



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

## 2006 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

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

**By Kerry E. Kenwood and Barbara E. Kus**

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Assistant Chief of Staff, Environmental Security  
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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 15 August 2006. Thirty-five transient flycatchers of unknown subspecies were detected during surveys. Transients occurred in a range of habitat types including mixed willow riparian, willow-sycamore dominated riparian, oak-sycamore dominated riparian, riparian scrub, and upland scrub. The distance from transient locations to the nearest surface water averaged  $328 \pm 515$  m (N = 35).

Twenty-two southwestern willow flycatcher territories were located. With the exception of two territories at Lake O' Neill on Fallbrook Creek, all other territories were along the Santa Margarita River. All territories were located in mixed willow riparian habitat. Exotic vegetation, particularly poison hemlock (*Conium maculatum*) was present in all territories, and was dominant (% cover > 50) in 5% (1/22) of resident flycatcher locations. Distance to surface water averaged  $75 \pm 63$  m (N = 22).

The resident flycatcher population included 12 males and 19 females. Three of the males were unpaired, four formed monogamous pairs, and five were polygynous, each pairing with 2-4 of the remaining 15 female flycatchers, forming 15 "polygynous pairs". Nesting was documented for 18 pairs (one female disappeared before nesting activity was documented), which produced 1-3 nests each. Fifty-two percent (13/25) of nests were successful, and flycatchers fledged an average of 1.8 young per pair. No instances of cowbird parasitism were observed. Pairs placed nests in seven species of plants, including black willow (*Salix gooddingii*), arroyo willow (*S. lasiolepis*), sand bar willow (*S. exigua*), mule fat (*Baccharis salicifolia*), stinging nettle (*Urtica dioica*), poison hemlock, and wild grape (*Vitis girdiana*).

Eight resident males and 13 females present in 2006 were banded previously at Camp Pendleton between 2001 and 2005. Fifty-two percent (13/25) of the banded adults in 2005 returned in 2006. Thirty-nine percent of those moved to different breeding areas. Fifteen percent (4/26) of nestlings banded in 2005 returned to the Base as adults in 2006. Two resident males and three females were captured and color banded in 2006, and 28 nestlings in 11 nests were banded. None of the transients observed during surveys were seen to carry bands; however three transients were caught and banded at the MAPS banding stations on Base.



## INTRODUCTION

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

Willow flycatchers in southern California co-occur with the least Bell's vireo (*Vireo bellii pusillus*), another riparian obligate endangered by habitat loss and cowbird parasitism. However, unlike the vireo, which has increased six-fold since the mid-1980's in response to management alleviating these threats (USGS Western Ecological Research Center, San Diego Field Station unpubl. data), willow flycatcher numbers have remained low. Currently, the majority of southwestern willow flycatchers in California are concentrated in three sites: the South Fork of the Kern River in Kern County (Schuetz and Whitfield 2007), the Upper San Luis Rey River, including a portion of the Cleveland National Forest in San Diego County (Varanus Biological Services 2001), and Marine Corps Base Camp Pendleton in San Diego County (Kus and Kenwood 2006b). 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).

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 15 August 2006 (Figure 1). Field work was conducted by Matthew Dresser, David Hadersbeck, Scarlett Howell, Dana Kamada, Kerry Kenwood, Barbara Kus, Todd Martin, Eric Nolte, Jay Rourke, and Mike Wellik. The specific areas surveyed are as follows:

***Santa Margarita River:*** between Stuart Mesa Road and the Base boundary, including Ysidora Basin and Stagecoach Canyon (Appendix A, Figures 4, 5).

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

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

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

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

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

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

***Piedra de Lumbre Canyon:*** between the confluence with Las Flores Creek and the upstream limit of riparian habitat (Appendix A, Figure 8).

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

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

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

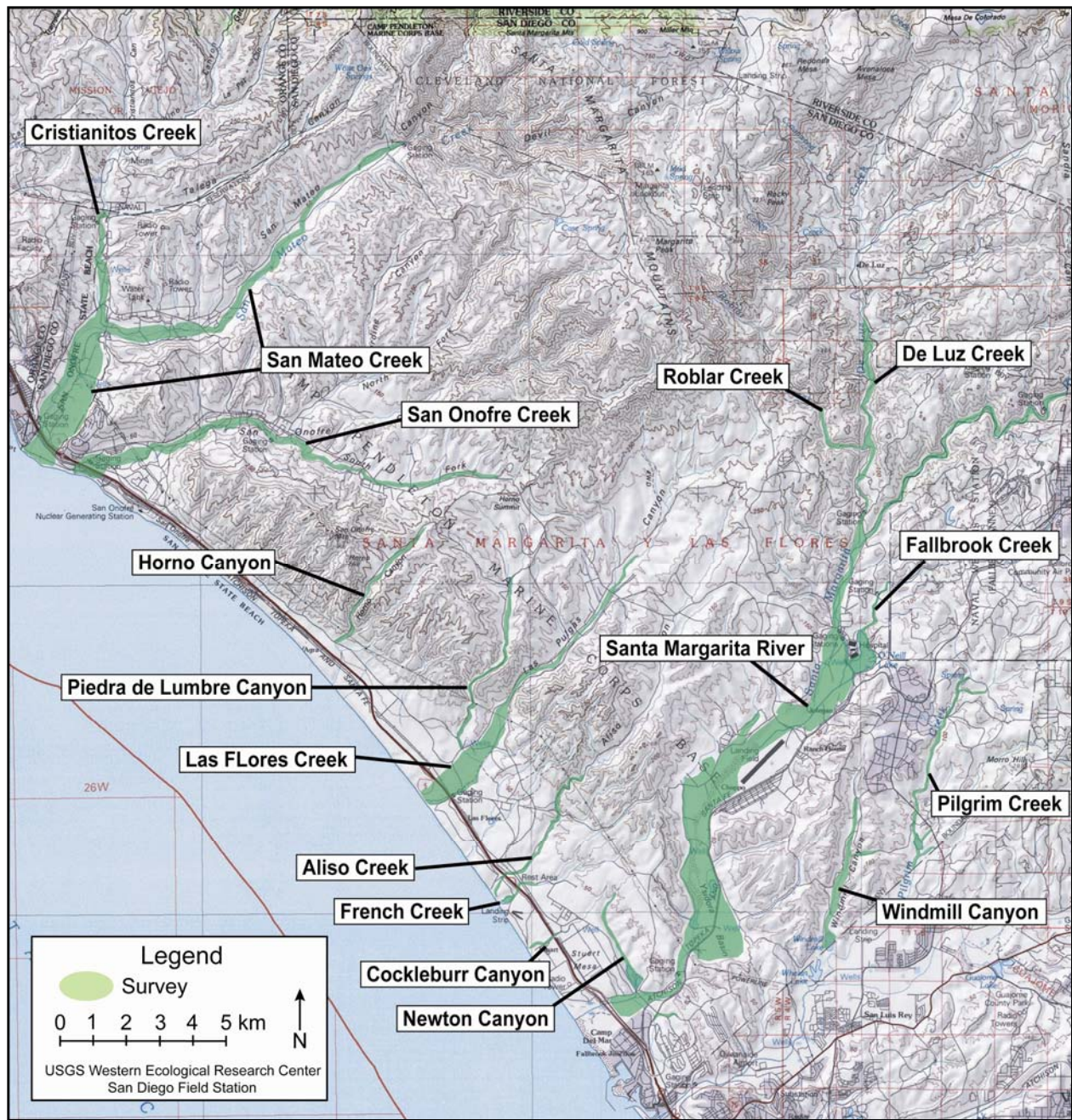


Figure 1. Southwestern willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2006.

**San Onofre Creek:** between the Pacific Ocean and the access road to Range 219 (Appendix A, Figures 6, 8).

**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, Figure 6, 7).

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

**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, Figure 9).

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

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 14 July, and the fourth from 15 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 (WGS84). Distance to the nearest surface water was recorded for each location, and habitat type specified according to the following categories based on dominant vegetation:

**Mixed willow riparian:** Habitat dominated by one or more willow species including *Salix gooddingii*, *S. lasiolepis*, and *S. laevigata*, with *Baccharis salicifolia* as a frequent co-dominant.

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

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

**Sycamore-oak:** Woodlands in which *P. racemosa* and *Quercus agrifolia* occur as co-dominants.

**Riparian scrub:** Dry and/or sandy habitat dominated by *S. exigua* or *B. salicifolia*, with few other species.

**Upland scrub:** Disturbed coastal sage scrub adjacent to riparian habitat.

**Non-native:** Sites vegetated exclusively with non-native species such as *Arundo donax*, *Conium maculatum*, *Brassica nigra*, and *Tamarix ramosissima*.

Percent cover of exotic vegetation at each location was estimated using cover categories of <5%, 5-50%, and > 50%, 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 (*Molothrus ater*) to nest sites; typically, there were three to four 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. Fledging was confirmed by detection of young outside the nest, and rarely by the presence of feather dust in the nest. Characteristics of nests, including height, host species, and host height were recorded following abandonment or fledging of nests.

## **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 bi-colored metal band on the other. Returning second year birds banded as nestlings in 2005 with one silver aluminum federal numbered band on the right leg were recaptured in their territories and banded with a bi-colored metal band on the left 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, including three birds caught in MAPS station nets (Howell and Kus in prep; Figures 10-18). All transients located during surveys were detected between 18 May and 9 June. One of the transients captured at the MAPS station was caught on 4 May before the first survey period began, and the other on 15 Aug, well after the final survey period ended. Transients occurred on

seven of the drainages surveyed in 2006. No willow flycatchers were detected at Horno, Piedra de Lumbre, Aliso, French, Cockleburr, Roblar, Pilgrim, and Windmill Creeks.

### Residents

Nineteen females and 12 males were detected throughout the breeding season (Figures 10-12, 19-26). Three of the males were single and nine were paired. Five of the nine paired males were polygynous, one pairing with two females and four pairing with three females each. One of the polygynous males was initially paired with four females, but lost one of them after her first nesting attempt when she switched mates to pair with a later-arriving nearby male (Figure 22). This latter male had moved from his initial territory over 2 km away where he was paired with a different female who disappeared in early June (Figure 26). Overall, 19 female flycatchers formed pair bonds with 9 male willow flycatchers in 2006 (Figures 19-26).

Resident flycatchers were restricted to the Santa Margarita River and Lake O'Neill on Fallbrook Creek. Flycatcher distribution on the Santa Margarita River expanded relative to previous years, with birds detected in the northern (Above Hospital) region (Figure 20). This is the first time resident flycatchers have been detected this far upstream on the Santa Margarita River on Base. Breeding flycatchers in 2004 (Kus and Kenwood 2006a) re-colonized the vicinity of the Air Station on the east side of the river, and this area was occupied again in 2005 by a single male (Kus and Kenwood 2006b); however in 2006 this area was devoid of flycatchers. Habitat in the Treatment Ponds area, adjacent to the sewage treatment plant, was re-colonized in 2005 by a single male (Kus and Kenwood 2006b), and was occupied in 2006 by several breeding flycatchers (Figure 22). Portions of the Santa Margarita River that historically included resident flycatchers (southern part of the Bell (El Camino Real) area, some parts of the Pueblitos Canyon area, and the eastern section of Ysidora Ponds) were, like in 2005 (Kus and Kenwood 2006b), devoid of territories in 2006. However, one section of the Pueblitos area lacking resident flycatchers in 2005 was re-colonized in 2006 (Figure 24). The distribution of resident flycatchers away from the Santa Margarita River included two single males at Lake O'Neill in a location historically occupied by breeding pairs (Figure 19). No resident flycatchers were detected on Las Flores Creek, which was colonized by a nesting pair in 2003 (Kus and Kenwood 2005) and occupied by a single male in 2004 (Kus and Kenwood 2006a).

### **Habitat Characteristics**

Sixty-one percent (35/57) of all flycatcher sightings occurred in habitat classified as mixed willow riparian (Table 1), with a dense understory of stinging nettles (*Urtica dioica*), poison hemlock (*C. maculatum*), or blackberry (*Rubus ursinus*) often present. Eighteen percent (10/57) of the locations were in upland scrub habitat, predominantly on San Mateo Creek. The remaining birds were detected in habitats characterized as willow-sycamore (9%, 5/57) or oak-sycamore (5%, 3/57) woodlands, as well as riparian scrub (7%, 4/57). While transients used all habitat types, resident flycatchers were found exclusively (22/22) in mixed willow riparian.

**Table 1. Habitat characteristics of willow flycatcher locations at Marine Corps Base Camp Pendleton in 2006.**

Bird ID	Drainage	Status <sup>a</sup>	Habitat Type <sup>b</sup>	% Cover Exotics <sup>c</sup>	Dominant Exotics <sup>d</sup>	Distance to Surface Water (m)
151	Cristianitos Creek	T	Mixed Willow	1	ARU	0
154	Cristianitos Creek	T	Willow/Sycamore	2	BRA	900
38	De Luz Creek	T	Willow/Sycamore	1	BRA	125
39	De Luz Creek	T	Mixed Willow	1	BRA	2100
FBG	Fallbrook Creek	S	Mixed Willow	1	CON	0
FRD	Fallbrook Creek	S	Mixed Willow	1	CON	0
175	Las Flores Creek	T	Mixed Willow	2	BRA, CON	1200
34	San Mateo Creek	T	Upland Scrub	2	CON	400
35	San Mateo Creek	T	Upland Scrub	3	CON	100
36	San Mateo Creek	T	Upland Scrub	3	CON	3
37	San Mateo Creek	T	Upland Scrub	3	CON	400
91	San Mateo Creek	T	Upland Scrub	3	CON	100
92	San Mateo Creek	T	Upland Scrub	3	CON	3
93	San Mateo Creek	T	Upland Scrub	3	CON	400
94	San Mateo Creek	T	Upland Scrub	1	BRA	400
95	San Mateo Creek	T	Willow/Sycamore	2	CON	10
96	San Mateo Creek	T	Upland Scrub	2	CON	400
97	San Mateo Creek	T	Upland Scrub	2	CON	400
130	San Mateo Creek	T	Oak/Sycamore	2	ANN, BRA	350
131	San Mateo Creek	T	Riparian Scrub	3	CON	15
132	San Mateo Creek	T	Riparian Scrub	3	CON	10
152	San Onofre Creek	T	Willow/Sycamore	2	CON	1150
153	San Onofre Creek	T	Oak/Sycamore	2	CON	1850
155	San Onofre Creek	T	Oak/Sycamore	1	BRA	10
01	Santa Margarita River	T	Mixed Willow	1	CON	0
02	Santa Margarita River	T	Mixed Willow	2	CON	50
03	Santa Margarita River	T	Mixed Willow	1	CON	0
31	Santa Margarita River	T	Mixed Willow	3	CON, BRA	75
33	Santa Margarita River	T	Mixed Willow	2	BRA, CON	200
40	Santa Margarita River	T	Mixed Willow	2	CON	200
101	Santa Margarita River	T	Mixed Willow	2	CON	10
126	Santa Margarita River	T	Mixed Willow	2	TAM	20
127	Santa Margarita River	T	Willow/Sycamore	2	BRA	15
128	Santa Margarita River	T	Mixed Willow	4	ARU	10
129	Santa Margarita River	T	Riparian Scrub	2	CON	30
150	Santa Margarita River	T	Mixed Willow	2	BRA	400
22W	Santa Margarita River	T	Riparian Scrub	1	SIL	150
BRS	Santa Margarita River	P	Mixed Willow	2	TAM, CON, ARU	230
EDY	Santa Margarita River	P	Mixed Willow <sup>b</sup>	2	CON	40
EMY	Santa Margarita River	P	Mixed Willow <sup>b</sup>	1	CON	60
EPC	Santa Margarita River	P	Mixed Willow <sup>b</sup>	1	CON	50

**Table 1 (continued). Habitat characteristics of willow flycatcher locations at Marine Corps Base Camp Pendleton in 2006.**

Bird ID	Drainage	Status <sup>a</sup>	Habitat Type <sup>b</sup>	% Cover Exotics <sup>c</sup>	Dominant Exotics <sup>d</sup>	Distance to Surface Water (m)
EPI	Santa Margarita River	S	Mixed Willow	2	CON	150
ERN	Santa Margarita River	P	Mixed Willow <sup>b</sup>	1	ARU, CON, BRA	180
ETA	Santa Margarita River	P	Mixed Willow <sup>b</sup>	2	CON	60
ETC	Santa Margarita River	P	Mixed Willow <sup>b</sup>	3	CON	40
HAR	Santa Margarita River	P	Mixed Willow	2	CON	0
MPS	Santa Margarita River	P	Mixed Willow <sup>b</sup>	2	ARU	140
MSL	Santa Margarita River	P	Mixed Willow <sup>b</sup>	2	CON	150
MYS	Santa Margarita River	P	Mixed Willow	2	CON	95
PIT	Santa Margarita River	P	Mixed Willow <sup>b</sup>	2	CON, BRA	60
PNB	Santa Margarita River	P	Mixed Willow <sup>b</sup>	2	CON	90
PRM	Santa Margarita River	P	Mixed Willow	2	CON	75
PRN	Santa Margarita River	P	Mixed Willow <sup>b</sup>	2	CON, BRA	50
TAR	Santa Margarita River	P	Mixed Willow	2	CON	0
THN	Santa Margarita River	P	Mixed Willow <sup>b</sup>	2	CON	0
TLM	Santa Margarita River	P	Mixed Willow <sup>b</sup>	2	CON	80
TOR	Santa Margarita River	P	Mixed Willow <sup>b</sup>	2	CON	90

<sup>a</sup> T = transient, P = breeding pair, S = single resident male.

<sup>b</sup> For paired birds, habitat type is considered within the male's territory boundary except for those pairs that include polygynous males, in which case habitat type is assessed within the female's use area.

<sup>c</sup> 1 = <5%, 2 = 5-50%, 3 = 50-95%, 4 = >95%.

<sup>d</sup> ARU = *Arundo donax*, BRA = *Brassica nigra*, CON = *Conium maculatum*, ANN = Annual grasses, TAM = *Tamarix* sp., SIL = *Silybum* sp.

Exotic vegetation was recorded in 100% (57/57) of flycatcher locations, and was the dominant vegetation (% cover of exotics > 50; Table 1) in 19% (11/57) of those sites. Most of the exotic-dominated sites (10/11) were occupied by transient flycatchers as opposed to residents (1/11). The most common exotic plants in habitat used by flycatchers in 2006 were poison hemlock, mustard (*B. nigra*), and giant reed (*A. donax*).

Flycatcher locations differed in their proximity to surface water (Table 1). Transient flycatchers exhibited a bimodal distribution with regard to distance to the nearest surface water, with 51% within 100 m, and the rest 100 m away or greater. Of those transients more than 100 m from water, most (76%) were 200 m away or farther. The majority (77%) of resident detections were within 100 m of water, and the rest 140-230 m from it. On average, transients were more than four times as far from surface water as were residents (transients:  $\bar{x} = 328 \pm 515$  m, residents:  $\bar{x} = 75 \pm 63$  m). This is similar to previous years (excluding the wet year of 2005) when transients were typically 2-4 times as far from water as were residents (Kus and Kenwood 2003, 2005, 2006b).



## Breeding Activities

Nesting was observed for all but one (BRS female disappeared before nesting activity was observed) of the 19 pairs (Table 2). The earliest confirmed lay date was 1 June and the latest was 10 July. Sixty-seven percent (12/18, Table 2) of pairs had initiated nesting by 15 June and all but one pair (17/18, 94%) were nesting by 25 June; the remaining pair initiated on 2 July. Six pairs attempted more than one nest, all following an unsuccessful initial attempt (although not all pairs unsuccessful on their first attempt re-nested). Of the re-nesting pairs, one attempted a third nest after two unsuccessful attempts. Nesting continued through August, with the last young fledged on 8 August. Seventy-two percent of pairs (13/18) fledged young by the end of the season.

**Table 2. Nesting activity of southwestern willow flycatcher pairs at Marine Corps Base Camp Pendleton in 2006.**

Pair ID	Lay Date	# Eggs	# Nestlings	# Fledglings	Comments
BRS	NA	NA	NA	NA	Female disappeared; no nesting observed.
EDY	11-Jun-06	3	3	3	
EMY	17-Jun-06	3 <sup>a</sup>	3 <sup>b</sup>	3	
EPC	08-Jun-06	3	3	0	Depredated.
ERN	12-Jun-06	2 <sup>c</sup>	2 <sup>c</sup>	2	Nest not located.
ETC	10-Jun-06	4	0	0	Depredated.
ETC	03-Jul-06	3	0	0	Host and surrounding vegetation shifted constricting nest and causing abandonment.
ETA	22-Jun-06	3	3	3	
HAR	08-Jun-06	3	0	0	Depredated.
MSL	01-Jun-06	3	2	2	1 individual disappeared either during egg or nestling stage.
MPS	NA	0	0	0	Nest abandoned during building stage.
MPS	25-Jun-06	3	3	3	
MYS	20-Jun-06	3	3	3	
PNB	02-Jun-06	4	4	1	1 nestling disappeared; nest was depredated near end of nestling stage but at least 1 offspring survived to fledge.
PIT	02-Jul-06	2	2	2	
PRM	NA	0	0	0	Surrounding vegetation collapsed crushing nest before eggs were laid.
PRM	15-Jun-06	3	3	3	
PRN	08-Jun-06	3	0	0	Depredated; is possible eggs hatched before predation.

**Table 2 (continued). Nesting activity of southwestern willow flycatcher pairs at Marine Corps Base Camp Pendleton in 2006.**

Pair ID	Lay Date	# Eggs	# Nestlings	# Fledglings	Comments
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TAR	23-Jun-06	1	0	0	Depredated.
TAR	NA	0	0	0	Host and surrounding vegetation shifted displacing nest and causing abandonment; is possible eggs were laid before abandonment.
TAR	10-Jul-06	3	3	3	
TLM	14-Jun-06	1	0	0	Surrounding vegetation collapsed crushing nest.
TLM	30-Jun-06	3	2	2	1 egg did not hatch after $\geq 22$ days.
THN	07-Jun-06	4	2	0	Depredated; is possible remaining 2 eggs hatched before predation.
THN	03-Jul-06	2	1	0	1 egg disappeared; depredated.
TOR	07-Jun-06	4	4	2	2 nestlings disappeared.

<sup>a</sup> Minimum number, nest contents not seen during incubation stage.

<sup>b</sup> Minimum number, nest contents not seen until late in nestling stage.

<sup>c</sup> Minimum number, pair not found until fledgling stage - no nest found.

Twenty-five nesting attempts were documented and all but one of these nests were located and monitored throughout the period they were active (one nesting attempt by pair ERN was not discovered until the pair was seen with fledglings; Table 2). Thirteen nests (52%) were successful, fledging 1-3 young each. Twelve nests (48%) failed to fledge young. Seven of the unsuccessful nests (58%) were depredated; four during the egg stage, and three during the nestling stage. One nest was abandoned during building. Two nests that appeared to have been damaged, as a result of partial collapse of surrounding vegetation, were later abandoned. In these two instances, vegetation shifted causing constriction and displacement of the nests. Another two nests failed when surrounding vegetation, stinging nettle in one instance and a large willow branch in the other, collapsed, completely crushing the nests.

Clutch size, estimated from 18 nests containing known full clutches, averaged  $3.1 \pm 0.6$  eggs. Thirty-two fledglings were produced, yielding an estimate of seasonal productivity of 1.8 young per pair (32 young/18pairs).

## Nest Site Characteristics

Flycatchers placed nests in seven species of plants (Table 3), including arroyo willow (*S. lasiolepis*), black willow (*S. gooddingii*), sandbar willow (*S. exigua*), mule fat (*B. salicifolia*), stinging nettle, poison hemlock, and wild grape (*Vitis girdiana*). Ninety-two percent of nests were placed in native species: 58% (14/24) in willow, 21% (5/24) in stinging nettle, 8% (2/24) in mulefat, and 4% (1/24) in wild grape. Eight percent (2/24) of nests were placed in exotic species, both in poison hemlock. Nest height averaged  $1.5 \pm 0.3\text{m}$  (N = 24), while host height averaged  $5.5 \pm 3.9$  (N = 24).

**Table 3. Nest site characteristics of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2006.**

Pair ID	Host Species	Host Height (m)	Nest Height (m)
EDY	<i>Salix exigua</i>	2.2	1.5
EMY	<i>Baccharis salicifolia</i>	1.4	1.0
EPC	<i>Urtica californica</i>	5.0	1.6
ETC	<i>Baccharis salicifolia</i>	2.8	1.7
ETC	<i>Salix lasiolepis</i>	8.1	1.4
ETA	<i>Salix lasiolepis</i>	2.0	1.6
HAR	<i>Vitis girdiana</i>	5.3	1.1
MSL	<i>Urtica californica</i>	2.3	1.6
MPS	<i>Salix lasiolepis</i>	5.2	1.5
MPS	<i>Salix gooddingii</i>	4.5	1.7
MYS	<i>Urtica californica</i>	2.8	1.6
PNB	<i>Conium maculatum</i>	2.2	1.2
PIT	<i>Urtica californica</i>	3.3	1.6
PRM	<i>Salix lasiolepis</i>	9.0	1.5
PRM	<i>Conium maculatum</i>	2.2	1.5
PRN	<i>Salix lasiolepis</i>	7.0	0.3
TAR	<i>Salix lasiolepis</i>	16.0	1.6
TAR	<i>Salix lasiolepis</i>	6.5	1.4
TAR	<i>Salix lasiolepis</i>	11.0	1.7
TLM	<i>Salix exigua</i>	2.2	1.8
TLM	<i>Urtica californica</i>	3.0	1.9
THN	<i>Salix lasiolepis</i>	8.4	1.0
THN	<i>Salix gooddingii</i>	13.0	1.8
TOR	<i>Salix lasiolepis</i>	7.5	1.8

## Cowbird Parasitism

No instances of cowbird parasitism of southwestern willow flycatcher nests were observed in this study.

## Banded Birds

All of the resident flycatchers, except for one male and one female, were observed closely enough to determine with confidence whether they were banded (Table 4). Seventy-three percent of the males (8/11, excluding one male of undetermined band status) and 72% of the females (13/18, excluding one female of undetermined band status) were birds banded in previous years. All males and 11 females were originally banded on Camp Pendleton. The remaining two female flycatchers were banded on the San Luis Rey River.

**Table 4. Band status of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2006.**

Territory/ Bird ID	Status <sup>a</sup>	Male Banded? <sup>b</sup>	Female Banded? <sup>b</sup>	Nestlings Banded?	Comments <sup>c</sup>
BRS	P	Mdg : reye	Unbanded		Male banded in 2004. Female disappeared before nesting activity documented. Male moved to TAR part way through season and paired with new female for her second and third nest attempts.
EDY	P	Msi : rere	Msi : dbdb	3	Male polygynous. Male banded in 2005. Female banded at Guajome Lake on the San Luis Rey River in 2005.
EMY	P	Msi : yere	orwh : Msi		Male polygynous. Male banded in 2004. Female banded in 2006.
EPC	P	Msi : yere	whdg : Msi		Male polygynous. Male banded in 2004. Female banded in 2005.
EPI	S	dgre : Msi	NA		Male banded as nestling at Pump Road in 2005.
ERN	P	Msi : yere	redb : Mdg		Male polygynous. Male banded in 2004. Female banded in 2003.
ETC	P	Msi : rere	Msi : --		Male polygynous. Male banded in 2005. Female banded as nestling in 2004.
ETA	P	Msi : rere	yedg : Msi	3	Male polygynous. Male banded in 2005. Female banded in 2006.
FRD	S	Unbanded	NA		
FBG	S	LBBK : Mdg	NA		Male banded in 2001.
HAR	P	Undetermined	Mre : yedb		Female banded as nestling at Lake O'Neill in 2003.
MSL	P	Msi : dbwh	pupu : Mdg	2	Male polygynous. Male banded in 2005. Female banded in 2003.
MPS	P	Msi : dbwh	oror : Msi	3	Male polygynous. Male banded in 2005. Female banded in 2006.
MYS	P	orye : Msi	orre : Msi	3	Male banded in 2006. Female banded as nestling at Pump Road in 2005.
PNB	P	yeye : Msi	Unbanded		Male polygynous. Male banded in 2005.
PIT	P	yeye : Msi	Undetermined	2	Male polygynous. Male banded in 2005.

**Table 4 (continued). Band status of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2006.**

Territory/ Bird ID	Status <sup>a</sup>	Male Banded? <sup>b</sup>	Female Banded? <sup>b</sup>	Nestlings Banded?	Comments <sup>c</sup>
PRM	P	Msi : whdg	Mre : -	3	Male banded in 2006. Female banded as nestling at Pueblitos in 2003.
PRN	P	yeye : Msi	Msi : dgre		Male polygynous. Male banded in 2005. Female banded as nestling at Bell in 2004.
TAR	P	Msi : orwh	yewh : Msi		Male polygynous. Male banded in 2005. Female banded as nestling at Bell in 2005. Male paired with this female for first nest attempt only.
TAR	P	Mdg : reye	yewh : Msi	3	Male banded in 2004. Female banded as nestling at Bell in 2005. Male moved from BRS part way through season and paired with this female for second and third nest attempts.
TLM	P	Msi : orwh	dbye: Mgo	2	Male polygynous. Male banded in 2005. Female banded as nestling at Pump Road in 2005.
THN	P	Msi : orwh	Msi : redb	1	Male polygynous. Male banded in 2005. Female banded as nestling at Pueblitos in 2004.
TOR	P	Msi : orwh	Msi : dgdg	3	Male polygynous. Male banded in 2005. Female banded as nestling at Bell in 2004.

<sup>a</sup> P = pair, S = single male.

<sup>b</sup> Band combinations: left leg:right leg; Msi = federal aluminum band, Mdg = anodized green federal band, Mgo = anodized gold federal band, Mre = anodized red federal band. *Celluloid bands*: LBBK = light blue-black split. *Metal bands*: pupu = purple, yeye = yellow, dgdg = dark green, rere = red, dbdb = dark blue, oror = orange, dbwh = dark blue-white split, orwh = orange-white split, whdg = white-dark green split, yewh = yellow-white split, yedb = yellow-dark blue split, yere = yellow-red split, yedg = yellow-dark green split, dbye = dark blue-yellow split, dgre = dark green-red split, redb = red-dark blue split, reye = red-yellow split, orye = orange-yellow split, orre = orange-red split.

<sup>c</sup> see Figures 2 and 3 for Camp Pendleton locations mentioned in the comments.

No banded transients were detected during surveys. Three transients were caught and banded at MAPS station nets, one bird with one silver federal band and two with full color combinations (Howell and Kus, in prep).

Two adult males and three adult females were captured and banded in 2006 (Table 4). In addition, four second year birds that were banded with one band as nestlings in 2005 were recaptured and banded with a second band to provide unique combinations. Twenty-eight nestlings in 11 nests were banded (Appendix D); all, except one nestling from one nest, are believed to have fledged.

## Survivorship, Site Fidelity, and Movement

The recapture and resighting of banded birds allowed us to determine the rate at which flycatchers previously documented on Base returned to hold territories in 2006. Although this is the minimum number of flycatchers known to survive, and does not include birds that dispersed off Base or 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 banded adult flycatchers present during the 2005 breeding season, 64% (7/11) of males and 43% (6/14) of females returned to Camp Pendleton in 2006. Overall, adult survivorship from 2005 on Camp Pendleton was 52% (13/25). Survivorship was calculated based on the banded population seen at Camp Pendleton only, and does not include an additional female detected on Base in 2006 who was banded at Guajome Lake on the San Luis Rey River in 2005. In addition, two adult females, one last seen as a nestling in 2003, and one last seen as an adult in 2004, reappeared in 2006, increasing the survivorship estimate of the 2003 and 2004 populations respectively. Another female, seen with one non-anodized federal band on the left leg (signifying that she was banded as a nestling in 2004), was not re-captured and identified, and was therefore excluded from survivorship estimates.

Four of the 26 nestlings banded in 2005 that survived to fledge were resighted and re-captured at Camp Pendleton in 2006, yielding an estimate of first year survivorship of 15%. These birds included three females and one male (Table 4). All returning second year females paired and nested in 2006 and the returning second year male held a territory as a single male.

Willow flycatchers at Camp Pendleton generally settle into breeding concentrations or areas where groups of birds establish territories (Figures 2 and 3). Resighting banded birds allowed us to identify individuals that returned to the same area they used the previous year. In 2006, eight of the 13 banded returning adults (62%, excluding female ETC (Table 4), whose previous territory location could not be determined) returned to the breeding area that they occupied in 2005 (Table 5). Adding two birds, territories ERN female and HAR female last seen in 2004 and 2003 respectively, who returned to Camp Pendleton in 2006 (one to the same area (ERN) and one to a different area (HAR)) decreases area fidelity to 60% (9/15; Table 5). Sixty-seven percent (6/9; three males and three females, including the female, ERN, last seen in 2004) of the adult flycatchers returning to the same areas also returned to the same territories they previously occupied, while three flycatchers, two females and one male, (33%) shifted territory locations within the area (Table 5).

In contrast to returning adults, none of the four second year birds banded as nestlings in 2005 and of known origin returned to their natal areas to breed (see below).

We were also able to detect willow flycatchers that returned to different areas than they had occupied in 2005. Of the 13 banded adults detected at Camp Pendleton in 2005 that returned to the Base, five (39%; excluding one bird (banded as a nestling in 2004, consequently an adult in 2005) that was not recaptured and therefore of unconfirmed origin; Table 4) returned to different breeding areas in 2006, all within the Santa Margarita River (Table 6, Figure 2). Of **Table 5. Area fidelity and between-year, within-area movement of southwestern willow flycatcher adults at Marine Corps Base Camp Pendleton in 2006.**

Drainage	Area <sup>a</sup>	# Banded Birds in Area, 2005	# Birds Returning to Area	Area Fidelity (%)	# (%) Birds Moved Within Area	Range of Distances Moved (m)
Fallbrook Creek	O'Neill Lake Above	2 <sup>b</sup>	1	50%	0	N/A
Santa Margarita	Hospital	0	0	0%	N/A	N/A
	Pump Road	4	2	50%	1(50)	57
	Pueblitos	3 <sup>c</sup>	3 <sup>c</sup>	100%	2(67)	675-855
	Ysidora Ponds	3	2	67%	0	N/A
	Bell	3	1 <sup>d</sup>	33%	0	N/A
<b>Overall Totals</b>		<b>15</b>	<b>9</b>	<b>60%</b>	<b>3(33)</b>	<b>57-855</b>

<sup>a</sup> Figures 2 and 3 show flycatcher concentration areas.

<sup>b</sup> Includes one flycatcher not detected in 2005, but last seen banded as a nestling in 2003 at Lake O'Neill.

<sup>c</sup> Includes one flycatcher not detected in 2005, but last seen banded in 2004 at Pueblitos.

<sup>d</sup> This flycatcher returned to Bell, then moved to a different area part way through the season.

these five, three were males and two were females, all paired. Three birds, two from Bell and one from Pump Road, moved into Treatment Ponds, one bird from Ysidora Ponds moved into Pump Road, and one bird moved from Pump Road into Pueblitos (Table 6, Figure 2). One additional banded flycatcher detected in the Lake O'Neill area in 2003 was not detected in 2004 or 2005, but was seen as a female in 2006 in the Above Hospital area (Table 6, Figure 2), raising the proportion of adult birds moving between years to 43%. On average, adults move  $1.7 \pm 0.9$  km between years.

Second year birds banded as nestlings in 2005 also exhibited between-year movement from 2005 to 2006 with all four returning birds moving to areas other than their natal areas. Three second year birds banded as nestlings at Pump Road in 2005 returned (one each) to Pueblitos, Ysidora Ponds, and Treatment Ponds, and one from Bell returned to the Treatment Ponds area (Table 6, Figure 2). The average distance that second year birds dispersed from their natal areas was  $1.3 \pm 0.9$  km.

One bird, a female banded in 2005 as an adult at Guajome Lake on the San Luis Rey River 9.4 km away, immigrated onto the Base in 2006 and established a territory in the Pueblitos area (Table 6, Figure 2).

**Table 6. Between-year, between-area movement of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2006.**

<b>Year Last Detected</b>	<b>Area<sup>a</sup>/Territory Last Detected</b>	<b>Area<sup>a</sup>/Territory Detected in 2006</b>	<b>Distance Moved (km)</b>	<b>Band Combination<sup>b</sup></b>	<b>Age in 2006<sup>c</sup></b>	<b>Sex</b>
2005	Pump Road / PHL	Pueblitos / EDY&ETC&ETA	0.6	Msi : rere	ASY	M
2005	Pump Road / PIT	Pueblitos / EPI	0.7	dgre : Msi	SY	M
2005	Pump Road / PIC	Ysidora Ponds / MYS	1.6	orre : Msi	SY	F
2005	Pump Road / PRM	Treatment Ponds / TLM	0.5	dbye : Mgo	SY	F
2005	Pump Road / PIC	Treatment Ponds / TOR	0.4	Msi : dgdg	TY	F
2005	Ysidora Ponds / MNO	Pump Road / PNB&PIT&PRN	2.2	yeye : Msi	ASY	M
2005	Bell / BRS	Treatment Ponds / TAR	2.4	yewh : Msi	SY	F
2005	Bell / BEE	Treatment Ponds / TLM&THN&TOR	2.3	Msi : orwh	TY	M
2005	Bell / BEE	Treatment Ponds / THN	2.3	Msi : redb	TY	F
2005	Guajome Lake, San Luis Rey	Pueblitos / EDY	9.4	Msi : dbdb	ASY	F
2003	Lake O'Neill / FBG	Above Hospital / HAR	2.2	Mre : yedb	4Y	F

<sup>a</sup> Figures 2 and 3 show flycatcher concentration areas.

<sup>b</sup> Band combinations: left leg:right leg; Msi = federal aluminum band, Mre = anodized red federal band, Mgo = anodized gold federal band. Metal bands: dgdg = dark green, rere = red, yeye = yellow, dbdb = dark blue, dgre = dark green-red split, redb = red-dark blue split, yedb = yellow-dark blue split, dbye = dark blue-yellow split, yewh = yellow-white split, orwh = orange-white split, orre = orange-red split.

<sup>c</sup> Age codes: SY = second year - fledged 2005, TY = third year - fledged 2004, 4Y = fourth year - fledged 2003, ASY = after second year - bird is known to be at least three years old.



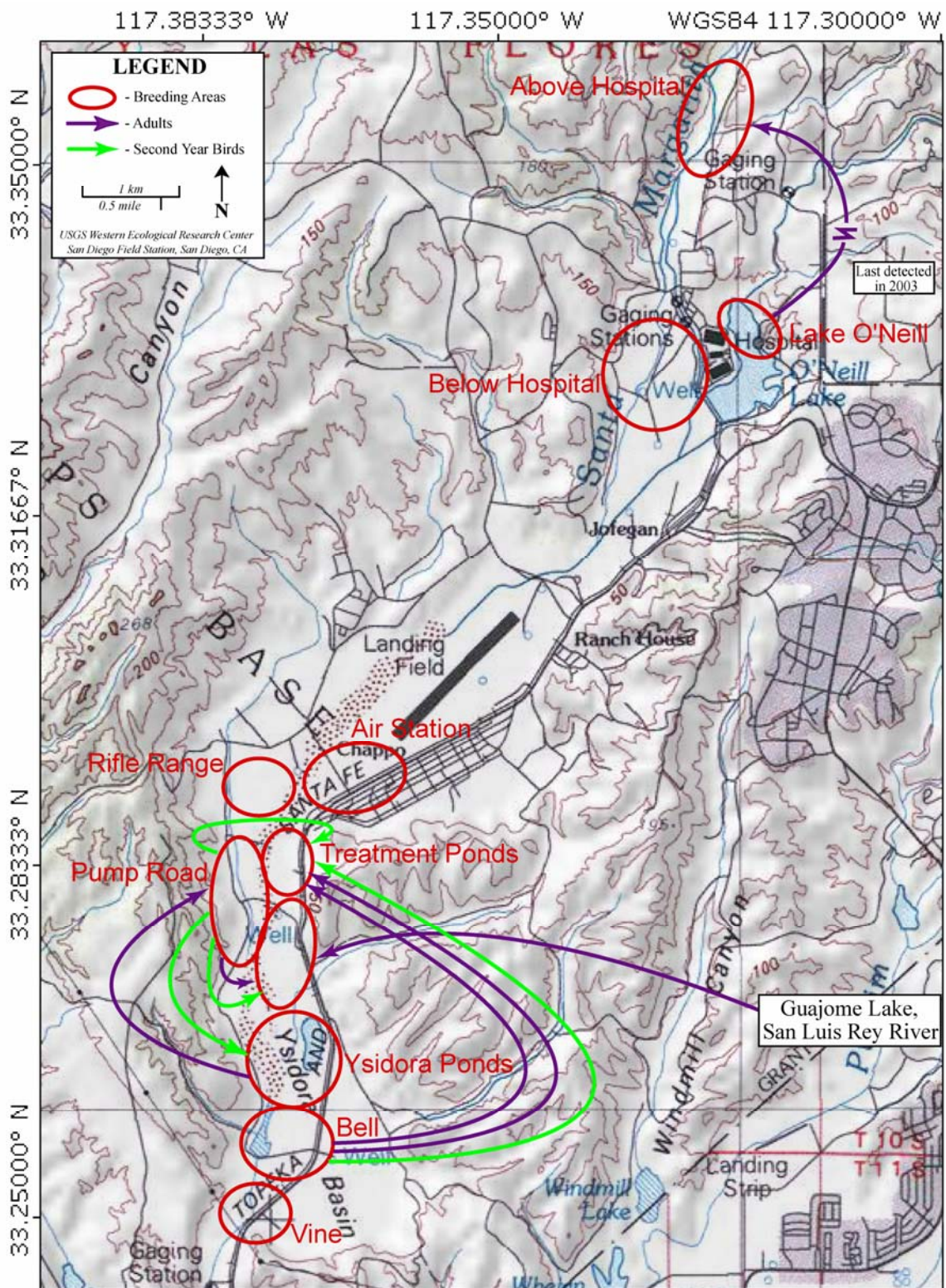


Figure 2. Between-year, between-area movement by adult and second year southwestern willow flycatchers at Marine Corps Base Camp Pendleton, 2006.

Two instances of movement by adult willow flycatchers within the 2006 season were observed (Table 7, Figure 3). A male and female in territory BRS in the Bell area (Figure 26) were documented as paired at the beginning of the season. The female disappeared by early June, before nesting activity was documented, leaving the male as single in the same territory. The male then later moved to Treatment Ponds (territory TAR, Figure 22) where he paired with a different female for her second and third nesting attempts (this female was previously paired with a nearby polygynous male in the Treatment Ponds area for her first nesting attempt; Figure 22).

**Table 7. Within-year, between-area movement of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2006.**

Area <sup>a</sup> / Territory First Detected	Area <sup>a</sup> / Territory Later Detected	Distance Moved (km)	Band Combination <sup>b</sup>	Age <sup>b</sup>	Status	Comments
Bell / BRS	Treatment Ponds / TAR	2.4	Mdg : reye	ATY	Pair	Movement occurred part way through season. Paired with a new female at new location (for her 2nd and 3rd nest attempts).
Bell / BRS	not seen again	N/A	Unbanded	AHY	Pair	Movement occurred part way through season before nesting activity documented. Bird not detected after disappeared.

<sup>a</sup> Figures 2 and 3 show flycatcher concentration areas.

<sup>b</sup> Band combinations: left leg:right leg; Mdg = anodized green federal band, reye = red-yellow split.

<sup>c</sup> Age codes: AHY = after hatch year - bird is known to be at least in its second year, ATY = after third year - bird is known to be at least three years old.

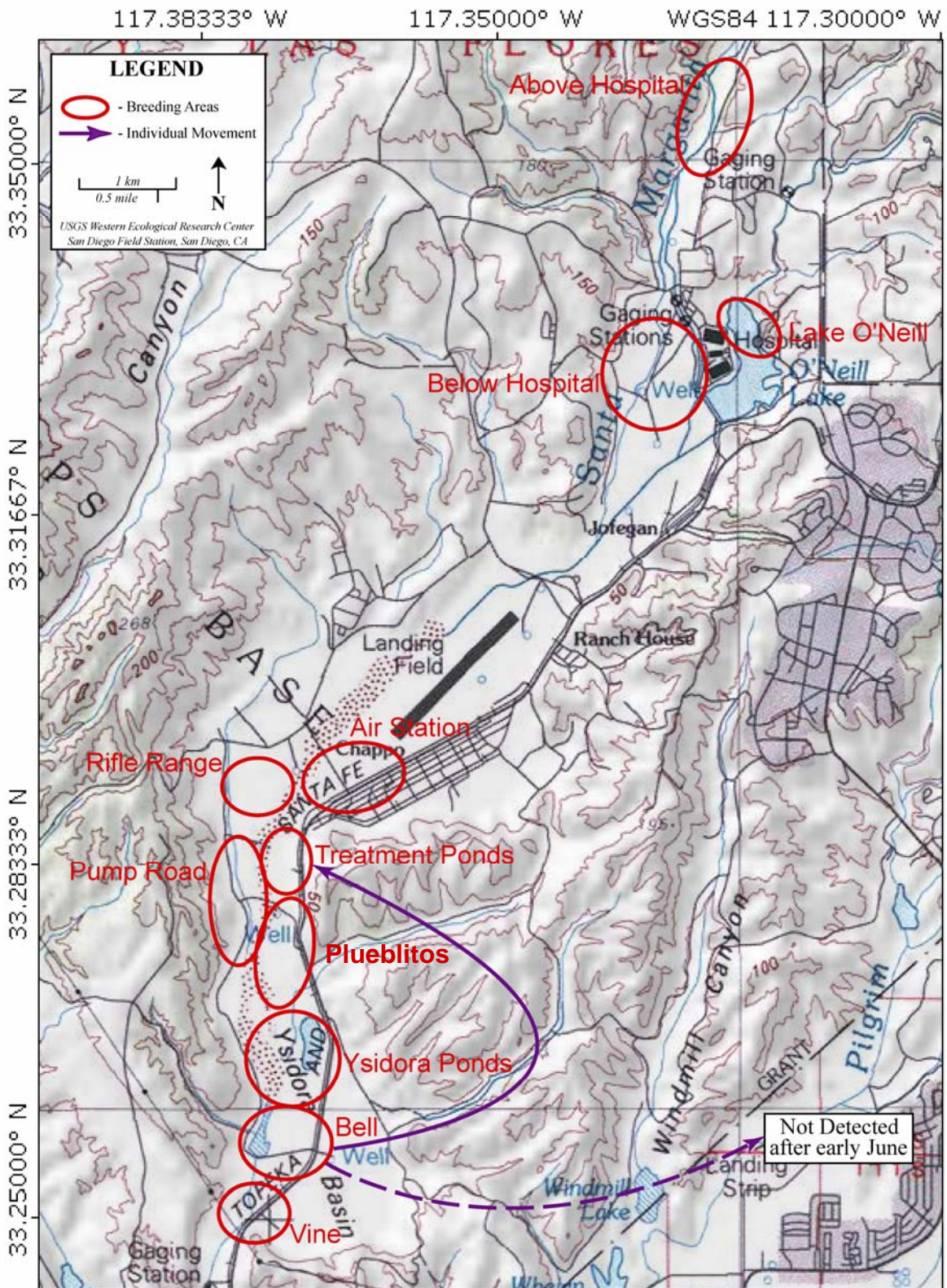


Figure 5. Same-year, between-area movement by southwestern willow flycatchers at Marine Corps Base Camp Pendleton, 2006.

## DISCUSSION

The 2006 breeding season followed a winter (October-March) of below average precipitation (9.3 cm) in dramatic contrast to the 2005 season which followed a winter of record-breaking rainfall (55.3 cm; Western Regional Climate Center 2006). The 2005 flooding in San Diego County which scoured floodplains and widened channels resulted in dramatic changes to the habitat used by willow flycatchers at Camp Pendleton that were still apparent in 2006, although the affected vegetation appeared to be filling in with new willow growth as well as an undergrowth of herbaceous vegetation. Flood-related changes in habitat still appear to be influencing flycatcher distribution and habitat use.

The number of transient willow flycatchers detected in 2006 (35) was identical to that of 2005, less than half the number seen in 2004 (82; Kus and Kenwood 2006a), and comparable to the number seen in previous years (39 in 2003; Kus and Kenwood 2005). The number of transients observed annually can be highly variable despite consistent survey scope and effort, and it is difficult to explain differences between years. Transients in 2006 were on average within 328 m of standing water, much farther than the average of 108 m in 2005, but consistent with the previous three years when distance to water averaged between 200 and 489 m (Kus and Kenwood 2003, 2005, 2006a). This probably reflects a change in the distribution of surface water back to pre-2005 levels rather than a change in habitat used by transient flycatchers.

Resident flycatchers exhibited slight changes in distribution in 2006. A pair of flycatchers settled to breed in a new area, as far north along the Santa Margarita River as has ever been documented, upstream of the hospital and approximately 650 m downstream of the confluence with De Luz Creek. The southern portion of the Bell area on the lower Santa Margarita River, which supported four pairs and one floater in 2004 (Kus and Kenwood 2006a) and only one floater in 2005 (Kus and Kenwood 2006b) was void of resident flycatchers in 2006. The eastern section of Ysidora Ponds, and most of the southern section of the Pueblitos area did not support birds again in 2006, except for one portion of the southern Pueblitos area that was re-established with multiple territories. The Air Station, which was re-colonized in 2004 and was occupied for only part of the season in 2005 by a single male, was in 2006 devoid of territories. The density of birds in traditional use areas (e.g., Pump Road, Bell) along the middle Santa Margarita River decreased, and the density of other areas (Treatment Ponds) increased. The Treatment Ponds, occupied in 2001 (Kus and Ferree 2002) and again in 2005 by a single male (Kus and Kenwood 2006b), supported four breeding territories in 2006. The majority of between-year movement of adult and second year birds was from these various concentration areas into the Treatment Ponds area. Overall, movement of individuals between years, detected through resighting of banded birds, increased from 28% of returning adults between 2003-2004 and from 45% of returning adults between 2004-2005 to 52% of returning adults between 2005-2006.

The number of resident flycatcher pairs in 2006 (19) increased from the 17 pairs observed in 2005 (Kus and Kenwood 2006b) but has not been restored to the 22 pairs in 2004 (Kus and Kenwood 2006a), the largest number of pairs documented at the Base since 1999.

However, it remains within the range of breeding pairs present in other previous years (16-18; Kus and Ferree 2002, Kus and Kenwood 2003, 2005). The degree of polygyny in the population decreased, but still remained high with 56% (5/9) of paired males polygynous, and 74% (14/19) of females sharing males. As in 2005, single males were present during the breeding season, but the majority of females paired instead with polygynous males. Despite the availability of unpaired males the number of females (19) exceeded the number of males (12) creating conditions where polygyny benefits females as well as males if the alternative for females is failure to mate. 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 was lower in 2006 than in 2005 (52% versus 60%, respectively). Predation accounted for the majority of nest failures, at 58% (7/12); however plant collapse and abandonment also contributed to lower nest success with 33% (4/12) of failures the result of nest host and surrounding vegetation collapse, and 8% (1/12) the result of abandonment at an early stage. Host plant collapse has been associated with the placement of nests in poison hemlock, which has been the most commonly used nest substrate in recent years (Kus and Kenwood 2005, 2006a, 2006b). The use of poison hemlock declined considerably from 42% of nests in 2004 and 36% in 2005 to 8% of nests in 2006, possibly because of the increased growth of stinging nettle in areas where poison hemlock dominated in previous years. Neither of the nests placed in hemlock in 2006 failed as a result of collapse; however host plant collapse was documented in native hosts, stinging nettle and willow, indicating that this source of nest failure is not limited to the exotic poison hemlock.

Although nest success decreased in 2006 relative to 2005, seasonal productivity increased slightly from 1.7 fledglings per pair to 1.8 fledglings per pair. This did not result from an increase in clutch size, as average clutch size declined slightly from 3.2 eggs per nest in 2005 to 3.1 eggs per nest in 2006. Rather, it resulted from a smaller number of eggs that failed to hatch (N=1) and fewer instances of egg or nestling disappearance (N=6) from nests that otherwise fledged young. Of the 39 eggs laid in successful nests in 2006, these seven losses represent an 18% reduction in the potential number of young that could have been produced had they hatched/survived. The disappearance of individual eggs and nestlings from nests, suggestive of partial predation, was not as extensive as it was in 2005; however was similar to that of previous years (e.g., reduction of 24% (12/51) in 2004 (Kus and Kenwood 2006a); 16% (9/57) in 2003 (Kus and Kenwood 2005)).

The return of banded adults between 2005 and 2006 (52%) was nearly double that observed between 2004 and 2005 (31%), but similar to that between 2003 and 2004 (56%). Return of second year birds was comparable between the three years (15% in 2006, 17% in 2005, 15% in 2004). Although the rate of return of second year birds seems low and the fraction of the breeding population made up of second year birds decreased from 33% in 2005 (the highest ever documented at the Base) to 13% in 2006, it appears that the Pendleton population has reached a stage of turnover where older birds are being replaced in substantial numbers by

first-time breeders. This creates the opportunity to collect life-time reproductive data for a growing segment of the population, which will facilitate identification of age- and sex-related patterns in life history characteristics that influence population size, productivity, and genetic structure.

Inbreeding is a potentially serious problem whose probability of occurrence increases in smaller populations (Meffe and Carroll 1997). In 2006 within the willow flycatcher population on Camp Pendleton, inbreeding was documented as a male bred with one of his 2005 offspring. The potential for inbreeding is reduced, however, through immigration and emigration, and 2006 marked the fourth year during which immigration onto the Base has been documented, bringing to five the number of birds entering the Pendleton flycatcher population. The immigration of a female from Guajome Lake on the San Luis Rey River (a distance of 9.4 km) is an encouraging sign that regional flycatcher populations are connected through dispersal over a large area. Further banding and resighting of flycatchers throughout their range will allow a better determination of the extent of movement between populations and the role such movement plays in maintaining genetic diversity and persistence in these populations.

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**APPENDIX A**

**SOUTHWESTERN WILLOW FLYCATCHER SURVEY AREAS AT  
MARINE CORPS BASE CAMP PENDLETON, 2006**

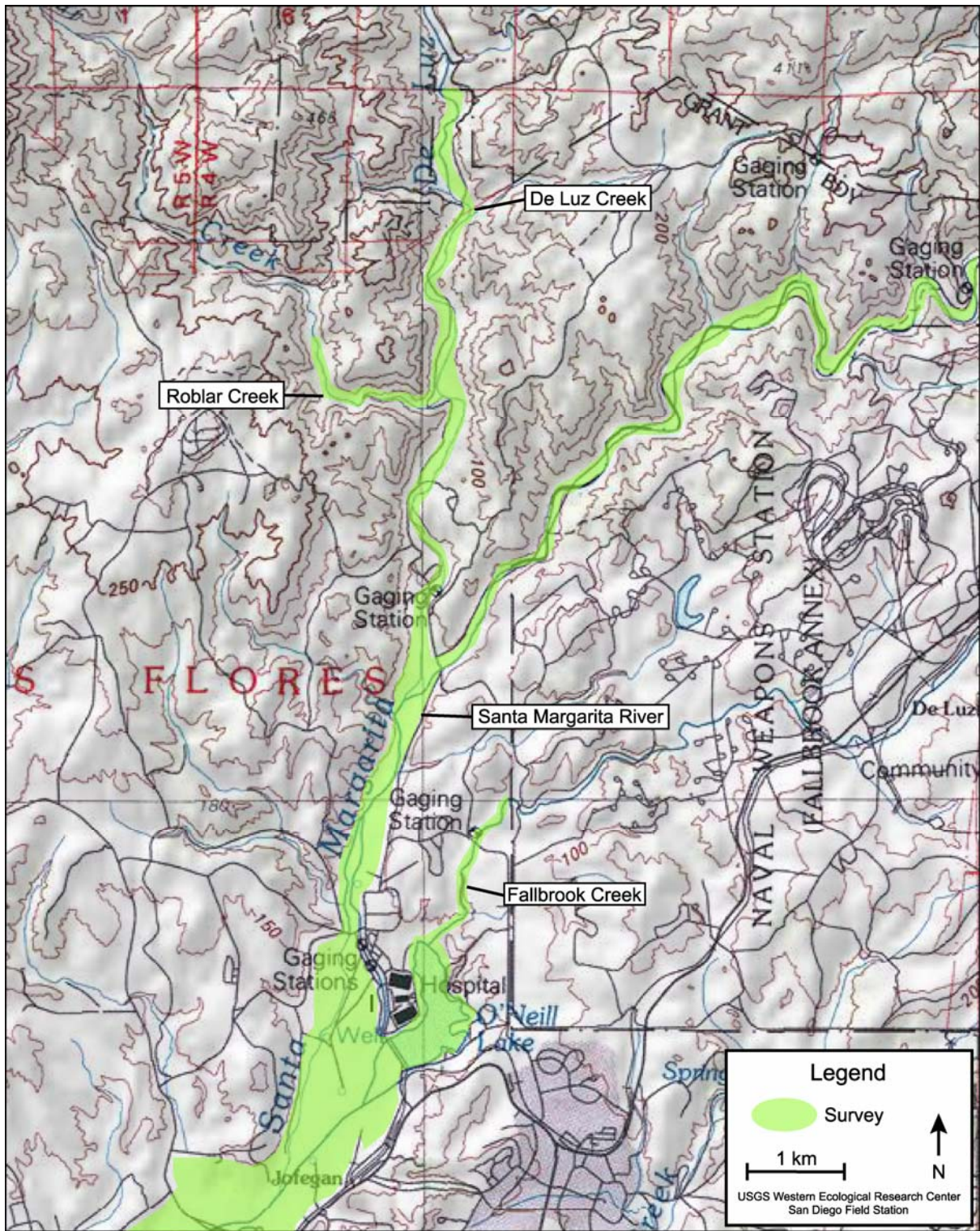


Figure 4. Willow Flycatcher Survey Areas at Marine Corps Base Camp Pendleton, 2006: Santa Margarita River, Fallbrook Creek, De Luz Creek and Roblar Creek



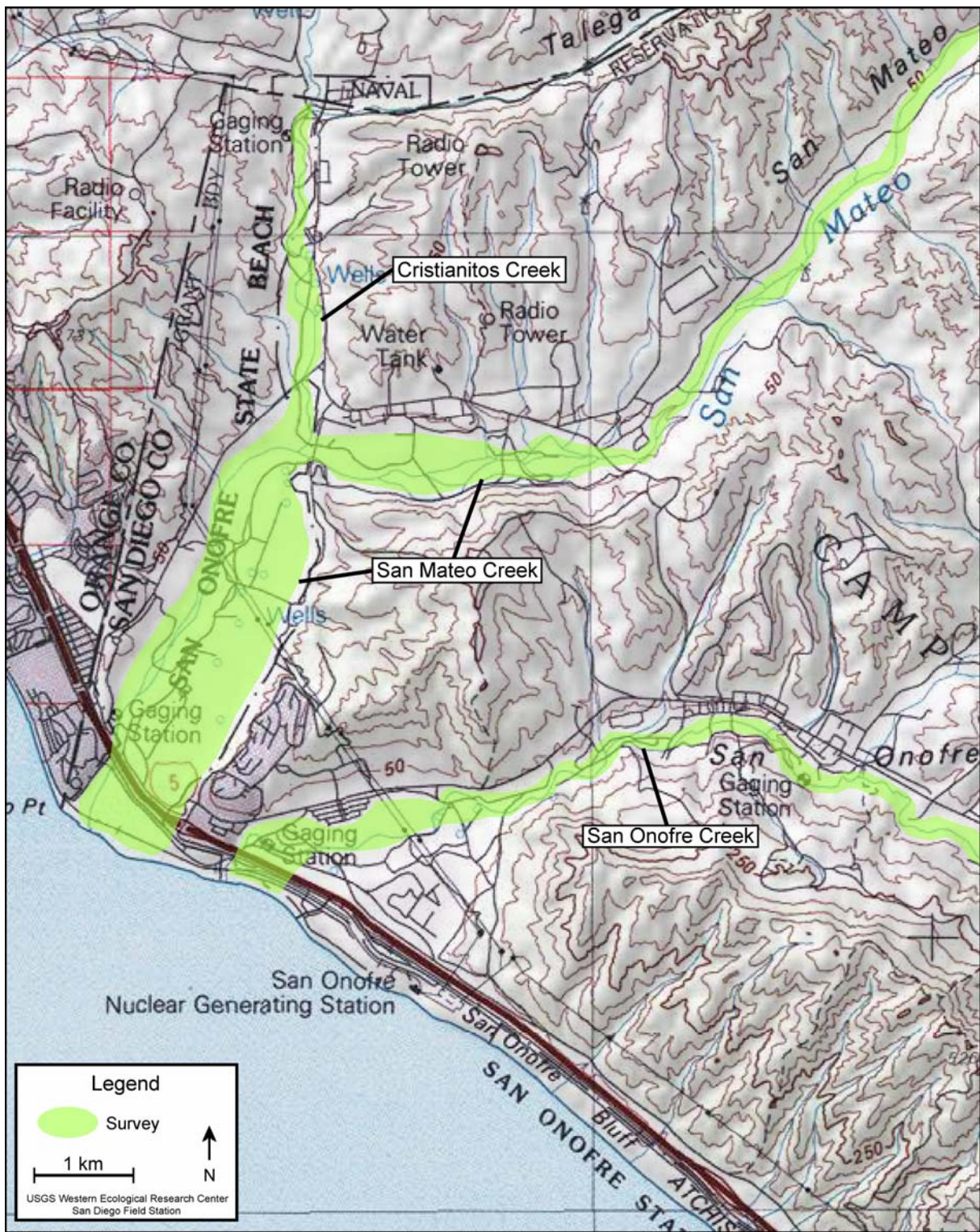


Figure 6. Willow Flycatcher Survey Areas at Marine Corps Base Camp Pendleton, 2006: Cristianitos Creek, San Mateo Creek and San Onofre Creek

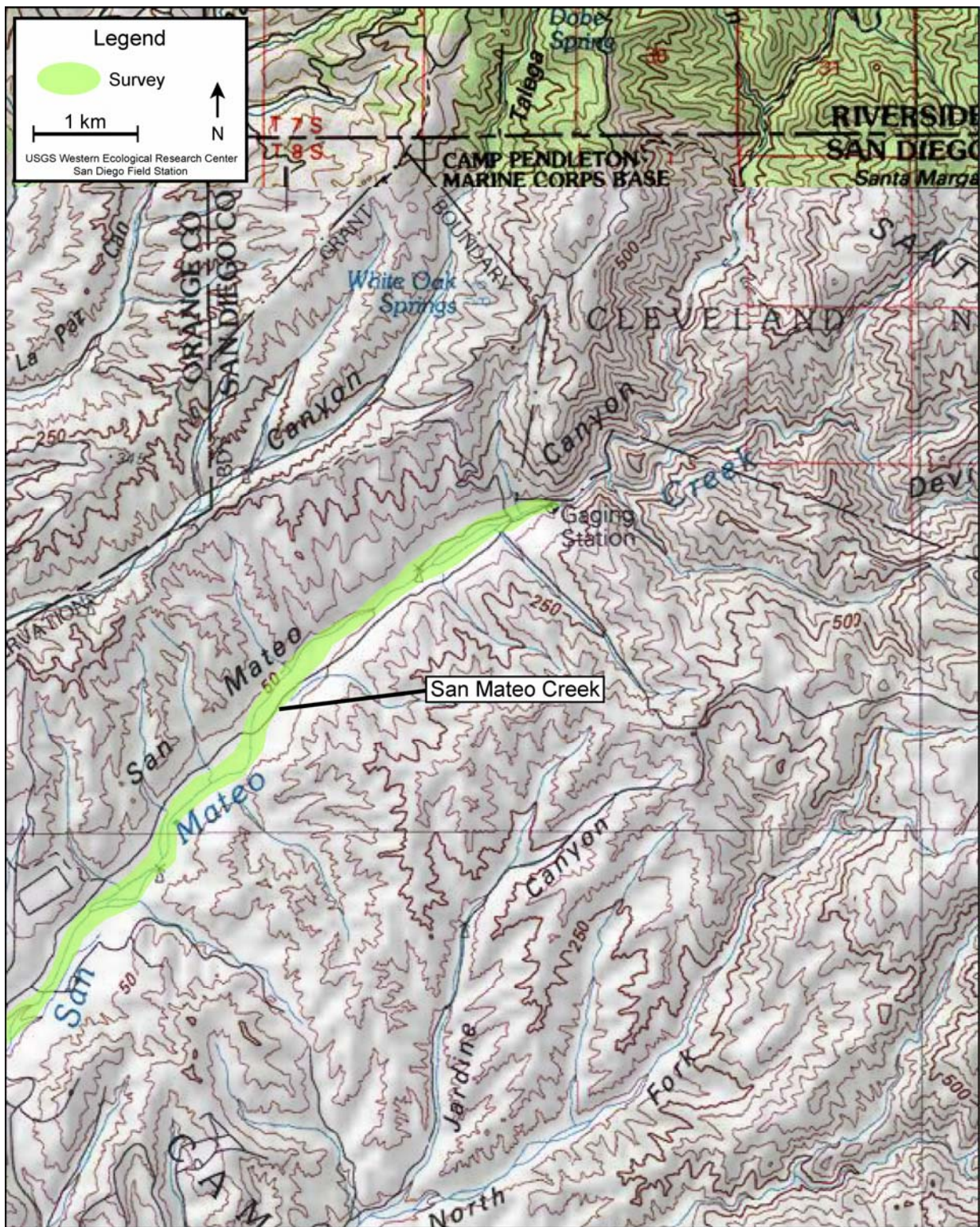


Figure 7. Willow Flycatcher Survey Areas at Marine Corps Base Camp Pendleton, 2006:  
San Mateo Creek

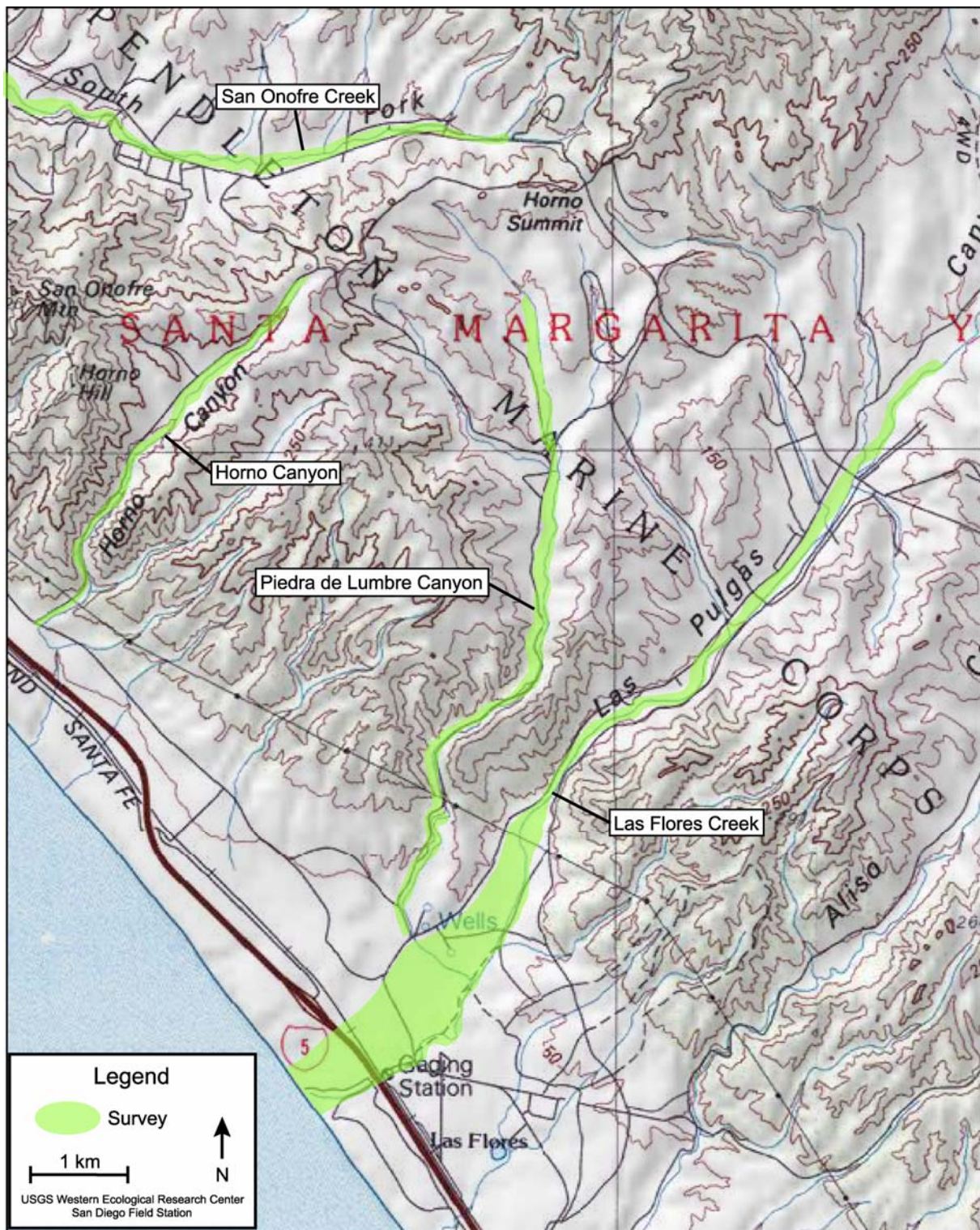


Figure 8. Willow Flycatcher Survey Areas at Marine Corps Base Camp Pendleton, 2006:  
Las Flores Creek, Piedra de Lumbre Canyon, Horno Canyon, and San Onofre Creek

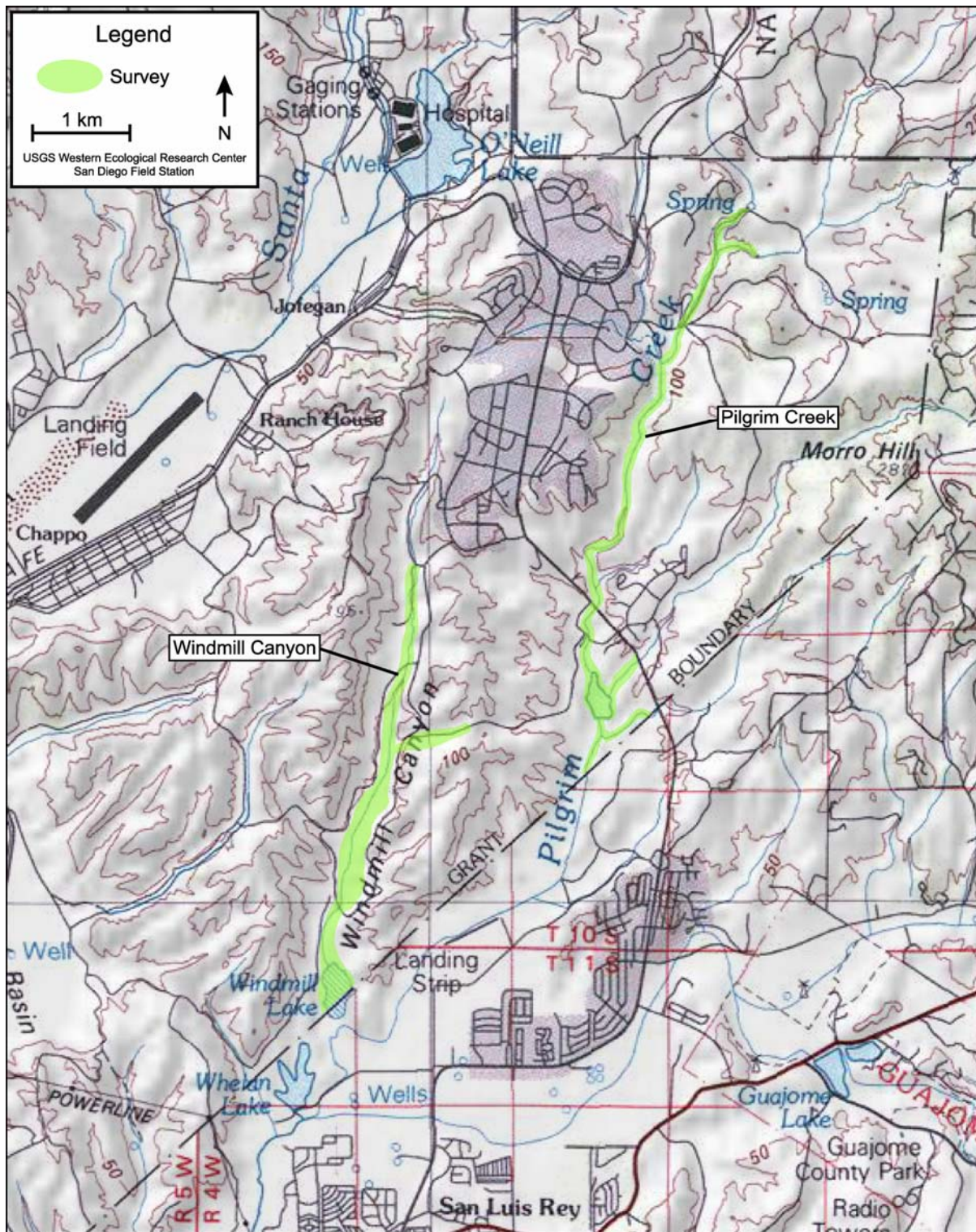


Figure 9. Willow Flycatcher Survey Areas at Marine Corps Base Camp Pendleton, 2006:  
Windmill Canyon and Pilgrim Creek



**APPENDIX B**

**LOCATIONS OF SOUTHWESTERN WILLOW FLYCATCHER AT  
MARINE CORPS BASE CAMP PENDLETON, 2006**

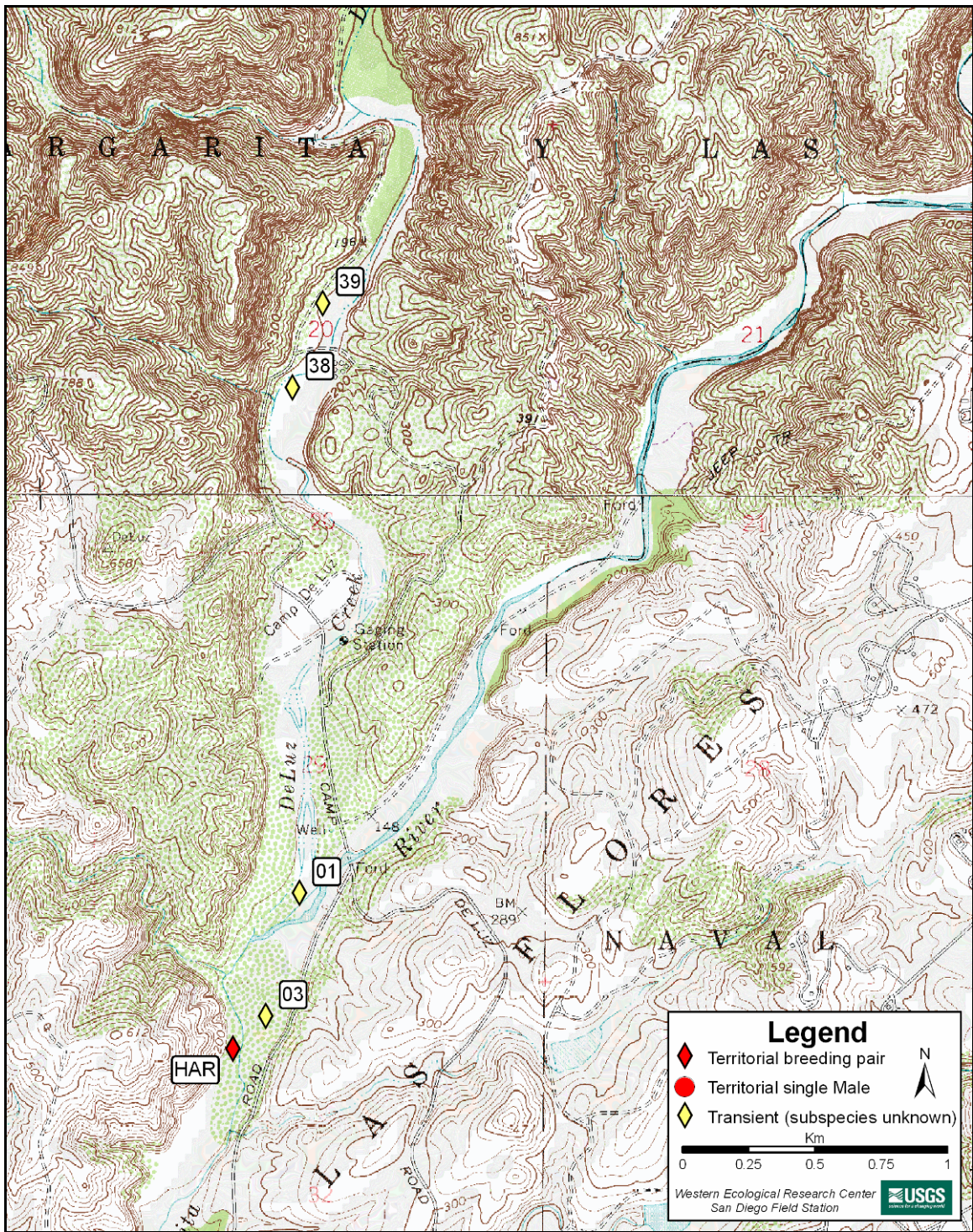


Figure 10. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2006: Santa Margarita River (upstream) and De Luz Creek

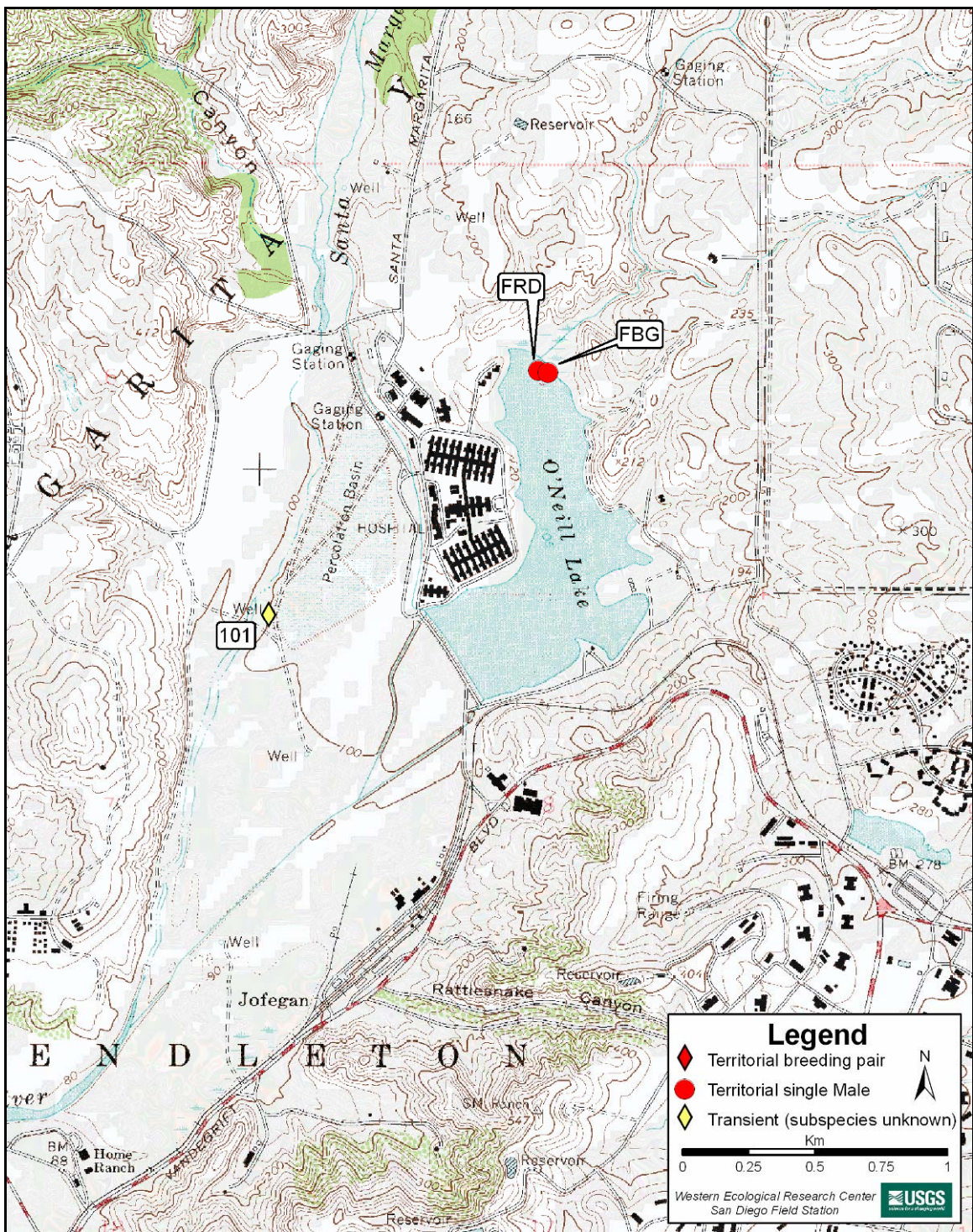


Figure 11. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2006: Santa Margarita River and Fallbrook Creek

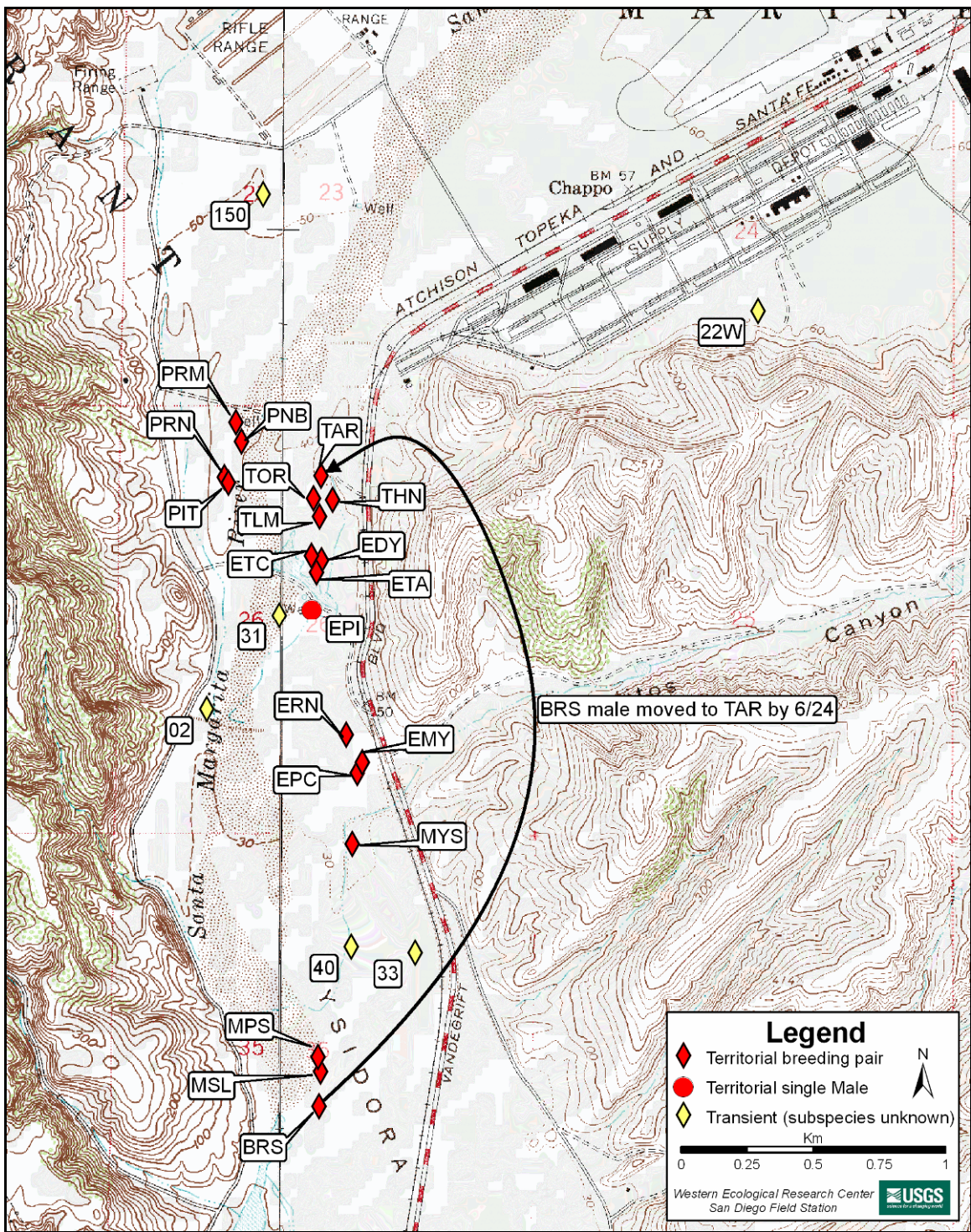


Figure 12. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2006: Santa Margarita River

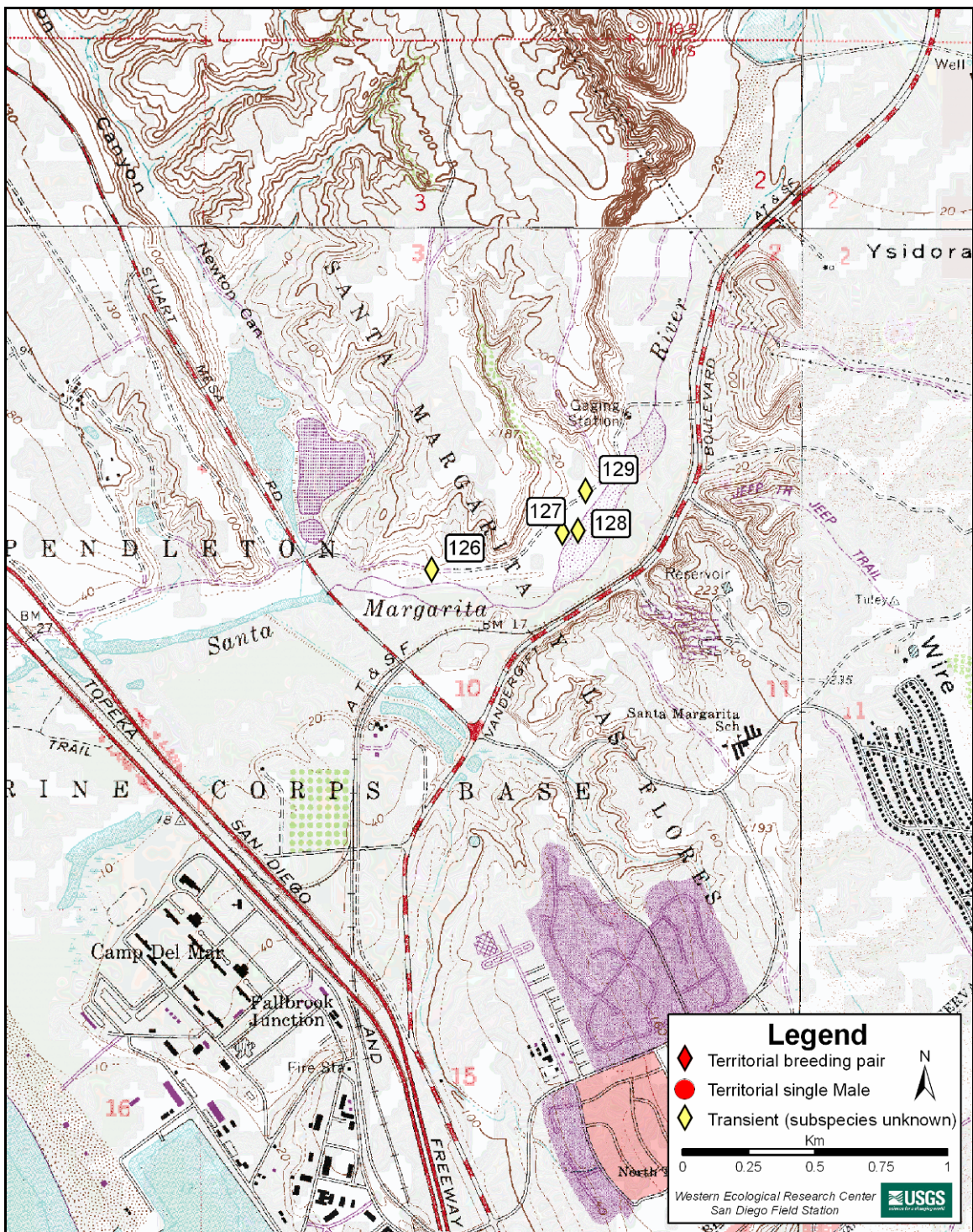


Figure 13. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2006: Santa Margarita River (downstream)



Figure 14. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2006: Cristianitos Creek and San Mateo Creek (upstream)

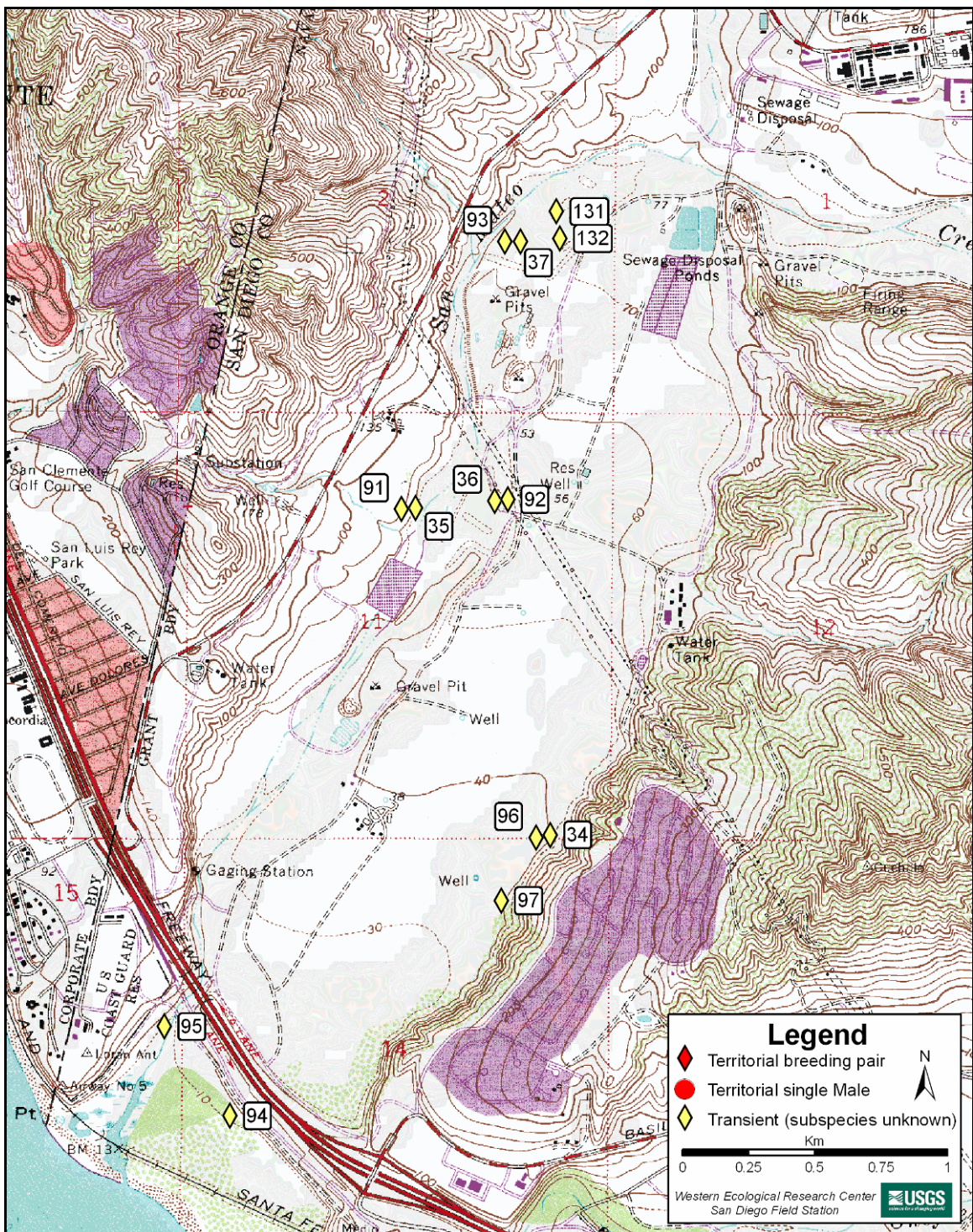


Figure 15. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2006: San Mateo Creek (downstream)

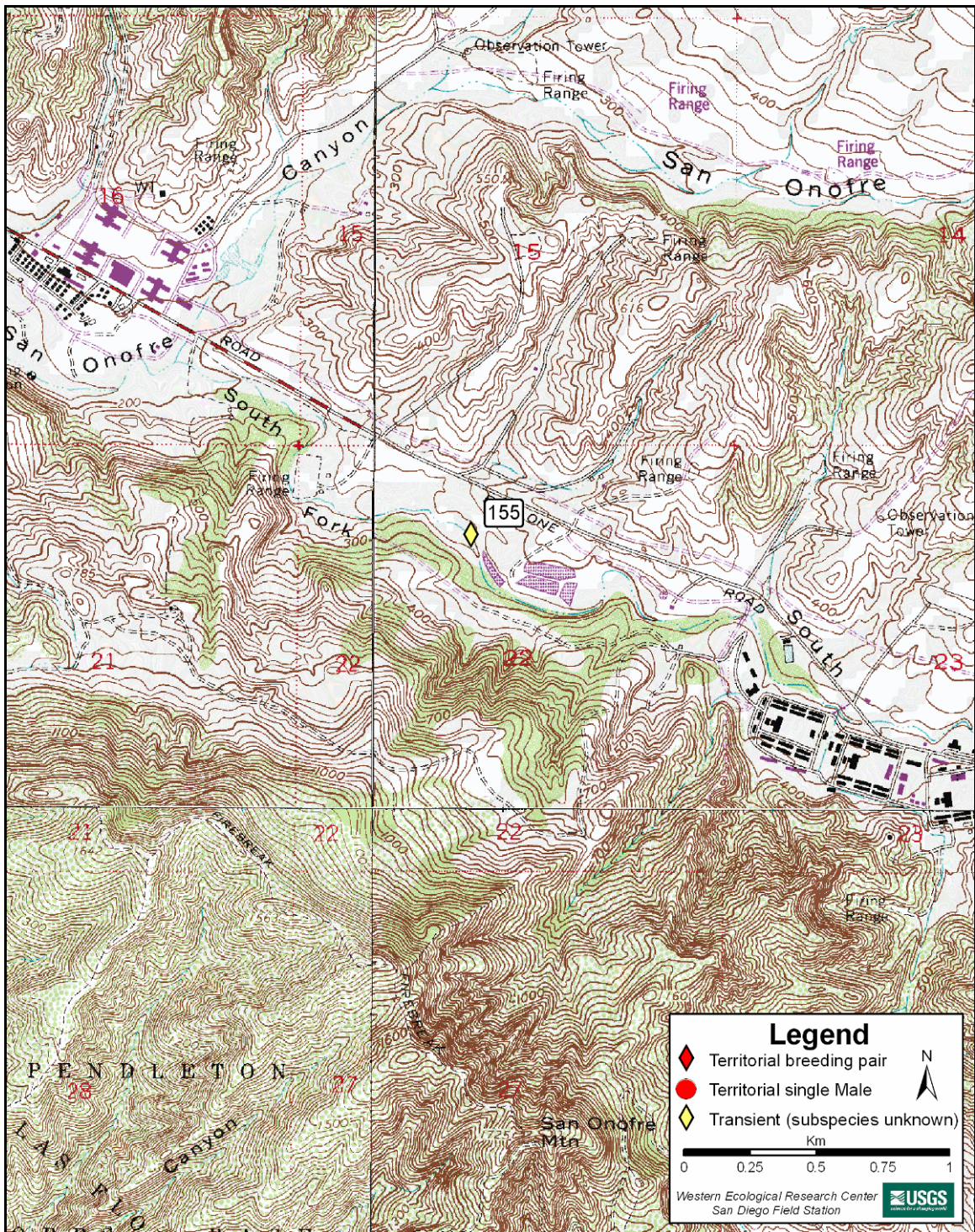


Figure 16. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2006: San Onofre Creek (upstream)



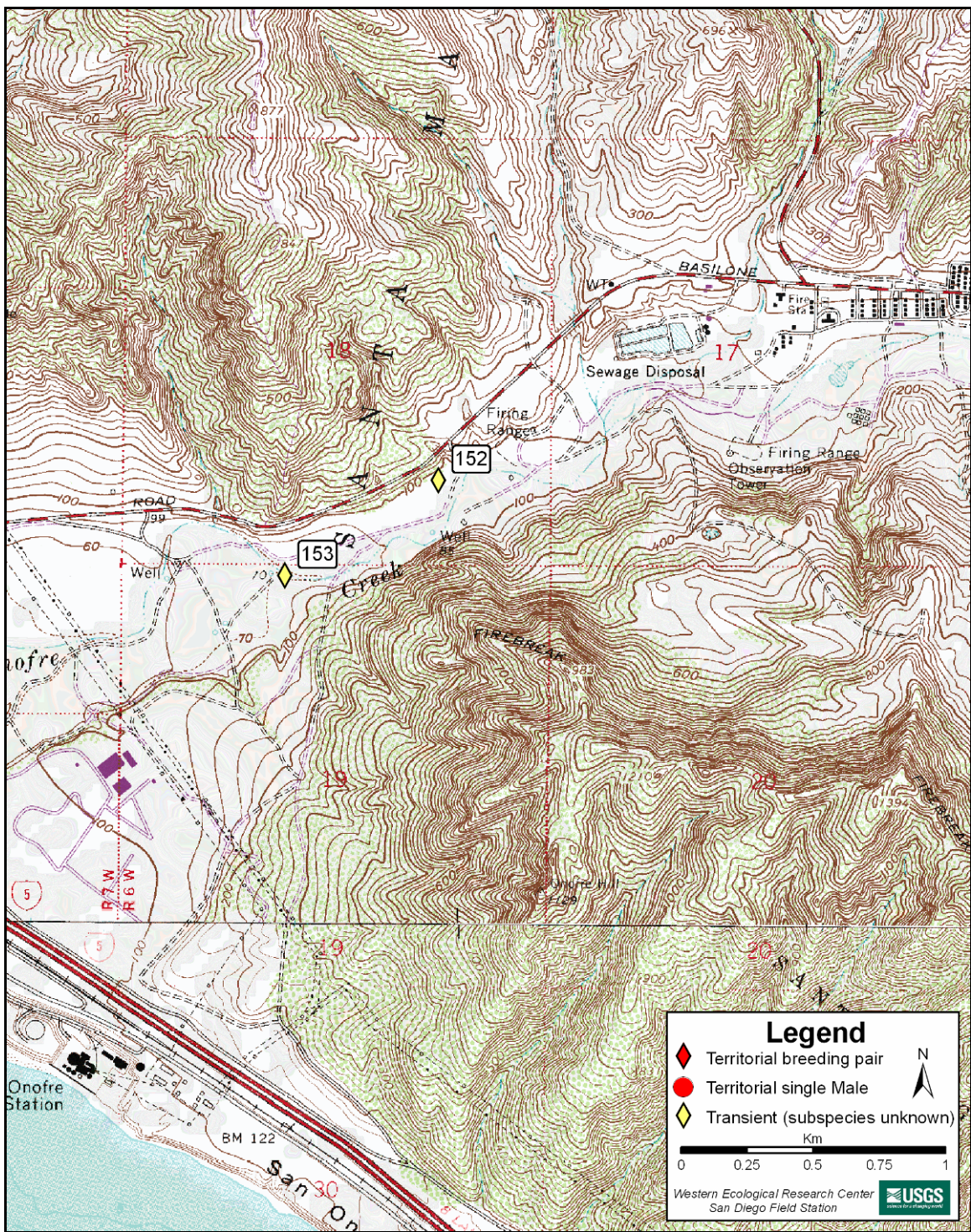


Figure 17. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2006: San Onofre Creek (downstream)

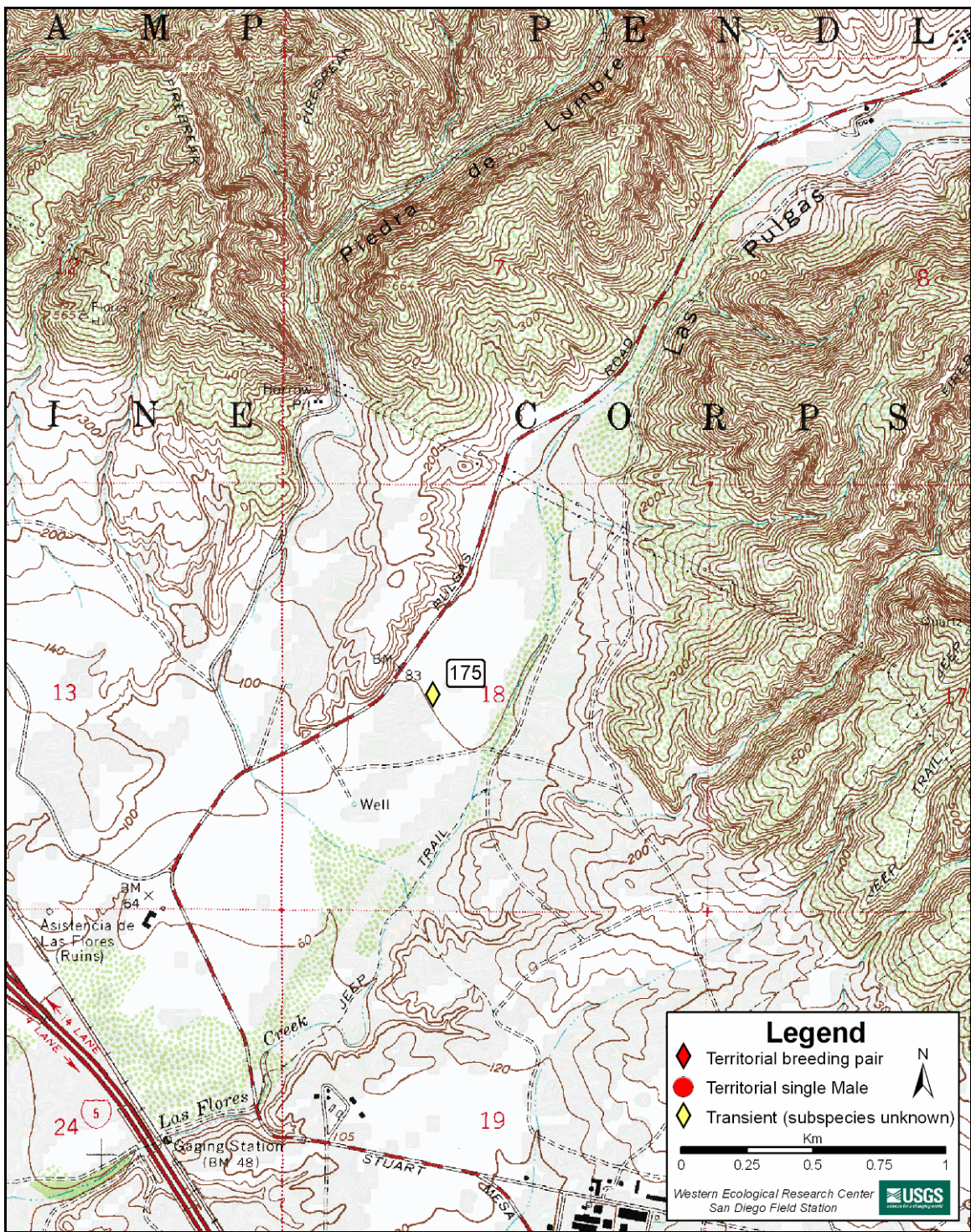


Figure 18. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2006: Las Flores Creek

**APPENDIX C**

**SOUTHWESTERN WILLOW FLYCATCHER BREEDING LOCATIONS  
AT MARINE CORPS BASE CAMP PENDLETON, 2006**

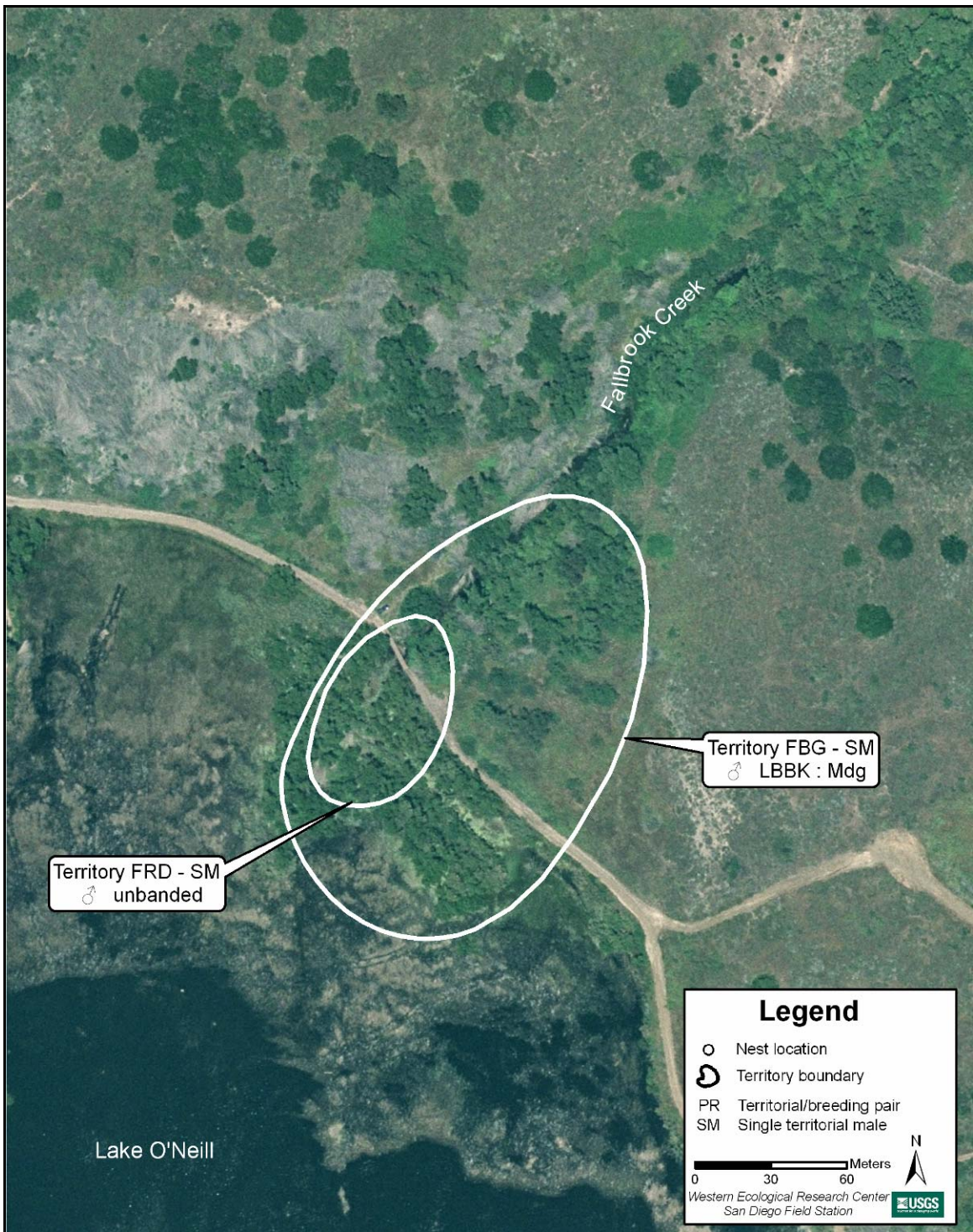


Figure 19. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2006: Lake O'Neill, Fallbrook Creek

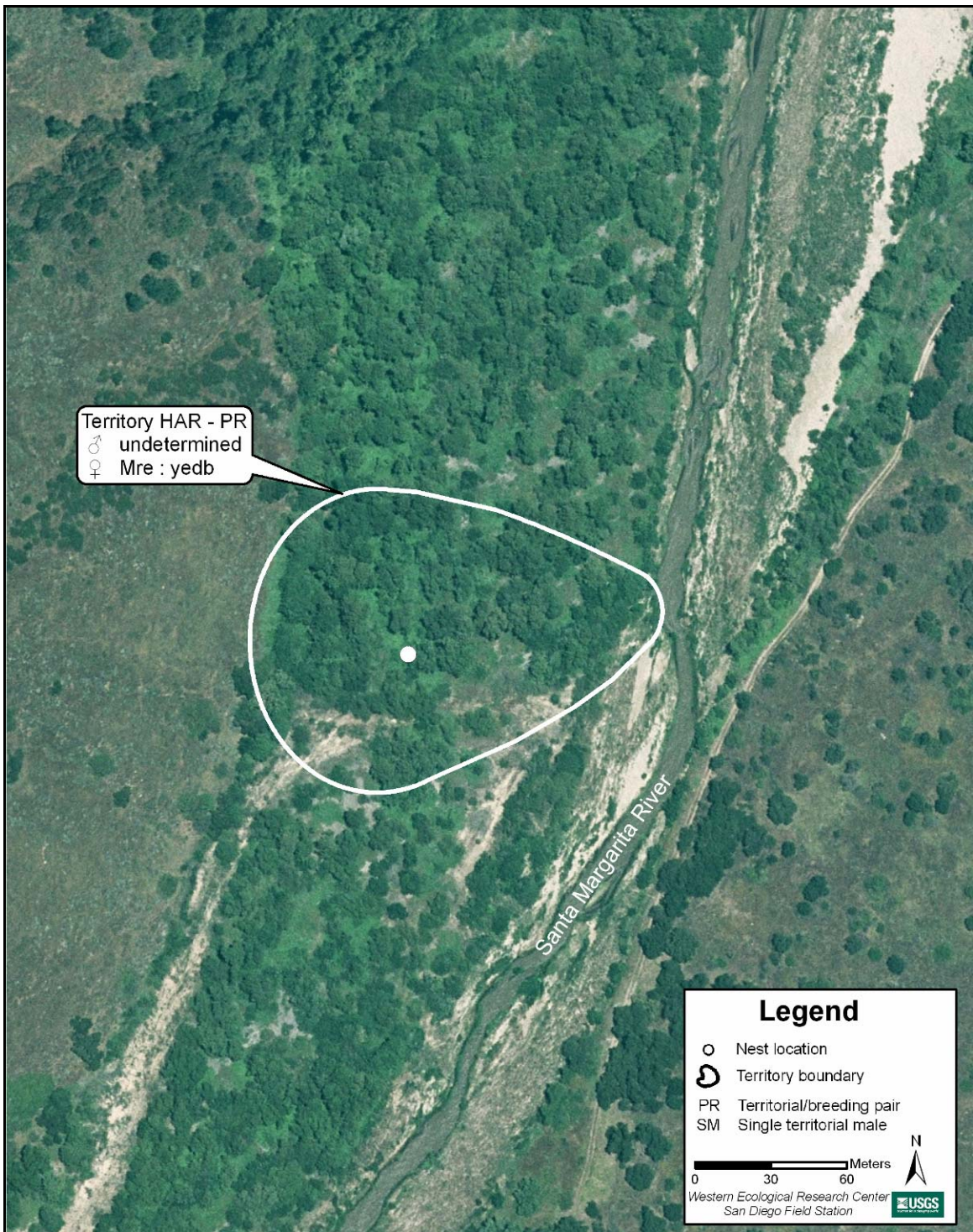


Figure 20. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2006: Above Hospital, Santa Margarita River

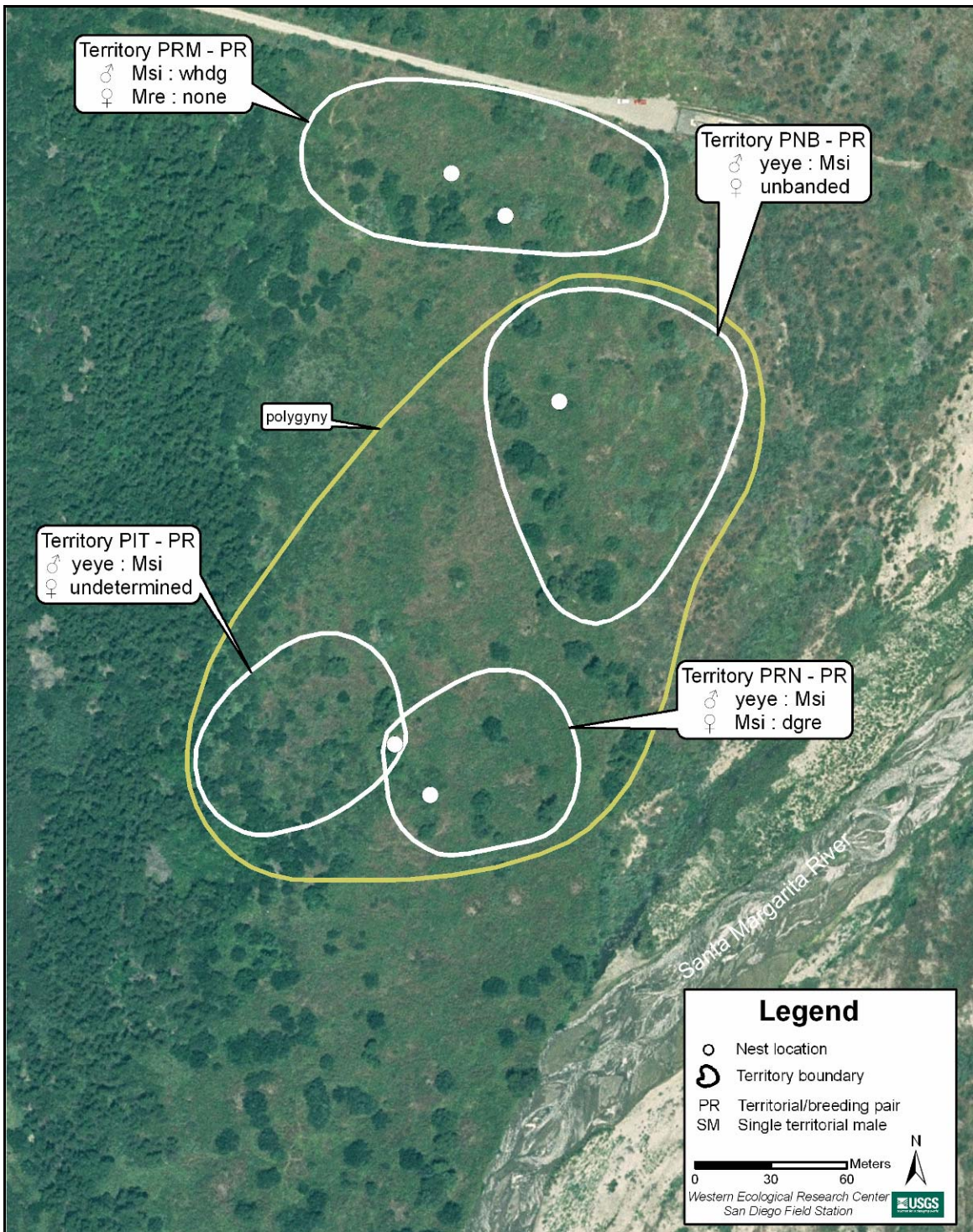


Figure 21. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2006: Pump Road, Santa Margarita River

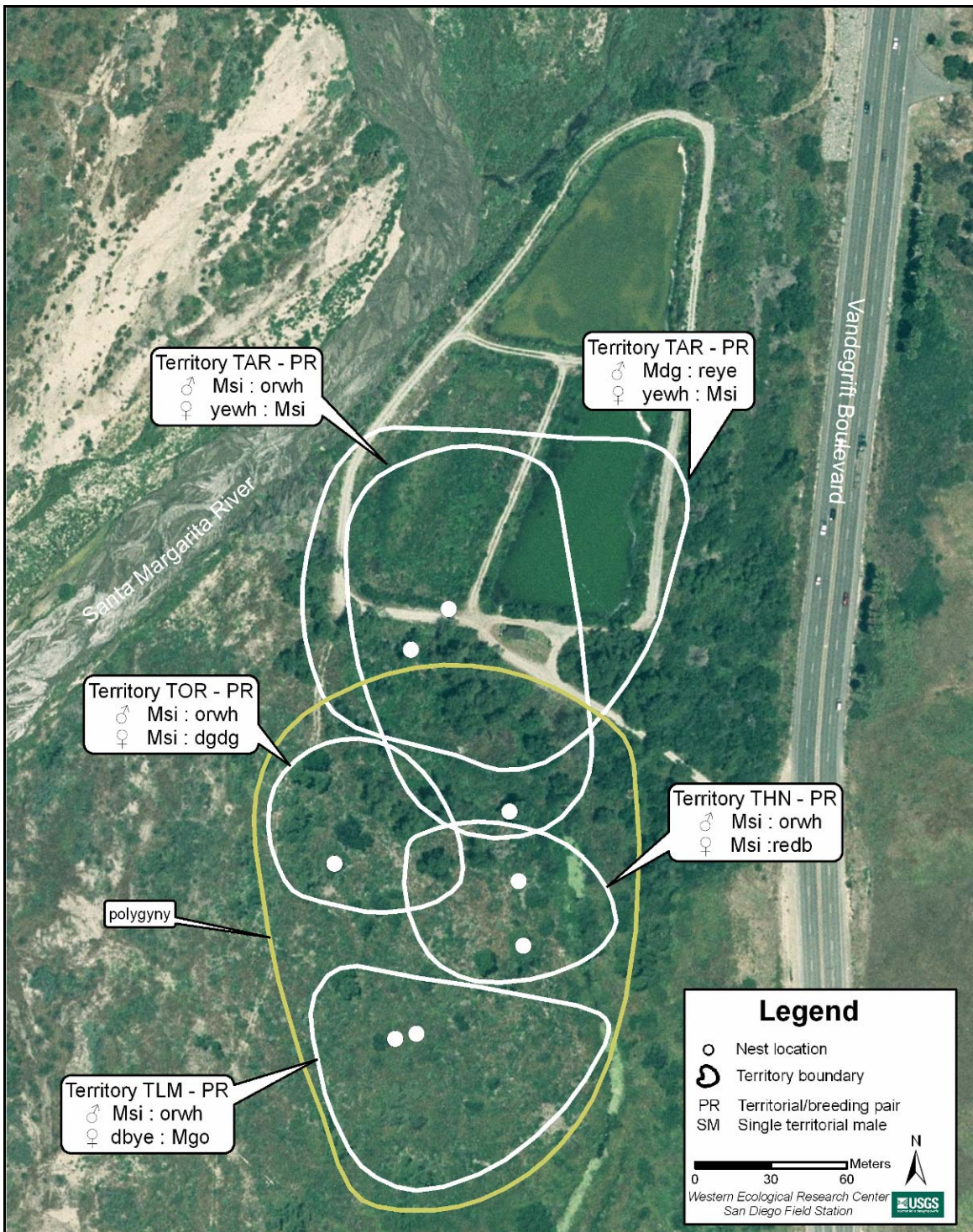


Figure 22. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2006: Treatment Ponds, Santa Margarita River

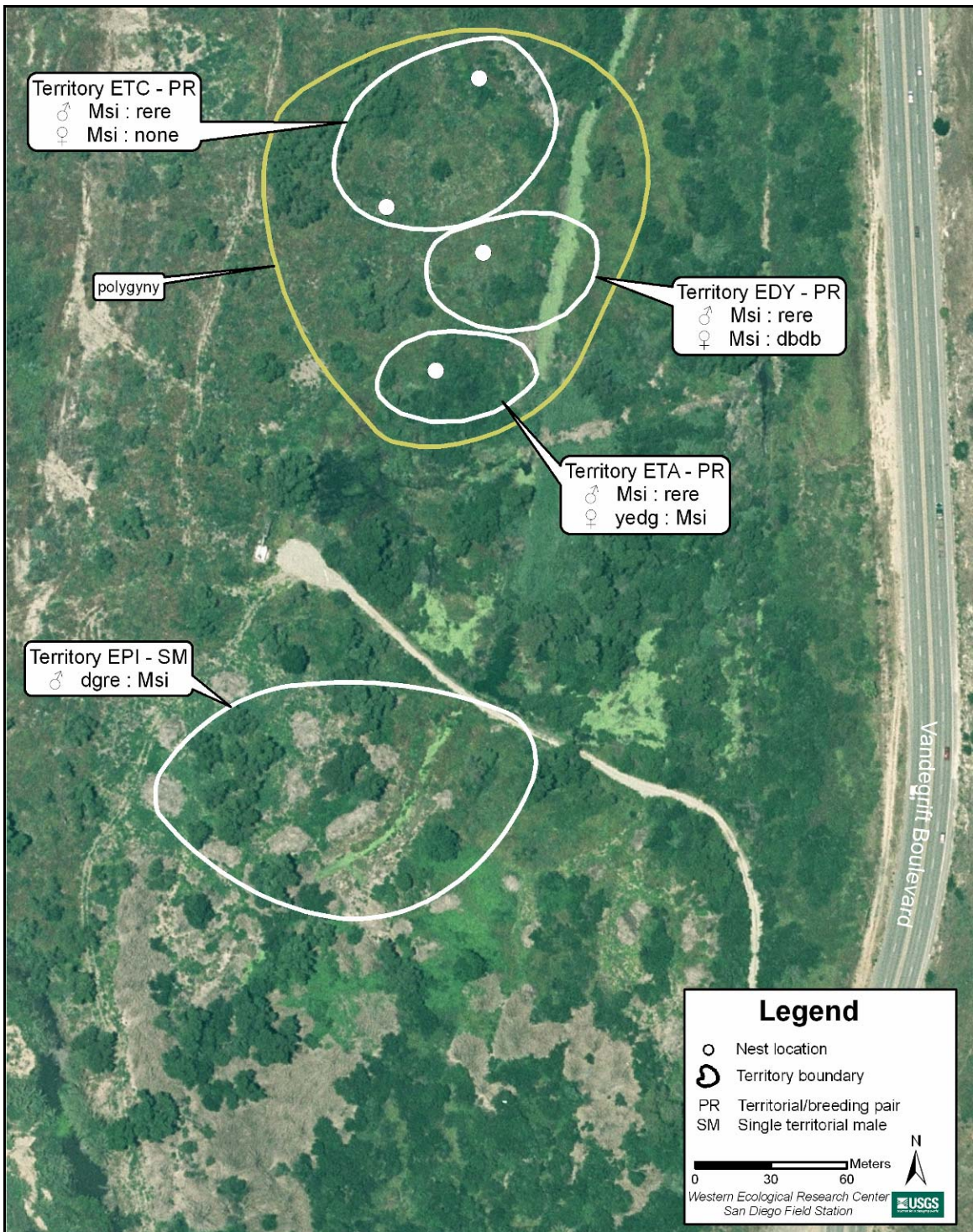


Figure 23. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2006: Pueblitos Canyon (upper), Santa Margarita River



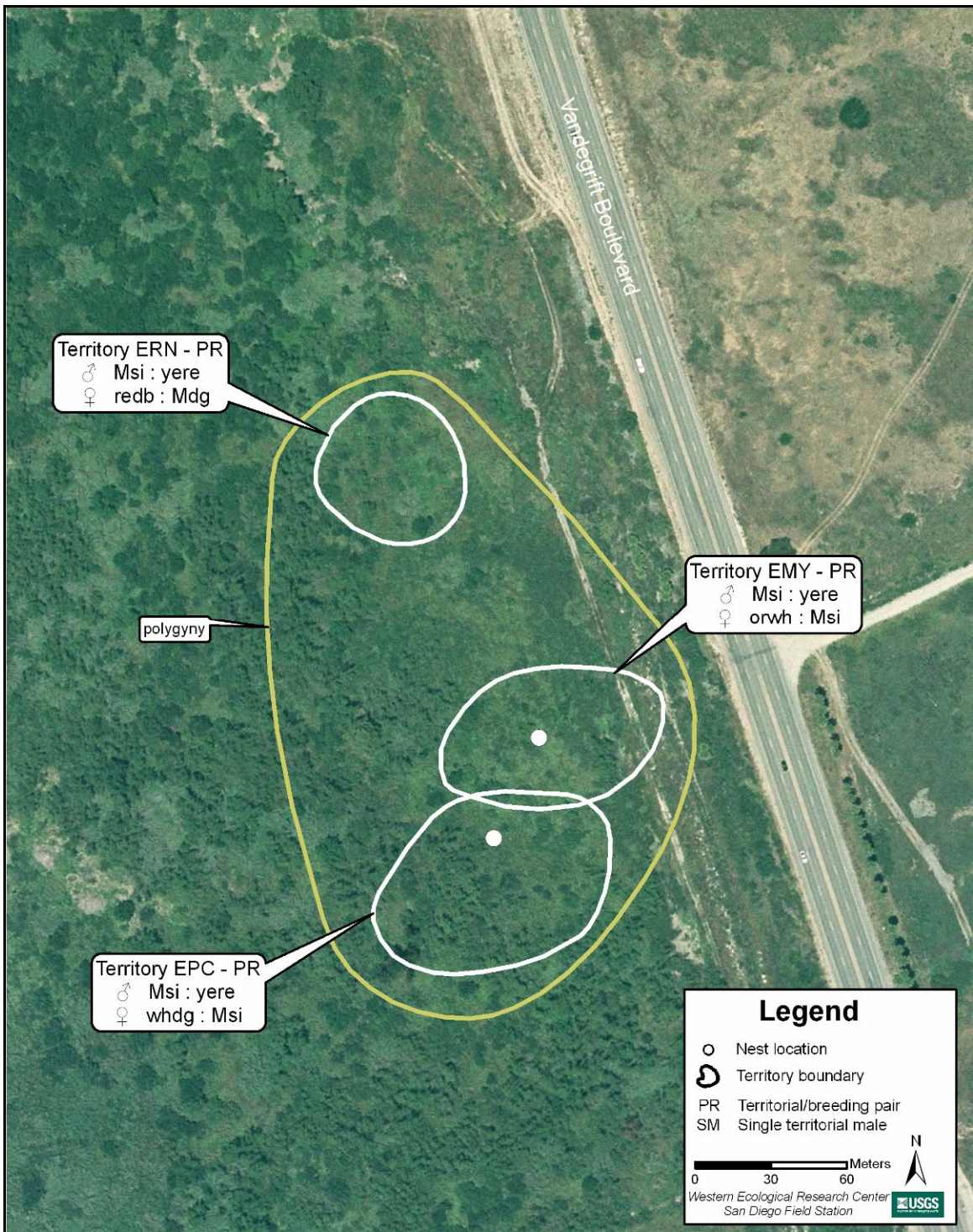


Figure 24. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2006: Pueblitos Canyon (lower), Santa Margarita River

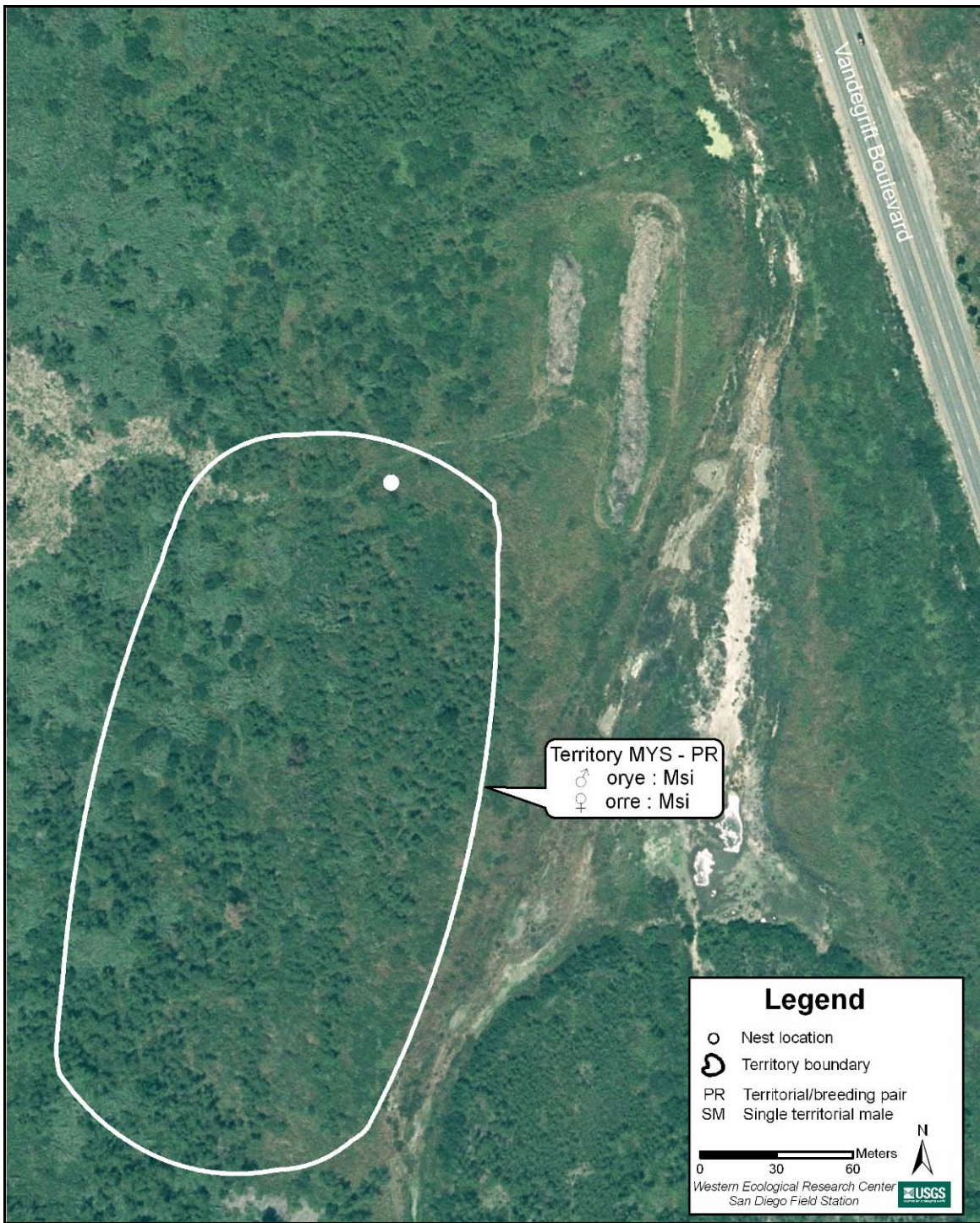


Figure 25. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2006: Ysidora Ponds (upper), Santa Margarita River

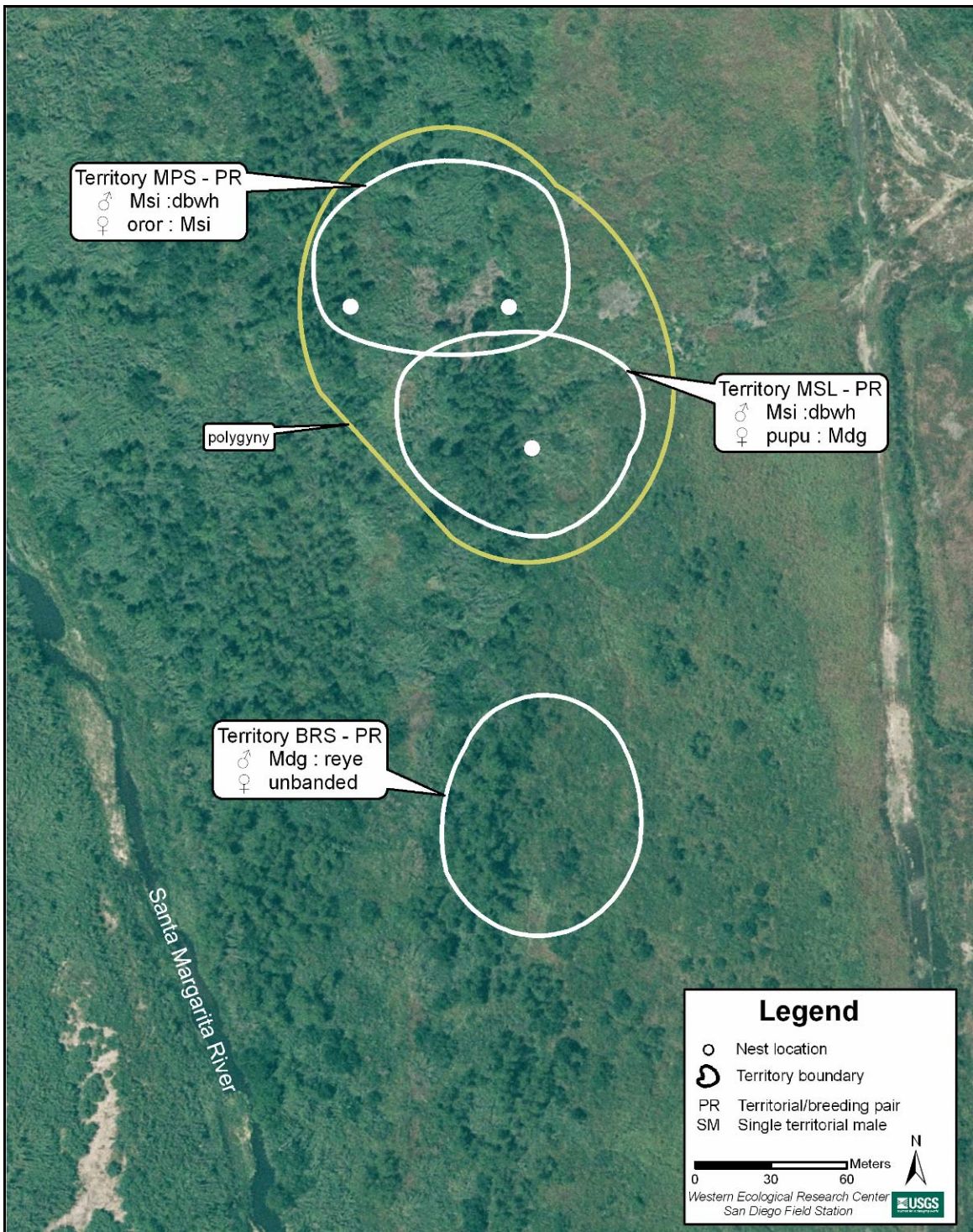


Figure 26. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2006: Ysidora Ponds (lower) and (El Camino Real), Santa Margarita River

**APPENDIX D**

**BAND COMBINATIONS AND IDENTIFICATION OF SOUTHWESTERN WILLOW  
FLYCATCHER NESTLINGS BANDED ON MARINE CORPS BASE CAMP  
PENDLETON IN 2006**

Band combinations and identification of southwestern willow flycatcher nestlings banded on Marine Corps Base Camp Pendleton in 2006.

<b>Territory ID</b>	<b>Nest ID</b>	<b>Nestling Band Combination<sup>a</sup></b>	<b>Federal Band Number</b>
EDY	1	Msi : none	237003247
EDY	1	Msi : none	237003248
EDY	1	Msi : none	237003249
ETA	1	Msi : none	237003259
ETA	1	Msi : none	237003260
ETA	1	Msi : none	237003261
MPS	2	Msi : none	237003263
MPS	2	Msi : none	237003264
MPS	2	Msi : none	237003265
MSL	1	Msi : none	237003240
MSL	1	Msi : none	237003241
MYS	1	Msi : none	237003255
MYS	1	Msi : none	237003256
MYS	1	Msi : none	237003257
PIT	1	Msi : none	228058462
PIT	1	Msi : none	228058463
PRM	2	Msi : none	228058455
PRM	2	Msi : none	228058456
PRM	2	Msi : none	228058457
TAR	3	Msi : none	237003270
TAR	3	Msi : none	237003271
TAR	3	Msi : none	237003272
THN	2	Msi : none	237003268
TLM	2	Msi : none	237003266
TLM	2	Msi : none	237003267
TOR	1	Msi : none	237003243
TOR	1	Msi : none	237003244
TOR	1	Msi : none	237003246

<sup>a</sup> Band combinations: left leg : right leg; Msi = federal aluminum band, none = no bands present.