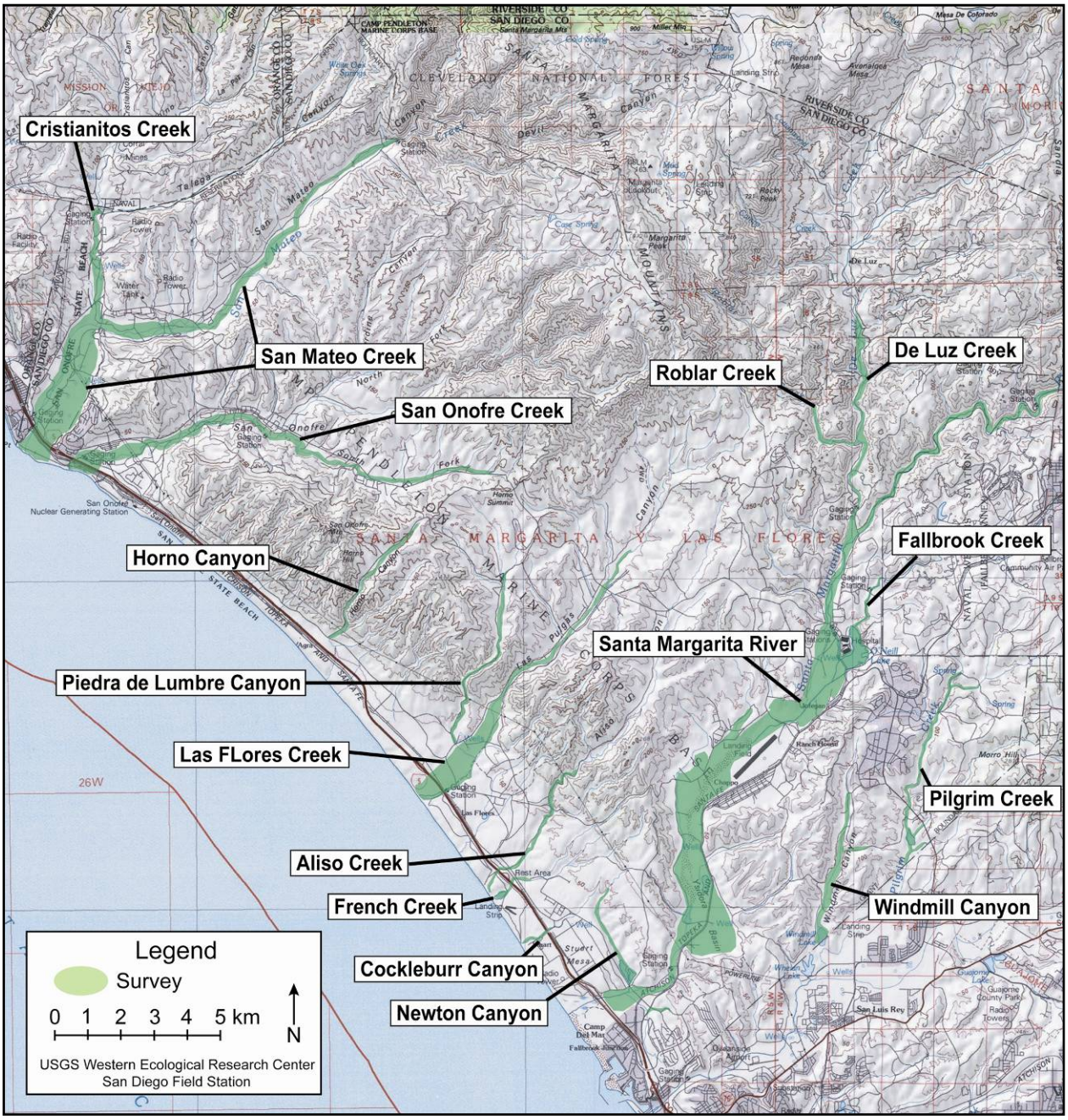

Fig. 1. Southwestern Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2009.

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

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

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 15 May and 31 July. The first period extended from 15 May through 31 May, the second period from 1 June through 21 June, the third from 22 June through 11 July, and the fourth from 12 July through 31 July.

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). For all resident flycatchers, territory boundaries were approximated by mapping singing perches and the extent of the male and female's use area on 1":12,000" aerial photographs. 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 (*Baccharis salicifolia*) 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 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.

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

(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.

(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 site characteristics were recorded following the abandonment or fledging of nests. Measurements included nest height, host species, host height, distance the nest was placed to the edge of the host species, and distance the nest was placed to the edge of the clump of riparian vegetation. Distance to edge of clump is expressed as a negative number if the nest is not located in a clump of riparian vegetation. For example, if the nest is located in a field of poison hemlock without any other non-hemlock vegetation present, the distance to the nearest clump of riparian vegetation is measured, and the value is expressed as a negative number.

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 used Pearson's correlations to investigate the 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 (National Weather Service (NWS) ID #045733), Target Range (NWS ID #045732), and Ammo Dump (NWS ID #045738; WRCC 2009). 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 right 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 2008, with a single silver aluminum federal numbered band on the left leg, were recaptured in their territories and banded with a colored metal band on the right leg to yield a full, unique combination.

RESULTS

Population Size and Distribution

Transients

Thirty-five Willow Flycatchers of unknown sub-species were observed during Base-wide surveys (Appendix B, Figs. 11-19). All transients were detected between 14 May and 16 June (one bird detected before the official survey period). Transients occurred on 10 of the 16 drainages surveyed in 2009. No Willow Flycatchers were detected at Aliso Creek, Cristianitos Creek, Fallbrook Creek, Horno Canyon, Piedra de Lumbre Canyon, or Roblar Creek.

Residents

Eight males, eight females, and one non-territorial "floater" bird were detected throughout the 2009 breeding season (Appendix B, Figs. 11, 17; Appendix C, Figs. 20-24). Five of the males were paired while three of the males remained single. One of the five paired males was polygynous with four females (Appendix C, Fig. 21). One single male (PNB, 19 May-25 Jun; ARC, 2-10 Jul) defended territories in two locations separated by more than 1 km. The floater bird was detected once in mid-June, downstream from a historical breeding area (Appendix B, Fig. 17). The bird was called a floater rather than a transient because it was banded with a single band on the left leg, suggesting that it was a returning 2008 nestling. Overall, 12 territories (i.e., 3 unpaired males, 1 holding 2 separate territories, and 8 female nesting locations) were established in 2009, with 8 females forming pair bonds with 5 male Willow Flycatchers. Overall, the flycatcher population on Base increased by 13% from 2008 to 2009 (Fig. 2).

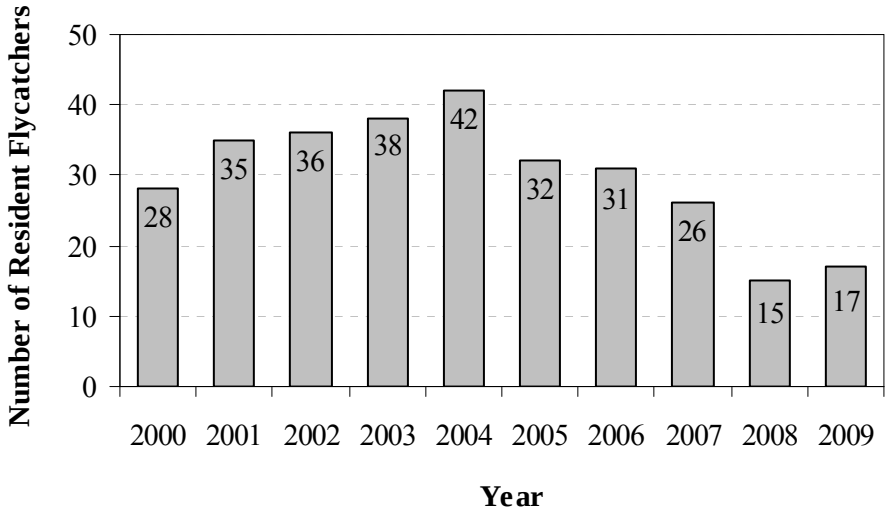

Fig. 2. Southwestern Willow Flycatcher population estimates for Marine Corps Base Camp Pendleton, 2000-2009

Resident flycatchers were restricted to the Santa Margarita River (Appendix B, Fig. 17; Appendix C, Figs. 21-24) and lower San Mateo Creek (Appendix B, Fig. 11; Appendix C, Fig. 20). Along the Santa Margarita River, four core flycatcher breeding areas (those annually supporting multiple flycatcher territories) were occupied in 2009: Air Station, Treatment Ponds, northern Pueblitos, and Pump Road. The Air Station site supported the largest concentration of breeding flycatchers with four pairs and a single male, followed by the Treatment Ponds area, which supported two breeding pairs. The remaining two areas, Pump Road and the northern portion of Pueblitos, each hosted a single nesting pair and one single male. Overall, flycatcher distribution on the Santa Margarita River remained contracted relative to previous years, with portions of the Santa Margarita River that historically supported resident flycatchers (Vine, Bell, Ysidora Ponds, and the southern portion of Pueblitos breeding areas) absent of flycatcher territories in 2009 (Table 1). Flycatcher distribution away from the Santa Margarita River was limited to one single male detected at San Mateo Creek.

Table 1. Distribution of territorial Willow Flycatchers at Marine Corps Base Camp Pendleton, 2000-2009.

		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009	
Santa Margarita River		M[a]	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
SWFL Breeding Areas	Above Hospital	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
	Below Hospital	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
	Air Station	3	3	2	3	1	1	-	-	1	1	-	-	-	-	2	2	2	2	1	4
	Rifle Range	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	2	-	-	-	-
	Pump Road	1	1	3	3	3	3	2	3	5	6	3	6	2	4	3	5	2	1	2	1
	Treatment Ponds	1	-	1	-	-	-	-	-	-	-	1	-	1	4	2	2	1	1	2	2
	Pueblitos	4	-	3	4	3	3	4	5	4	4	1	3	3	6	1	1	2	3	2	1
	Ysidora Ponds	4	2	4	4	2	2	2	2	2	4	4	5	2	3	2	1	-	-	-	-
	Bell	2	1	2	2	3	3	1	2	4	6	2	3	1	1	-	-	-	-	-	-
	Vine	2	2	1	1	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
	Stuart Mesa	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lake O'Neill		1	1	1	1	1	1	2	1	1	1	1	-	2	-	-	-	-	-	-	-
Las Flores Creek		-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-
San Mateo Creek		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	-
Total		**18**	**10**	**17**	**18**	**17**	**16**	**16**	**16**	**18**	**22**	**12**	**17**	**12**	**19**	**12**	**14**	**7**	**7**	**8**	**8**

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

Sources: Kus 2001; Kus and Ferree 2002; Kus and Kenwood 2003, 2005, 2006a, 2006b; Kenwood and Kus 2007; Rourke *et al.* 2008; Howell and Kus 2009

Habitat Characteristics

Forty-eight percent (23/48) of all flycatcher sightings occurred in habitat classified as mixed willow riparian, 70% (16/23) of which occurred along the Santa Margarita River (Table 2). Forty percent (19/48) of locations were in riparian scrub, dominated by mule fat and/or sandbar willow. An additional 2% (1/48) of birds occupied willow habitat co-dominated by sycamore. The remaining 10% of the flycatcher detections were in more arid habitats including areas dominated by a mix of sycamores and oaks (2%, 1/48) or upland vegetation (8%, 4/48). No flycatchers were documented in habitats consisting solely of non-native vegetation. While transients used all habitat types, resident flycatchers were found almost exclusively (12/13) in mixed willow riparian.

Table 2. Habitat characteristics of Willow Flycatcher locations at Marine Corps Base Camp Pendleton in 2009.

Bird ID	Drainage	Status[a]	Habitat Type[b]	Exotic Cover Class[c]	Dominant Exotics[d]	Distance to Surface Water (m)
CCF01	Cockleburr Creek	T	Mixed Willow	1	-	40
CCF02	Cockleburr Creek	T	Mixed Willow	1	-	30
DN01WIFL	De Luz Creek	T	Mixed Willow	1	-	300
WIFL01FR	French Creek	T	Mixed Willow	1	-	0
LL01F	Las Flores Creek	T	Riparian Scrub	3	CON	425
LL02F	Las Flores Creek	T	Riparian Scrub	2	CON	475
UL01WIFL	Las Flores Creek	T	Upland Scrub	2	BRA	40
ULWIFL02	Las Flores Creek	T	Riparian Scrub	2	BRA	5
NC01F	Newton Canyon	T	Mixed Willow	2	TAM	100
NC02F	Newton Canyon	T	Mixed Willow	2	TAM	100
MB01F	San Mateo Canyon	T	Riparian Scrub	2	CON	1975
MB02F	San Mateo Canyon	T	Riparian Scrub	1	-	100
MB03F	San Mateo Canyon	T	Riparian Scrub	2	CON	100
MB04F	San Mateo Canyon	T	Mixed Willow	2	CON	230
MB05F	San Mateo Canyon	S	Riparian Scrub	2	CON	0
MB06F	San Mateo Canyon	T	Riparian Scrub	2	BRA	810
MB07F	San Mateo Canyon	T	Riparian Scrub	2	CON	730
MB08F	San Mateo Canyon	T	Riparian Scrub	3	BRA, CON	1100
MB09F	San Mateo Canyon	T	Riparian Scrub	3	BRA, CON	1100
MB10F	San Mateo Canyon	T	Riparian Scrub	2	CON	1650
MB11F	San Mateo Canyon	T	Riparian Scrub	2	CON	730
MU01F	San Mateo Canyon	T	Upland Scrub	1	-	2500
MU02F	San Mateo Canyon	T	Riparian Scrub	2	BRA	310
MU03F	San Mateo Canyon	T	Riparian Scrub	1	-	560
MU04F	San Mateo Canyon	T	Riparian Scrub	3	BRA	370
MU05F	San Mateo Canyon	T	Oak/Sycamore	2	BRA	175
MU06F	San Mateo Canyon	T	Riparian Scrub	1	-	6
WIFL01	San Onofre Creek	T	Upland Scrub	2	SIL	350
WIFL02	San Onofre Creek	T	Upland Scrub	2	SIL	350
AH01F	Santa Margarita River	T	Mixed Willow	2	CON	60
AMZ	Santa Margarita River	P	Mixed Willow	1	CON	130
ANG	Santa Margarita River	P	Mixed Willow	1	CON	80
APL	Santa Margarita River	P	Mixed Willow	1	CON	40
ARC	Santa Margarita River	S	Mixed Willow	2	CON	110
ASA	Santa Margarita River	P	Mixed Willow	2	CON	120
AWWIFL01	Santa Margarita River	T	Riparian Scrub	2	BRA	1
EDY	Santa Margarita River	S	Mixed Willow	2	CON	50
ETA	Santa Margarita River	P	Mixed Willow	2	CON	40
HE01F	Santa Margarita River	T	Mixed Willow	1	-	10
PNB	Santa Margarita River	S	Mixed Willow	2	CON	70

Table 2 (*continued*). Habitat characteristics of Willow Flycatcher locations at Marine Corps Base Camp Pendleton in 2009.

Bird ID	Drainage	Status[a]	Habitat Type[b]	Exotic Cover Class[c]	Dominant Exotics[d]	Distance to Surface Water (m)
PR01F	Santa Margarita River	T	Mixed Willow	2	ARU, CON	10
PR02F	Santa Margarita River	T	Mixed Willow	2	ARU, CON	20
PR03F	Santa Margarita River	T	Riparian Scrub	2	TAM	10
PR04F	Santa Margarita River	F	Mixed Willow	2	ARU	0
PRN	Santa Margarita River	P	Mixed Willow	2	CON	60
TAR	Santa Margarita River	P	Mixed Willow	2	CON	30
TLM	Santa Margarita River	P	Mixed Willow	2	CON	75
WC01F	Windmill Canyon	T	Willow/Sycamore	3	FOE	1000

[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*), SIL = milk thistle (*Silybum* sp.), TAM = salt cedar.

Exotic vegetation was recorded in 100% (48/48) of flycatcher locations, and was considered the dominant vegetation (percent cover of exotics >50; Table 2) in 10% (5/48) of the sites. All of the exotic-dominated sites were occupied by transient flycatchers (5/5). The most common exotic plants in habitat used by transient flycatchers in 2009 were poison hemlock and black mustard. Within resident flycatcher territories, 69% (9/13) were composed of 5-50% exotic vegetation, primarily poison hemlock.

Flycatcher locations differed in their proximity to surface water (Table 2). On average, transients were nearly seven times as far from surface water (451 ± 593 m [std]), as were resident flycatchers (67 ± 47 m [std]). The majority (69%, 9/13) of resident detections were within 100 m of water, and all resident flycatchers were located within 200 m of water. In contrast, just 49% (17/35) 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 2-5 times as far from water as were residents (Kus and Kenwood 2003, 2005, 2006a, 2006b; Kenwood and Kus 2007; Rourke *et al.* 2008; Howell and Kus 2009).

Breeding Activities

Nine nesting attempts by Willow Flycatchers were documented during the 2009 breeding season (Table 3). Nesting was initiated in early June. The earliest confirmed lay date was 7 June and the latest was 12 July. Only one pair attempted more than one nest, following an unsuccessful initial attempt. Nesting continued into August, with the last young fledging on 10 August. Of the eight breeding pairs, 75% (6/8) fledged young during the 2009 breeding season.

Table 3. Nesting activity of Southwestern Willow Flycatcher pairs at Marine Corps Base Camp Pendleton in 2009.

Pair ID	Lay Date	# Eggs	# Nestlings	# Fledglings	Nest Fate[a]	Comments
AMZ	03-Jul	3	0	0	PRE	
ANG	25-Jun	3	3	0	PRE	No fledglings observed and no adults defending or present in territory after expected fledge date. Nest lining pulled up but nest otherwise intact.
APL	30-Jun	3	3	1	SUC	Host vegetation shifted; nest found tilted on side with one nestling missing on 21 Jul. 2nd nestling found dead in nest after 3rd nestling fledged.
ASA	10-Jun	3	3	3	SUC	
ETA	11-Jun	3	2	2	SUC	One egg did not hatch and was removed when nestlings were banded.
PRN	12-Jun	3	1	1	SUC	One egg disappeared and one egg punctured between 25 and 29 June.
TAR	24-Jun	3	0	0	OTH	Nest constructed in poison hemlock. Vegetation shifted; nest tipped over and eggs fell out.
	12-Jul	3	2	2	SUC	One egg did not hatch and was removed when nestlings were banded.
TLM	07-Jun	3	2	2	SUC	One egg did not hatch and was removed when nestlings were banded.

[a] OTH = Nest failed for other reasons, PRE = Nest failed as a result of predation, SUC = Nest fledged at least one young.

In 2009, 67% (6/9) of nests successfully fledged at least one flycatcher young. Predation was believed to be the primary source of nest failure, although no predation events were witnessed. Predation accounted for 67% (2/3) of nest failures. Substrate failure was the cause of the other failure. Partial predation is suspected in the disappearance of one egg and puncture of a second egg in the PRN nest.

Mean clutch size, estimated from nine nests known to have full clutches, was 3.0 ± 0.0 eggs. Three nests contained an infertile egg that did not hatch. One nestling from the APL nest

was found dead inside the nest; the cause of death was unknown. Eleven fledglings were produced, yielding an estimate of seasonal productivity of 1.4 young per pair (11 young/8 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 ($r = 0.34$, $P = 0.33$) or young/pair ($r = 0.46$, $P = 0.18$). However, we found that average clutch size was positively correlated with annual precipitation ($r = 0.66$; $P = 0.04$; Fig. 3).

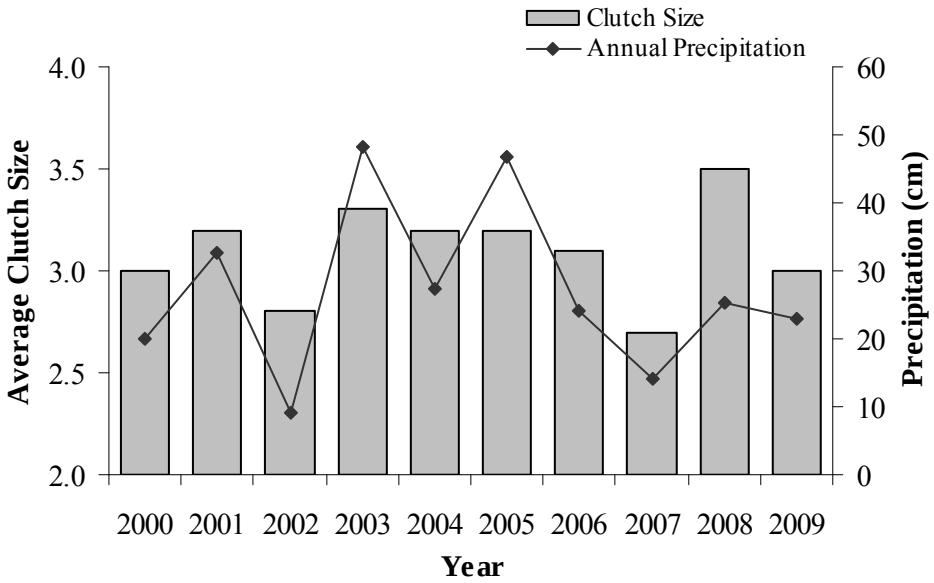

Fig. 3. Average clutch size of Southwestern Willow Flycatchers in relation to total precipitation in the preceding rainfall year (July – June), 2000-2009.

Nest Site Characteristics

Flycatchers placed nests in five species of plants (Table 4), including arroyo willow, black willow, sandbar willow, California black walnut, and poison hemlock. Seventy-eight percent of nests were placed in native species: 67% (6/9) in willow and 11% (1/9) in California black walnut. Two nests (22%, 2/9) were placed in the exotic species poison hemlock. Nest height averaged 1.9 ± 0.5 m, while host height averaged 6.8 ± 3.6m.

Table 4. Nest site characteristics of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2009. All measurements are in meters.

					Distance to the edge of:	
Pair ID	**Nest ID**	**Host Species**	**Host Height**	**Nest Height**	**Host Plant**	**Clump**
AMZ	1	Sandbar willow	4.8	1.7	0.6	1.2
ANG	1	Sandbar willow	6.0	2.0	1.9	4.0
APL	1	California black walnut	10.2	1.7	0.7	4.0
ASA	1	Sandbar willow	2.9	2.2	0.0	7.0
ETA	1	Black willow	12.0	2.6	1.1	6.0
TAR	1	Poison hemlock	3.2	2.8	0.1	-0.2
TAR	2	Arroyo willow	9.0	1.5	0.8	1.3
TLM	1	Poison hemlock	2.8	1.4	0.1	5.0
PRN	1	Black willow	10.5	1.4	2.1	2.1

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 2009.

Banded Birds

All resident Willow Flycatchers were observed closely enough to determine with confidence whether they were banded (Table 5). One hundred percent (8/8) of males, 88% (7/8) of females, and the unknown sex floater were banded in previous years. Of these, three second-year females and one second-year male that were banded with a single federal band as nestlings in 2008 were recaptured and banded with a second band to provide unique combinations. Six males and four females were originally banded on Camp Pendleton. One male, one female, and the unknown sex floater were most likely banded on Camp Pendleton as nestlings in 2008; however, they were not recaptured to confirm their natal origins. One male and one female were originally banded on the San Luis Rey River, at Whelan Lake and Guajome Regional Park, respectively.

One unbanded adult female was captured and banded with a unique combination. Fifteen nestlings from seven nests were banded (Appendix D). All, except three nestlings from ANG and one nestling from APL, are believed to have fledged.

The colored pin-striping on the TLM female's band appeared to have peeled off, rendering identification impossible. Multiple attempts to target-net the female to replace the band and determine her identity were unsuccessful.

No banded transients were detected during surveys.

Table 5. Band status of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2009.

Territory / Bird ID	Status[a]	Male Banded?[b]	Female Banded?[b]	Nestlings Banded?	Comments[c]
AMZ	P	Msi : rere	Msi : -		Male banded in 2005 as an adult at Air Station. Female likely banded as a nestling in 2008, but disappeared before recapture. Male polygynous with three other females (ANG, APL, ASA).
ANG	P	Msi : rere	ordb : Msi	3	Female banded in 2009. Male polygynous with three other females (AMZ, APL, ASA).
APL	P	Msi : rere	Msi : reor	2	Female banded in 2008 as a nestling at Pump Road and color-banded in 2009. Male polygynous with three other females (AMZ, ANG, ASA).
ARC	S	Msi : yere	N/A		Male banded in 2004 as a nestling at Ysidora Ponds.
ASA	P	Msi : rere	Msi : orye	3	Female banded in 2008 as a nestling at Treatment Ponds and color-banded in 2009. Male polygynous with three other females (AMZ, ANG, APL).
EDY	S	Msi : -	N/A		Male likely banded as a nestling in 2008, but could not be recaptured to confirm identity.
ETA	P	Msi : yewh	Msi : dgye	2	Male banded in 2008 as an adult at Pueblitos and color-banded in 2009. Female banded in 2005 as an adult at Guajome Lake on the San Luis Rey River. The female's band was changed; originally banded Msi :dbdb.
MB05F	S	Msi : dbre	N/A		Male banded in 2008 as a nestling at Pueblitos and color-banded in 2009.
PNB	S	Msi : yere	N/A		Male banded in 2004 as a nestling at Ysidora Ponds. Moved to ARC territory part way through the 2009 season.
PRN	P	dbdb : Msi	Msi : sire	1	Male banded in 2005 as a nestling at Whelan Lake on the San Luis Rey River. Female banded in 2004 as a nestling at Bell.
PR04F	F	Msi : -			Unknown sex bird likely banded as a nestling in 2008, but could not be recaptured to confirm identity.

Table 5 (*continued*). Band status of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2009.

Territory / Bird ID	Status[a]	Male Banded?[b]	Female Banded?[b]	Nestlings Banded?	Comments[c]
TAR	P	Mdg : reye	Msi : whwh	2	Male banded in 2004 as an adult at Pueblitos. Female banded in 2008 as a nestling at Air Station and color-banded in 2009.
TLM	P	orye : Msi	sisi : Msi	2	Male banded in 2006 as an adult at Ysidora Ponds. Female was banded, but colored pin-striping on band appears to have peeled off.

[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, dbre = dark blue-red split, dgye = dark green-yellow split, ordb = orange-dark blue split, orye = orange-yellow split, reor = red-orange split, rere = red, reye = red-yellow split, sire = silver-red split, sisi = silver, whwh = white, yeor = yellow-orange split, yere = yellow-red split, yewh = yellow-white split.

[c] See Fig. 4; Appendix B, Figs. 11, 17; Appendix C, Figs. 20-24 for breeding area and territory locations.

Survivorship, Site Fidelity, and Movement

The recapture and resighting of banded birds allowed us to determine the proportion of flycatchers previously documented on Base that returned to hold territories in 2009. 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 2008 breeding season, 100% (6/6) of males and 29% (2/7) of females returned to Camp Pendleton in 2009. Overall, adult survivorship from 2008 on Camp Pendleton was 62% (8/13). Return rates were calculated based on banded birds with confirmed, unique color-band combinations, and do not include the TLM female whose original band combination could not be determined. Because adult flycatchers exhibit high site fidelity, it is likely that the TLM female was present during the 2008 breeding season. If TLM is incorporated into the survivorship calculations, the estimate of total adult survivorship from 2008 on Camp Pendleton increases to 69% (9/13), with a revised female return rate of 43% (3/7).

Four of the 20 nestlings banded in 2008 that survived to fledge were resighted and re-captured at Camp Pendleton in 2009, and one additional 2008 nestling was captured off-Base, yielding an estimate of first-year survivorship of 25% (5/20). The four birds returning to Camp Pendleton included three females and one male (Table 6). All returning second-year females paired and nested in 2009 and the returning second-year male held a territory as a single male. Three additional birds were resighted in 2009 with a single federal band on the left leg, suggesting that they were 2008 nestlings; however, they could not be recaptured to confirm this. If these birds are incorporated into the return rate, the estimate of first-year survivorship increases to 40% (8/20).

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. At the onset of the 2009 breeding season, seven of the eight banded returning adults (88%) had returned to the breeding area they occupied in 2008 (Table 6). Five of the adult flycatchers were male, and two were female, and either returned to the same territories they previously occupied, or occupied a territory that encompassed a portion of the area they previously defended. The other returning adult, a single male, initially moved to a different breeding area within the Santa Margarita River at the beginning of the 2009 breeding season (Table 6, Fig. 4). The male flycatcher moved from the Air Station area to the Pump Road area, approximately 1.3 km away. However, this male moved back to the Air Station area mid-season and defended the same territory he held in 2008. The average distance moved by adult flycatchers between the 2008 and 2009 breeding seasons was 0.2 ± 0.5 km.

In contrast to returning adults, none of the four returning second-year birds banded as nestlings in 2008 returned to their natal areas to breed. The second-year male, banded as a nestling in the Pueblitos area, dispersed to San Mateo Creek, a distance of 22.9km. Of the three females, two were banded as nestlings in the Pump Road and Treatment Ponds areas, and dispersed to the Air Station area, approximately 1.6 and 1.4 km away, respectively (Table 6, Fig. 4). The other female was banded in the Air Station area and dispersed to the Treatment Ponds area, approximately 1.4 km away (Table 6, Fig. 4). The average distance that second-year birds dispersed from their natal areas was 4.6 ± 9.0 km.

One instance of emigration occurred during the 2009 breeding season. A single male, originally banded as a nestling in 2008 in the Treatment Ponds area, was detected 61 km south of the Base on the San Diego River (Lynn *et al.* 2010). No instances of immigration were seen in 2009.

Two instances of movement by adult Willow Flycatchers within the 2009 season were observed. The first instance occurred when a single male in the Pump Road area (PNB) moved to the Air Station area. He remained single and defended the same territory he held during the 2008 breeding season (ARC). The second instance involved the AMZ female nesting in the Air Station area. This female was not detected after her first nesting attempt failed.

Table 6. Between-year, between-area movement of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2009.

Year Last Detected	Area (Territory Last Detected)[a]	Area (Territory in 2009)	Dispersal Distance (km)	Band Combination[b]	Age in 2009	Sex[c]
2008	Air Station (ANG/ASA)	Air Station (AMZ/ANG/APL/ASA)	0.0	Msi : rere	≥ 5 yrs	M
2008	Pueblitos (ETA)	Pueblitos (ETA)	0.0	Msi : yewh	≥ 2 yrs	M
2008	Treatment Ponds (TAR)	Treatment Ponds (TAR)	0.0	Mdg : reye	≥ 6 yrs	M

Table 6 (*continued*). Between-year, between-area movement of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2009.

Year Last Detected	Area (Territory Last Detected)[a]	Area (Territory in 2009)	Dispersal Distance (km)	Band Combination[b]	Age in 2009	Sex[c]
2008	Pueblitos (ETC/EWN)	Treatment Ponds (TLM)	0.2	orye : Msi	≥ 4 yrs	M
2008	Air Station (ARC)	Pump Road (PNB)	1.3	Msi : yere	5 yrs	M
2008	Pump Road (PRN)	Pump Road (PRN)	0.0	dbdb : Msi	4 yrs	M
2008	Pueblitos (ETA)	Pueblitos (ETA)	0.0	Msi : dgye	≥ 5 yrs	F
2008	Pump Road (PRN)	Pump Road (PRN)	0.0	Msi :sire	5 yrs	F
2008	Pueblitos (ETA)	San Mateo Creek (MB05F)	22.9	Msi : dbre	1 yr	M
2008	Pump Road (PRN)	Air Station (APL)	1.6	Msi : reor	1 yr	F
2008	Treatment Ponds (TAR)	Air Station (ASA)	1.4	Msi : orye	1 yr	F
2008	Air Station (ASA)	Treatment Ponds (TAR)	1.4	Msi : whwh	1 yr	F

[a] See Fig. 4, Appendix B, Figs. 11, 17; Appendix C, Figs. 20-24 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, dbre = dark blue-red split, dgye = dark green-yellow split, orye = orange-yellow split, reor = red-orange split, rere = red, reye = red-yellow split, sire = silver-red split, whwh = white, yere = yellow-red split, yewh = yellow-white split.
[c] Sex: M = male, F = female.

Human Activities in Riparian Habitat

A large swath of riparian vegetation including arroyo willow and mule fat was mowed in an active flycatcher territory during the 2009 breeding season. The MB05F territory, located inside the San Mateo sewage ponds, was occupied by a single male. During a routine territory visit, we discovered the mowers in the process of removing vegetation in an adjacent pond, and the vegetation in the pond occupied by the flycatcher had already been removed. AC/S, Environmental Security was notified immediately and the mowing was stopped. However, the male flycatcher was not detected after vegetation removal.

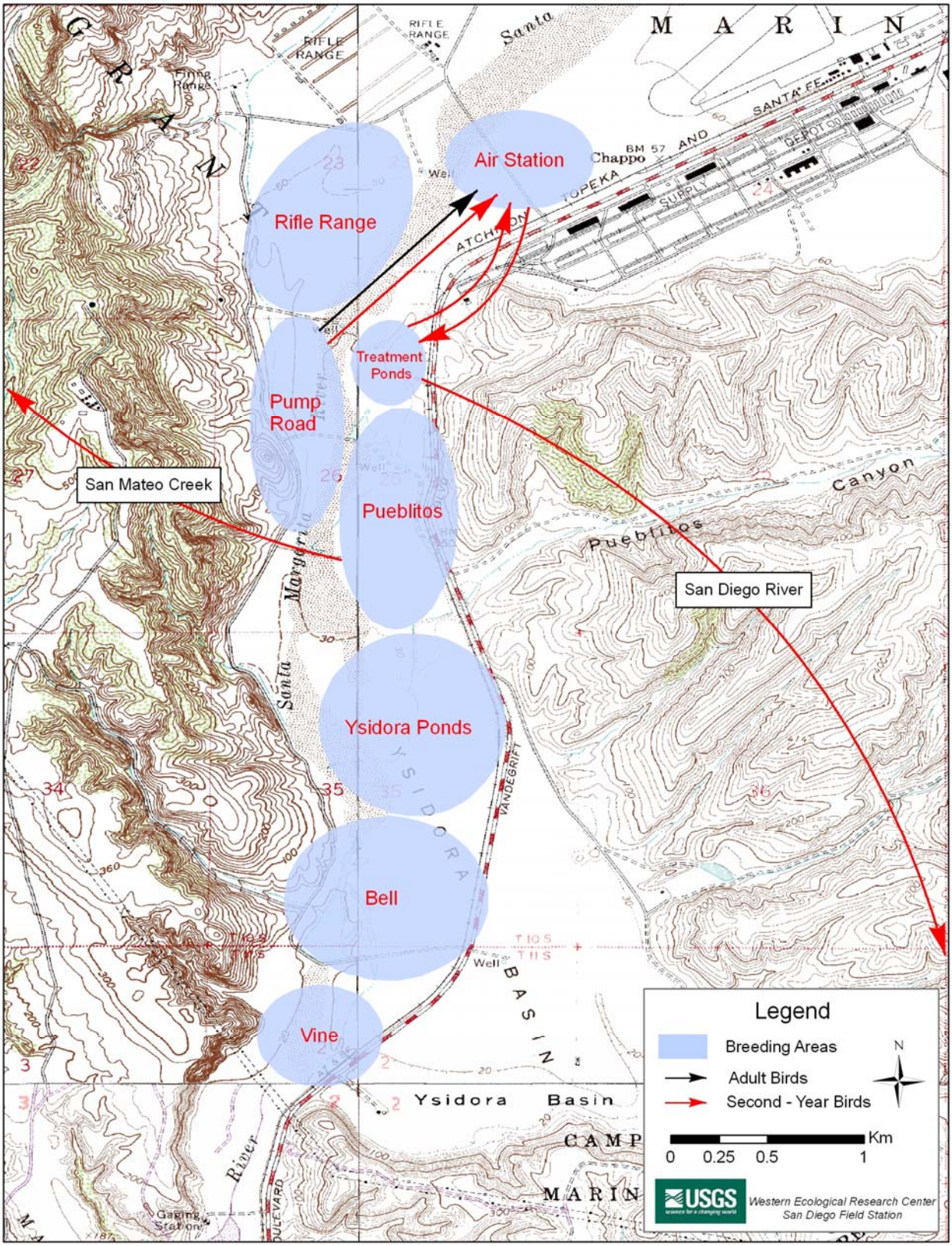

Fig. 4. Between-year, between-area movement by adult and second-year Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton, 2009.

DISCUSSION

Camp Pendleton continues to provide important habitat for both migrating and breeding Willow Flycatchers. The number of transient flycatchers detected in 2009 (35) was down from 2008 (55; Howell and Kus 2009), but equal to the numbers observed in 2005 and 2006 (Kus and Kenwood 2006b; Kenwood and Kus 2007). The number of transients detected annually since 2002 has varied greatly, despite consistent survey scope and effort, from a high of 102 (2002; Kus and Kenwood 2003), to a low of 35 (2005, 2006, and 2009; Kus and Kenwood 2006b; Kenwood and Kus 2007). On average, transient flycatcher detections were approximately 450 m from the nearest surface water, nearly seven times greater than resident flycatcher detections. Forty-six percent of transient flycatchers were detected along San Mateo Creek, which held very little surface water in 2009, explaining some of the variation in distance to nearest surface water between transients and residents.

The resident population of Southwestern Willow Flycatchers on Camp Pendleton in 2009 (17 individuals) increased slightly compared to 2008 (15); however, these numbers still represent a 50% decline compared to the 2000-2007 annual mean (34 ± 5 individuals). The resident population peaked in 2004 with 42 individuals but has declined markedly in recent years, most notably between 2007 and 2008 when the population declined by 42%.

As in previous years, resident flycatchers were largely distributed among historic breeding locations, although the number of territories in each location differed compared to previous years. Breeding flycatchers on the Santa Margarita River in 2009 increased slightly (eight pairs) compared to 2008 (seven pairs; Howell and Kus 2009). Distribution of resident flycatchers within two of the core breeding areas increased, with both the Air Station and Treatment Ponds sites supporting more birds than in 2008. Four resident pairs and one single male were documented within the Air Station site, up from two resident pairs, one single male, and a non-territorial floater in 2008. The Treatment Ponds area supported two breeding pairs in 2009, up from one breeding pair in 2008. The Pump Road area remained the same as in 2008, hosting a single nesting pair and one single male. Resident flycatchers in the Pueblitos area decreased to one breeding pair and one single male, down from three breeding pairs in 2008. There are no known causes for the decline of resident flycatchers in the Pueblitos area between 2008 and 2009. Factors influencing territory selection from year to year are poorly understood. Continued research may contribute to a better understanding of habitat selection in flycatchers. The distribution of resident flycatchers away from the Santa Margarita River was limited to a single male near San Mateo Creek. San Mateo Creek was initially colonized by a nesting pair in 2007 (Rourke *et al.* 2008), but was devoid of resident flycatchers in 2008 (Howell and Kus 2009).

The Air Station site presents an interesting look at flycatcher response to giant reed removal. Prior to removal, the Air Station site (outside the current Marine Corps Air Station (MCAS) levee) supported three to four pairs annually from 1996 to 2000 (Griffith Wildlife Biology 1997, 1998, 1999a, 1999b; Kus 2001). Giant reed removal took place during the fall of 2000, creating more open conditions with little to no understory for the 2001 breeding season, when two pairs returned. In 2002, a single pair used some habitat in the Air Station, but nested

inside the MCAS levee. No birds were detected in 2003; 2004 had one nesting pair; 2005 had a single male; and again no birds were detected in 2006. Two pairs nested in 2007; and two pairs, a single male, and a floater held territories in 2008. With four resident pairs and one single male holding territories in 2009, flycatchers are once again occupying the Air Station site in numbers comparable to pre-removal surveys. While no data on vegetation recovery were taken to support these observations, the understory has returned and vegetative cover has improved. It appears that the habitat at the Air Station site is returning to conditions favored by breeding Willow Flycatchers after a six to seven year lag time.

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 2009, the majority (88%; 7/8) of adult flycatchers were documented holding a territory that was the same or encompassed a portion of the territory they held in 2008, the highest percentage of site faithful adults since monitoring began in 2000 (Kus 2001; Kus and Ferree 2002; Kus and Kenwood 2003, 2005, 2006a, 2006b; Kenwood and Kus 2007; Rourke *et al*. 2008; Howell and Kus 2009). Between-year site fidelity is highly variable from year to year, ranging from a low of 40% in 2008 (Howell and Kus 2009) to a high of 88% in 2009. Habitat conditions and suitability may be an important factor in annual flycatcher movement between breeding sites. It is possible that 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. The one adult flycatcher that moved to a different breeding area in 2009 had remained single during the 2008 breeding season (Howell and Kus 2009). At the beginning of the 2009 breeding season, he returned to an area close to his 2007 territory, where he last successfully fledged young (Rourke *et al.* 2008). After failing to pair at this location, he moved within the breeding season to defend the same territory he held in 2008. In contrast to adults, all returning 2008 nestlings dispersed to areas away from their natal territories.

While all the banded male flycatchers present in 2008 returned to Camp Pendleton in 2009, only 43% (including TLM female whose exact identity was unknown) of 2008 banded females returned in 2009. The low return rate of females in 2008 (36%; Howell and Kus 2009) and 2009 returned the breeding population to an equal sex ratio after four years (2004-2007) with a female-biased sex ratio. Prior to the 2008 breeding season, the number of female Willow Flycatchers had 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), with the mean number of female flycatchers averaging 17.0 ± 2.6 (std) per year from 2001 to 2007.

The degree of male polygyny in the population dropped to 20% in 2009, with only 1/5 paired males polygynous; however, the rate of female polygyny remained high with 50% (4/8) of females sharing mates. As in previous years, single males were present in the population during the 2009 breeding season, but half the females still chose instead to pair with a polygynous bird. 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.

Nest success remained high during the 2009 breeding season, with 67% of nests fledging at least one flycatcher young, down from a high of 88% in 2008, but still above the 2001-2008 annual mean (58%; Kus and Ferree 2002; Kus and Kenwood 2003, 2005, 2006a, 2006b; Kenwood and Kus 2007; Rourke *et al*. 2008; Howell and Kus 2009). Although nest success was high, seasonal productivity matched the record low set in 2007 (Rourke *et al.* 2008) of 1.4 young per pair. Eleven young were fledged in 2009, almost half the number fledged in 2008 (20; Howell and Kus 2009), and one more than the number fledged in 2007 (10; Rourke *et al.* 2008). The reduction in overall productivity did not appear to stem from a decrease in clutch size; average clutch size was 3.0 eggs/nest, comparable to the 2001-2008 mean (3.1 eggs/nest), but rather from a combination of losses during the egg and nestling stages. Five losses occurred during the egg stage as a result of inviable eggs that failed to hatch ($n = 3$) and suspected partial predation ($n = 2$). Two losses occurred during the nestling stage: one nestling disappeared after vegetation shifted, causing the nest to tilt, and one nestling died for unknown reasons. Of the 18 eggs laid in successful nests in 2009, these seven losses represent a 39% reduction in the number of young that could have been produced had they hatched/survived. Additionally, three young disappeared on or around fledge date, further reducing overall productivity.

The return rate of banded adults between 2008 and 2009 (62%) was the highest seen since 2002 when 70% of banded birds from the previous year returned (Kus and Kenwood 2003). The return of second-year birds to Camp Pendleton was equal to that in 2008 at 20% (4/20). If we include the three additional birds seen with a natal band that could not be captured to confirm that they were 2008 nestlings, the 2009 return rate would set a record high of 35% (7/20), beating the previous record high set in 2003 (27%; Kus and Kenwood 2005). The total percentage of adults within the breeding population that were banded as nestlings tends to increase annually. In 2009, 53% (9/17; including the three unconfirmed 2008 nestlings) of the adult flycatchers on Base were originally banded as nestlings, compared to 40% (6/15) in 2008 (Howell and Kus 2009) and 31% (8/26) in 2007 (Rourke *et al.* 2008). 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.

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 ten times since 2002, with eight individuals immigrating from the nearby population on the San Luis Rey River (9-24 km distance; Kus and Kenwood 2003, 2006a, 2006b; Kenwood and Kus 2007; Howell and Kus 2009), and two birds emigrating off Base to Guajome Regional Park on the San Luis Rey River (Kus and Kenwood 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. While no immigration of banded birds onto Base was seen in 2009, one unbanded flycatcher entered the breeding population. One instance of emigration off Base was observed in 2009. A second-year male dispersed from his natal site in the Treatment Ponds breeding area to the San Diego River, a

distance of 61 km. This is the first detection of a Camp Pendleton natal bird off Base since monitoring began in 2000 (Kus 2001; Kus and Ferree 2002; Kus and Kenwood 2003, 2005, 2006a, 2006b; Kenwood and Kus 2007; Rourke *et al.* 2008; Howell and Kus 2009). We also observed long distance movement between drainages on Camp Pendleton, which given the distance, could be considered emigration. A second-year male dispersed from his natal site in the Pueblitos breeding area to San Mateo Creek, a distance of 22.9 km. The average dispersal distance of second-year males returning to Camp Pendleton (n = 6) from 2001-2008 was 1.03 ± 0.5 km. (Kus and Ferree 2002; Kus and Kenwood 2003, 2005, 2006a, 2006b; Kenwood and Kus 2007; Rourke *et al*. 2008; Howell and Kus 2009). The movement of both birds is an encouraging sign that movement between regional flycatcher populations may not be limited to sources close to Camp Pendleton. With historical sources such as Whelan Lake and Guajome Regional Park on the San Luis Rey River now defunct, long distance dispersal will become increasingly important in maintaining genetic diversity in the Camp Pendleton population. 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.

With the continued decline of Southwestern Willow Flycatchers on Base, communication between AC/S, Environmental Security and other military departments will become increasingly important. Coordination of maintenance activities such as vegetation clearing through AC/S, Environmental Security will minimize impacts in active territories. Coordination and cooperation among the various departments will help maintain a balance between the sometimes competing land uses on Base including military activities, recreation, habitat protection, and endangered species management.

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 (Schuetz *et al.* 2008) and the lower San Luis Rey River (Ferree and Kus 2008) have experienced steep declines or been eradicated in recent years. The exception appears to be the upper San Luis Rey population, where the number of territories declined only slightly between 1999 (18; Kus *et al*. 1999) and 2009 (15; USGS Western Ecological Research Center, San Diego Field Station unpubl. data). It is encouraging that one unbanded flycatcher was detected on Base in 2009, suggesting that there is still emigration occurring from other nearby drainages. This may also suggest that the habitat on Camp Pendleton is still suitable for flycatchers. 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 habitat restoration by removing and treating exotic vegetation to improve 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, 2009

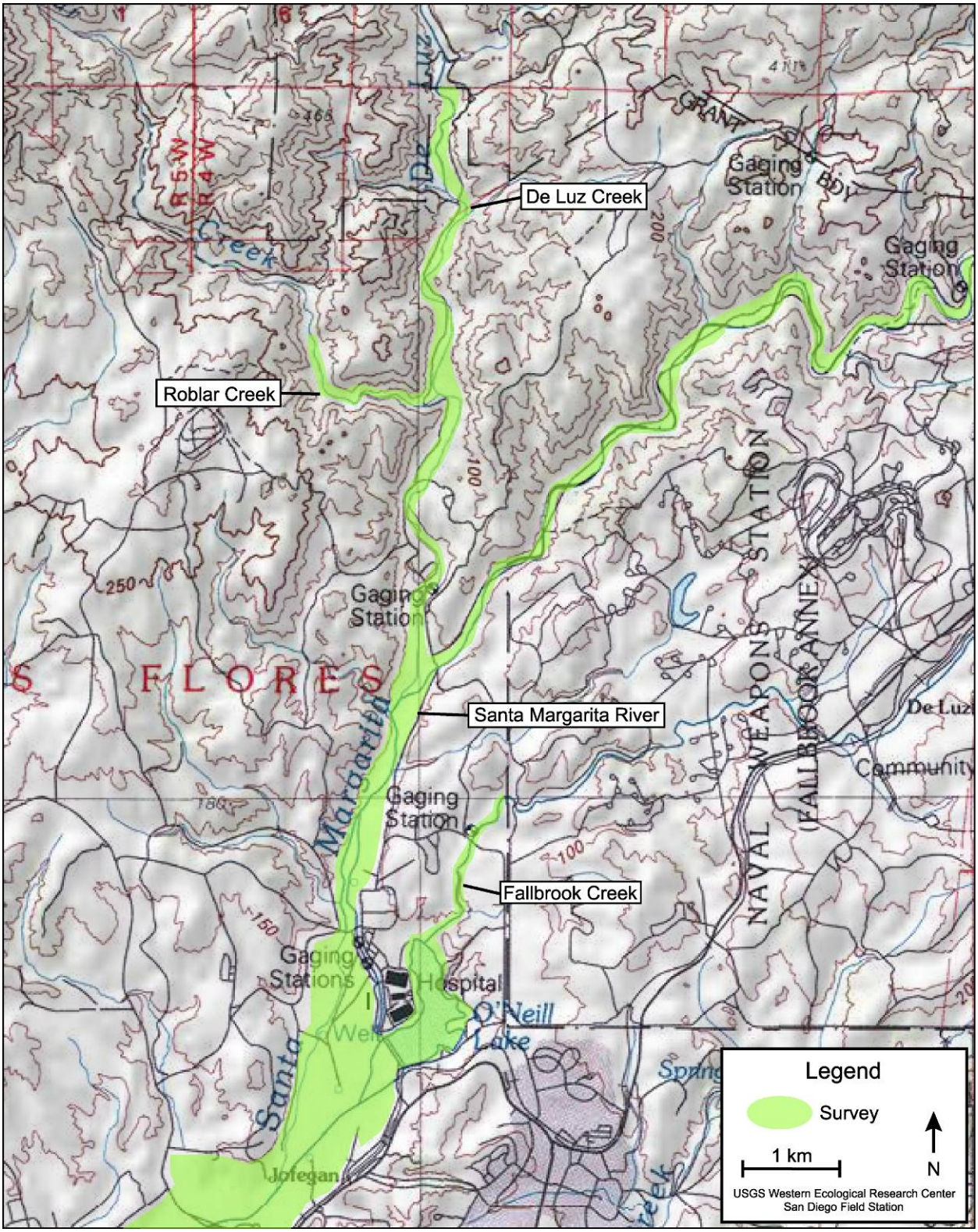

Fig. 5. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2009: Santa Margarita River, Fallbrook Creek, De Luz Creek and Roblar Creek.

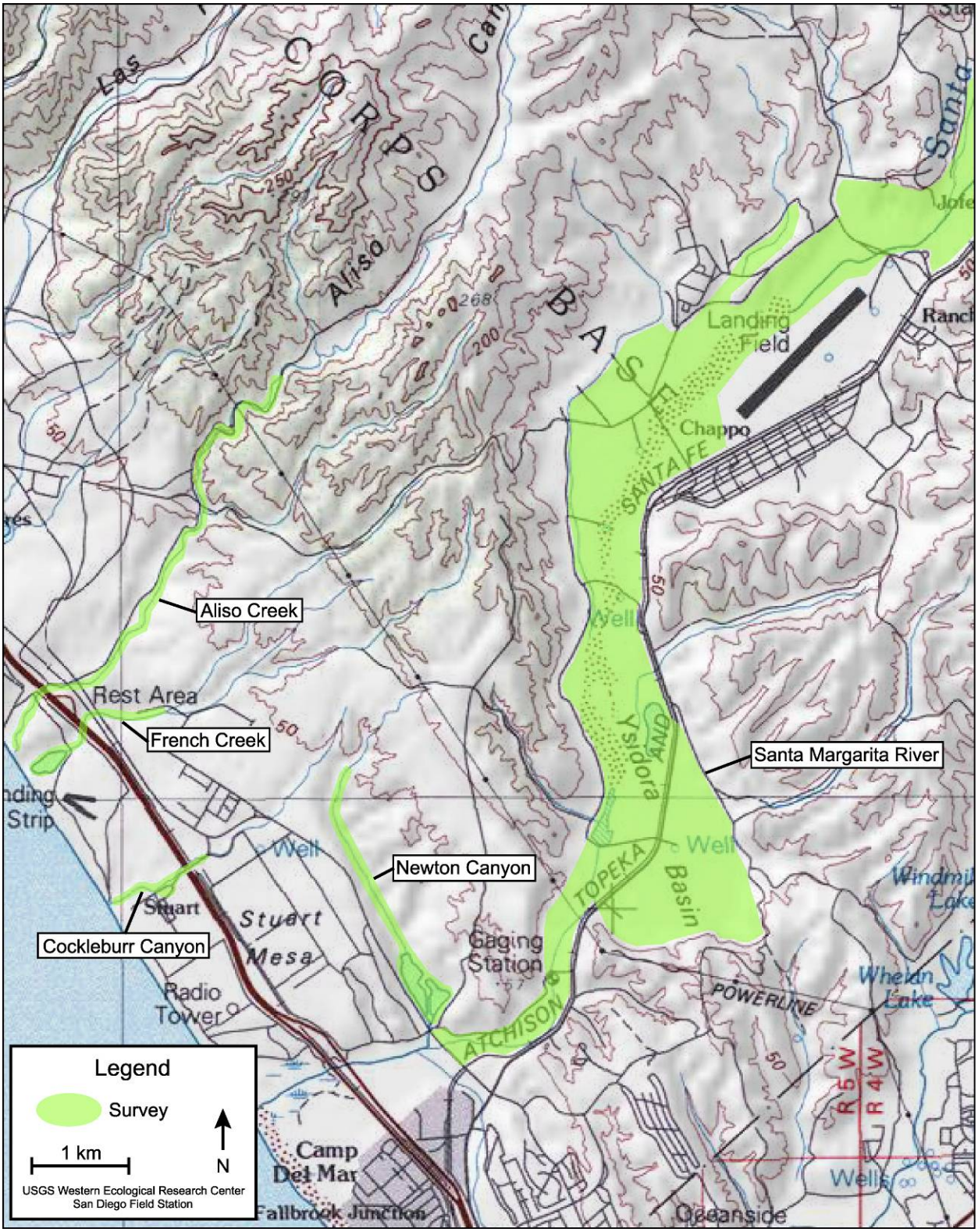

Fig. 6. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2009: Santa Margarita River, Newton Canyon, Cockleburr Canyon, French Creek, and Aliso Creek.

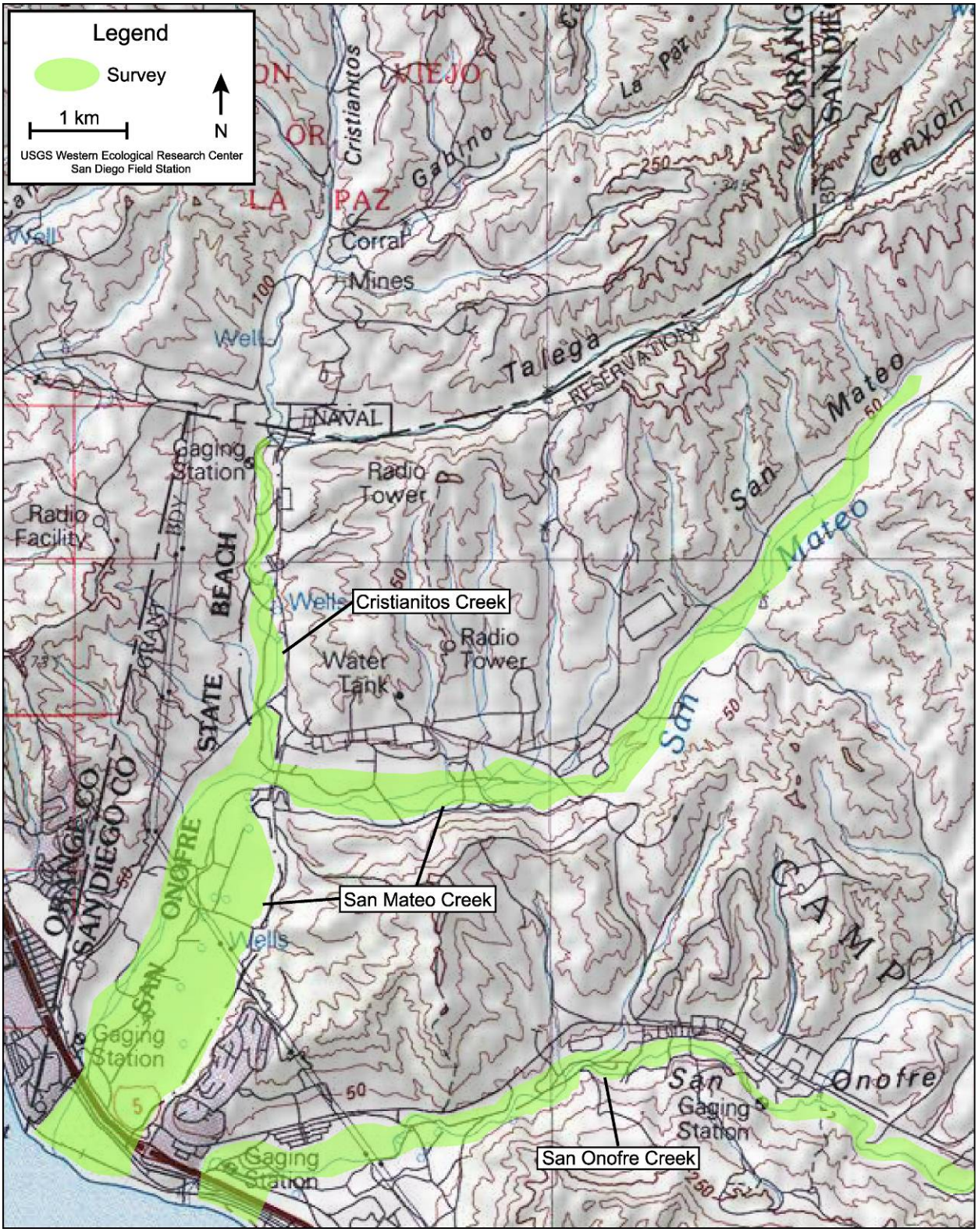

Fig. 7. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2009: Cristianitos Creek, San Mateo Creek and San Onofre Creek.

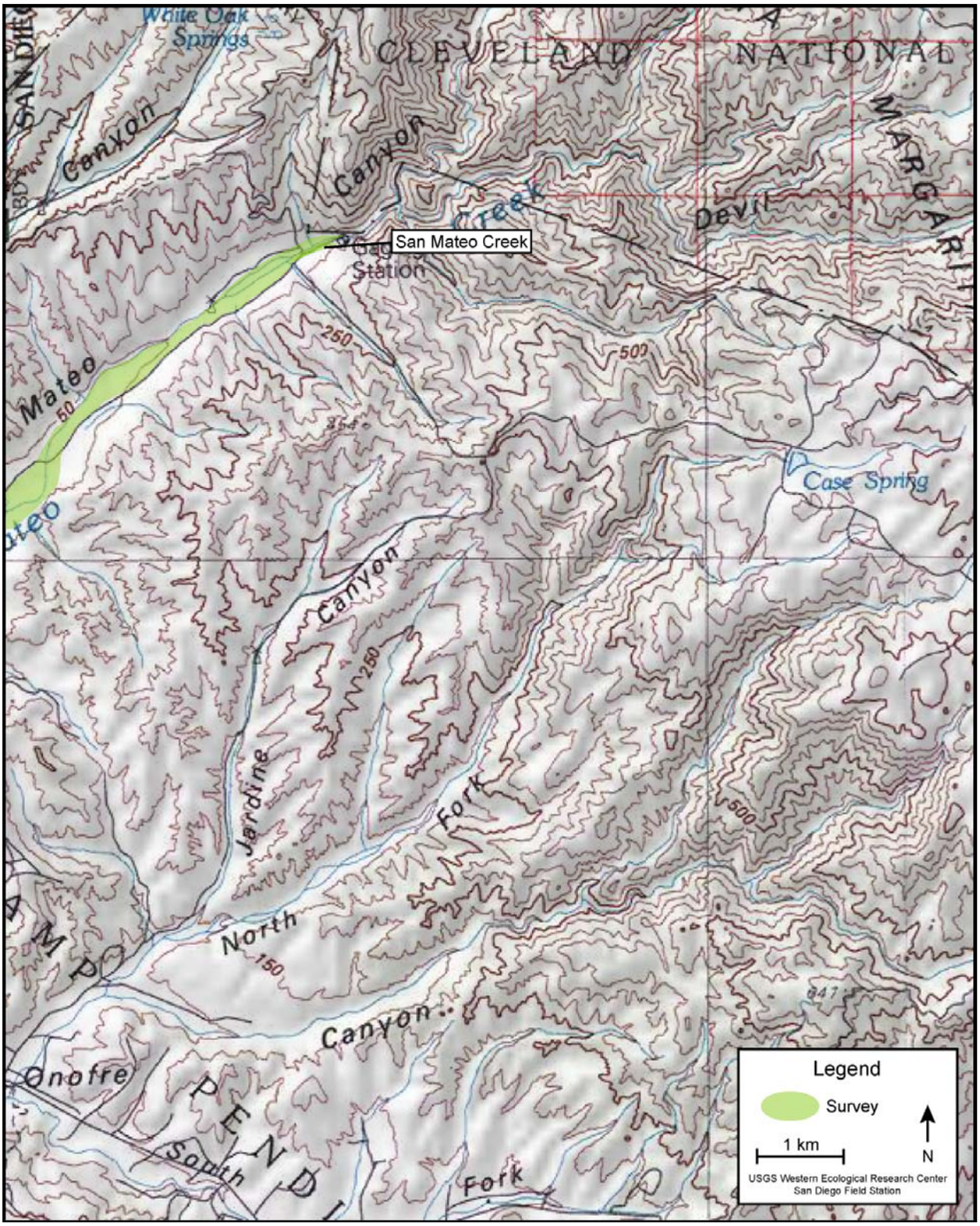

Fig. 8. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2009: San Mateo Creek.

Fig. 9. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2009: Las Flores Creek, Piedra de Lumbre Canyon, Horno Canyon, and San Onofre Creek.

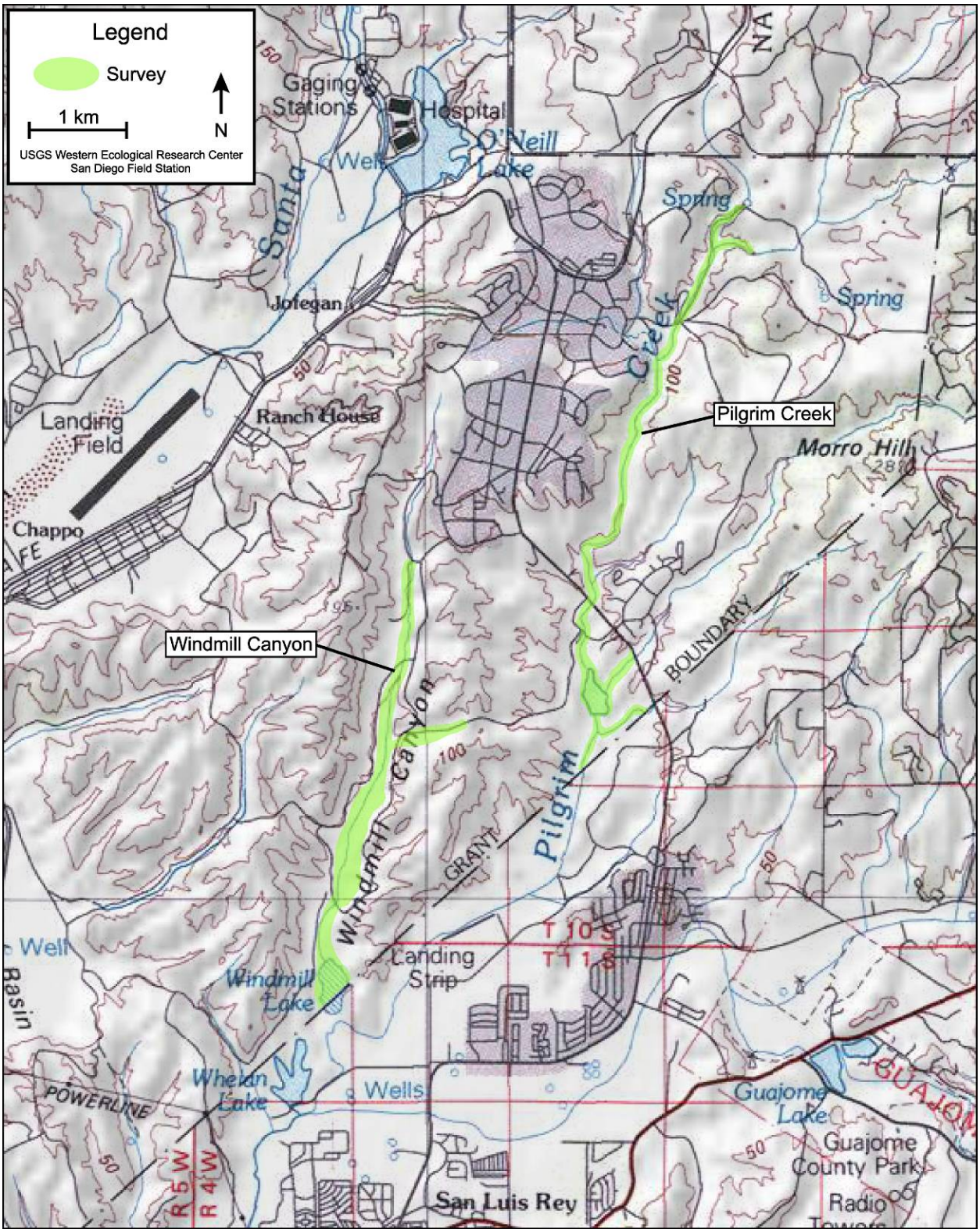

Fig. 10. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2009: Windmill Canyon and Pilgrim Creek.

APPENDIX B

LOCATIONS OF SOUTHWESTERN WILLOW FLYCATCHERS AT MARINE CORPS BASE CAMP PENDLETON, 2009

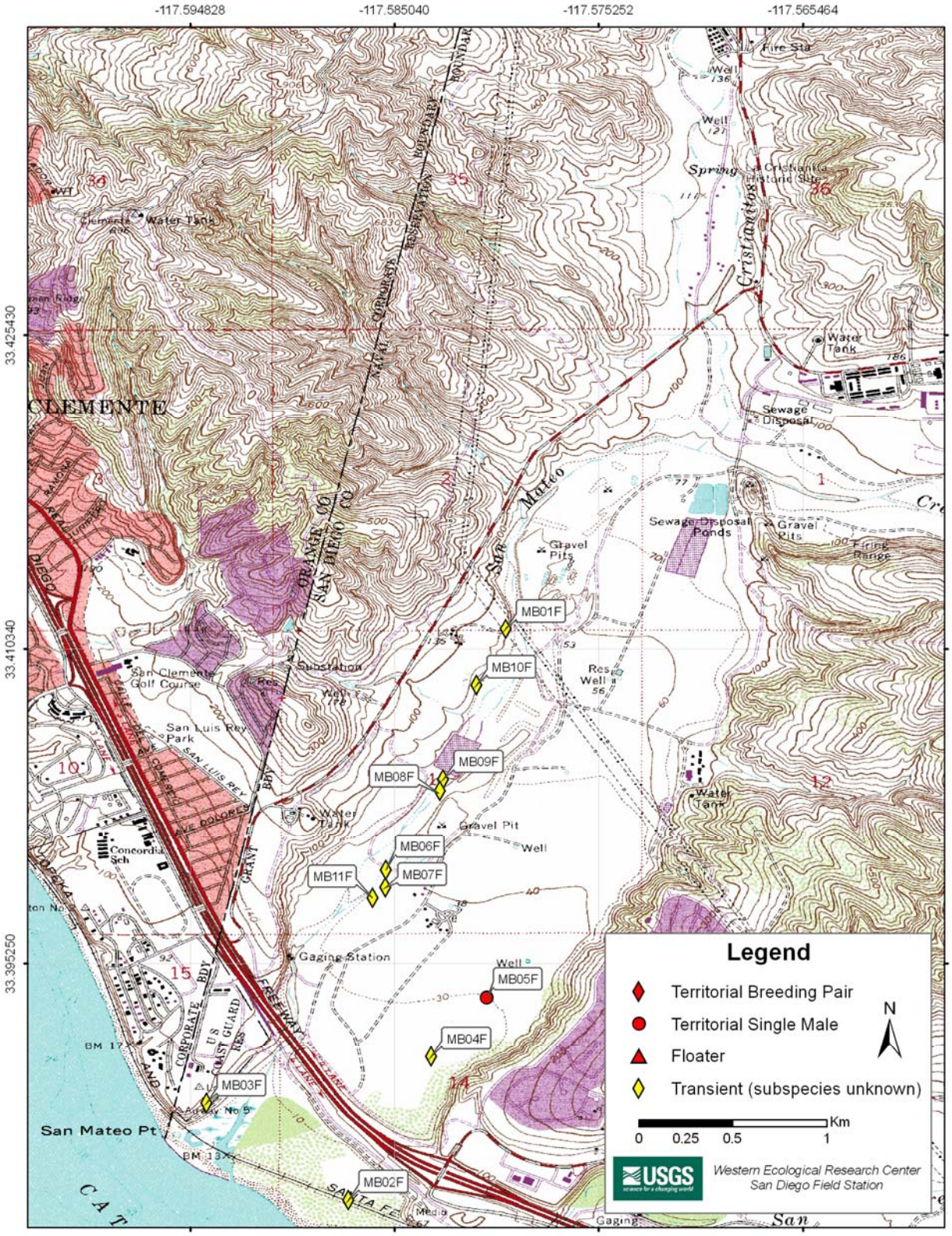

Fig. 11. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2009: San Mateo Creek (downstream).

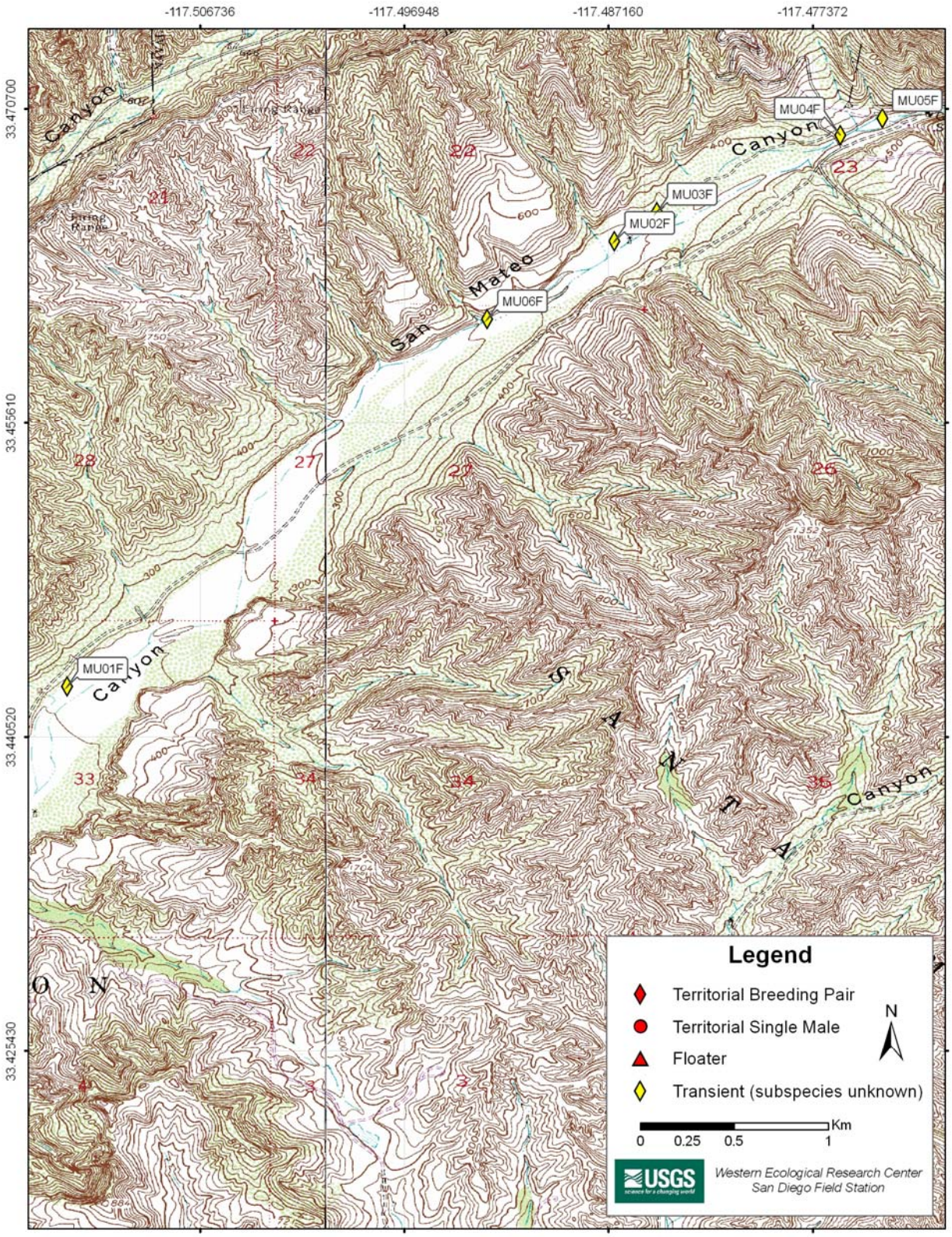

Fig. 12. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2009: San Mateo Creek (upstream).

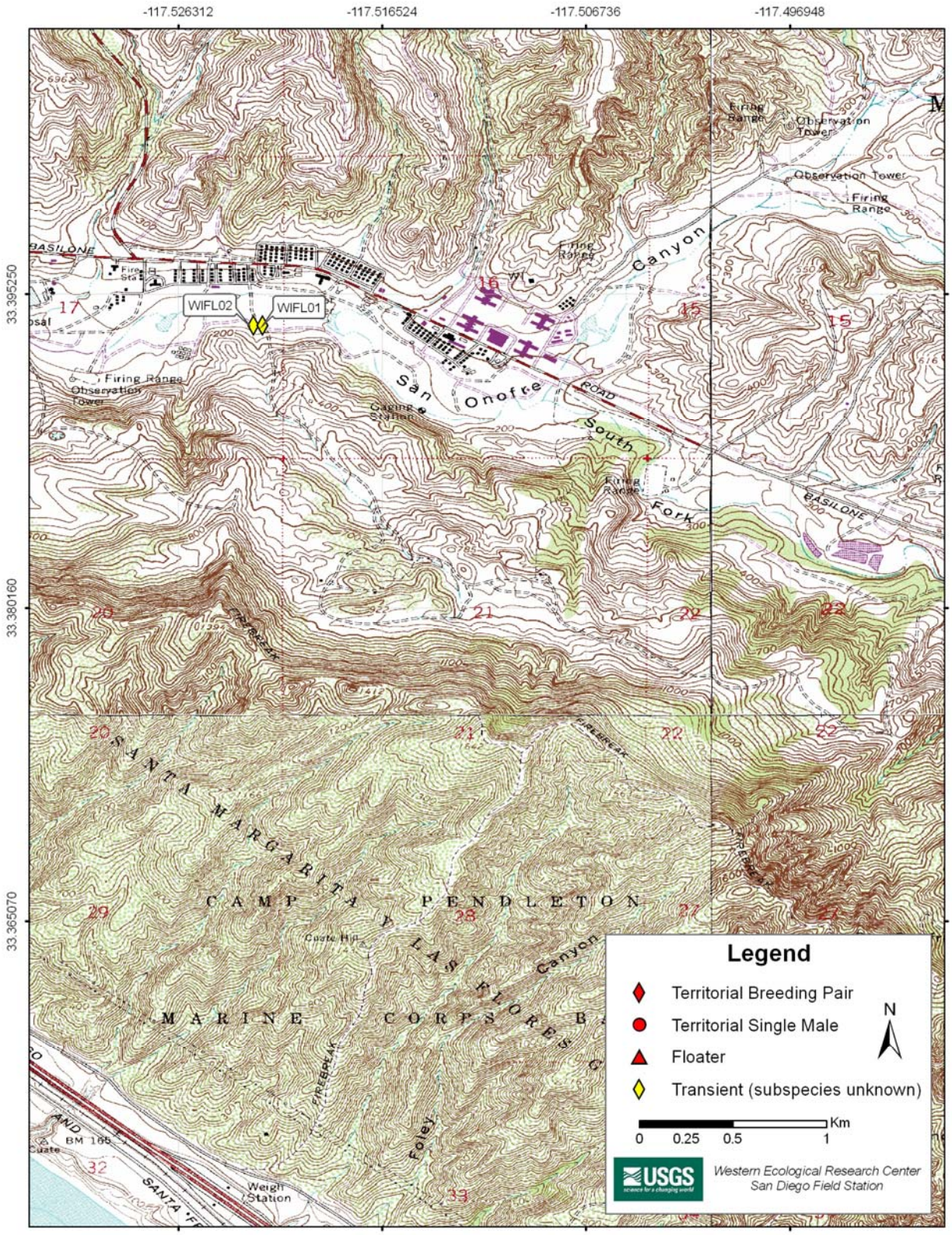

Fig. 13. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2009: San Onofre Creek (uptream).

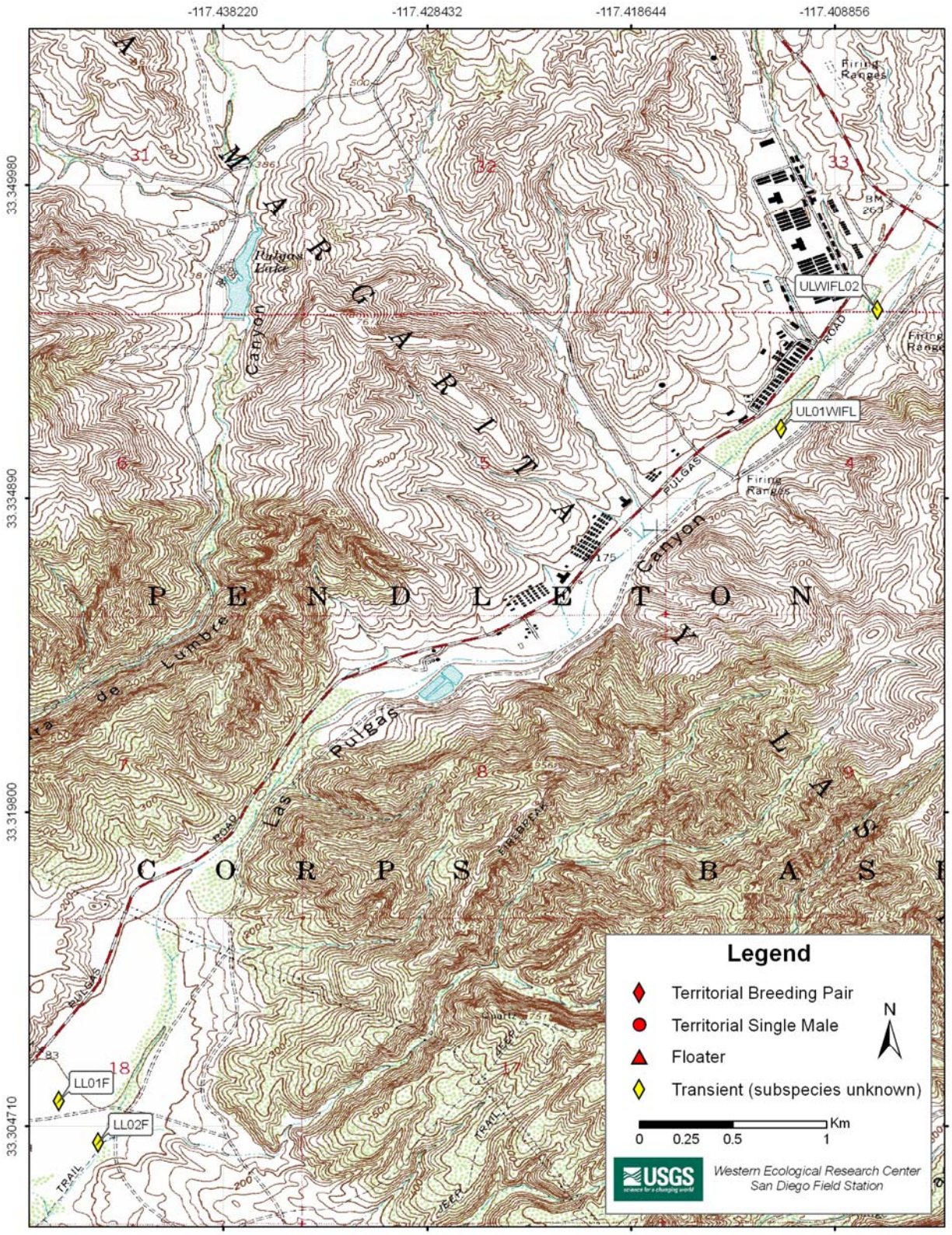

Fig. 14. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2009: Las Flores Creek.

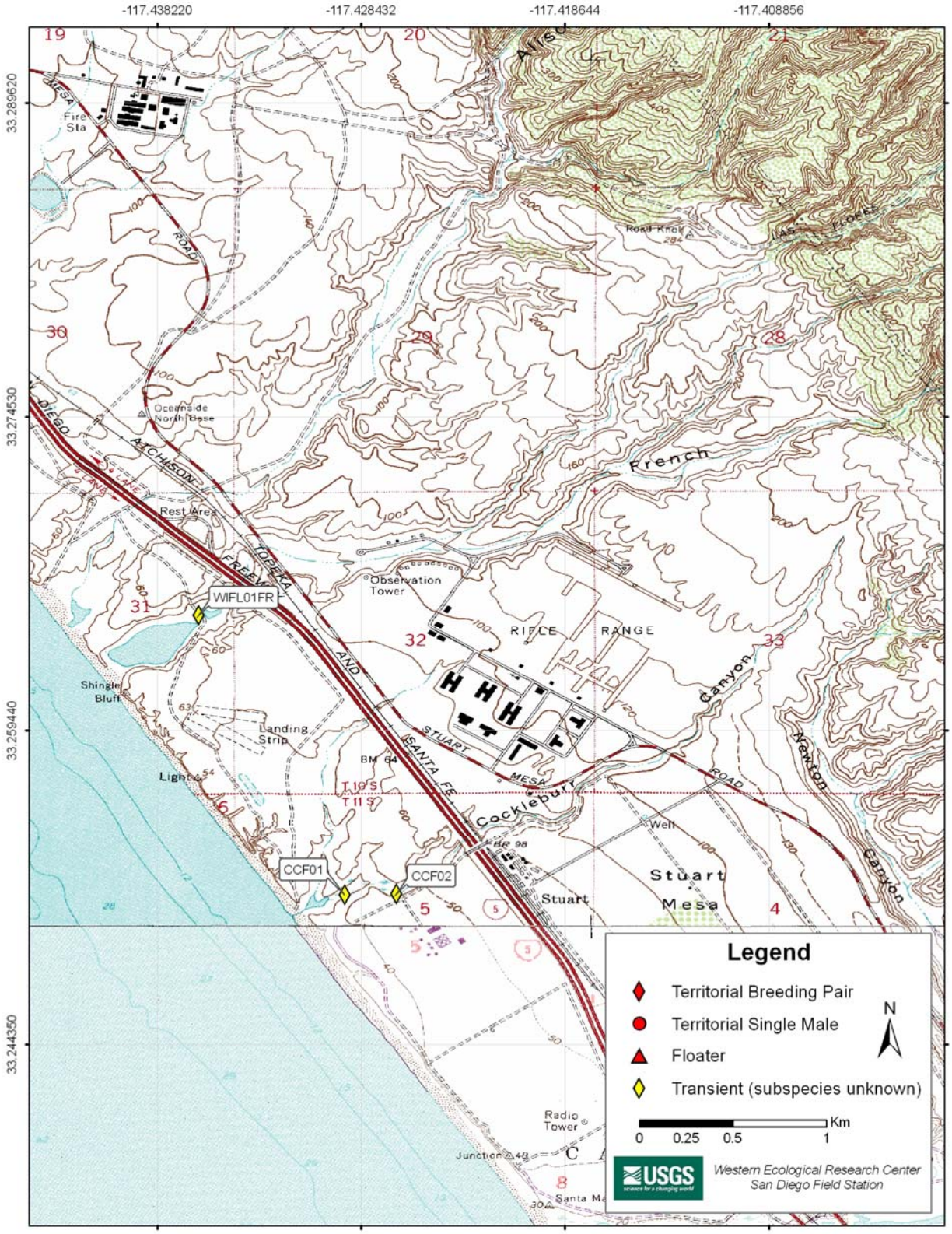

Fig. 15. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2009: French Creek and Cockleburr Canyon.

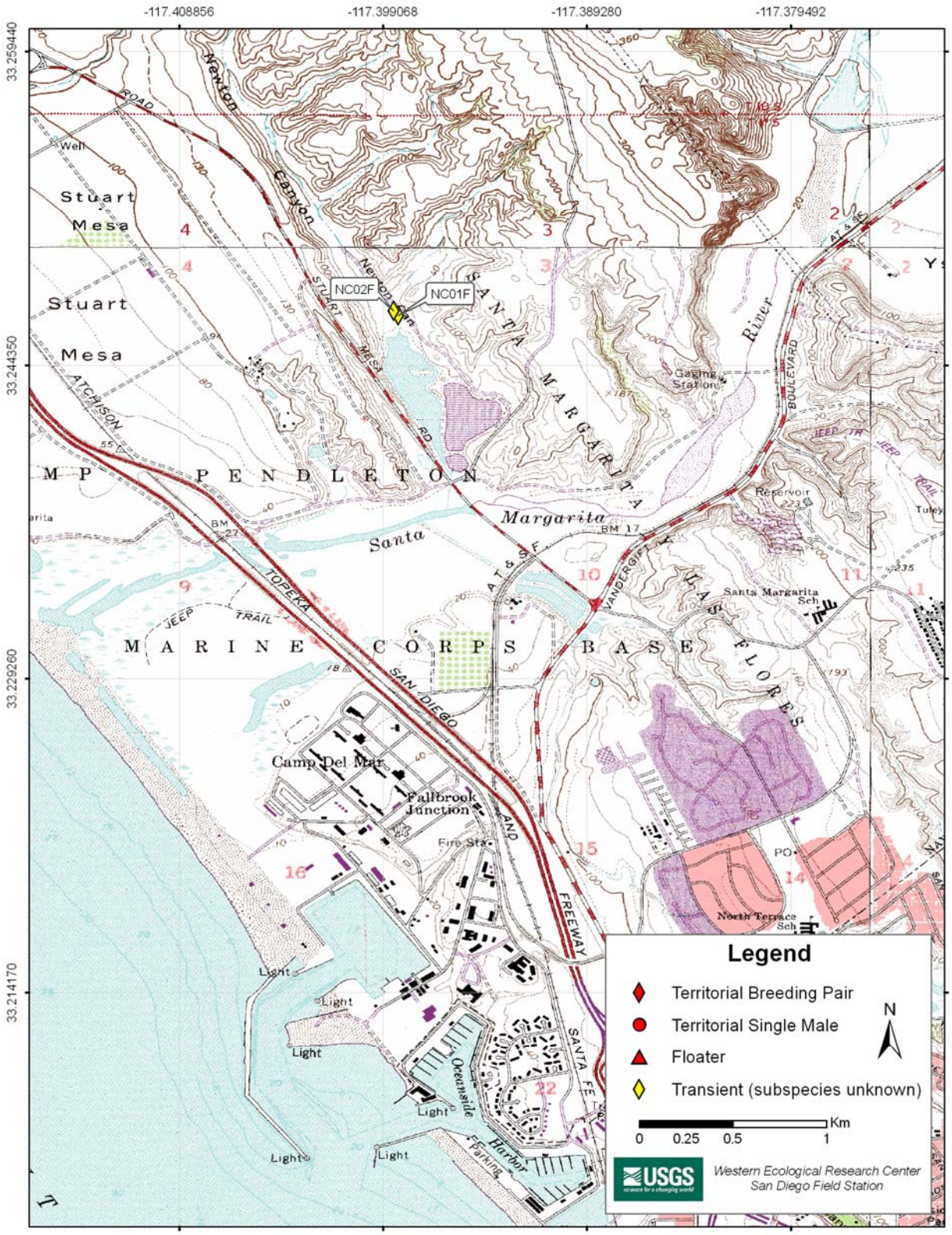

Fig. 16. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2009: Newton Canyon and Santa Margarita River (downstream).

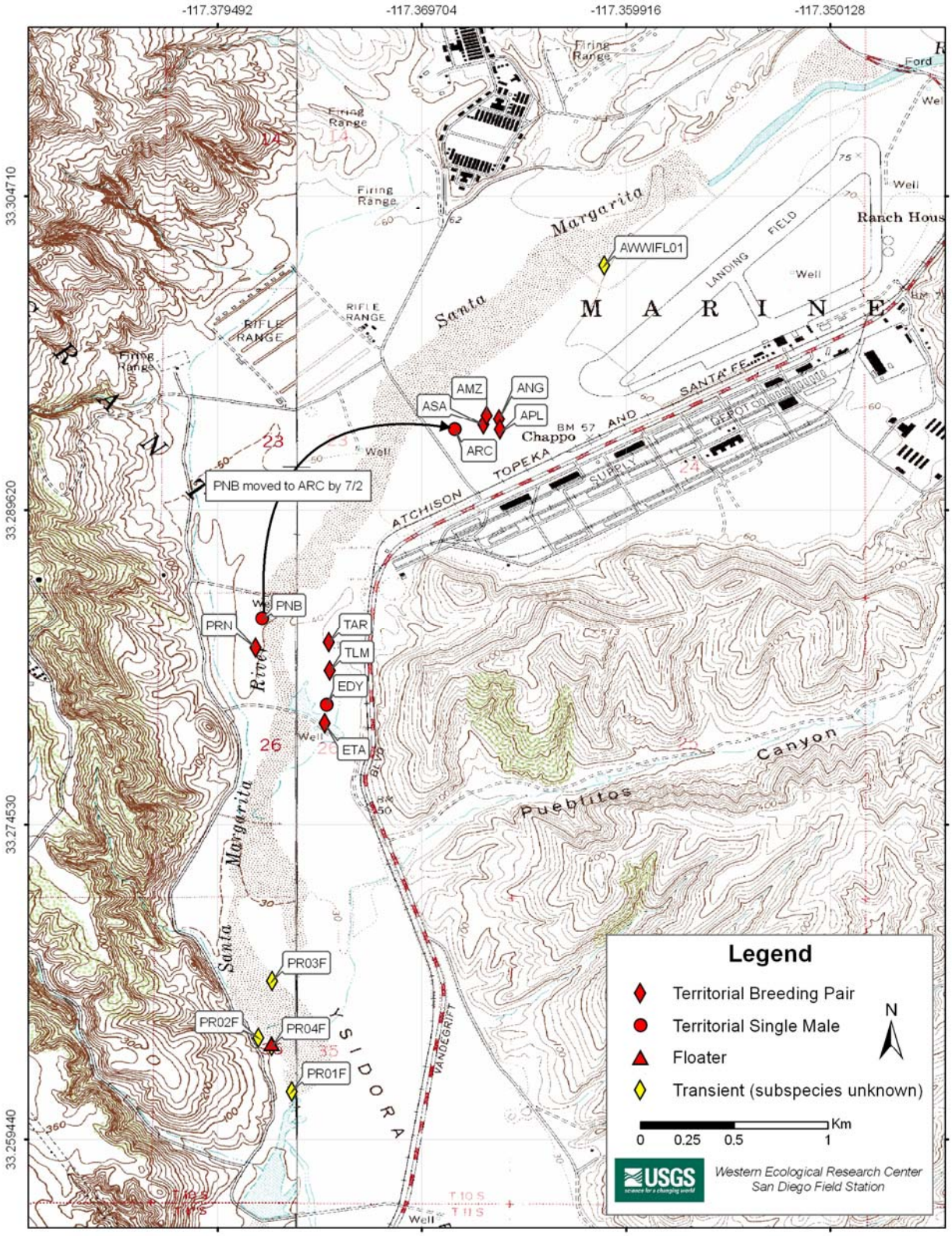

Fig. 17. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2009: Santa Margarita River (midstream).

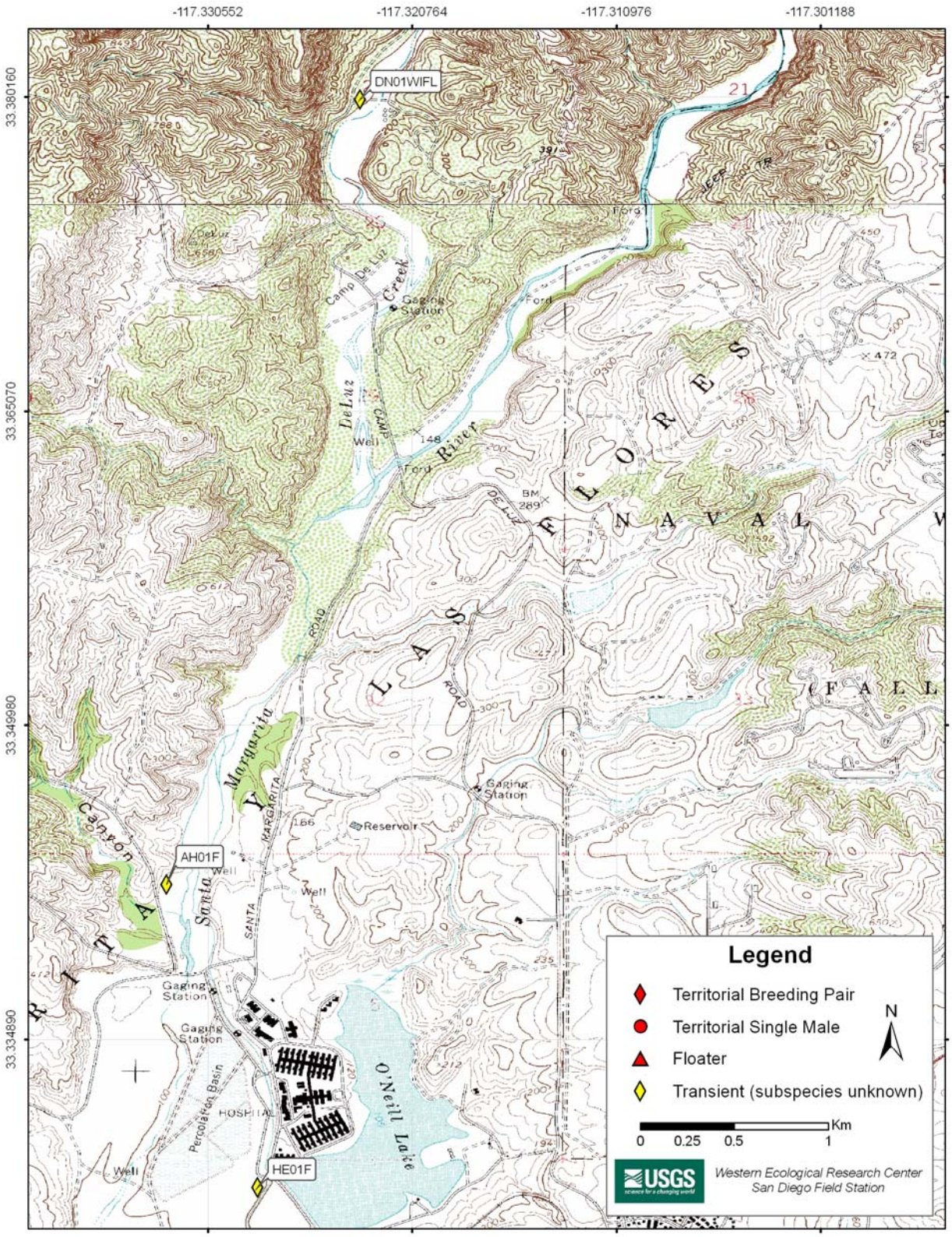

Fig. 18. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2009: Santa Margarita River (upstream) and De Luz Creek.

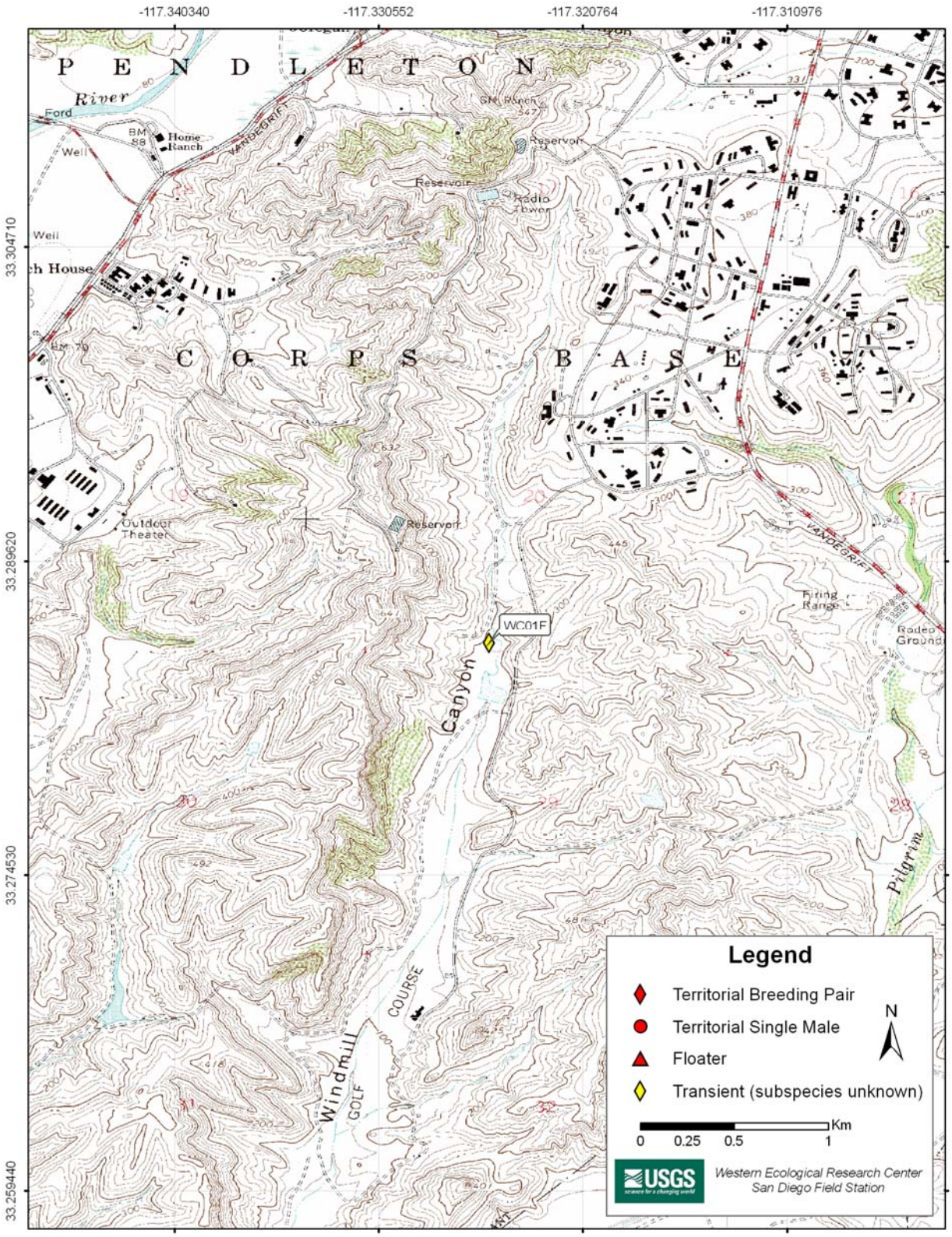

Fig. 19. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2009: Windmill Canyon.

APPENDIX C

SOUTHWESTERN WILLOW FLYCATCHER TERRITORY LOCATIONS AT MARINE CORPS BASE CAMP PENDLETON, 2009

Fig. 20. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2009: San Mateo Creek.

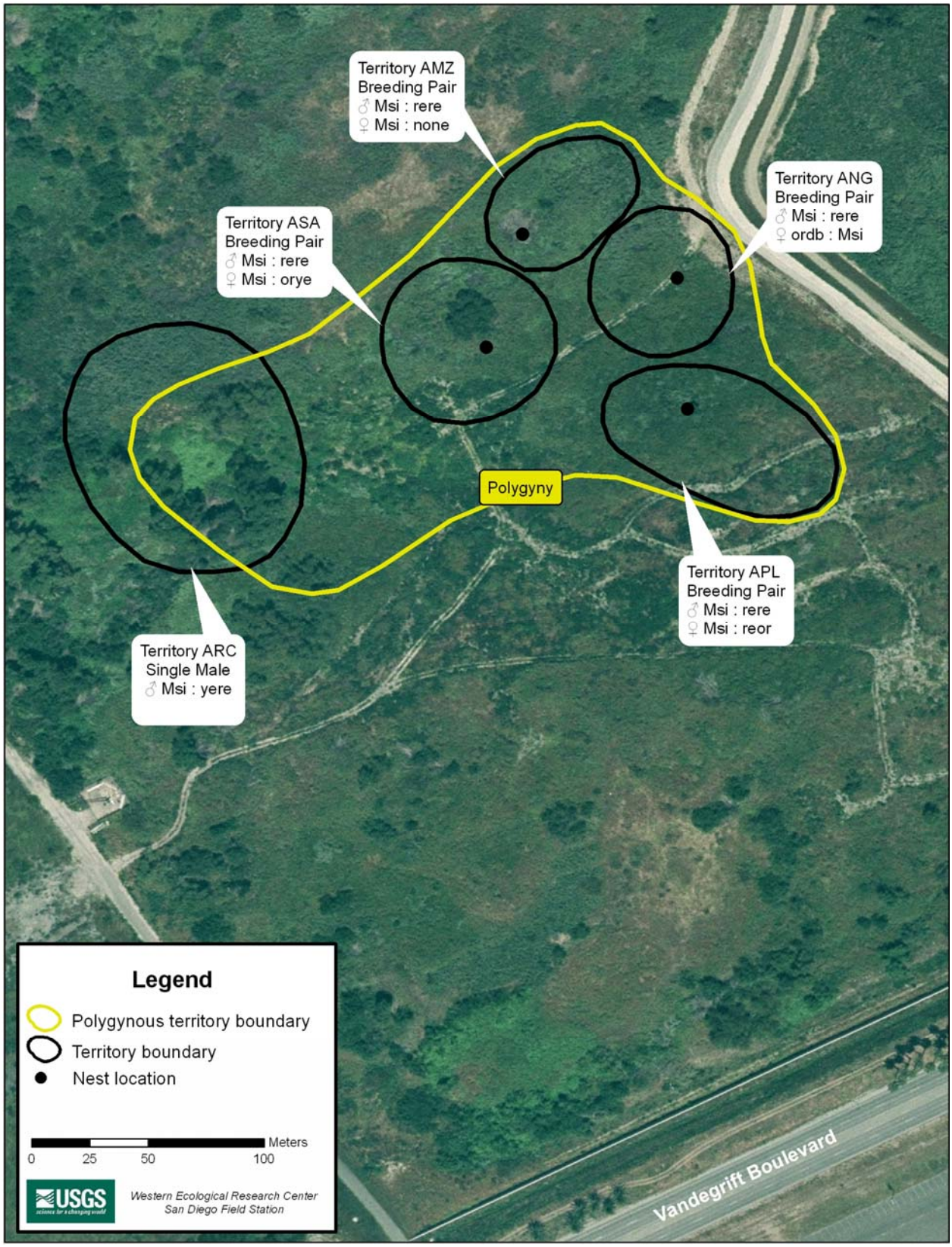

Fig. 21. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2009: Air Station Breeding Area, Santa Margarita River.

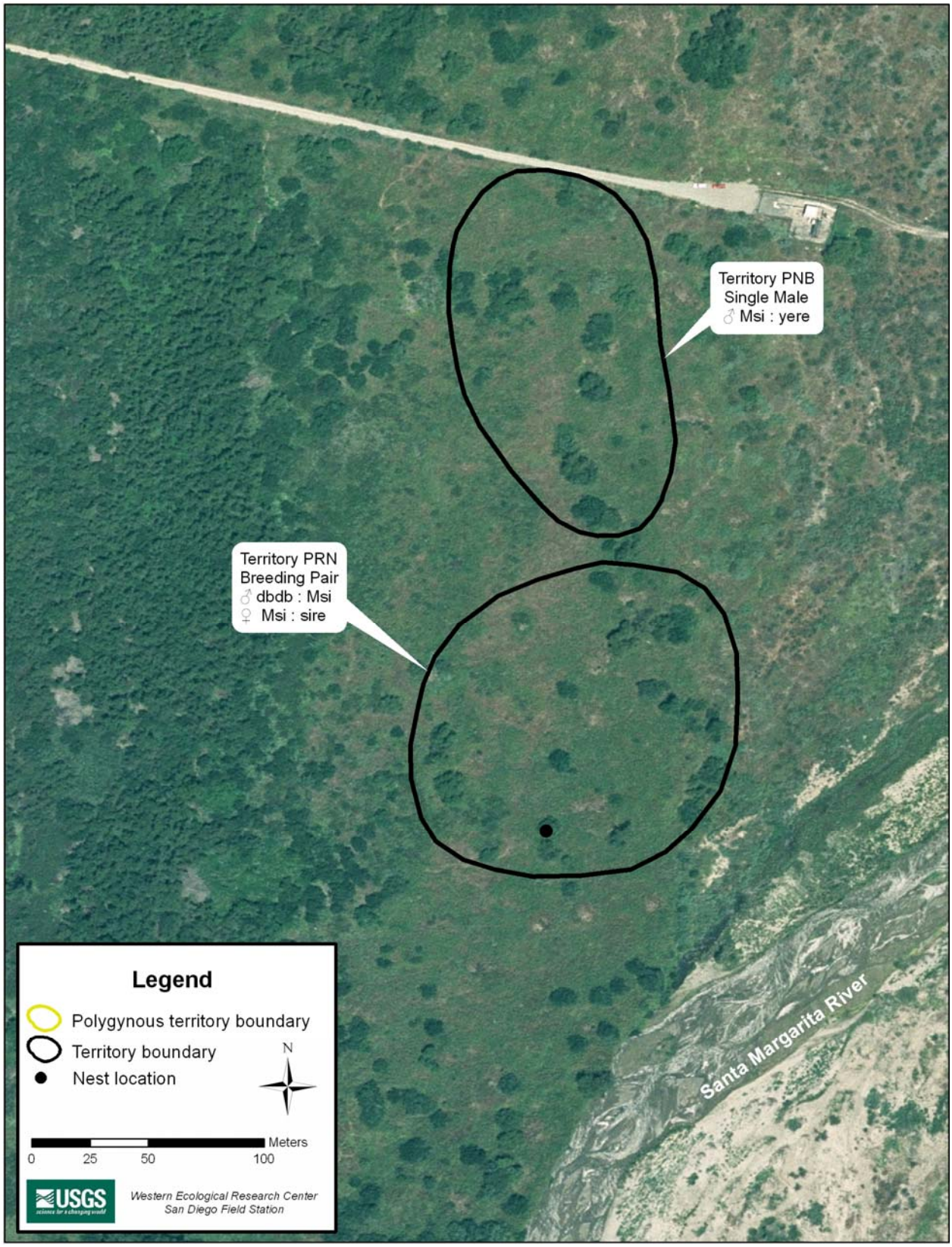

Fig. 22. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2009: Pump Road Breeding Area, Santa Margarita River.

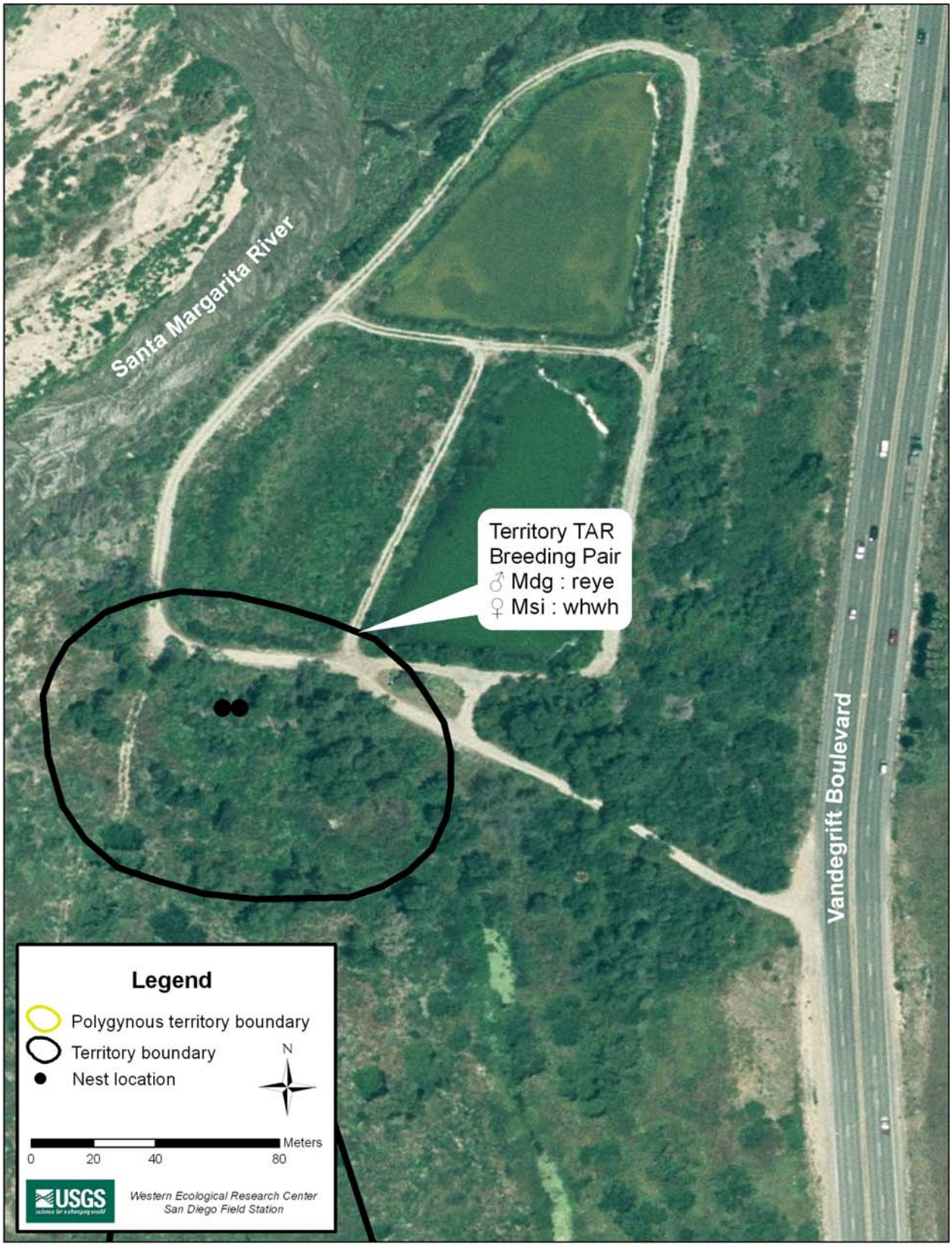

Fig. 23. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2009: Treatment Ponds Breeding Area, Santa Margarita River.

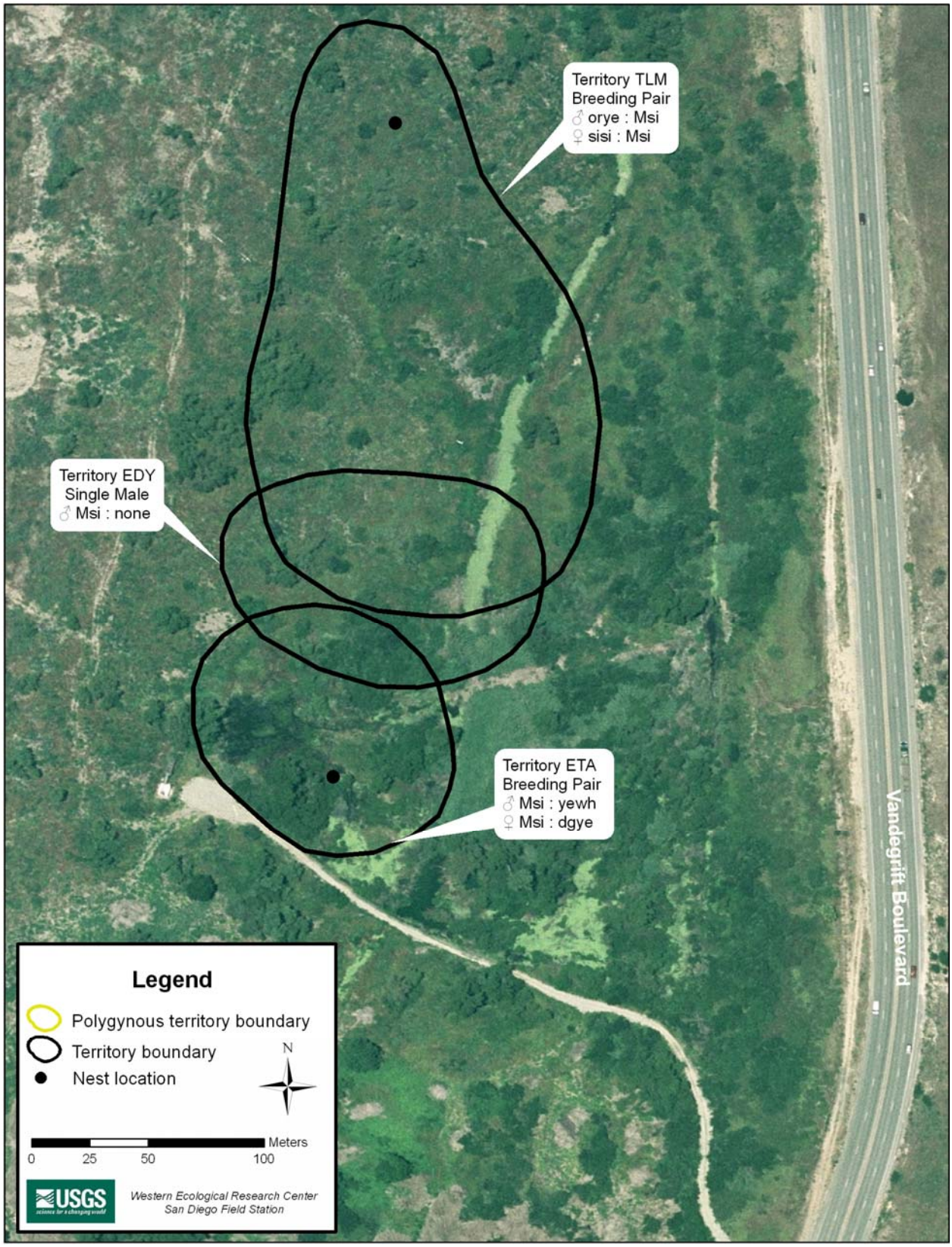

Fig. 24. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2009: Pueblitos Breeding Area, Santa Margarita River.

APPENDIX D

BAND COMBINATIONS AND IDENTIFICATION OF SOUTHWESTERN WILLOW FLYCATCHER NESTLINGS BANDED ON MARINE CORPS BASE CAMP PENDLETON, 2009

Band combinations and identification of Southwestern Willow Flycatcher nestlings banded on Marine Corps Base Camp Pendleton in 2009.

Territory ID	Nest ID	Nestling Band Combination[a]	Federal Band Number
TLM	1	none : Msi	254083411
TLM	1	none : Msi	254083412
ASA	1	none : Msi	254083413
ASA	1	none : Msi	254083414
ASA	1	none : Msi	254083415
ETA	1	none : Msi	254083416
ETA	1	none : Msi	254083417
PRN	1	none : Msi	254083418
ANG	1	none : Msi	254083420
ANG	1	none : Msi	254083421
ANG	1	none : Msi	254083422
APL	1	none : Msi	254083424
APL	1	none : Msi	254083425
TAR	2	none : Msi	254083426
TAR	2	none : Msi	254083427

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