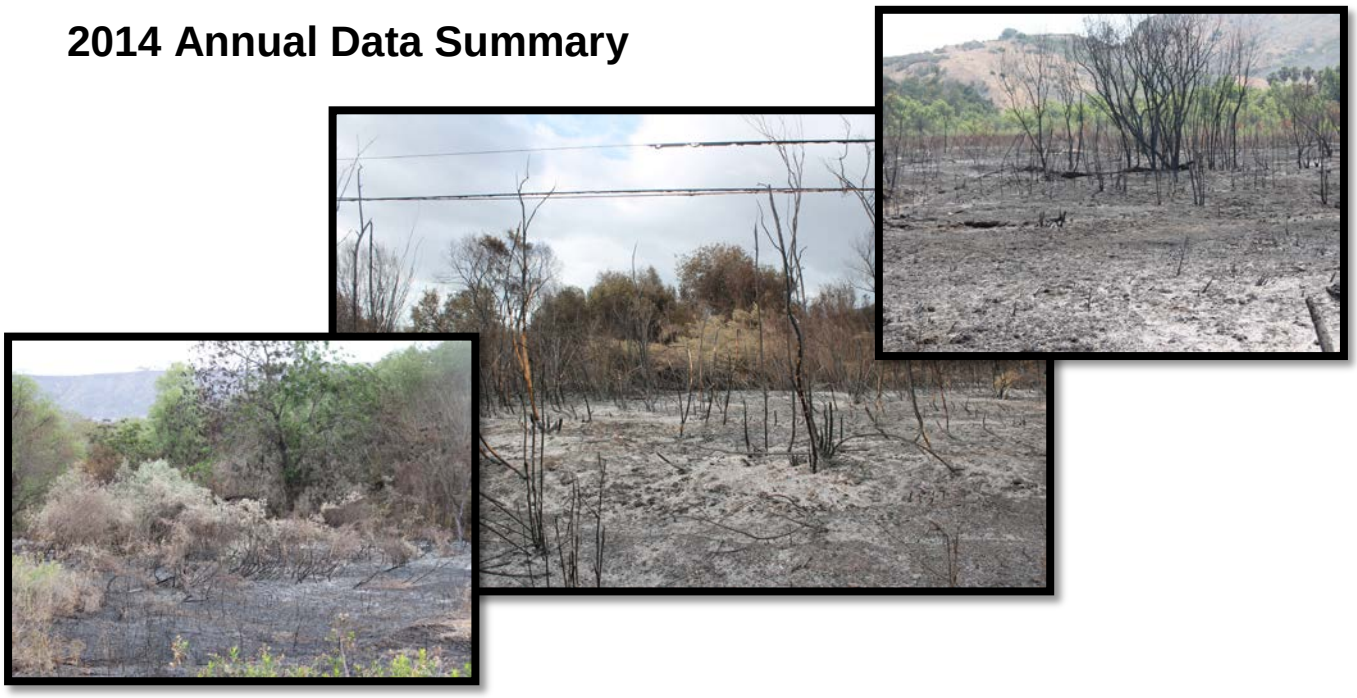
Distribution, Abundance, and Breeding Activities of the Southwestern Willow Flycatcher at Marine Corps Base Camp Pendleton, California

2014 Annual Data Summary



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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EXECUTIVE SUMMARY

Surveys for the endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*) were conducted at Marine Corps Base Camp Pendleton, California, between 20 May and 29 July 2014. Ninety-seven transient Willow Flycatchers of unknown subspecies were observed during Base-wide surveys. Transients occurred on 9 of the 16 drainages surveyed in 2014. No Willow Flycatchers were detected at Cockleburr Canyon, Cristianitos Creek, Fallbrook Creek, French Creek, Newton Canyon, Roblar Creek, or Windmill Canyon. 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, and riparian scrub.

In 2014, the resident Southwestern Willow Flycatcher population on Base consisted of three males and six females. No single males or non-territorial floaters were observed in 2014, and no male was detected in one of the breeding territories. Six breeding territories were established, consisting of five pairs (two polygynous groups consisting of two males each pairing with two different females, and one monogamous pair), and one additional female breeding territory. The resident population of Southwestern Willow Flycatchers on Camp Pendleton in 2014 (nine individuals) declined by 47% from 2013 (17 individuals) and was the smallest documented since monitoring began in 2000. Resident flycatchers were restricted to the Santa Margarita River and Pilgrim Creek. Flycatcher distribution on the Santa Margarita River remained contracted relative to previous years. All territories were located in mixed willow riparian habitat. Poison hemlock (*Conium maculatum*) was present in the majority of the territories.

Fifty percent (3/6) of Southwestern Willow Flycatcher pairs or breeding females successfully fledged at least one young during the 2014 breeding season. Nesting was initiated in early June and continued into late July. Eight nesting attempts were documented, of which 38% (3/8) were successful. Predation accounted for the majority of nest failures. Seven fledglings were produced, yielding a seasonal productivity of 1.2 young/breeding female (seven young/six breeding females). No instances of Brown-headed Cowbird (*Molothrus ater*) parasitism were observed. Flycatchers placed nests in six species of plants, including sandbar willow (*S. exigua*), black willow *(S. gooddingii*), red/arroyo willow (*S. laevigata*/*S. lasiolepis*), stinging nettle (*Urtica dioica*), mule fat (*Baccharis salicifolia*), and wild grape (*Vitis girdiana*). All flycatcher nests were placed in native plant species.

Nine birds (three males and six females) that were banded in previous years were present at Camp Pendleton in 2014. Of the banded adult flycatchers present during the 2013 breeding season, 33% (1/3) of males, 56% (5/9) of females, and 100% (2/2) of floaters of unknown sex (in 2013) returned to Camp Pendleton in 2014; 75% (6/8) of those returned to the same breeding area they occupied in 2013. None of the nine nestlings banded in 2013 returned to Camp Pendleton in 2014, but one, a male, established a territory on the Otay River, approximately 86 km away. Seven nestlings from three nests were banded in 2014; all survived to fledging. None of the transients observed during surveys were seen to carry bands.

Three Camp Pendleton natal birds emigrated to Bonsall on the San Luis Rey River in 2014. One female, a nestling from 2010, first attempted to nest on Base at Pilgrim Creek, but moved to Bonsall after the nest failed in late June. She paired with the resident male but the re-nest failed. Two additional females, nestlings from 2011 and 2012, both paired and nested successfully.

A series of major wildfire events occurred on Marine Corps Base Camp Pendleton at the start of the 2014 Southwestern Willow Flycatcher breeding season, burning approximately 8,906 ha including flycatcher occupied riparian habitat. The Las Pulgas fire, which started on 15 May, burned for several days and substantially reduced the quantity of suitable flycatcher breeding habitat, leaving little or no herbaceous or shrub vegetation and scorching most trees through the canopy layer in 50% of the breeding areas occupied in recent years. Three flycatchers were likely displaced by the fire, shifting out of their 2013 breeding areas and into the remaining unburned habitat in 2014. The 2014 wildfire may have contributed to the overall population decline between 2013 and 2014.

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 (*Molothrus ater*) 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 10-fold since the mid-1980's in response to management alleviating these threats (USFWS 2006), 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 (Mary Whitfield, pers. comm.), the Upper San Luis Rey River, including a portion of the Cleveland National Forest in San Diego County (Clark et al. 2014), and Marine Corps Base Camp Pendleton (MCBCP) in San Diego County (Howell and Kus 2013). 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 (*Salix* spp.) 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. In addition, we report the effects of a series of major wildfire events during the study on Willow Flycatchers and their habitat. 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 20 May and 29 July (Fig. 1, Appendix A, Figs. 4-9). Field work was conducted by USGS personnel Katherine Allen, Lisa Allen, Patience Falatek, Aaron Gallagher, Scarlett Howell, Angela Johnson, Barbara Kus, Suellen Lynn, Melanie Madden, Brandon Miller, Eric Nolte, Jason Pietrzak, Devin Taylor, and Anne Winters. 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. 4, 5).

De Luz Creek: between the confluence with the Santa Margarita River and the Base boundary (Appendix A, Fig. 4).

Roblar Creek: from the confluence with De Luz Creek to a point approximately 1.5 km upstream (Appendix A, Fig. 4).

Fallbrook Creek: around Lake O'Neill as well as along the creek between the lake and the Base boundary (Appendix A, Fig. 4).

Newton Canyon: between the confluence with the Santa Margarita River and the upstream limit of riparian habitat (Appendix A, Fig. 5).

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

French Creek: between the Pacific Ocean and the Edson Range Impact Area (Appendix A, Fig. 5).

Aliso Creek: between the Pacific Ocean and 0.5 km upstream of the electrical transmission lines (Appendix A, Fig. 5).

Cristianitos Creek: between the confluence with San Mateo Creek and the Base boundary (Appendix A, Fig. 6).

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. 6, 7).

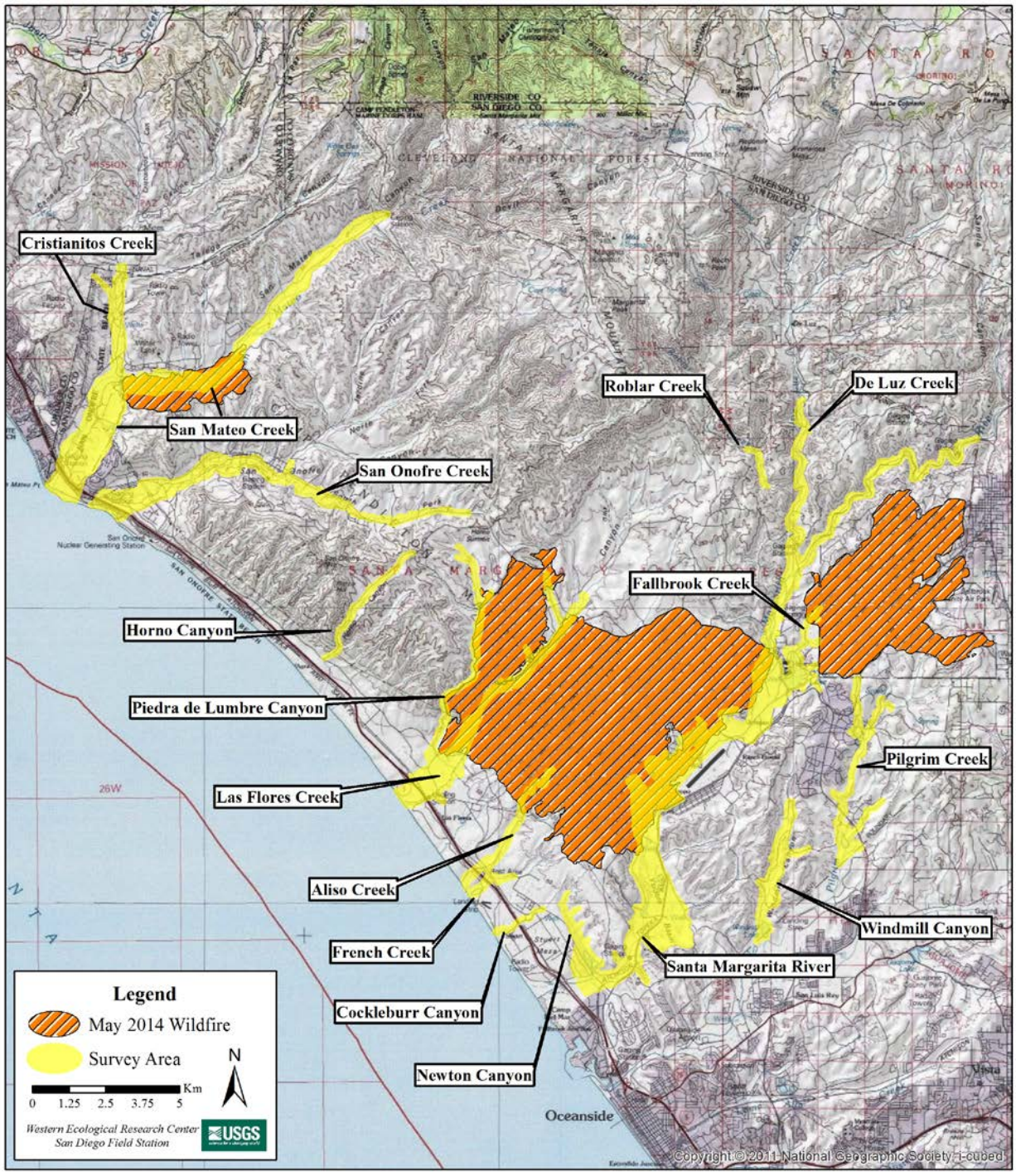

Fig. 1. Southwestern Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2014.

San Onofre Creek: between the Pacific Ocean and the access road to Range 219 (Appendix A, Figs. 6, 7).

Las Flores Creek: between the Pacific Ocean and a point approximately 800 m upstream of Basilone Road (Appendix A, Fig. 8).

Piedra de Lumbre Canyon: between the confluence with Las Flores Creek and the upstream limit of riparian habitat, approximately 2.7 km upstream of Las Pulgas Lake (Appendix A, Fig. 8).

Horno Canyon: between Old Highway 101 and the upstream limit of riparian habitat (Appendix A, Fig. 8).

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. 9).

Windmill Canyon: from the Base boundary to the golf course entrance (Appendix A, Fig. 9).

Drainages were surveyed two to four times at least 7 days apart. The majority of drainages were surveyed four times, with the exception of the upper portion of the Santa Margarita River which was surveyed twice.

Investigators followed standard survey protocol (Sogge et al. 2010), moving slowly (approximately 2 km/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 60 Global Positioning System (GPS) or Trimble Juno SB GPS unit with 1-15 m positioning accuracy to determine geographic coordinates (WGS84). For all resident flycatchers, territory boundaries were approximated by mapping singing perches and the extent of the male's and female's use area on 1":12,000" aerial photographs. Habitat type was recorded for each location according to the following categories based on dominant vegetation:

Mixed willow riparian: Habitat dominated by one or more willow species including black willow (*S. gooddingii*), arroyo willow (*S. lasiolepis*), 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 (*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 (*S. exigua*) 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 saltcedar (*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 were 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/nest. The first visit was timed to determine the number of eggs laid, the next to confirm 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 that had eggs or nestlings but were later found intact and empty before the expected fledge date with no evidence of eggs or nestlings on the ground, consistent with snake and bird predation which typically leave 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 2 weeks, and human disturbance such as mowing or weed-whacking. This category also includes 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.

(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 from the nest to the edge of the host species, and distance from the nest to the edge of the clump of riparian vegetation (Rourke et al. 1999). Distance to edge of clump was expressed as a negative number if the nest was not located in a clump of riparian vegetation. For example, if the nest was located in a field of poison hemlock (*Conium maculatum*) without any other non-hemlock vegetation present, the distance to the nearest clump of riparian vegetation was measured, and the value expressed as a negative number.

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 2013, 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.

Data Comparisons

All data from previous years at Marine Corps Base Camp Pendleton used in comparisons with current data can be found in Kus 2001; Kus and Ferree 2002; Kus and Kenwood 2003, 2005, 2006a, b; Kenwood and Kus 2007; Rourke et al. 2008; Howell and Kus 2009a, b, 2010a, 2011, 2012, and 2013.

RESULTS

The start of the 2014 Southwestern Willow Flycatcher protocol survey season (15 May; Sogge et al. 2010) was delayed for several days as a result of a series of major wildfire events that occurred on Marine Corps Base Camp Pendleton, burning approximately 8,906 ha including 837 ha of riparian habitat (Fig. 1). Six of the 16 drainages surveyed in 2014 were affected by the wildfires; San Mateo Creek, Las Flores Creek, Piedra de Lumbre Canyon, Aliso Creek, Fallbrook Creek, and the Santa Margarita River.

Population Size and Distribution

Transients

Ninety-seven Willow Flycatchers of unknown subspecies were observed during Base-wide surveys (Appendix B, Figs. 10-19). All transients were detected between 12 May and 26 June. Two transients were detected incidentally during Least Bell's Vireo monitoring prior to the start of official surveys and prior to the fire; the remainder of transients were detected after the fire. Transients occurred on 9 of the 16 drainages surveyed in 2014. No Willow Flycatchers were detected at Cockleburr Canyon, Cristianitos Creek, Fallbrook Creek, French Creek, Newton Canyon, Roblar Creek, or Windmill Canyon.

Residents

Nine Southwestern Willow Flycatchers, including three males and six females, were detected throughout the 2014 breeding season (Appendix B, Figs. 16 and 19; Appendix C, Figs. 20-22). All three males were paired; two of the paired males were polygynous with two females each, and the remaining male paired with one female (Appendix C, Figs. 20-21). No resident male was confirmed in the remaining female territory (PLG; Appendix C, Fig. 22); however, an unbanded Willow Flycatcher of unknown sex was detected in the same area once during the first survey. This bird may have been a resident male that paired with the PLG female, and then subsequently left the territory or disappeared for unknown reasons between the first and second surveys; however, the bird present on the first survey did not appear to be territorial. Alternatively, the unknown bird (PS11F) may have been a transient of unknown subspecies. Because of the ambiguity of this territory, we chose to represent it as two separate birds: one breeding female (PLG), and one bird of unknown sex and subspecies (PS11F; included in transient totals above). Overall, six breeding territories were established in 2014, with five females forming pair bonds with three male Southwestern Willow Flycatchers, and one additional female breeding territory. No single males or non-territorial floaters were observed in 2014. Overall, the resident flycatcher population on Base decreased by 47% from 2013 to 2014 (Fig. 2). At least two resident males and one female were present on Marine Corps Base Camp Pendleton prior to the start of the wildfires.

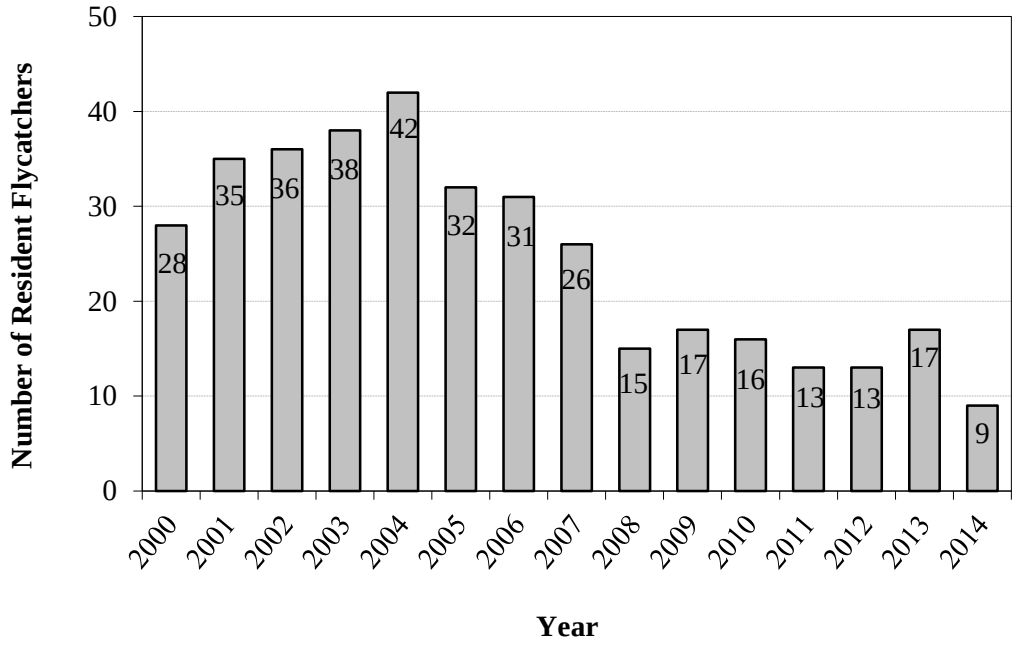

Fig. 2. Southwestern Willow Flycatcher population estimates for Marine Corps Base Camp Pendleton, 2000-2014.

Resident flycatchers were restricted to the Santa Margarita River (Appendix B, Fig. 16; Appendix C, Figs. 20-21) and Pilgrim Creek (Appendix B, Fig. 19; Appendix C, Fig. 22). The quantity of suitable flycatcher breeding habitat along the Santa Margarita River was substantially reduced by the Las Pulgas fire, which started on 15 May and burned for several days, leaving little or no herbaceous or shrub vegetation and scorching most trees through the canopy layer in 50% of the breeding areas occupied between 2008 and 2013 (Table 1), including Pump Road and Air Station. As a result, the Pump Road breeding area was devoid of resident flycatchers for the first time since monitoring began in 2000. Along the Santa Margarita River, three core flycatcher breeding areas (those annually supporting multiple flycatcher territories) were occupied in 2014: Air Station, Treatment Ponds, and Pueblitos. The Air Station and Treatment Ponds breeding areas both supported the largest concentration of breeding flycatchers with two pairs each, and the northern portion of the Pueblitos breeding area supported one breeding pair. 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, Pump Road, and the southern portion of Pueblitos breeding areas; see Fig. 3) devoid of flycatcher territories in 2014 (Table 1). Resident flycatcher distribution away from the Santa Margarita River was limited to one nesting female detected at Pilgrim Creek.

Table 1. Distribution of territorial Willow Flycatchers at Marine Corps Base Camp Pendleton, 2000-2014.

		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014	
Santa Margarita River		M[a]	F	M	F	M	F	M	F	M	F	M	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	2	4	2	3	1	5	1	4	1	2
	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	1	2	1	1	-[b]	1	-	2	-	-
	Treatment Ponds	1	-	1	-	-	-	-	-	-	-	1	-	1	4	2	2	1	1	2	2	2	2	1	2	1	2	1	3	1	2
	Pueblitos	4	-	3	4	3	3	4	5	4	4	1	3	3	6	1	1	2	3	2	1	-[b]	1	1	-	-	-	-[b]	1	1	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	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Las Flores Creek		-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pilgrim Creek		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
San Mateo Creek		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	-	1	-	1	-	1	-	-	-	-	-
Total		**18**	**10**	**17**	**18**	**17**	**16**	**16**	**16**	**18**	**22**	**12**	**17**	**12**	**19**	**12**	**14**	**7**	**7**	**8**	**8**	**6**	**9**	**6**	**6**	**4**	**8**	**3**	**10**	**3**	**6**

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

[b] One male's territory spanned two breeding areas; included in Treatment Ponds total.

Habitat Characteristics

Seventy-seven percent (79/103) of all flycatcher sightings occurred in habitat classified as mixed willow riparian, 61% (48/79) of which occurred along the Santa Margarita River (Table 2). Eleven percent (11/103) of locations were in willow habitat co-dominated by sycamore, and an additional 7% (7/103) were found in riparian scrub, dominated by mule fat and/or sandbar willow. The remaining detections were located either in habitat dominated by a mix of sycamores and oaks (5%; 5/103) or upland coastal sage scrub (<1%; 1/103). While transients used all habitat types, resident flycatchers were found exclusively in mixed willow riparian.

The most common exotic plant in habitat used by flycatchers in 2014 was poison hemlock. Fifty percent (51/103) of flycatcher locations were composed of 5-50% exotic vegetation, primarily black mustard (*Brassica nigra*; Table 2). Six percent (6/103) of sites were dominated by exotic vegetation (percent cover of exotics >50%), with poison hemlock the dominant species.

Table 2. Habitat characteristics of Willow Flycatcher locations at Marine Corps Base Camp Pendleton in 2014.

Bird ID	Drainage	Status[a]	Habitat Type[b]	Exotic Cover Class[c]	Dominant Exotics[d]
AL01F	Aliso Creek	T	Willow/Sycamore	1	EUC
AH50F	De Luz Creek	T	Mixed Willow	1	-
DN01F	De Luz Creek	T	Oak/Sycamore	1	-
DN02F	De Luz Creek	T	Willow/Sycamore	2	CON
DS01F	De Luz Creek	T	Oak/Sycamore	3	CON
DS02F	De Luz Creek	T	Willow/Sycamore	3	CON, RIN
DS03F	De Luz Creek	T	Willow/Sycamore	3	CON

Table 2 (*continued*). Habitat characteristics of Willow Flycatcher locations at Marine Corps Base Camp Pendleton in 2014.

Bird ID	Drainage	Status[a]	Habitat Type[b]	Exotic Cover Class[c]	Dominant Exotics[d]
HO01F	Horno Canyon	T	Mixed Willow	2	BRA
LL01F	Las Flores Creek	T	Mixed Willow	1	-
LL02F	Las Flores Creek	T	Mixed Willow	1	-
LL03F	Las Flores Creek	T	Mixed Willow	1	-
LL04F	Las Flores Creek	T	Mixed Willow	1	-
LL05F	Las Flores Creek	T	Mixed Willow	1	-
LL06F	Las Flores Creek	T	Mixed Willow	2	TAM
LN01F	Las Flores Creek	T	Mixed Willow	2	BRA
LN02F	Las Flores Creek	T	Mixed Willow	2	BRA
LN03F	Las Flores Creek	T	Mixed Willow	2	RAP
PD01F	Piedra de Lumbre Canyon	T	Mixed Willow	2	FOE
PD02F	Piedra de Lumbre Canyon	T	Oak/Sycamore	1	-
PN01F	Pilgrim Creek	T	Willow/Sycamore	2	CON
PS01F	Pilgrim Creek	T	Mixed Willow	1	-
PS02F	Pilgrim Creek	T	Willow/Sycamore	1	-
PS03F	Pilgrim Creek	T	Mixed Willow	1	-
PS04F	Pilgrim Creek	T	Mixed Willow	1	-
PS05F	Pilgrim Creek	T	Mixed Willow	1	-
PS06F	Pilgrim Creek	T	Mixed Willow	2	BRA, CON, FOI
PS07F	Pilgrim Creek	T	Mixed Willow	1	-
PS08F	Pilgrim Creek	T	Willow/Sycamore	2	BRA
PS09F	Pilgrim Creek	T	Willow/Sycamore	2	BRA, SIL
PS10F	Pilgrim Creek	T	Mixed Willow	1	-
PS11F	Pilgrim Creek	T	Mixed Willow	1	-
Pilgrim	Pilgrim Creek	U	Mixed Willow	1	-
PS12F	Pilgrim Creek	T	Mixed Willow	1	-
PS13F	Pilgrim Creek	T	Mixed Willow	1	-
PS14F	Pilgrim Creek	T	Mixed Willow	2	BRA, CON
PS15F	Pilgrim Creek	T	Mixed Willow	1	-
PS16F	Pilgrim Creek	T	Mixed Willow	1	-
PS17F	Pilgrim Creek	T	Upland	1	-
MB01F	San Mateo Creek	T	Mixed Willow	1	-
MB02F	San Mateo Creek	T	Willow/Sycamore	1	-
MB03F	San Mateo Creek	T	Mixed Willow	1	-
MB04F	San Mateo Creek	T	Mixed Willow	1	-
MB05F	San Mateo Creek	T	Mixed Willow	1	-
MT01F	San Mateo Creek	T	Mixed Willow	2	FOE
FW01F	San Onofre Creek	T	Oak/Sycamore	2	EUC
OE01F	San Onofre Creek	T	Riparian Scrub	2	BRA
OE02F	San Onofre Creek	T	Riparian Scrub	2	BRA

Table 2 (*continued*). Habitat characteristics of Willow Flycatcher locations at Marine Corps Base Camp Pendleton in 2014.

Bird ID	Drainage	Status[a]	Habitat Type[b]	Exotic Cover Class[c]	Dominant Exotics[d]
OW01F	San Onofre Creek	T	Riparian Scrub	2	BRA
OW02F	San Onofre Creek	T	Willow/Sycamore	2	BRA
OW03F	San Onofre Creek	T	Riparian Scrub	2	FOE
OW04F	San Onofre Creek	T	Riparian Scrub	2	BRA
AE01F	Santa Margarita River	T	Mixed Willow	2	BRA, CON
AE02F	Santa Margarita River	T	Mixed Willow	2	BRA, CON
AE99F	Santa Margarita River	T	Mixed Willow	2	BRA, CON
Angel	Santa Margarita River	P	Mixed Willow	2	BRA, CON
Archie	Santa Margarita River	P	Mixed Willow	2	BRA, CON
AW01F	Santa Margarita River	T	Mixed Willow	1	-
AW02F	Santa Margarita River	T	Mixed Willow	1	-
AW03F	Santa Margarita River	T	Mixed Willow	1	-
BN01F	Santa Margarita River	T	Mixed Willow	2	BRA, CON
BN02F	Santa Margarita River	T	Mixed Willow	2	TAM
BN03F	Santa Margarita River	T	Mixed Willow	1	BRA
BN04F	Santa Margarita River	T	Mixed Willow	2	CON
BN50F	Santa Margarita River	T	Mixed Willow	2	CON
BN51F	Santa Margarita River	T	Mixed Willow	2	CON
BS01F	Santa Margarita River	T	Mixed Willow	2	ARU
BS02F	Santa Margarita River	T	Mixed Willow	3	CON
ES03F	Santa Margarita River	T	Mixed Willow	1	-
ES99Fa	Santa Margarita River	T	Mixed Willow	2	CON
ES99Fb	Santa Margarita River	T	Mixed Willow	2	CON
Etta	Santa Margarita River	P	Mixed Willow	1	-
HE01F	Santa Margarita River	T	Mixed Willow	2	CON
HE50F	Santa Margarita River	T	Riparian Scrub	1	-
HE51F	Santa Margarita River	T	Mixed Willow	1	-
HE52F	Santa Margarita River	T	Mixed Willow	1	-
HE53F	Santa Margarita River	T	Oak/Sycamore	1	-
HE54F	Santa Margarita River	T	Mixed Willow	1	-
HE55F	Santa Margarita River	T	Mixed Willow	2	CON
HE56F	Santa Margarita River	T	Riparian Scrub	2	BRA, CON
HW01F	Santa Margarita River	T	Mixed Willow	1	-
PO01F	Santa Margarita River	T	Mixed Willow	2	BRA
PO02F	Santa Margarita River	T	Mixed Willow	2	CON
PO03F	Santa Margarita River	T	Mixed Willow	2	BRA
PR47F	Santa Margarita River	T	Mixed Willow	1	-
PR48F	Santa Margarita River	T	Mixed Willow	1	-
PR49F	Santa Margarita River	T	Mixed Willow	2	BRA

Table 2 (*continued*). Habitat characteristics of Willow Flycatcher locations at Marine Corps Base Camp Pendleton in 2014.

Bird ID	Drainage	Status[a]	Habitat Type[b]	Exotic Cover Class[c]	Dominant Exotics[d]
PR50F	Santa Margarita River	T	Mixed Willow	2	BRA
PR51F	Santa Margarita River	T	Mixed Willow	1	-
SE01F	Santa Margarita River	T	Mixed Willow	2	BRA, FOE
SE02F	Santa Margarita River	T	Mixed Willow	2	FOE
SE03F	Santa Margarita River	T	Mixed Willow	2	BRA
SE04F	Santa Margarita River	T	Mixed Willow	2	FOE
SG01F	Santa Margarita River	T	Mixed Willow	2	TAM
SG02F	Santa Margarita River	T	Mixed Willow	2	CON
SG03F	Santa Margarita River	T	Mixed Willow	2	CON
SW01F	Santa Margarita River	T	Mixed Willow	2	TAM
SW02F	Santa Margarita River	T	Mixed Willow	2	ARU
Thelma	Santa Margarita River	P	Mixed Willow	1	-
Twister	Santa Margarita River	P	Mixed Willow	1	-
UM01F	Santa Margarita River	T	Willow/Sycamore	1	-
YB01F	Santa Margarita River	T	Mixed Willow	2	CON
YB02F	Santa Margarita River	T	Mixed Willow	3	BRA, CON
YB03F	Santa Margarita River	T	Mixed Willow	3	BRA, CON

[a] P = breeding pair, T = transient, U = unknown status bird.

[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, EUC = Eucalyptus (*Eucalyptus sp.*), FOE = fennel (*Foeniculum vulgare*), RAP = wild radish (*Raphanus sativus*), RIN = castor bean (*Ricinus communis*), SIL = milk thistle (*Silybum marianum*), TAM = saltcedar.

Breeding Activities

Nesting was observed for five pairs and the female of unknown status (Table 3). Nesting was initiated in early June. The earliest confirmed lay date was 8 June and the latest was 11 July. Two pairs attempted more than one nest, both following an unsuccessful initial attempt. Nesting continued into July, with the last young fledging on 21 July. Of the six breeding females, 50% (3/6) fledged young during the 2014 breeding season.

Eight nesting attempts by Southwestern Willow Flycatchers were documented during the 2014 breeding season. Thirty-eight percent (3/8) of nests successfully fledged at least one flycatcher young. Although no predation events were witnessed, predation was believed to be the primary source of nest failure, accounting for 80% (4/5) of nest failures, and the remaining failed nest (PLG) may have experienced partial predation. Two predation events took place during the egg stage, and two during the nestling stage; the remaining predation event occurred on or near estimated hatch day, so it is possible the nest hatched prior to failure. Only one of the four breeding females whose initial nests failed re-nested successfully. One female's second nest

was also depredated, one female disappeared after the initial failure, and the PLG female of unknown status moved off Base and paired with a male on the San Luis Rey River for her second nest attempt.

Mean clutch size, estimated from seven nests known to have full clutches, was 2.4 ± 0.8 eggs. Seven fledglings were produced, yielding a seasonal productivity of 1.2 young/breeding female (seven young/six breeding females).

Table 3. Nesting activity of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2014.

Breeding Territory ID	Lay Date	# Eggs	# Nestlings	# Fledglings	Nest Fate[a]	Comments
ANG	08-Jun-14	3	3	0	PRE	Nest intact but empty.
ARC	15-Jun-14	3	1	1	SUC	Two eggs did not hatch.
ETA	11-Jun-14	3	3	3	SUC	
PLG	18-Jun-14[b]	2	0	0	OTH	Nest found 19 June with two eggs; on 20 June one cracked egg was found below nest, one egg remained in nest. Possible partial predation. Female continued incubating until at least 26 June, but abandoned territory by 30 June. Remaining egg was infertile.
TLM	09-Jun-14	2	0	0	PRE	Nest intact but empty. Cracked eggs on ground below nest.
	21-Jun-14	3	3	3	SUC	
TWI	15-Jun-14	1	0	0	PRE	Intact but empty on or past estimated hatch date. Female incubated empty nest for 1 week until nest was removed to trigger re-nest.
	11-Jul-14	2	2	0	PRE	Nest intact but empty.

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

[b] Lay date estimated - nest found with eggs.

Nest Site Characteristics

Flycatchers placed nests in six species of plants (Table 4), including sandbar willow, black willow, red or arroyo willow, stinging nettle (*Urtica dioica*), mule fat, and wild grape (*Vitis girdiana*). All flycatcher nests were placed in native species; 63% (5/8) of nests were placed in willow, and the remaining nests were evenly distributed among the other three native

species. No nests were placed in exotic species in 2014. Nest height averaged 1.9 ± 0.9 m, while host height averaged 3.9 ± 1.8 m. The two nests located in the Air Station breeding area (Appendix C, Fig. 20) were located less than 10 m from the burn perimeter.

Table 4. Nest site characteristics of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2014. 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	2.0	1.8	1.0	1.3
ARC	1	Black Willow	3.4	1.6	0.6	0.7
ETA	1	Stinging Nettle	2.0	0.9	0.1	1.3
PLG	1	Black Willow	5.3	3.6	0.3	2.5
TLM	1	Red/Arroyo Willow	6.2	1.3	0.8	0.8
TLM	2	Mule Fat	3.1	2.3	0.3	0.4
TWI	1	Wild Grape	3.0	1.2	0.1	0.6
TWI	2	Black Willow	6.4	2.3	0.3	1.6

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 2014.

Banded Birds

All resident Southwestern Willow Flycatchers were observed closely enough to determine with confidence whether they were banded (Table 5). All resident males and females were banded in previous years. Of these, one resident female that was banded with a single federal band as a nestling in 2010 was recaptured and banded with a second band to provide a unique combination in 2014. The remaining eight birds had been banded with unique color combinations prior to 2014. All known and confirmed banded birds were originally banded on Camp Pendleton.

Seven Southwestern Willow Flycatcher nestlings from three nests were banded in 2014 (Appendix D); all are believed to have fledged.

Table 5. Band status of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2014.

Territory / Bird ID	Status[a]	Male Banded?[b]	Female Banded?[b]	Nestlings Banded?	Comments[c]
ANG	P	Msi : puor	rewh : Msi		Male banded in 2010 as an adult at Air Station. Female banded in 2009 as a nestling at Pueblitos. Male polygynous with one other female (ARC).
ARC	P	Msi : puor	Msi : yedb	1	Female banded in 2008 as a nestling at Treatment Ponds. Male polygynous with one other female (ANG).
ETA	P	dbye : Msi	Msi : orpu	3	Male banded in 2013 as an adult at Treatment Ponds. Female banded in 2010 as an adult at Pump Road.
PLG	U	N/A	Msi : whdb		No male confirmed in territory. Female banded in 2010 as a nestling at Pueblitos.
TLM	P	Msi : dbor	yepu : Msi	3	Male banded in 2012 as a nestling at Air Station. Female banded in 2013 as an adult at Treatment Ponds. Male polygynous with one other female (TWI).
TWI	P	Msi : dbor	yere : Msi		Female banded in 2011 as an adult at Treatment Ponds. Male polygynous with one other female (TLM).

[a] P = breeding pair, U = unknown breeding status.

[b] Band combinations: left leg : right leg; Msi = federal aluminum band. *Metal bands:* dbor = dark blue-orange split, dbye = dark blue-yellow split, orpu = orange-purple split, puor = purple-orange split, rewh = red-white split, yedb = yellow-dark blue split, yepu = yellow-purple split, yere = yellow-red split, whdb = white-dark blue split.

[c] See Fig. 3, Appendix B, Figs. 16 and 19; Appendix C, Figs. 20-22 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 2014. Although this is the minimum number of flycatchers known to survive, and does not include all 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 2013 breeding season, 33% (1/3) of males, 56% (5/9) of females, and 100% (2/2) of the floaters of unknown sex (in 2013) returned to Camp Pendleton in 2014. Overall, adult survivorship from 2013 on Camp Pendleton was 57% (8/14).

None of the nine nestlings banded in 2013 that survived to fledge were resighted or recaptured at Camp Pendleton in 2014, but one was captured off Base, yielding a minimum first-year survivorship estimate of 11% (1/9). The bird captured off Base was a male that established a territory along the Otay River, approximately 86 km away. Three female birds last seen as

nestlings in 2010, 2011, and 2012 reappeared in 2014, increasing the first-year survivorship estimate of the 2010 cohort to 17% (3/18), the 2011 cohort to 33% (5/15), and the 2012 cohort to 23% (3/13). The 2010 bird established a breeding territory at Pilgrim Creek (Table 6), and both the 2011 and 2012 birds established breeding territories off Base at Bonsall along the San Luis Rey River (Houston and Kus 2014).

Willow Flycatchers at Camp Pendleton generally settle into breeding concentrations or areas where groups of birds establish territories (Fig. 3). Resighting banded birds allowed us to identify individuals that returned to the same area they used the previous year. Six of the eight banded adults seen in both 2013 and 2014, three males and three females, returned to the same breeding area they last occupied (Table 6). All three males either returned to the same territories they previously occupied, or occupied a territory that encompassed a portion of the area they previously used. Two of these males were floaters of unknown sex in 2013, and did not defend a territory in 2013, but returned in 2014 to breed in the same or a portion of the territory where they were detected last year. All three females moved a short distance within the same breeding area they last occupied, but to different territories.

The two remaining banded birds, both females, that that were seen in both 2013 and 2014, moved to a different breeding area and were likely displaced by fire. Both females (ETA and ANG; Table 6) nested in the Pump Road breeding area in 2013, but this area was severely burned in the fires, leaving no suitable habitat. The ETA female moved to the Pueblitos breeding area, approximately 0.7 km from the Pump Road breeding area. The ANG female has moved between the Pump Road and Air Station breeding areas multiple times since she entered the breeding population in 2010 (Pump Road 2010 and 2013; Air Station 2011 and 2014; not detected in 2012), so it is possible that she had already established a territory in Air Station before the fires started. The ANG female nested less than 0.1 km from her 2011 nesting location (which was severely burned), in a small area of habitat that did not burn. The average distance moved by adult flycatchers between the 2013 and 2014 breeding seasons was 0.2 ± 0.5 km (excluding PLG female not seen since 2010).

The returning nestling from 2010 (PLG) was detected breeding on Base for the first time in 2014. The female was originally banded as a nestling in the Pueblitos area, and was redetected at Pilgrim Creek, approximately 6.6 km away (Table 6, Fig. 3).

Two instances of movement by adult Southwestern Willow Flycatchers within the 2014 breeding season were observed. The first instance involved the ARC female who was displaced by fire. The ARC female has nested in the Air Station breeding area for the past 4 years and was observed for a few days after the fires in the APL territory where she nested in 2010, 2012, and 2013. However, the territory was severely burned, and she ultimately moved approximately 0.2 km south into a small area of habitat that did not burn. The second instance involved the PLG female who was first detected in the Pilgrim Creek area, just north of the dam. The female was found mid-season with an active two-egg nest, but no male was detected in the territory. The female abandoned the nest a week after one of the eggs disappeared and the remaining egg did not hatch. She was re-detected a few days later building a new nest off Base on the San Luis Rey River near Bonsall, approximately 7.7 km away (Houston and Kus 2014).

Table 6. Between-year, between-area movement of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2014.

Year Last Detected	Breeding Area[a] (Territory Last Detected)	Breeding Area (Territory in 2014)	Dispersal Distance (km)	Band Combination[b]	Age in 2014	Sex[c]
2013	Air Station (ANG/APL/APR/ASA)	Air Station (ANG/ARC)	0.0	Msi : puor	≥ 5 yrs	M
2013	Treatment Ponds (Floater in TLM/ETA)	Pueblitos (ETA)	0.0	dbye : Msi	≥ 2 yrs	M
2013	Treatment Ponds (Floater in TWI)	Treatment Ponds (TLM/TWI)	0.0	Msi : dbor	2 yrs	M
2013	Air Station (APL)	Air Station (ARC)	0.2	Msi : yedb	6 yrs	F
2013	Pump Road (PLM)	Pueblitos (ETA)	0.7	Msi : orpu	≥ 5 yrs	F
2013	Pump Road (PNB)	Air Station (ANG)	1.5	rewh : Msi	≥ 5 yrs	F
2013	Treatment Ponds (TLM)	Treatment Ponds (TWI)	0.1	yere : Msi	≥ 4 yrs	F
2010	Pueblitos (ETC)	Pilgrim Creek (PLG)	6.6	Msi : whdb	4 yrs	F
2013	Treatment Ponds (TOR)	Treatment Ponds (TLM)	0.1	yepu : Msi	≥ 2 yrs	F

[a] See Fig. 3, Appendix B, Fig. 16; Appendix C, Figs. 20-22 for breeding area and territory locations.
[b] Band combinations: left leg : right leg; Msi = federal aluminum band. *Metal bands:* dbor = dark blue-orange split, dbye = dark blue-yellow split, orpu = orange-purple split, puor = purple-orange split, rewh = red-white split, yedb = yellow-dark blue split, yepu = yellow-purple split, yere = yellow-red split, whdb = white-dark blue split.
[c] Sex: M = male, F = female.

Four instances of between-year emigration were seen in 2014, including the PLG female discussed previously. A male originally banded as a nestling in 2013 in the Air Station area established a territory on the Otay River, approximately 86 km away from his natal territory (S. Howell, pers. obs). Two females, one originally banded as a nestling in 2011 in the Air Station area and one originally banded as a nestling in 2012 in the Treatment Ponds area both established breeding territories on the San Luis Rey River near Bonsall, approximately 13 km away (Houston and Kus 2014). Neither of these two females had been detected since they were banded as nestlings at their natal territories.

Human Activities in Riparian Habitat

No evidence of human activities in riparian habitat occupied by Willow Flycatchers was witnessed during the 2014 breeding season.

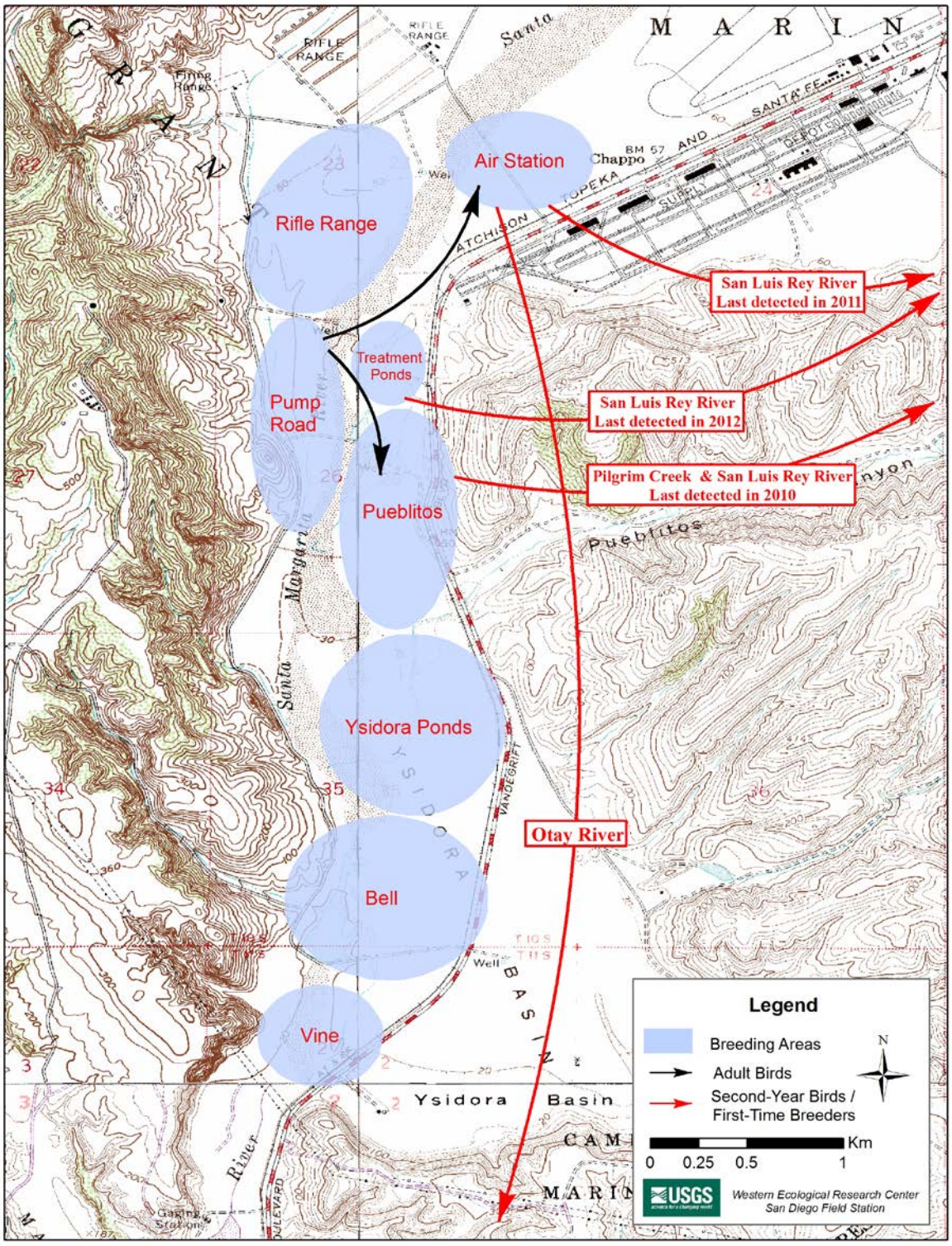

Fig. 3. Between-year, between-area movement by adult and second-year/first-time breeder Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton, 2014. Includes some 2014 non-Pendleton data, but may not represent a complete picture of emigration off Base.

DISCUSSION

Southwestern Willow Flycatchers during the 2014 breeding season were affected by two extreme events, wildfire and prolonged drought. In May 2014, a series of massive wildfires destroyed 8,906 ha on Marine Corps Base Camp Pendleton, including 837 ha of riparian habitat. The fires occurred during the time when resident flycatchers were arriving and selecting breeding territories and transient flycatchers were migrating through the Base on the way to their breeding sites. In addition to the wildfire, drought conditions continued to plague southern California, with rainfall well below average for the third year in a row (OWR 2014).

Transient flycatcher movement did not appear to be altered by the fire, with detections occurring before and after the fire, and flycatchers were observed foraging in burned areas. Drought conditions may have played a role in the number of transient flycatchers using the Base as a stop-over during migration. The number of transient flycatchers detected in 2014 (97) was more than double the number seen in 2013 (45), although comparable to numbers seen in previous years. The number of transients detected annually since 2002 has varied greatly, despite consistent survey scope and effort, from a high of 102 in 2002, to a low of 25 in 2010. Although factors influencing the migratory route of transient Willow Flycatchers are unclear, it is possible that they are responding to ecological variables such as precipitation when choosing a migration route. In years with low rainfall (ie. 2002, 2007, 2014), it appears that more Willow Flycatchers migrate through Camp Pendleton, whereas fewer birds were detected in years with higher precipitation (ie. 2005, 2010). This may be related to differences in food availability in coastal environments; it is possible that coastal vegetation is less affected by fluctuations in precipitation and supports a more reliable prey base for migrating flycatchers. A Willow Flycatcher diet study in Arizona found a five-fold difference in arthropod biomass collected during a drought year (2002) compared to the following higher precipitation year (Durst 2004). Effects from low precipitation may be more pronounced along inland migration routes.

The resident population of Southwestern Willow Flycatchers on Camp Pendleton in 2014 (nine individuals) declined by 47% from 2013 (17 individuals) and was the smallest documented since monitoring began in 2000. The decrease was a result of the net loss of four breeding females between 2013 and 2014 while the number of breeding males in the population actually increased compared to 2013 with loss of one male offset by two new breeding males. In addition, there were no unpaired males or non-territorial floaters detected on Base during the 2014 breeding season. It is probable that some of the decline in 2014 was directly related to the loss of breeding habitat from the wildfires; however, the continuing drought may have also been a factor, prompting flycatchers that typically would have bred on Base to move to nearby locations off Base in search of suitable habitat. The decline seen in 2014 was similar to the decline seen between 2007 and 2008, following the last severe drought, when a loss of 42% was recorded.

As in 2012 and 2013, the sex ratio in 2014 was skewed towards females, and 67% of paired males were polygynous with multiple females. The rate of polygyny among males has ranged from 0-100% since monitoring began in 2000 and fluctuates in association with the sex ratio in the breeding population. In the occupied breeding areas along the Santa Margarita River (Air Station, Treatment Ponds, and Pueblitos), females outnumbered males by almost 2:1, and the high degree of polygyny in the population reflects this. The proportion of females sharing

males fell to 80%, after a record high in 2013 (100%), when females outnumbered males 5:1. In years when the sex ratio was closer to 1:1 (i.e., 2003, 2004, 2007, 2008, and 2009) the proportion of females that were polygynous fluctuated between 50-57%. The proportion of polygynous females was consistently higher (74-100%) in years when females outnumbered males (2005, 2006, 2010, 2011, 2012, and 2013). 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 and persistence of the population.

The number of breeding flycatcher territories on the Santa Margarita River in 2014 (five) decreased relative to 2013 (ten). As in previous years, resident flycatchers were largely distributed among historic breeding areas, although the number of territories in all areas differed compared to previous years. Among the occupied areas, one area had an increase, and two areas had a decrease. The northern portion of the Pueblitos breeding area supported a monogamous pair in 2014, an increase of one bird compared to 2013 when one female in this area paired with a polygynous male counted in the Treatment Ponds area. The Treatment Ponds breeding area decreased relative to 2013, hosting just two breeding pairs (one male, two females) compared to three breeding pairs (one male, three females) and two nonbreeding floaters in 2013. The Air Station breeding area also decreased, with two breeding pairs (one male, two females), compared to four breeding pairs (one male, four females) and one nonbreeding floater in 2013. The reduction in the number of occupied territories in the Air Station breeding area was likely a result of the loss of habitat from the Las Pulgas fire, as the majority of previously suitable breeding habitat at the Air Station breeding area was severely burned. The Pump Road breeding area was also affected by the fire, with all previously suitable habitat severely burned. Consequently, the number of territories in the Pump Road breeding area fell to zero, compared to two female territories in 2013.

The distribution of resident flycatchers away from the Santa Margarita River was limited to a breeding female detected in mid-June on Pilgrim Creek, although no breeding male was confirmed to be present in the territory with her. Pilgrim Creek historically supported two to six breeding pairs between 1986 and 1997 (Griffith Wildlife Biology 1999), but no breeding birds had been detected there since 1997. A single territorial male was discovered on Pilgrim Creek in 2013, but no evidence of breeding was seen. The presence of a seemingly single female was unusual, and may suggest that female flycatchers are selecting the best available habitat rather than the mate. Factors influencing territory selection from year-to-year are poorly understood and continued research may contribute to a better understanding of habitat selection in flycatchers.

The proximity of the breeding areas on the Santa Margarita River facilitates movement between areas annually, and often within breeding seasons. Site fidelity in 2014 was influenced by the Las Pulgas fire which likely forced some breeding flycatchers to move to unburned areas, rather than occupy previously held territories that burned. Seventy-five percent of adult flycatchers that returned in 2014 occupied the same breeding area that they used in 2013, compared to 100% in 2013. The 25% of adult flycatchers (all females) that moved to a different area were likely displaced by the fire, although it is hard to say for certain as the timing of the fires occurred when flycatchers were arriving and establishing territories. One of the birds

almost certainly moved because of the fire, as the Pump Road breeding area where she nested for the past 4 years was completely burned. The other female that moved, the ANG female, may have moved for reasons other than wildfire as she has moved back and forth between the Pump Road and Air Station breeding areas for the last 4 years. Last year she nested at Pump Road (completely burned) and this year at Air Station (patchily burned). It is possible that this female had already arrived at the Air Station before the fire burned Pump Road, as at least one female flycatcher was present in the Air Station breeding area the morning of 16 May, before the Las Pulgas fire entered the Santa Margarita River and burned the flycatcher breeding area.

Between-year site fidelity has been highly variable, ranging from a low of 40% in 2008 to a high of 100% in 2012 and 2013. Habitat condition and suitability are likely important factors in annual flycatcher movement between breeding areas. It is possible that flycatchers may be evaluating the habitat within the matrix of breeding areas on the Santa Margarita River each year in an attempt to maximize their fitness (i.e., ability to survive and reproduce successfully). High site fidelity in 2009 (88%), 2010 (83%), 2011 (83%), 2012 (100%), and 2013 (100%) suggests that the occupied areas represent the most suitable habitat currently available on Base. In addition to movement between breeding seasons, flycatchers periodically move within the breeding season. There were two instances of within-season movement, one involving a female displaced by fire, and one involving the female detected at Pilgrim Creek. The fire-displaced female moved to a different territory after her historic nesting territory was burned. The Pilgrim Creek female moved to a completely new area after a failed nest attempt and no apparent male present in her first territory. If there was a male present in the territory, the female likely would have re-nested at Pilgrim Creek. However, the female was detected a few days later at Bonsall on the San Luis Rey River where she paired with the resident male for her re-nest.

Nest success increased to 38% during the 2014 breeding season, nearly double the record low set in 2013 (20%). Seasonal productivity increased to 1.2 young/breeding female, compared to the record low set in 2013 (0.9 young/pair), but was still well below the annual mean (1.9 young/pair) from 2001 to 2013. Only 7 young were confirmed fledged in 2014. Several factors combined to create this overall reduction in productivity despite increased nest success and seasonal productivity compared to 2013. Average clutch size set a record low of 2.4 eggs/nest, well below the annual mean clutch size (3.1 eggs/nest). Higher than average predation impacts were also seen in 2014, with 50% of all flycatcher nests depredated, compared to the mean of 32 ± 15% from 2001 to 2013 (excluding the partial 2011 season). The majority of depredated nests appeared to be the result of avian or snake predation. It is possible that prolonged drought conditions are reducing other food sources used by these predators (i.e. small mammals, acorns), causing an increase in nest predation.

The return rate of banded adults between 2013 and 2014 (57%) was comparable to the return rate in 2013 (62%), and higher than the average return rate between 2001 and 2013 (48%). The return rate has fluctuated from a low of 25% in 2001 to a high of 70% in 2002. In contrast to banded adults, none of the nine natal birds banded in 2013 were detected on Base in 2014. This is the first year since 2001 that no natal birds returned to Camp Pendleton to breed, following a low of 20% in 2013. This lack of natal birds could signal that the amount of suitable habitat on Base was reduced by the 2014 fires, or perhaps that the lack of standing water on Base in an extreme drought year deemed the habitat less attractive than areas off Base with water

present. One 2013 Camp Pendleton natal bird, a male, was discovered on the Otay River, holding a territory that encompassed a marshy area with standing water. There were also fewer natal birds produced in 2013, so fewer would be expected to return.

As the flycatcher population on Camp Pendleton decreases, the risk of inbreeding will likely increase (Meffe and Carroll 1997). However, the potential for inbreeding is reduced through immigration and emigration. Unbanded flycatchers are regularly detected on Base. These unbanded flycatchers may be immigrants from other nearby populations, such as the population on the upper San Luis Rey River. While no new unbanded flycatchers were detected on Base in 2014, an unbanded bird captured in 2013 as a floater of unknown sex and given a unique band combination returned to Camp Pendleton and set up a breeding territory.

Four instances of emigration off Base were observed in 2014. The first instance was a second-year male discovered at the Otay River, a distance of 86 km from his 2013 natal site in the Air Station breeding area. In addition to the previously discussed female that first attempted to breed at Pilgrim Creek before moving to Bonsall, two additional females were detected at Bonsall on the San Luis Rey River. One female originated in the Treatment Ponds area in 2012, and the second female originated in the Air Station area in 2011, a distance of approximately 13 km. Both paired with the resident male (also originally from Camp Pendleton) and successfully nested. Emigration of birds off Base to the Bonsall area on the San Luis Rey River has been documented four times since 2010. One adult female bred on Base in the Air Station area in 2009, moved to Bonsall in 2010, and returned to the Treatment Ponds area on Base in 2011, 2012, and 2013; one natal male dispersed to Bonsall in 2011; and one natal male and one female dispersed to Bonsall in 2013. From 2001-2008, eight birds immigrated onto Camp Pendleton from nearby habitat along the San Luis Rey River and entered the breeding population, and from 2003-2014 12 birds (six in the last 2 years) emigrated from Camp Pendleton to hold territories on the Otay, San Diego, and San Luis Rey Rivers. The reason more flycatchers are emigrating off Base is unclear, but it may relate to the increasingly arid conditions on Base, possibly prompting flycatchers to disperse to nearby, off Base habitats containing more water. 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 (Mary Whitfield, pers. comm.) and the lower San Luis Rey River (Ferree et al. 2014) have experienced steep declines or have 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; Howell and Kus 2010b). The population on Marine Corps Base Camp Pendleton is reaching a critical low, and the reduction in suitable breeding habitat from the Las Pulgas fire and the high rate of emigration off Base may indicate that all currently suitable breeding habitat on Base is being occupied. The population on Base may not increase until additional habitat becomes available. Until that time, careful consideration should be given to any projects that alter the habitat in currently occupied areas. Additionally, restoration activities such as planting and watering of burned habitats in historically occupied areas may be warranted to enhance recovery and increase the chances of recolonization by Southwestern Willow Flycatchers. As demonstrated by the emigration of multiple birds to areas off Base with water, water is becoming more important as drought conditions continue. The creation or restoration of water features such as holding ponds on Base near historically occupied areas may increase the retention of Southwestern Willow Flycatchers leading to an increase in the population and enhancing recovery of flycatchers on Base and in the region.

With the continued decline of Southwestern Willow Flycatchers on Base, communication between the Assistant Chief of Staff (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.

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APPENDIX A

SOUTHWESTERN WILLOW FLYCATCHER SURVEY AREAS AT MARINE CORPS BASE CAMP PENDLETON, 2014

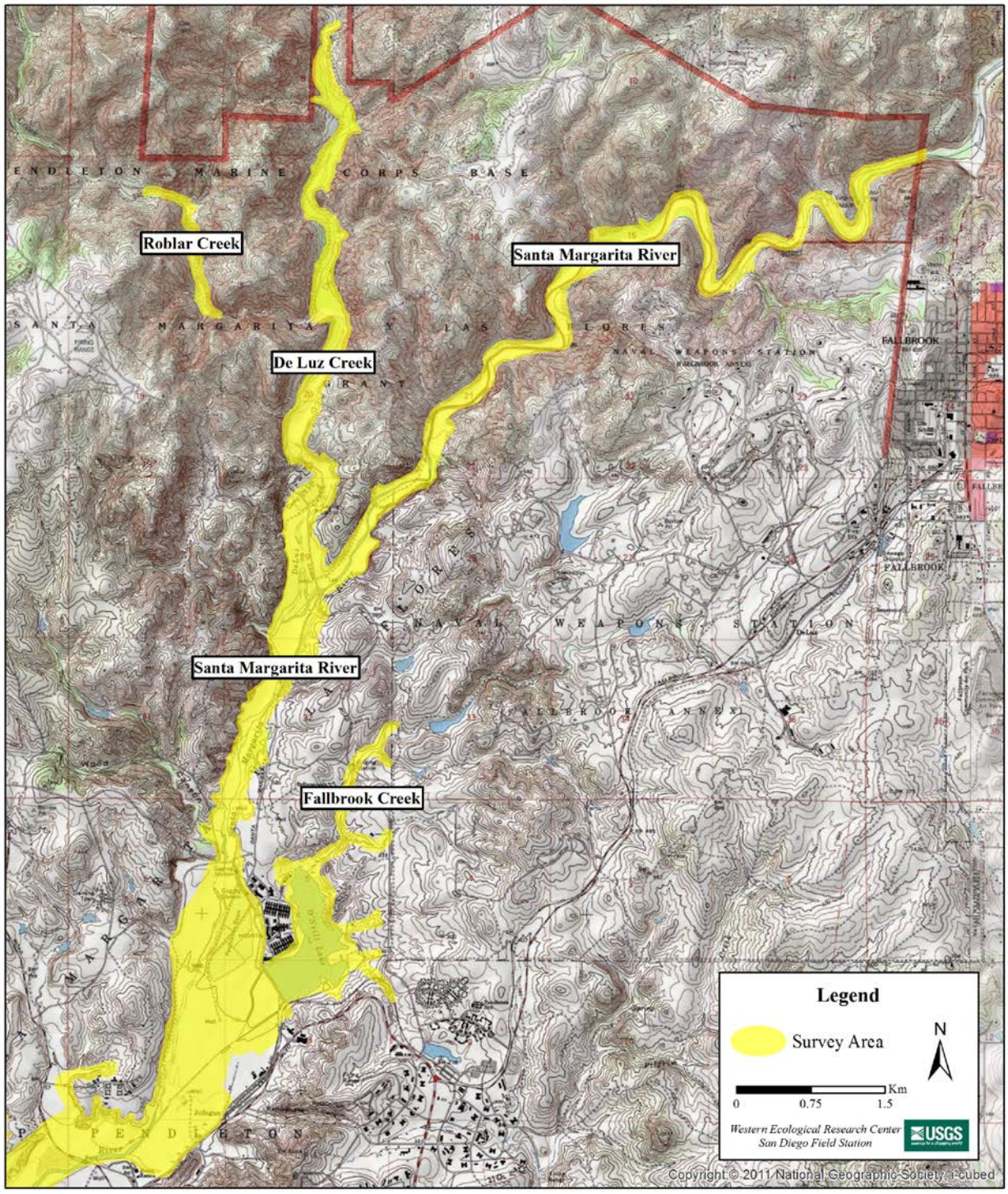

Fig. 4. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2014: Santa Margarita River, Fallbrook Creek, De Luz Creek and Roblar Creek.

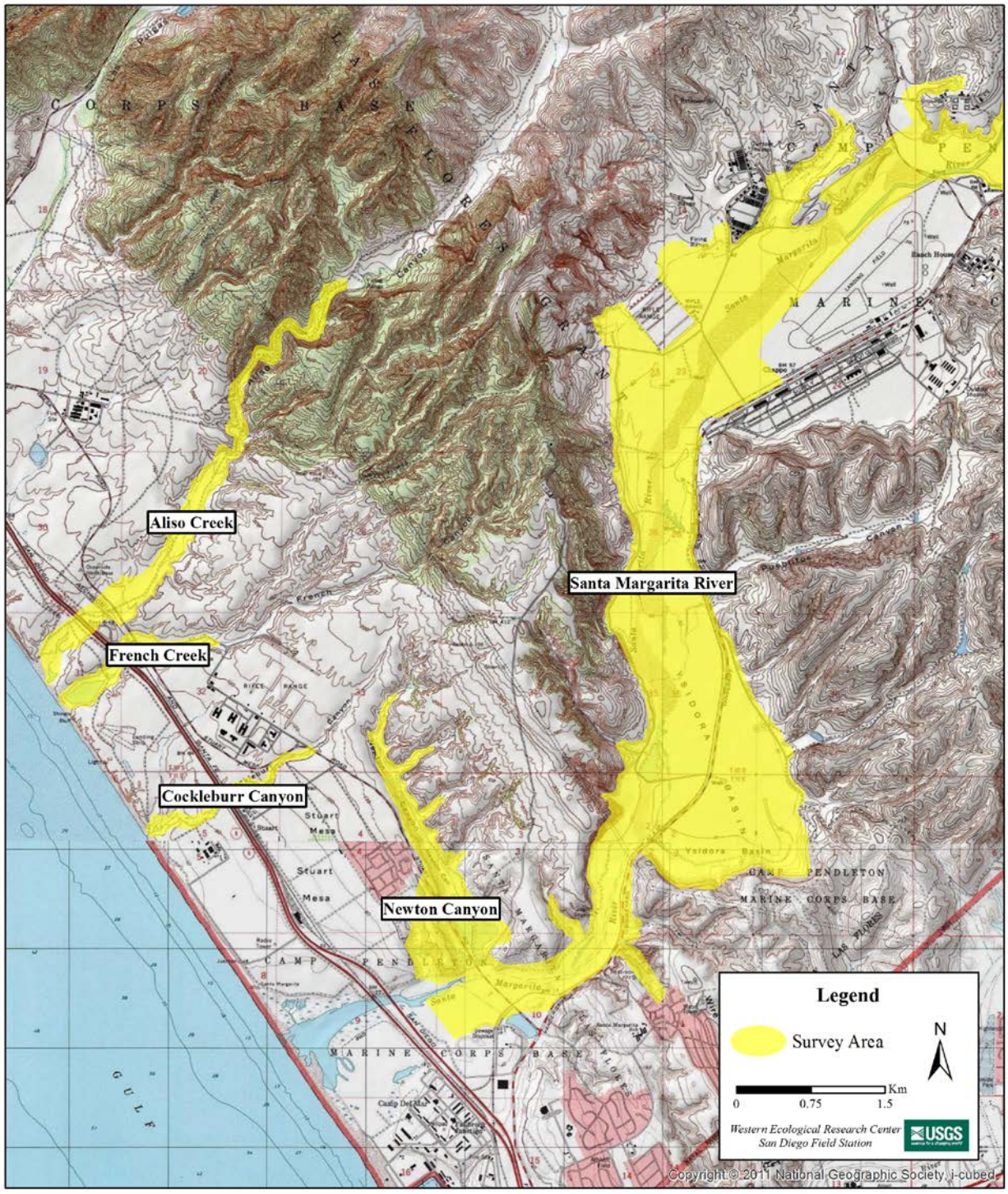

Fig. 5. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2014: Santa Margarita River, Newton Canyon, Cockleburr Canyon, French Creek, and Aliso Creek.

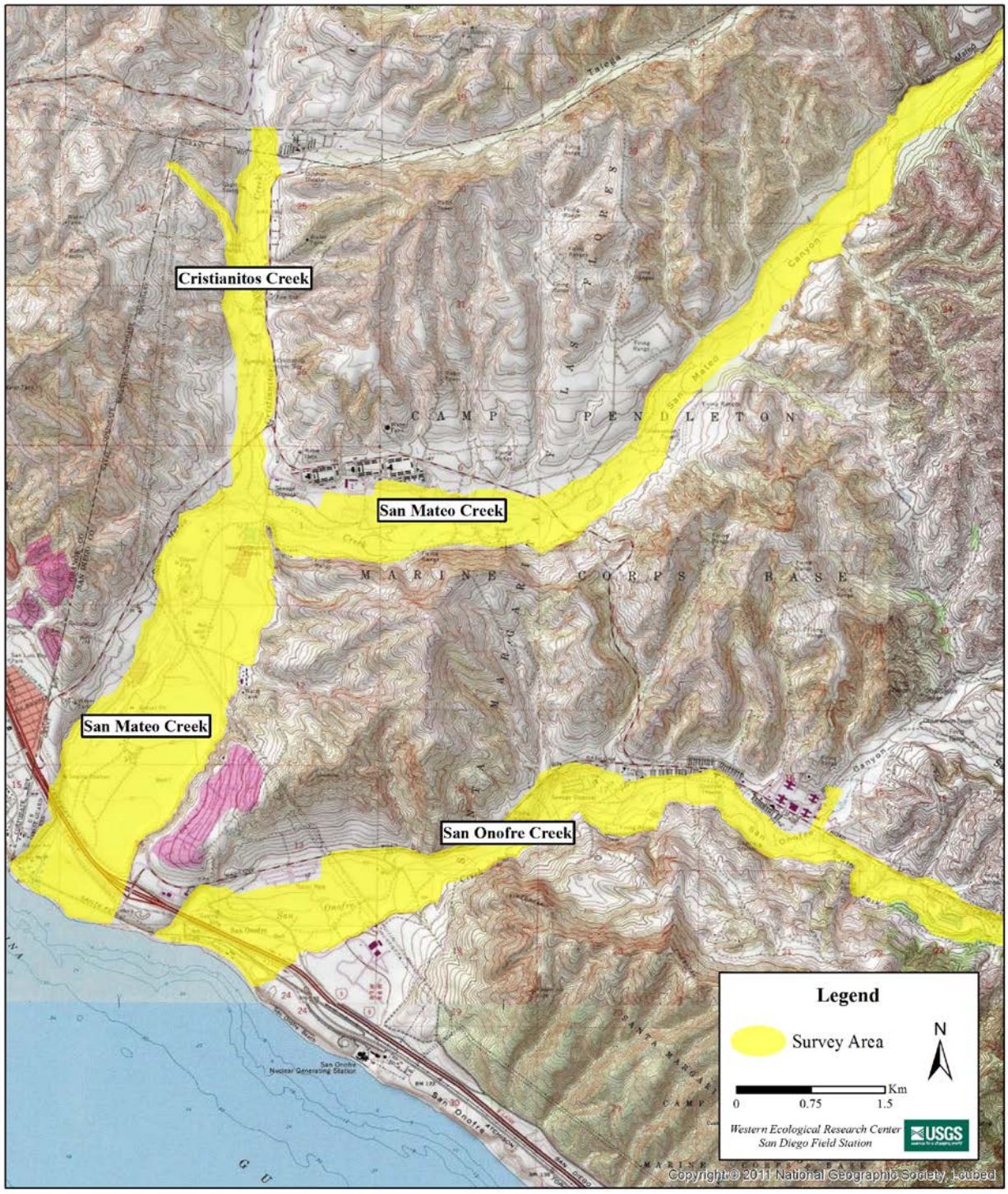

Fig. 6. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2014: Cristianitos Creek, San Mateo Creek and San Onofre Creek.

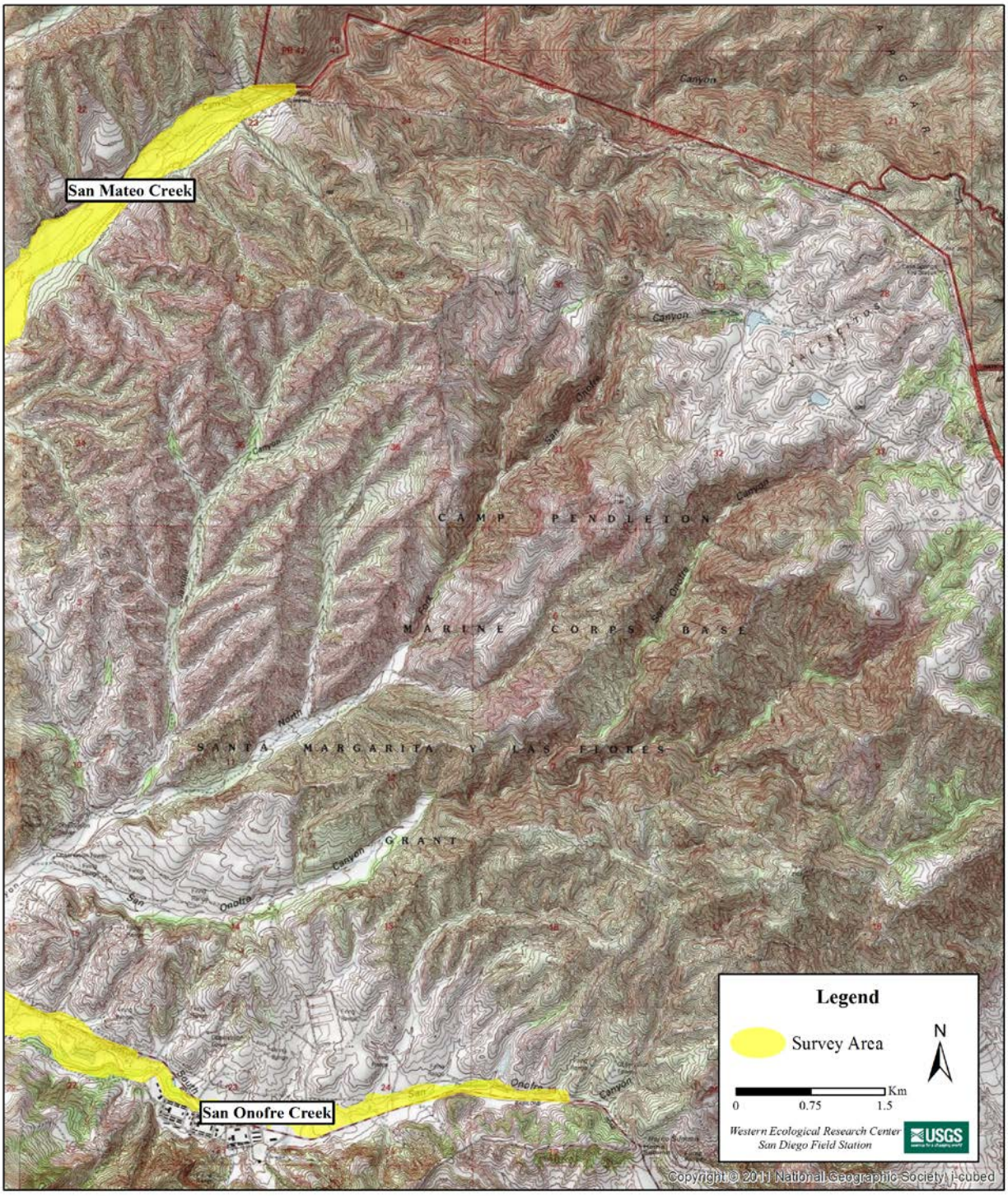

Fig. 7. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2014: San Mateo Creek and San Onofre Creek.

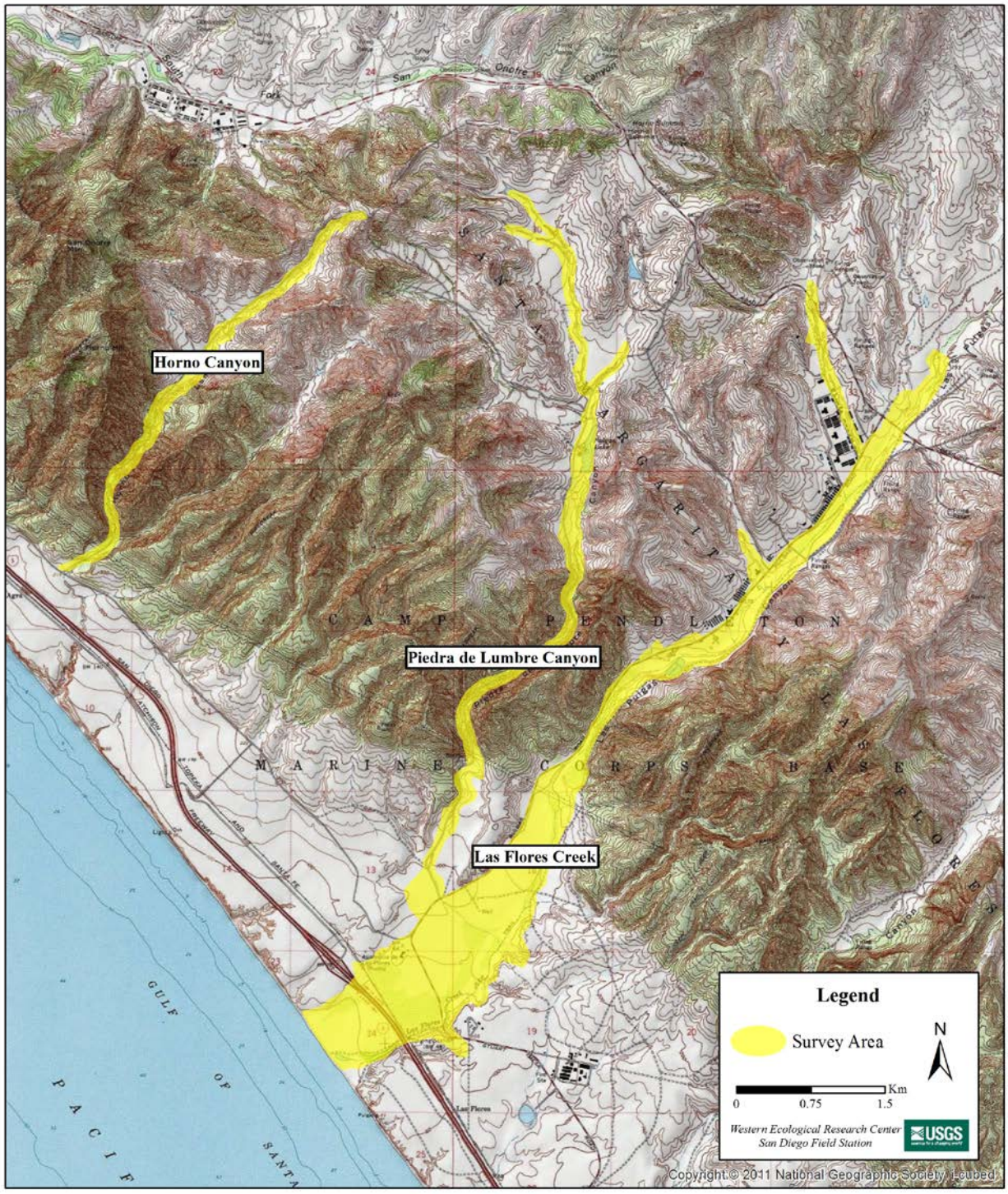

Fig. 8. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2014: Las Flores Creek, Piedra de Lumbre Canyon, and Horno Canyon.

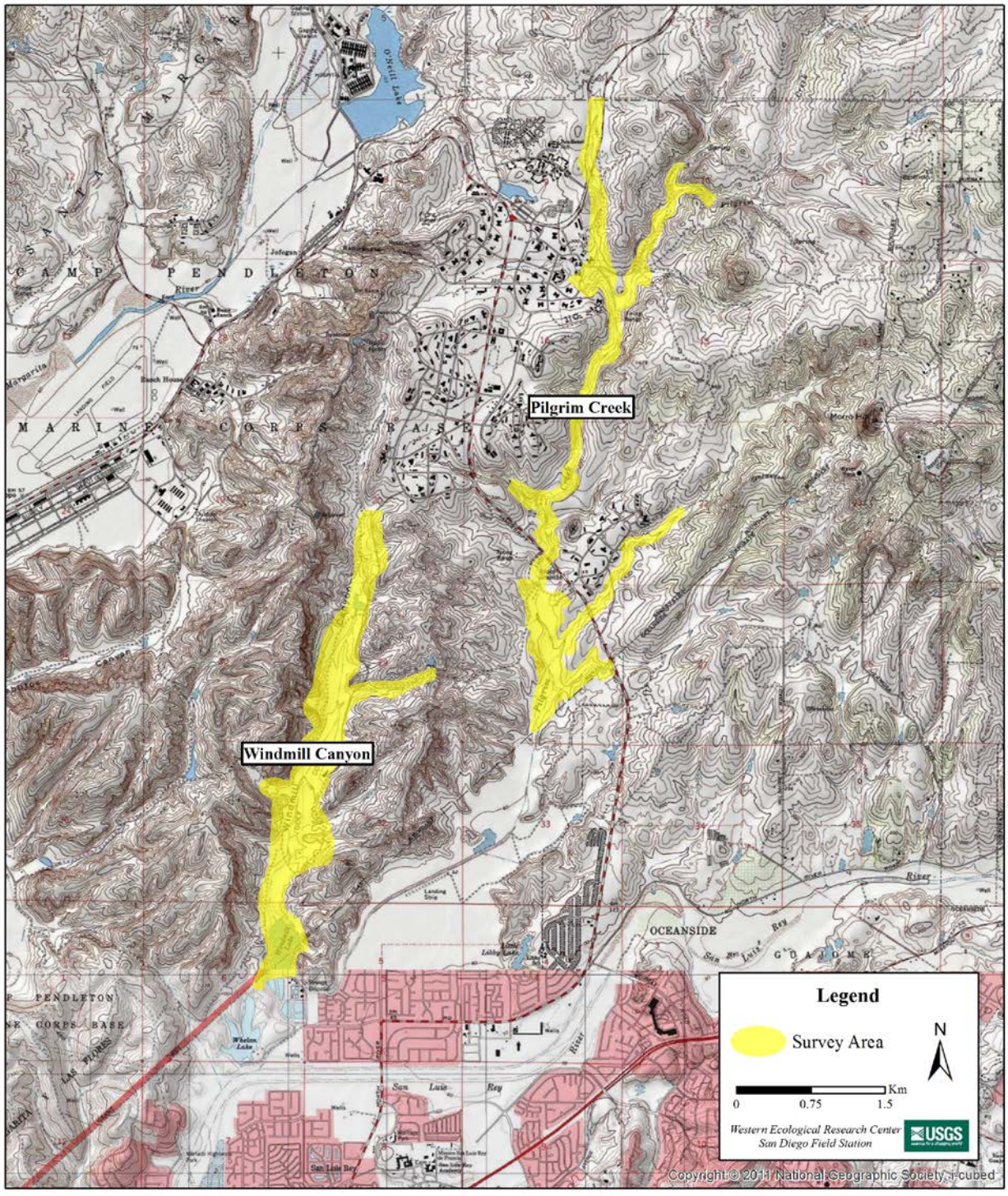

Fig. 9. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2014: Windmill Canyon and Pilgrim Creek.

APPENDIX B

LOCATIONS OF WILLOW FLYCATCHERS AT MARINE CORPS BASE CAMP PENDLETON, 2014

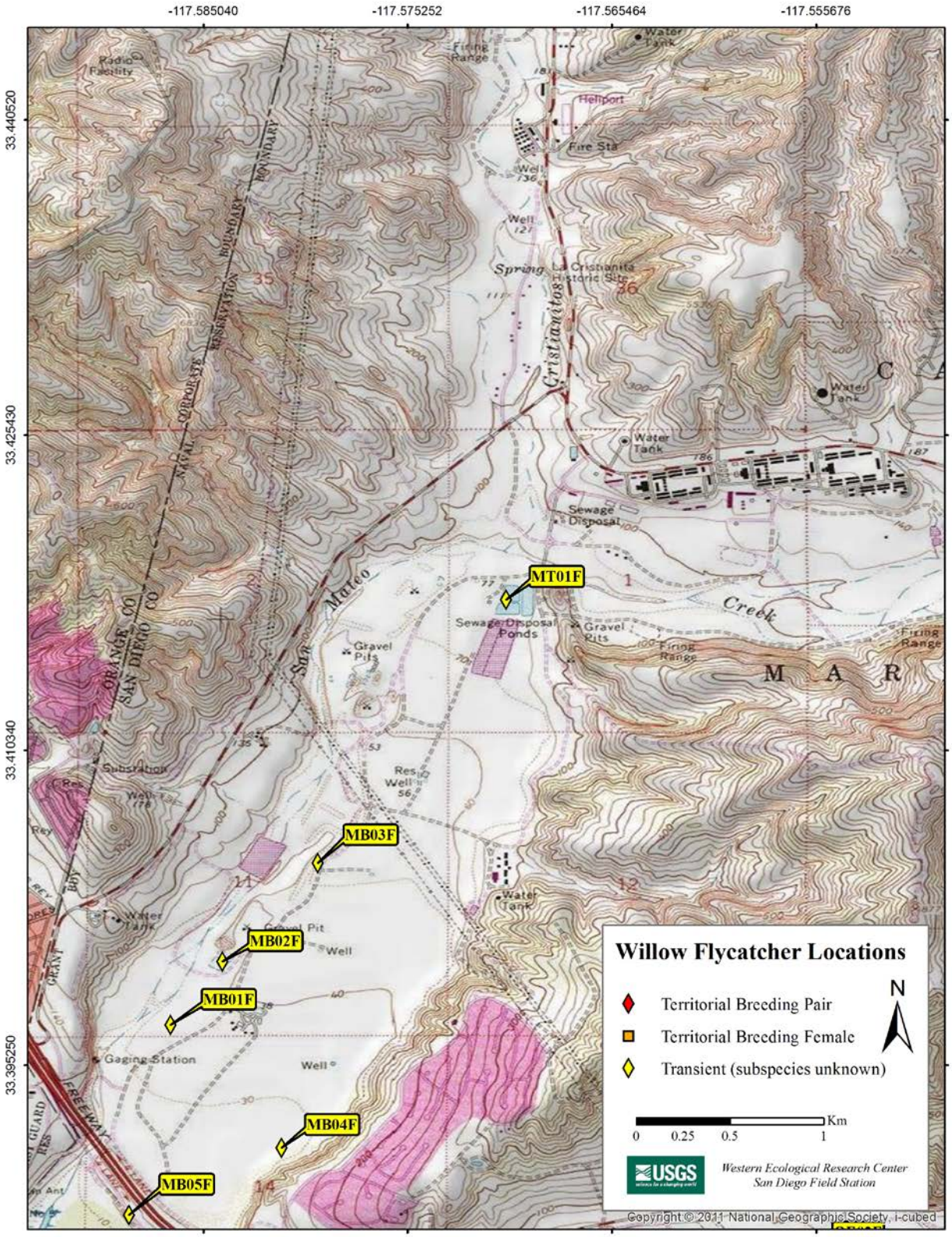

Fig. 10. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2014: San Mateo Creek and Cristianitos Creek.

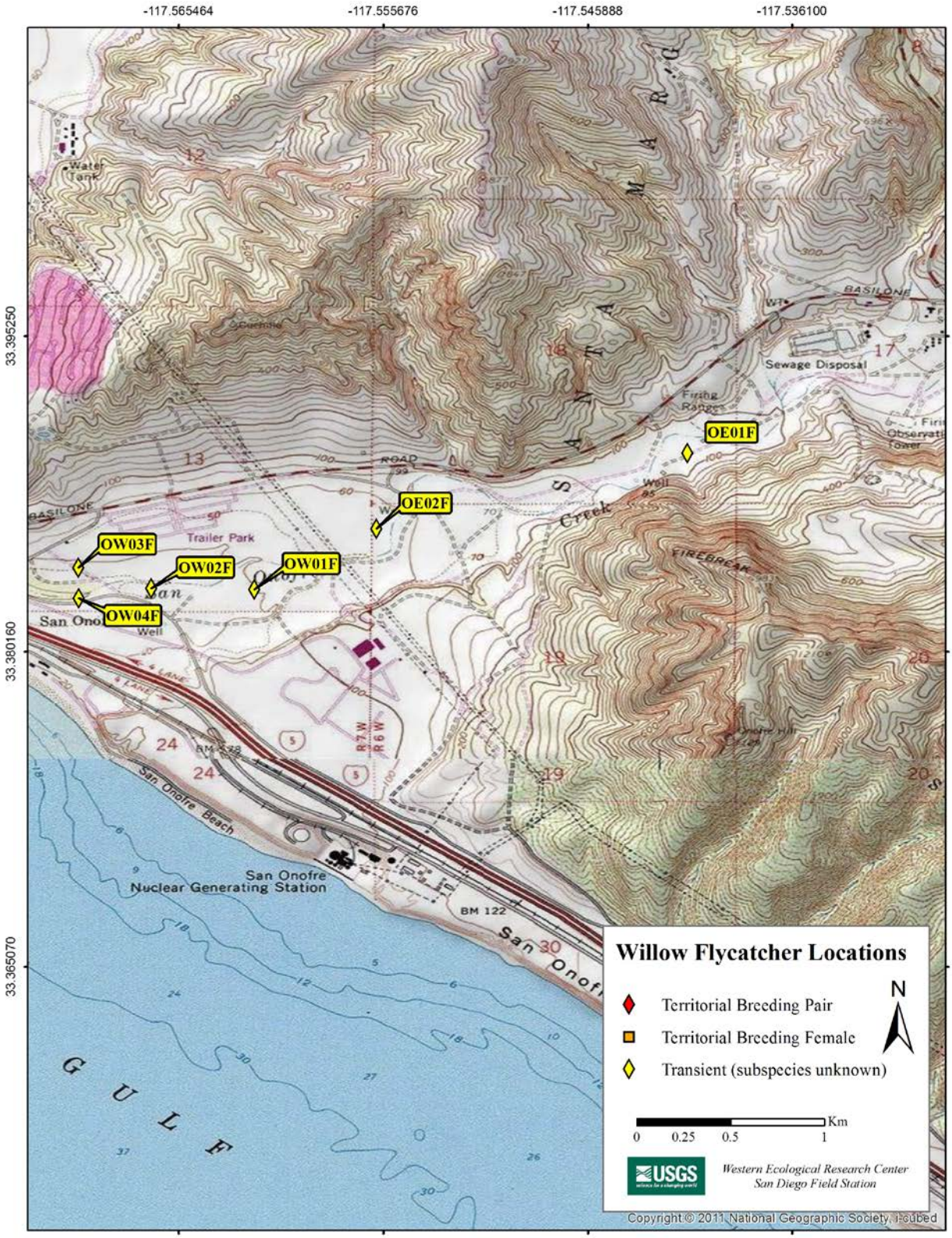

Fig. 11. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2014: San Onofre Creek (downtream).

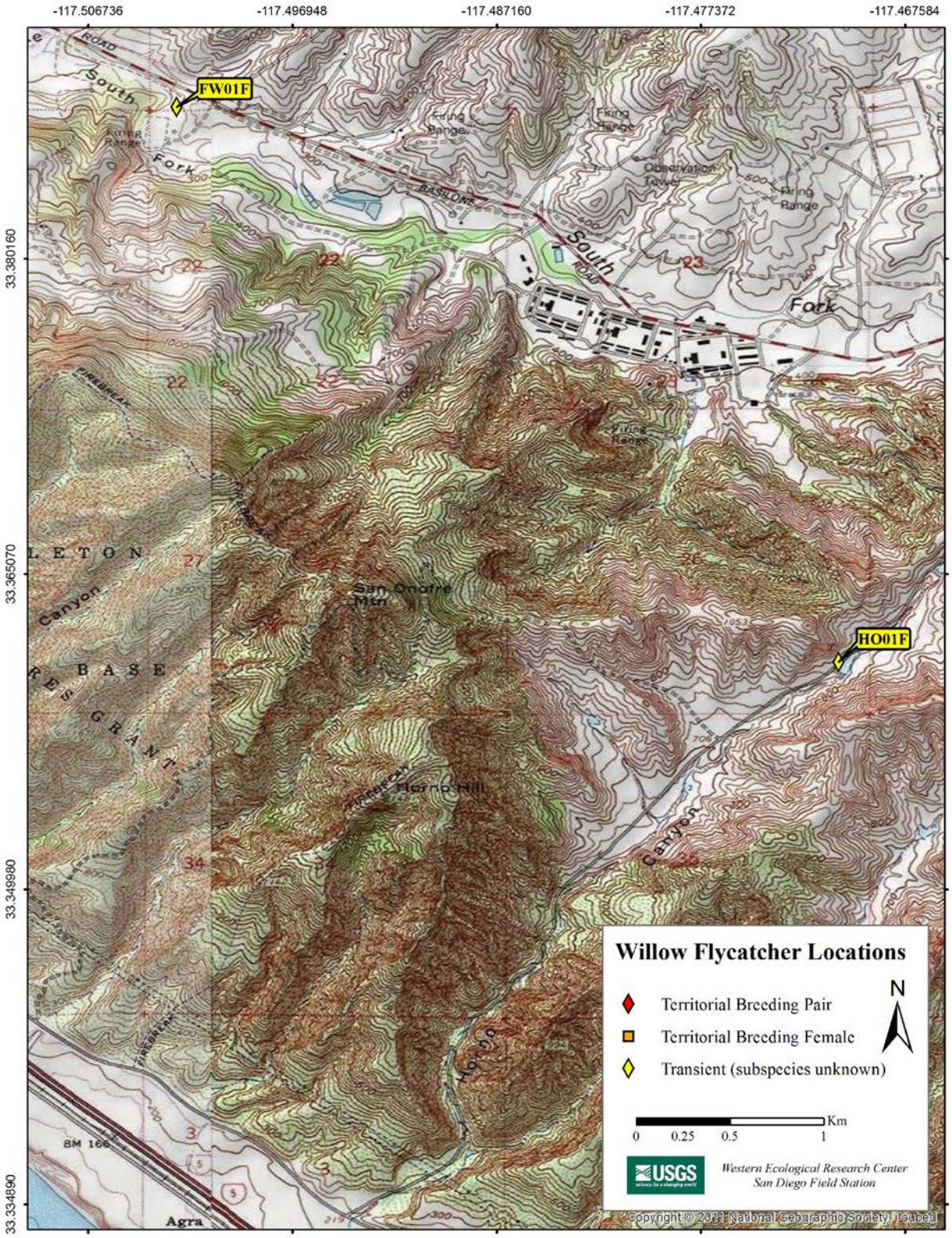

Fig. 12. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2014: San Onofre Creek (upstream) and Horno Canyon.

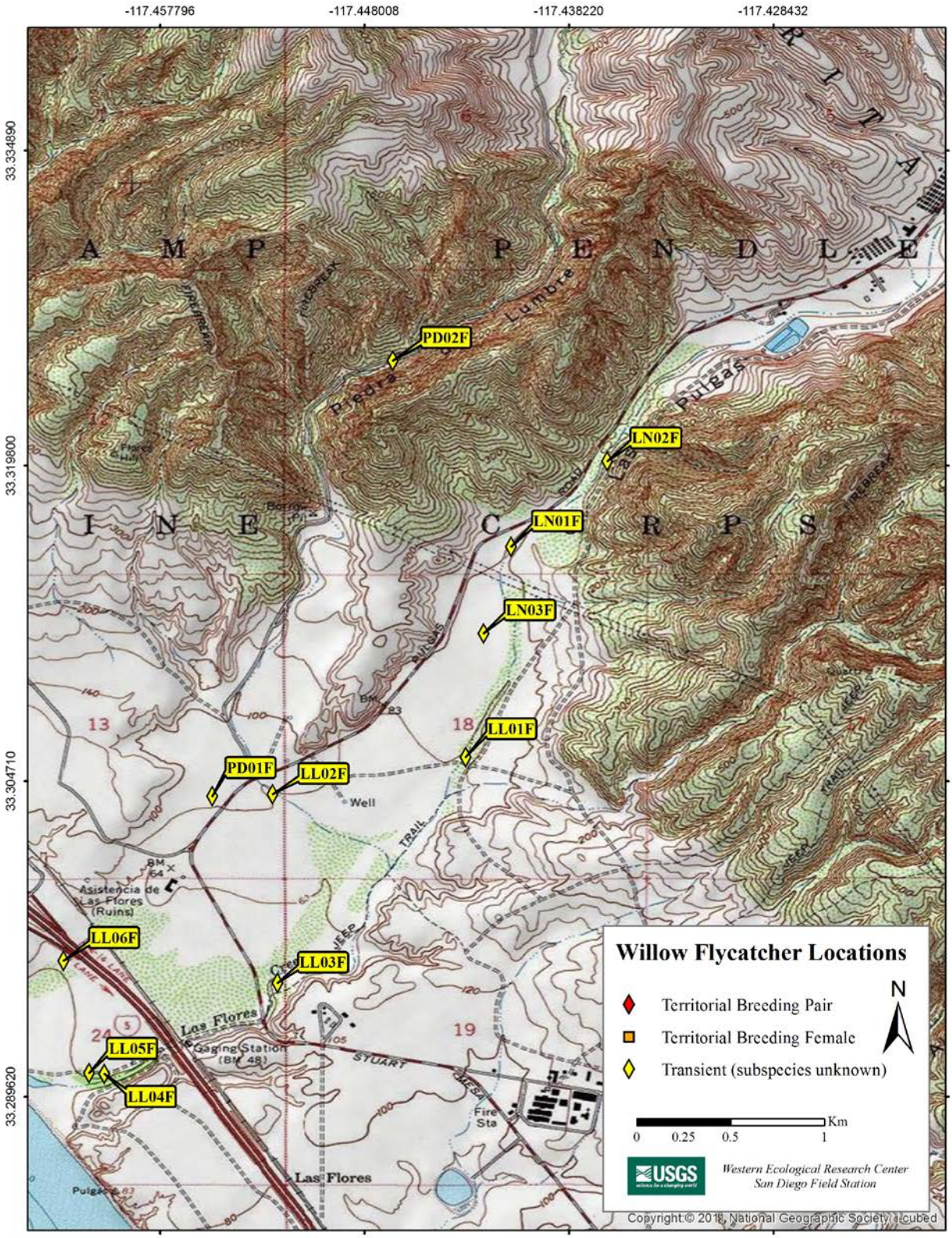

Fig. 13. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2014: Las Flores Creek and Piedra de Lumbre Canyon.

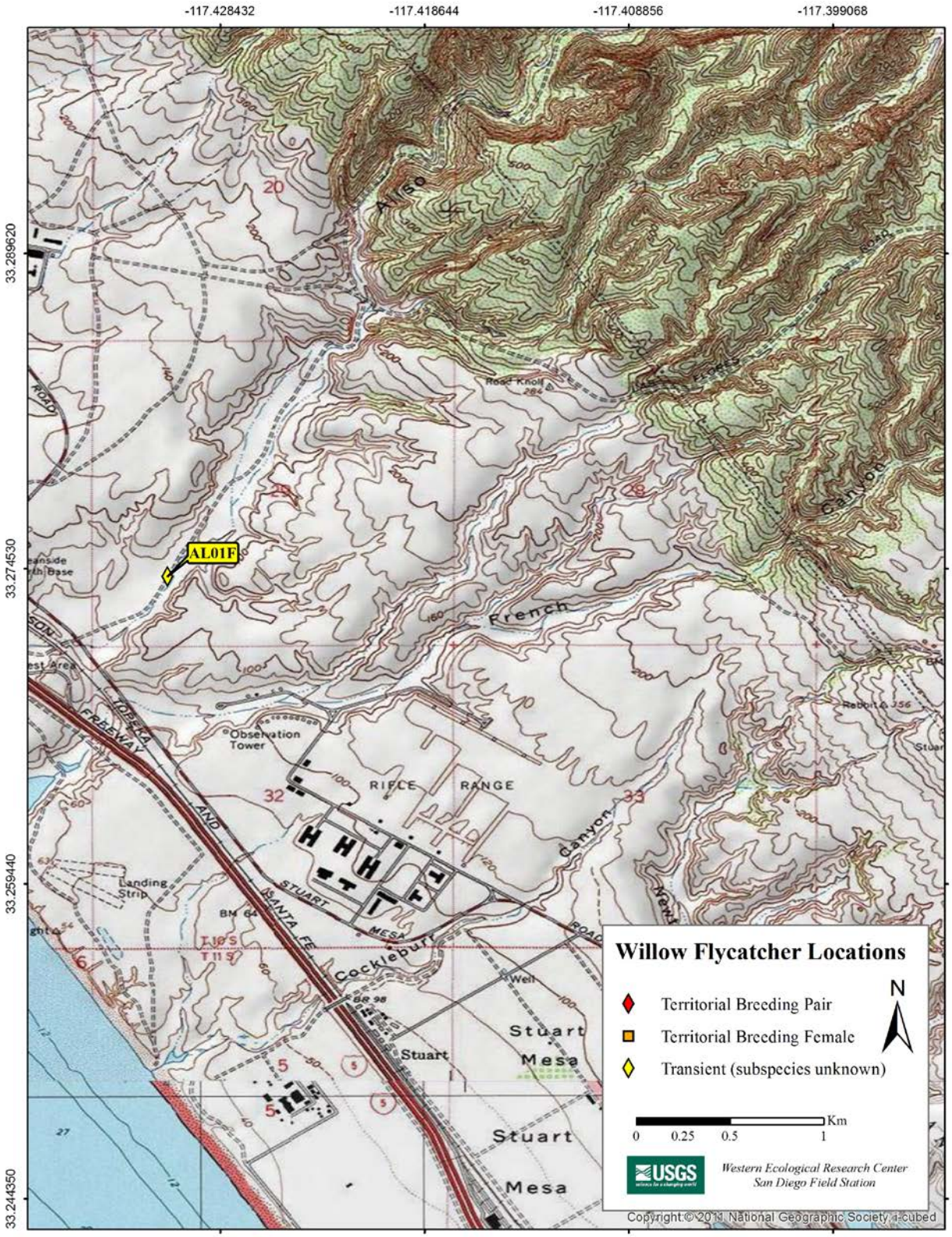

Fig. 14. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2014: Aliso Creek, French Creek, and Cockleburr Canyon.

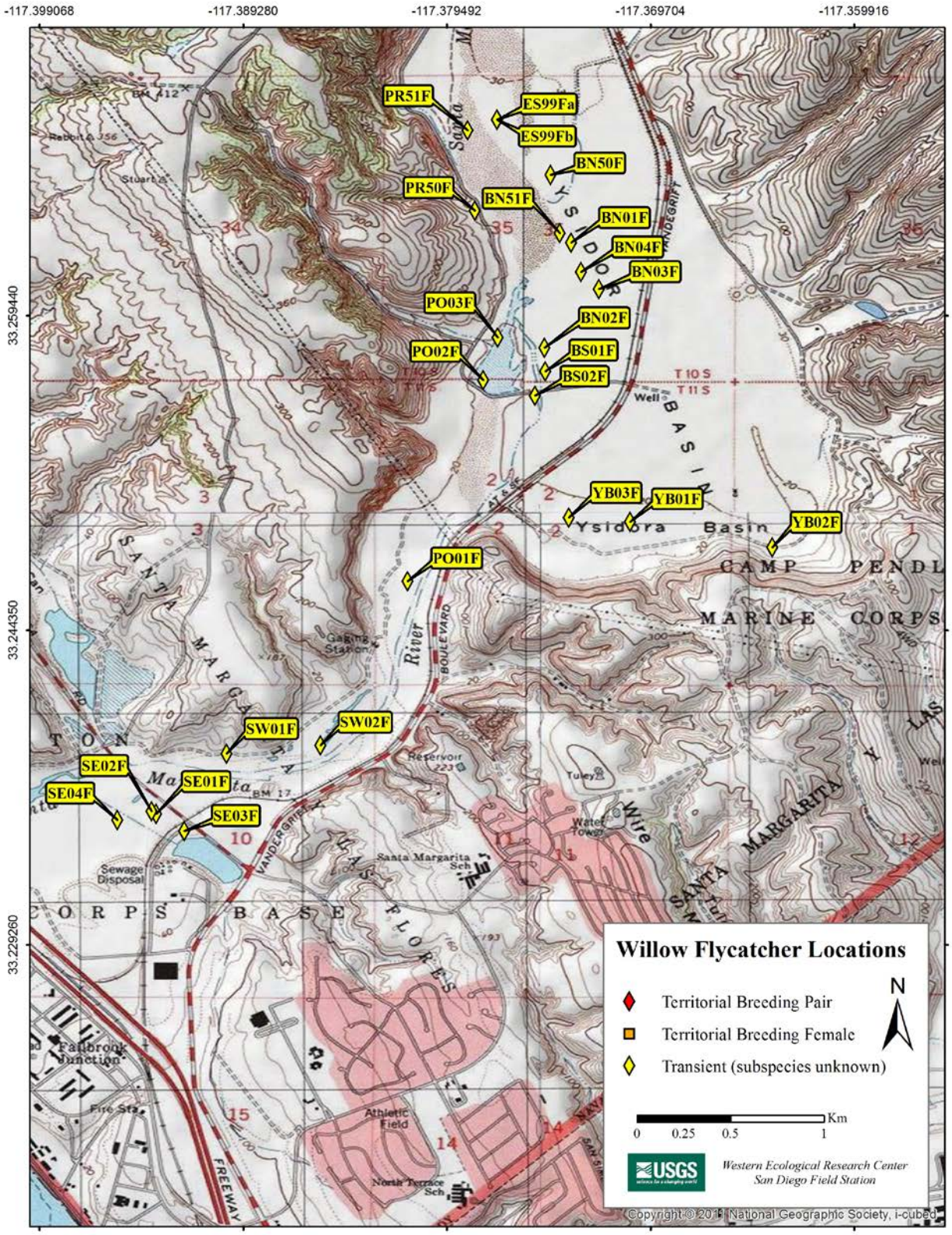

Fig. 15. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2014: Santa Margarita River (downstream).

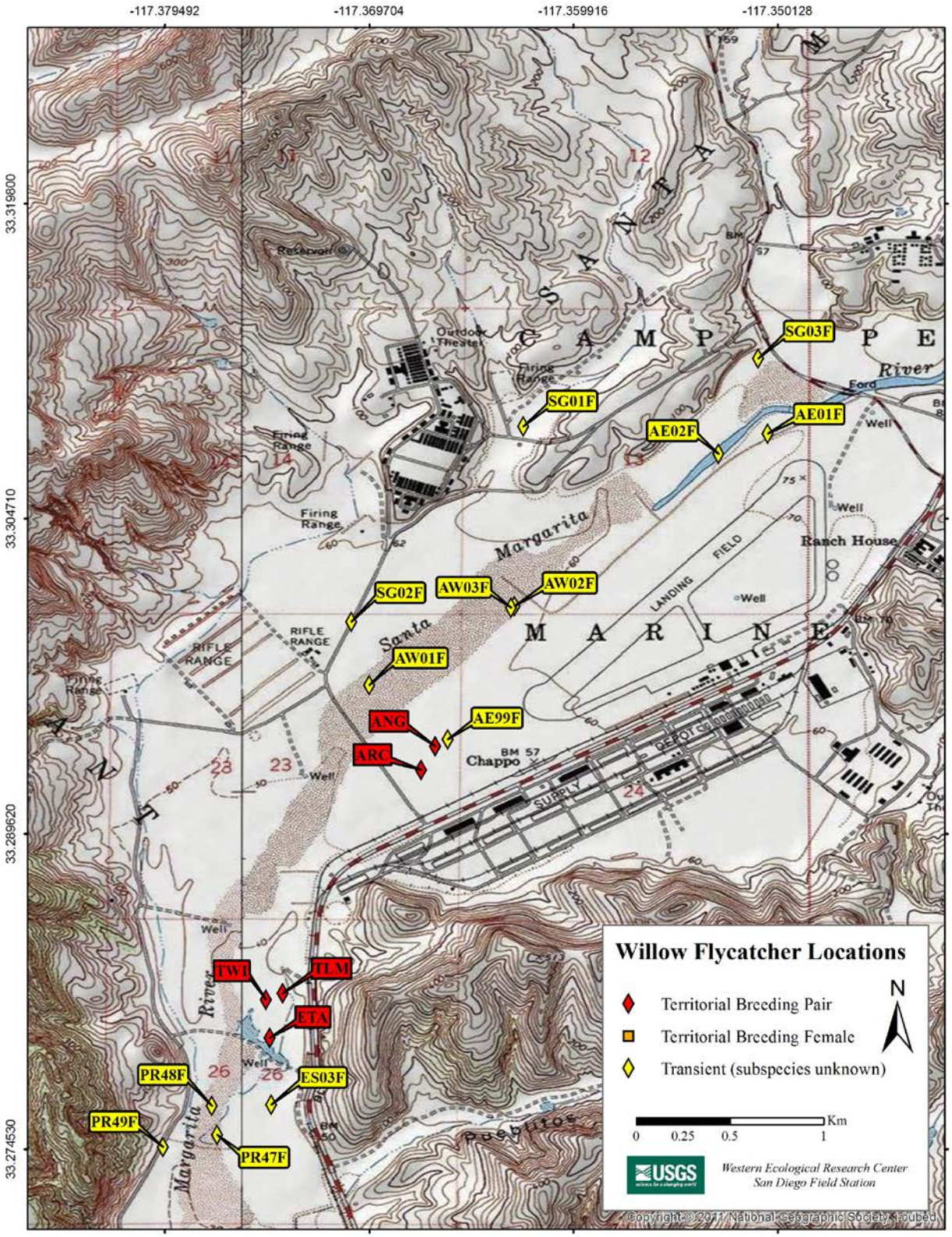

Fig. 16. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2014: Santa Margarita River (midstream).

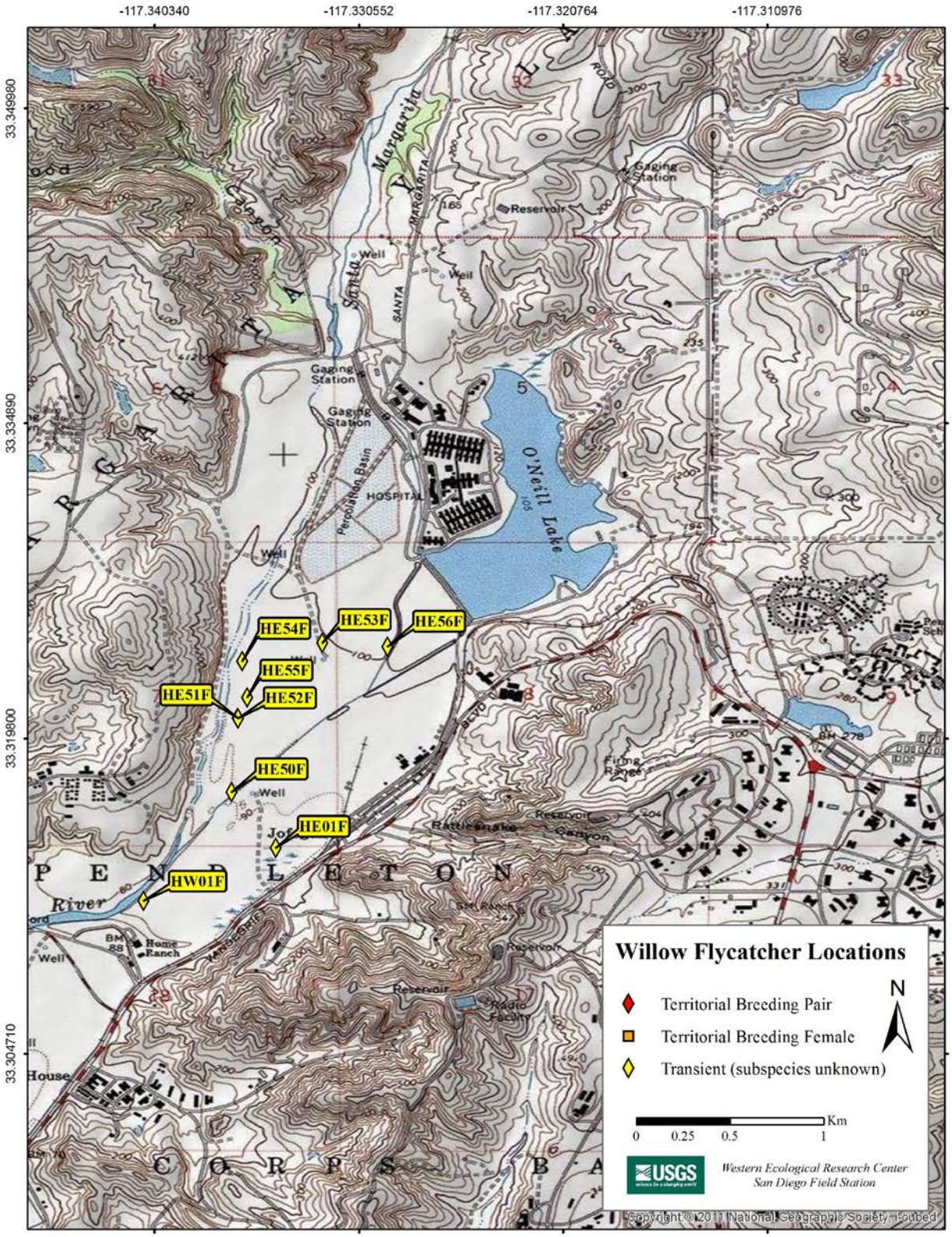

Fig. 17. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2014: Santa Margarita River (upstream) and Fallbrook Creek.

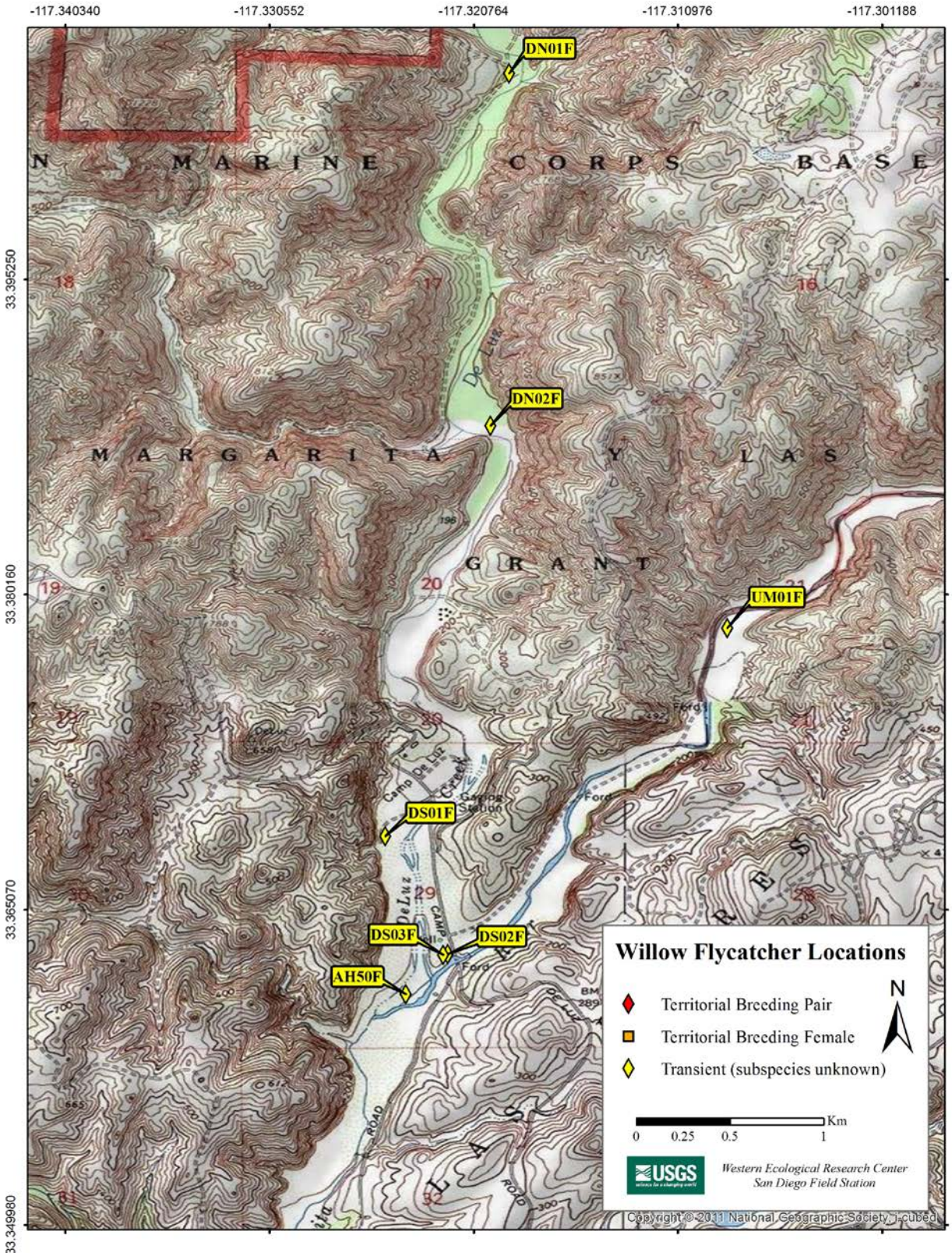

Fig. 18. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2014: Santa Margarita River (upper) and De Luz Creek.

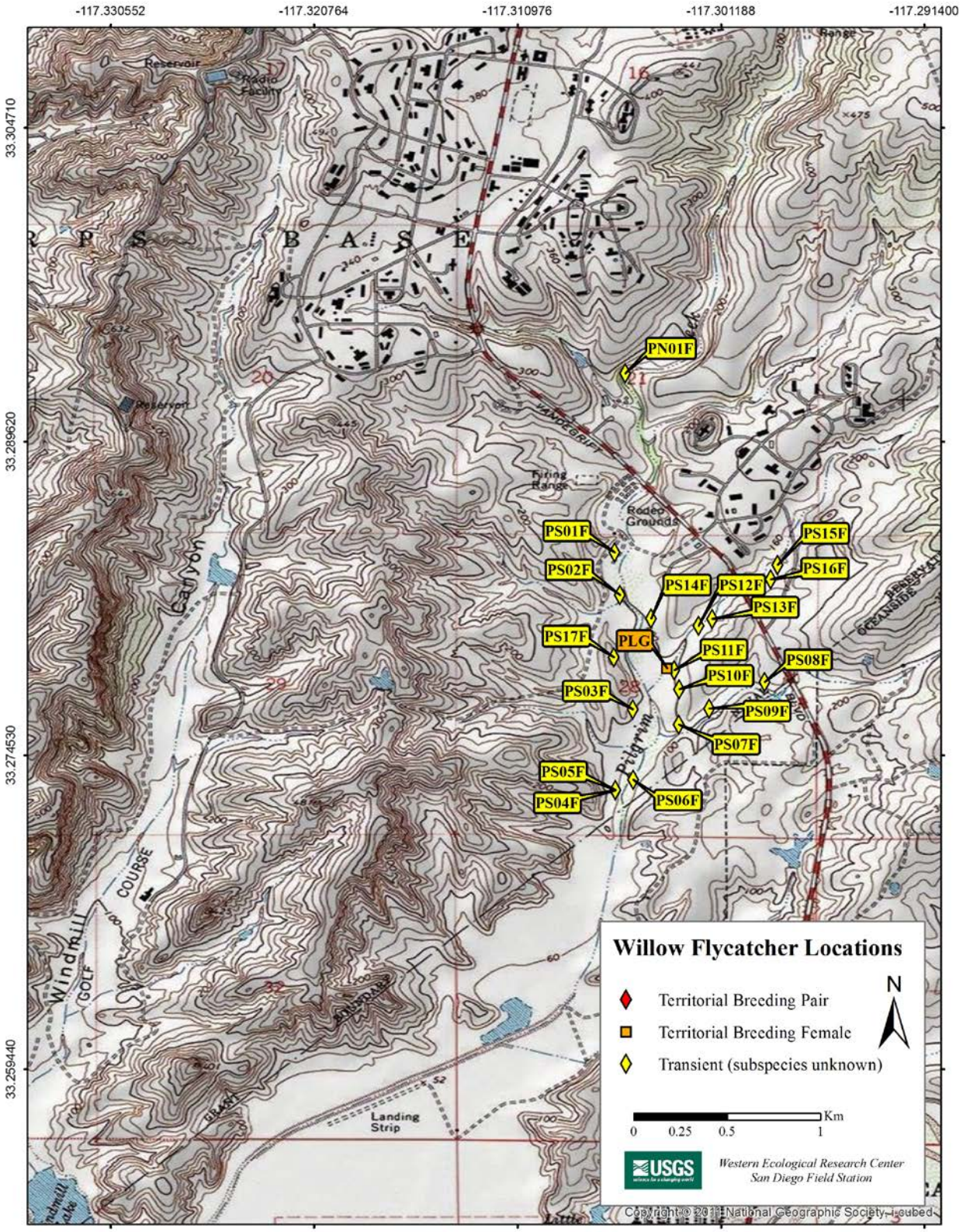

Fig. 19. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2014: Pilgrim Creek and Windmill Canyon.

APPENDIX C

SOUTHWESTERN WILLOW FLYCATCHER TERRITORY LOCATIONS AT MARINE CORPS BASE CAMP PENDLETON, 2014

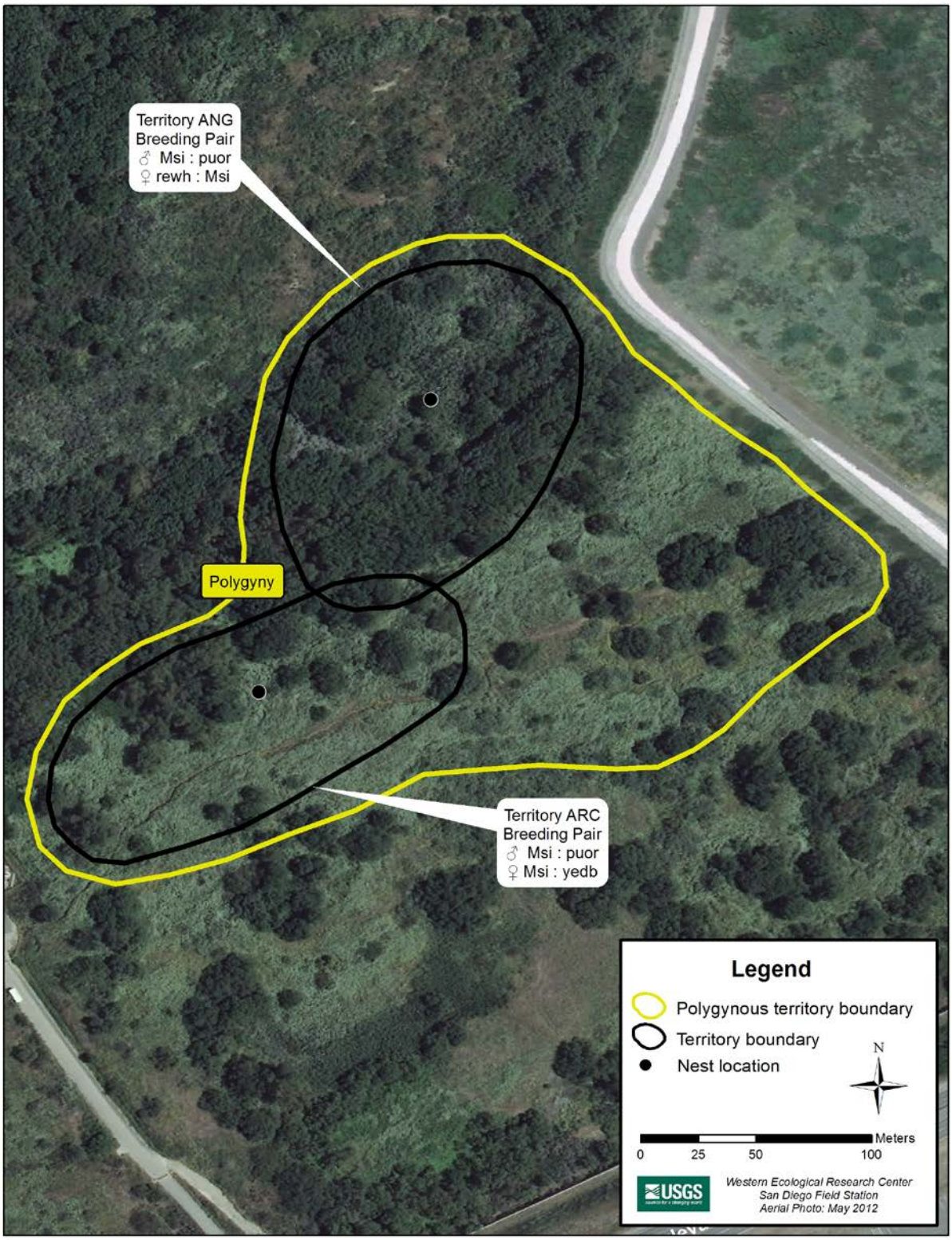

Fig. 20. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2014: Air Station Breeding Area, Santa Margarita River.

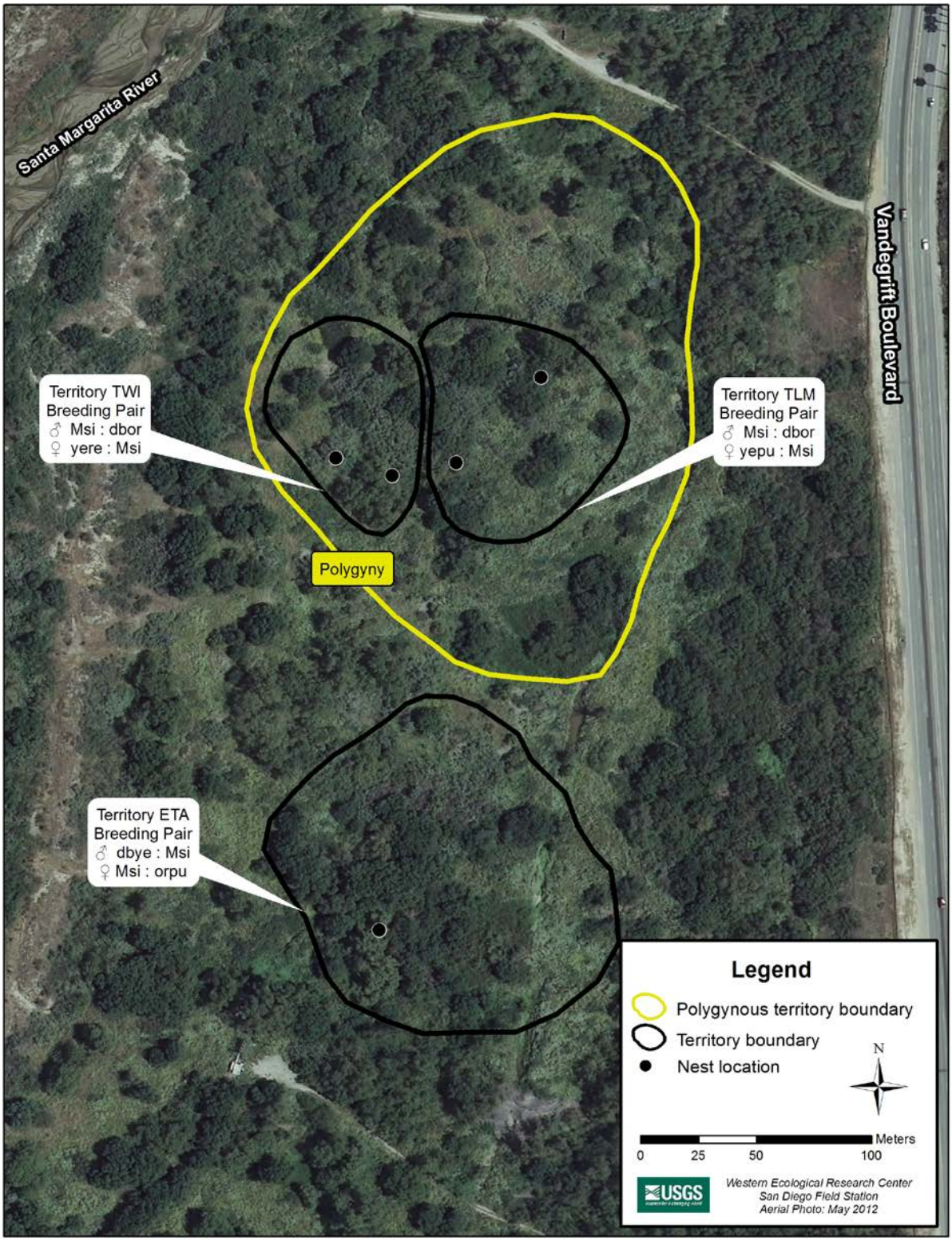

Fig. 21. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2014: Treatment Ponds and Northern Pueblitos Breeding Areas, Santa Margarita River.

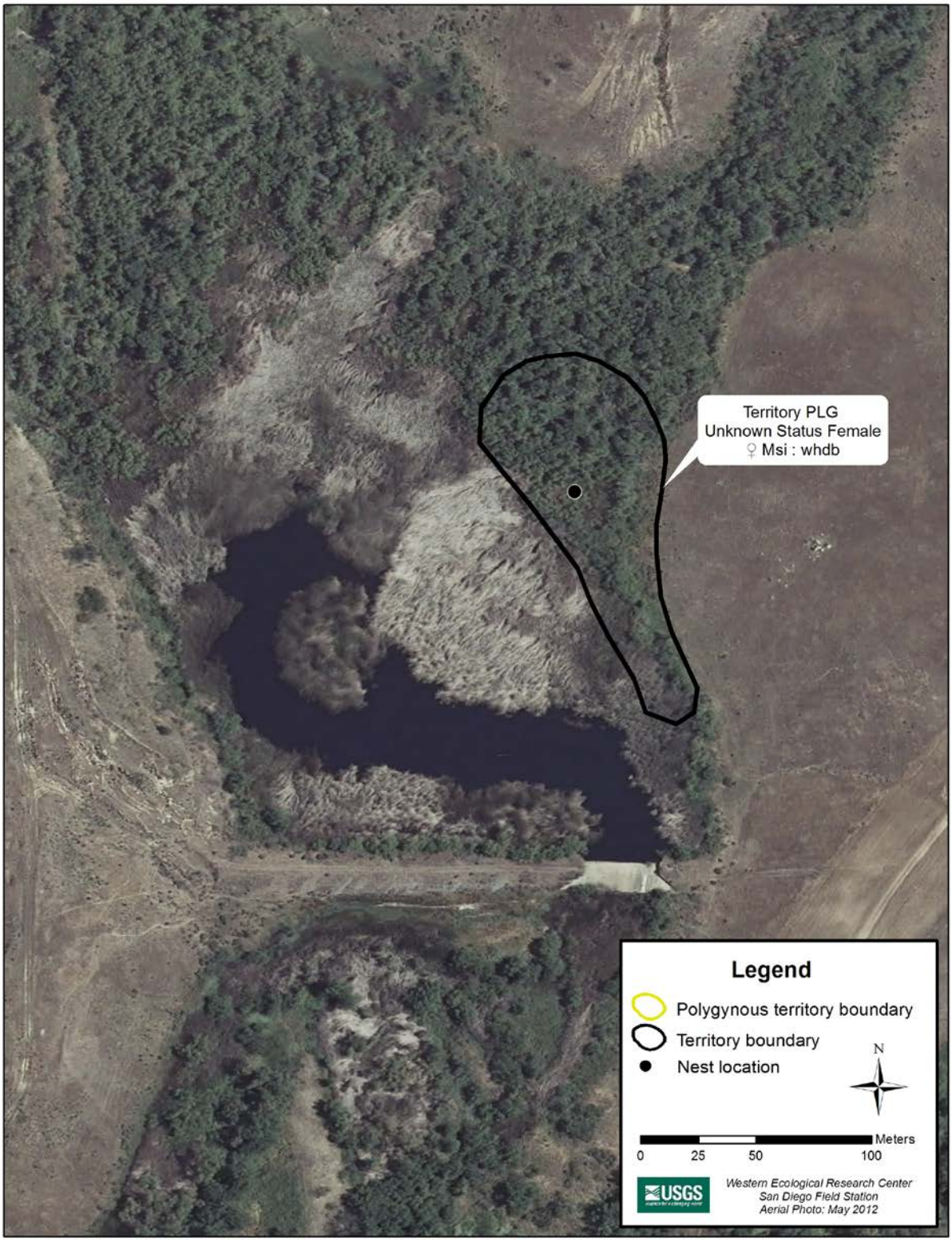

Fig. 22. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2014: Pilgrim Creek.

APPENDIX D

BAND COMBINATIONS AND IDENTIFICATION OF SOUTHWESTERN WILLOW FLYCATCHER NESTLINGS BANDED ON MARINE CORPS BASE CAMP PENDLETON, 2014

Band combinations and identification of Southwestern Willow Flycatcher nestlings banded on Marine Corps Base Camp Pendleton in 2014.

Territory ID	Nest ID	Nestling Band Combination[a]	Federal Band Number
ETA	1	Msi : none	271029330
ETA	1	Msi : none	271029331
ETA	1	Msi : none	271029332
ARC	1	Msi : none	271029336
TLM	2	Msi : none	271029337
TLM	2	Msi : none	271029338
TLM	2	Msi : none	271029339

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