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1995 Bird

RESULTS OF 1995 AVIAN SURVEYS FOLLOWING THE JANUARY 17, 1994 ARCO/FOUR CORNERS OIL SPILL ON THE SANTA CLARA RIVER, CALIFORNIA

Source USFWS Arco Spill

DRAFT
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Summary

This report presents preliminary results of the second year of avian surveys conducted in 1995, required by USFWS after the January 17, 1994 ARCO/Four Corners oil spill on the Santa Clara River, in Los Angeles County, California. In addition to the areas immediately affected by inundation of oil, two unaffected reference sites were chosen downstream to allow for comparison of bird population parameters between the affected and unaffected areas to assess any injuries to birds from the oil spill. Methods used to conduct the assessment included point counts, tape playback surveys, general surveys, and endangered species monitoring - which included least Bell's vireo, southwestern willow flycatcher, and yellow-billed cuckoo.

Point count data in 1995 indicated that both relative abundance and species richness were significantly greater in the reference sites compared to the affected area. In addition, the relative abundance of several water-related species (spotted sandpiper and combined fisheating species: great egret, great-blue heron, black-crowned night-heron, and belted kingfisher) was significantly lower in the affected area, increasing in abundance with greater distance from the spill origin. However, a common waterbird, the killdeer, showed no significant differences in relative abundance between the afffected area and reference sites. Statistical analysis comparing 1994 and 1995 data is not presented in this report.

No yellow-billed cuckoos were found during our surveys. Two non-singing southwestern willow flycatchers were found, at two locations in the affected area. Least Bell's vireos were present both in the affected area and reference sites - with 2 and 22 pairs, respectively. Productivity in the affected area in 1995 was higher than in 1994, and comparable to productivity in the reference sites. Overall productivity was consistent with that of wild populations elsewhere in the state.

Introduction

On 17 January 1994, an earthquake caused the rupture of an ARCO/Four Corners oil pipeline in Santa Clarita, California. The oil spilled into the Santa Clara River at McBean Parkway and spread approximately 15 miles to the Piru Creek confluence. In response to the spill, the California Department of Fish and Game (CDFG) and the US Fish and Wildlife Service (USFWS) on behalf of state and federal trust resources began conducting a cooperative preassessment to determine potential natural resource injuries. In an effort to assess impacts to these resources, namely wildlife and associated habitat, the CDFG and USFWS initiated studies within the spill area on macroinvertebrates, teleost fishes, herpetofauna, and avifauna. This document reports the results from the second year of field studies conducted in the spring of 1995.

The Impact Area

The Santa Clara River is one of the largest undammed rivers in Southern California, stretching east-west for 100 miles (Figure 1). The affected area is midway within the watershed and supports a variety of sensitive riparian habitats ranging in succession from mature willow and cottonwood forest to more disturbed areas of *Arundo*, *tamarix* and mulefat scrub. Several large marsh habitats are present which contain emergent bullrush, cattail, and young willow and cottonwood trees. In addition, much of this stretch of the river is contiguous with native upland habitats such as coastal sage scrub and oak woodland.

The abundance and distribution of birds is directly related to the quality and quantity of available habitat. As western riparian ecosystems are among the most productive habitats for birds in North America and among the rarest (Krueper 1992), it is not surprising that this part of the river supports a rich diversity of birds, including a number of endangered, threatened, and sensitive species. Much of this section of the river is included within US Fish and Wildlife Service Critical Habitat designation for the state and federally endangered least Bell's vireo.

Endangered and Threatened Species

Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)

The yellow-billed cuckoo is an insectivorous neotropical migrant. It occurs throughout North America and is divided into eastern (*C. a. americanus*) and western subspecies.

Western yellow-billed cuckoos arrive late in the season at the end of June through the beginning of July and stay until late August and September (Laymon & Halterman 1987). In general, this species requires broad woodlands of even-aged growth, preferring older growth

cottonwood or other canopied riparian woods for breeding sites (Gaines and Laymon 1984). Highly specific foods occurring in cyclic infestations (such as hairy caterpillars and tree frogs) are also important determinants in cuckoo distribution and productivity (Laymon & Halterman 1987).

The western yellow-billed cuckoo is listed state endangered and has no federal endangered status. Historically cuckoos were widespread in the state, but have declined to only three small populations (Gaines & Laymon 1984). Although detailed historical data are lacking from the South Coast region, cuckoo breeding has been documented along the Santa Clara River (Willet 1933). More recently, a cuckoo was observed between 23 June and 4 July 1979, on the Santa Clara River within the area affected by the oil spill (Webster in Garret & Dunn 1981). A dead cuckoo was found in the parking lot at Magic Mountain (adjacent to the affected area) on 3-5 July 1981 (specimen at CSU Northridge, California; Laymon pers. comm.). Finally, in July 1992, a cuckoo was heard within the affected area (Holmgren M. pers. comm.).

Least Bell's vireo (*Vireo bellii puscillus)*

The Bell's vireo is a small insectivorous neotropical migrant which nests in the low vegetation associated with thickets of willow and mulefat in riparian woodlands. The least Bell's vireo is one of the four subspecies recognized in North America (Brown 1993). Formerly widespread in California, the species underwent a dramatic decline in abundance and range during the first half of the 20th century (Grinnell and Miller 1944; Gaines 1977). It was designated an endangered species by the California Fish and Game Commission in 1980 (CDFG 1986) and was listed as endangered by the Federal government in 1986 (USFWS 1986).

Although the historic breeding range of least Bell's vireos extended throughout much of California (Wilbur 1979 and 1980), the present breeding range is limited to about 50 locations from Santa Barbara County south to San Diego County, where the majority of the population is found (Franzreb 1989). They have been observed within the spill area over the past decade (Independent Environmental Consultants 1993; Labinger et al. 1994) and breeding was documented by Holmgren (1992). Several other small populations exist on the lower stretch of the Santa Clara River outside the spill area (Labinger et al. 1994).

The species arrives in late March to early April and departs in late August to early September. Nesting usually begins several days after pair formation. Nests are typically placed in the fork of a shrub, small tree or in weeds, suspended within a meter of the ground in dense scrub vegetation found in riparian habitats, or between riparian and upland habitats (Gray and Greaves 1984).

Least Bell's vireo populations appear to be slowly increasing from approximately 300 pairs (1974-1985, Franzreb 1989) to over 1,000 pairs in 1994 (USFWS, unpubl. data). This increase apparently is due in part to removal of cowbirds from habitats near major breeding populations and improved protection of riparian woodlands along the major rivers of southern California (USFWS, unpubl. data).

Southwestern willow flycatcher (*Empidonax traillii extimus)*

The willow flycatcher is a small, insectivorous neotropical migratory species ranging broadly from the east coast through most of the lower 48 states and parts of Canada. Willow flycatchers breed in a variety of wet habitats, particularly swamps and riparian thickets, especially willow (Garrett & Dunn 1981). Formerly widespread in the southwest and sporadically distributed in California, the species has declined in recent decades.

There are three recognized subspecies of willow flycatcher in California (all are State Endangered), of which the southwestern race (recently listed as Federally Endangered) is the most likely to occur in coastal southern California (Schlorff 1990). A few small populations persist in coastal southern California, including one on the Santa Ynez River, Santa Barbara County (Unitt et al. in prep), and one on the Santa Margarita River in San Diego County (Buck, pers. comm.). On the Santa Clara River, no breeding birds have been documented in recent years within the area affected by the spill. However, Webster (in Garrett & Dunn 1981) encountered several singing males, assumed to be breeding, between June and July 1979, assumed to be breeding, within the study area, and several, apparently non-breeding individuals have been found during recent surveys (Labinger et al. 1994; and reported here for 1995).

The decline of the southwestern willow flycatcher is believed to be the result of habitat loss from agriculture, especially livestock grazing, water diversion projects and continued urbanization of riparian corridors. In addition, brood parasitism by cowbirds appears to have suppressed productivity, and probably hinders the re-colonization of former breeding areas (Whitfield 1990).

Methods

Two reference sites were chosen as control areas for comparison to the spill area (treatment). Both sites are located downstream of the spill area near Santa Paula approximately 20 and 25 miles, respectively (Figure 1). Each site is 4.5 km long and combined (9 km) they are exactly half the size of the affected area. The sites were chosen according to several criteria: 1) vegetation composition was similar to that found within major portions of the affected area; 2) both sites supported least Bell's vireos, allowing for species specific comparisons; 3) they were in close proximity geographically; and, 4) they were topographically similar to the

affected area (i.e. east-to-west river flow within the same river valley). No sites were chosen up river from the spill due to the lack of comparable habitat. Although the reference sites were located downstream of the spill, the sites should have been uncontaminated since the oil was contained by several earthen dams 20 miles upstream, and most of the oil was cleaned from the river before heavy rains could wash it past the affected area (Abajian, pers. com.). The location of all counting points is presented in Figures 2, 3, 4, and 5.

The study design in 1995 was identical to the 1994 study (Labinger et al. 1994). In general the study was composed of two parts: 1) impacts to the avian community, and 2) impacts to endangered species, including monitoring of known least Bell's vireo sub-populations (Labinger et al. 1994). Project design emphasized comparisons between points within the affected area, and between the affected area and non-affected areas. This approach allowed us to test the hypothesis that bird population parameters vary with respect to degree of habitat damage. Testing the validity of this hypothesis formed the basis of a damage assessment (USDI 1994).

Methods employed in the study included point counts, tape playback surveys, general surveys, and least Bell's vireo monitoring. Since data showed a significant decline in relative abundance from the first to the second point count survey, only the earlier survey was analyzed in 1994. Thus, in 1995, the point count survey was conducted only once by each observer.

Quality Control

The same three biologists from the 1994 study were employed in 1995. Labinger and Greaves have over 10 years and Haupt has six years of professional experience in field ornithology, including experience with the methods employed here.

Specific training procedures for each method are outlined in Labinger et al. (1994). Field data collected from each method was inspected daily by one of the biologists for accuracy and completeness.

Statistical Analysis

All pertinent data were entered into IBM-compatible computers by one or more of the field personnel. After all data were entered, hard copies were printed and compared with original data sheets by reading data aloud to a second biologist.

Statistical analysis concentrated mostly on point count data. We calculated mean relative abundance for each species from combined data of the three observers. Relative abundance and species richness (number of species) was determined for each point. Both parameters

were found to follow a normal distribution, thereby allowing for parametric methodology. The relationships between points within the affected area, and between the affected area and reference sites were examined using two sample t-tests and regression analysis. In this report we have not analyzed the 1995 results in relation to 1994 data.

The scope of this study did not include exhaustive literature search of historical data for the study area. Much of this information is in private documents since all the affected area is private property. Much of the information that is available can not be used for statistical comparisons due to differences in methodology.

Results

Point Counts

The mean relative abundance for each species is presented by study area section and reference sites in Appendix A. Species richness and total mean relative abundance is presented in Table I. Relative abundance of all species combined was significantly higher in the reference sites than in the affected area ($P < 0.001$). Species richness was also significantly greater in the reference sites ($P < 0.001$). No trends were found between points within the affected area in relative abundance or species rchness. In other words, these parameters did not increase or decrease in relation to distance from the initial spill area.

Relative abundance of the three most abundant species is presented in Table II. As with most census methods, point counts tend to be more accurate for abundant species (Verner 1985). Therefore, three of the most abundant species were analyzed separately. Of the three species, only the common yellowthroat showed a significant difference in mean relative abundance between the affected area and the reference sites ($P < 0.001$).

The relative abundance of water-related species were also examined separately. All of these species spend a majority of their time foraging and/or nesting on the ground near water, and therefore, were more likely to be directly affected by the oil spill. Of the two most common water-related species, spotted sandpiper and killdeer, only the spotted sandpiper was significantly more abundant in the reference sites ($P = 0.022$). The relative abundance of the less common waterbirds (all fish-eaters: great egret, great-blue heron, black-crowned night-heron, and belted kingfisher) were pooled for analysis to increase the sample size. Relative abundance of these species combined was significantly lower in the affected area than in the reference sites ($P < 0.05$).

The relationship between mean relative abundance of these three water-related species and points along the affected area and reference sites is graphed in Figure 6. A positive correlation with distance from the oil spill origin (i.e. upstream, point 1) was found for

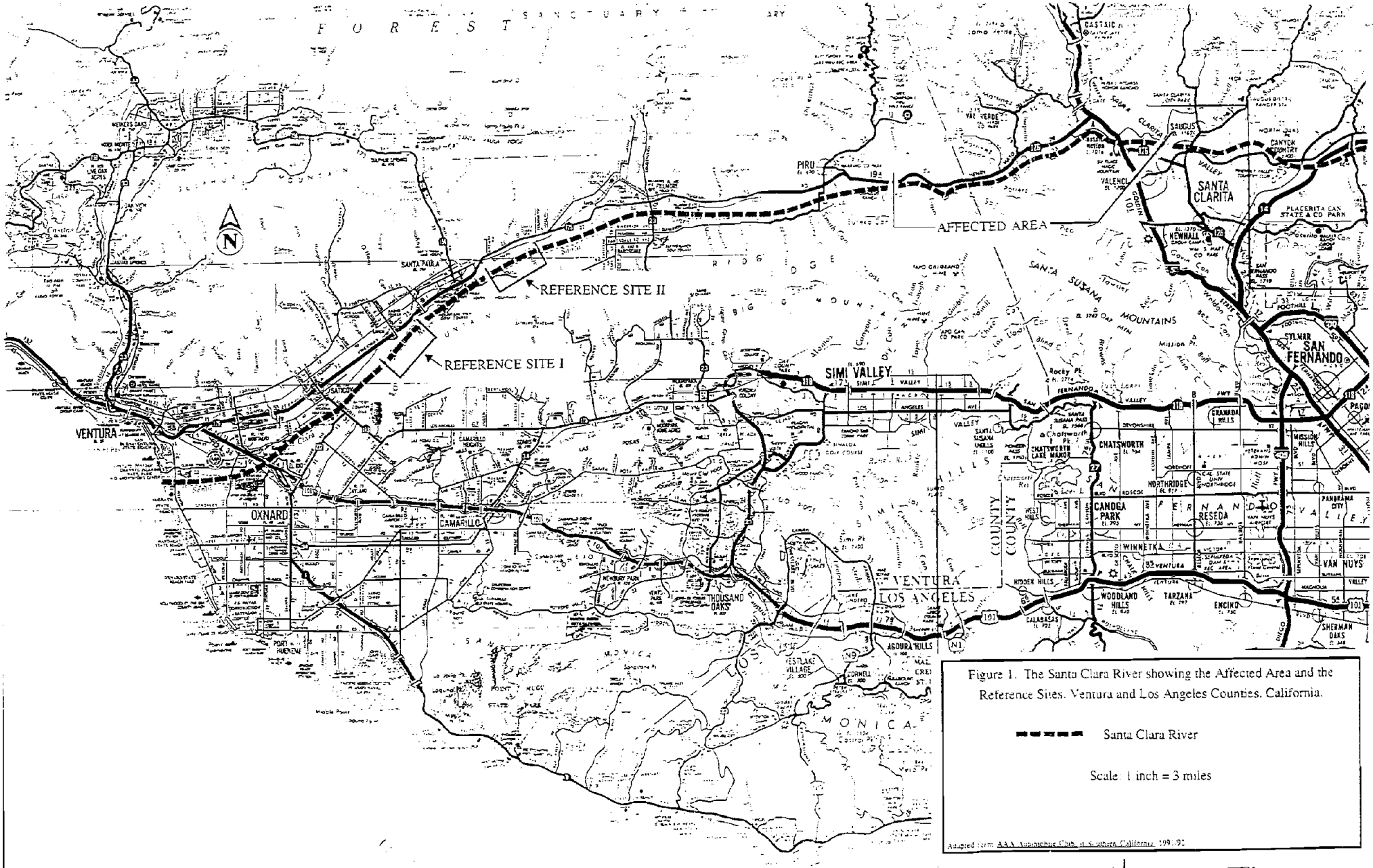

Figure 1. The Santa Clara River showing the Affected Area and the Reference Sites, Ventura and Los Angeles Counties, California.

Santa Clara River

Scale: 1 inch = 3 miles

Adapted from AAA Automobile Club of Southern California, 1991.

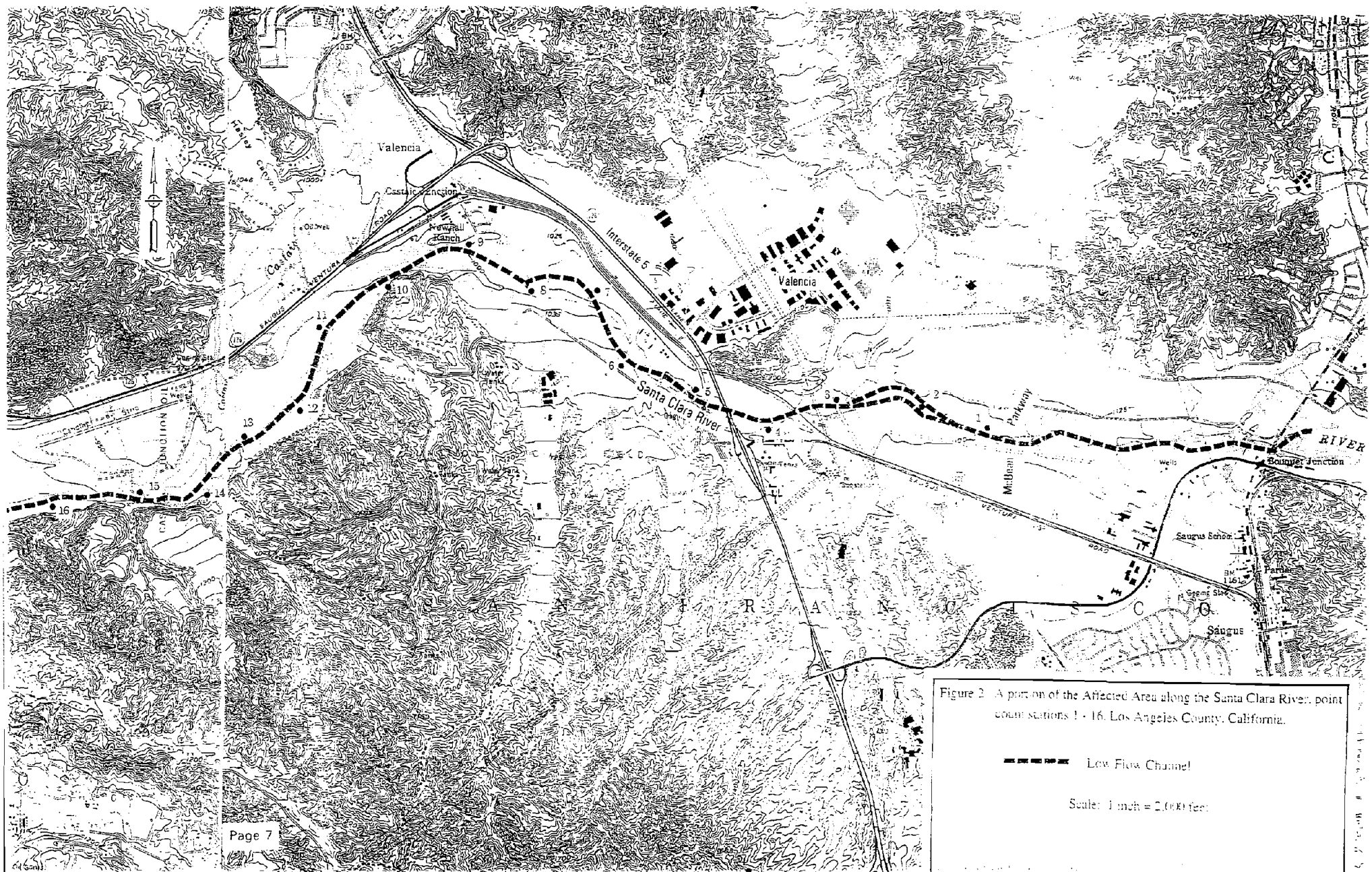

Figure 2. A portion of the Affected Area along the Santa Clara River, point count sections 1 - 16, Los Angeles County, California.

Low Flow Channel

Scale: 1 inch = 2,000 feet

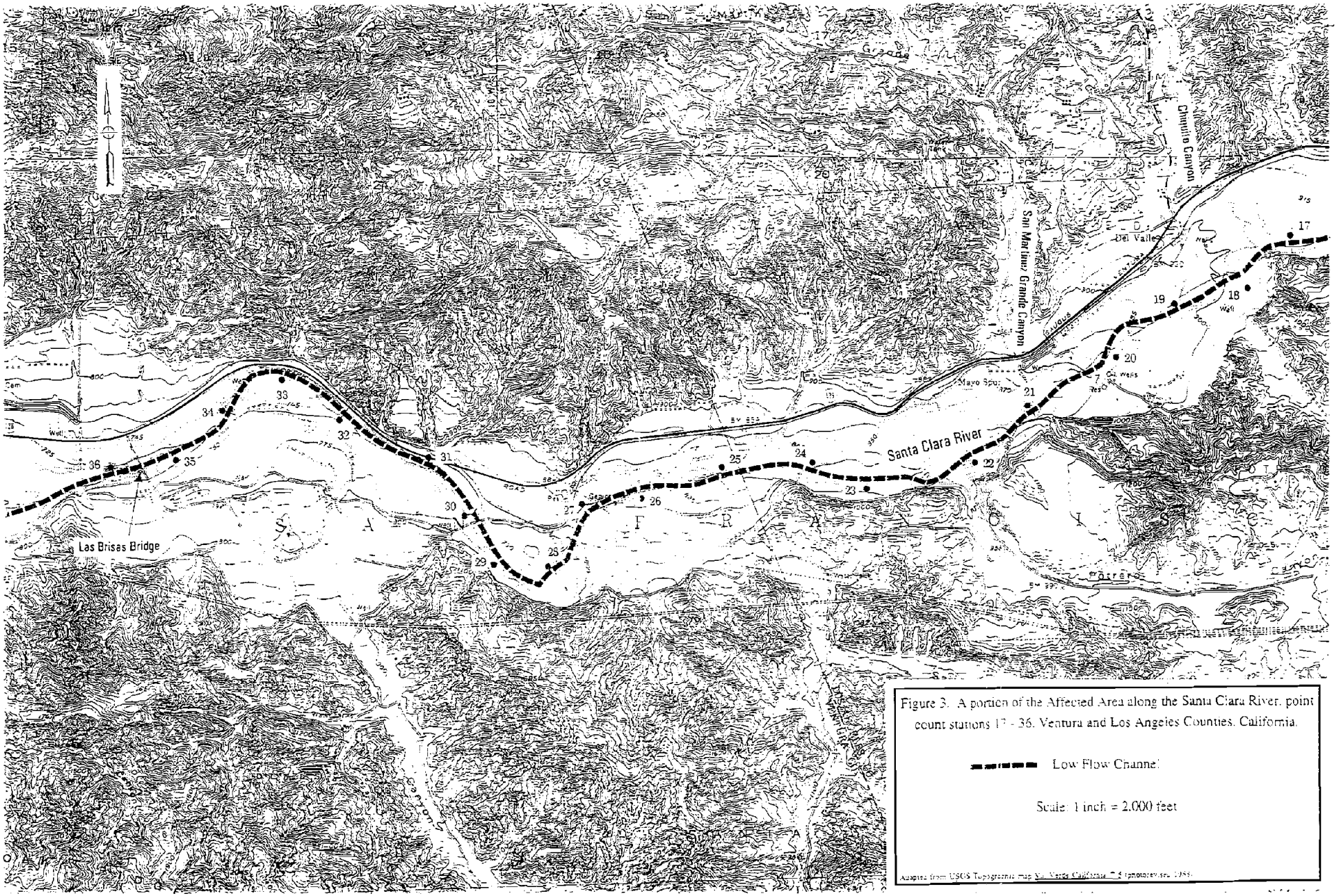

Figure 3. A portion of the Affected Area along the Santa Clara River, point count stations 17 - 36, Ventura and Los Angeles Counties, California.

Low Flow Channel

Scale: 1 inch = 2,000 feet

Adapted from USGS Topographic map Val Verde California 7.5 quadrangle, 1958.

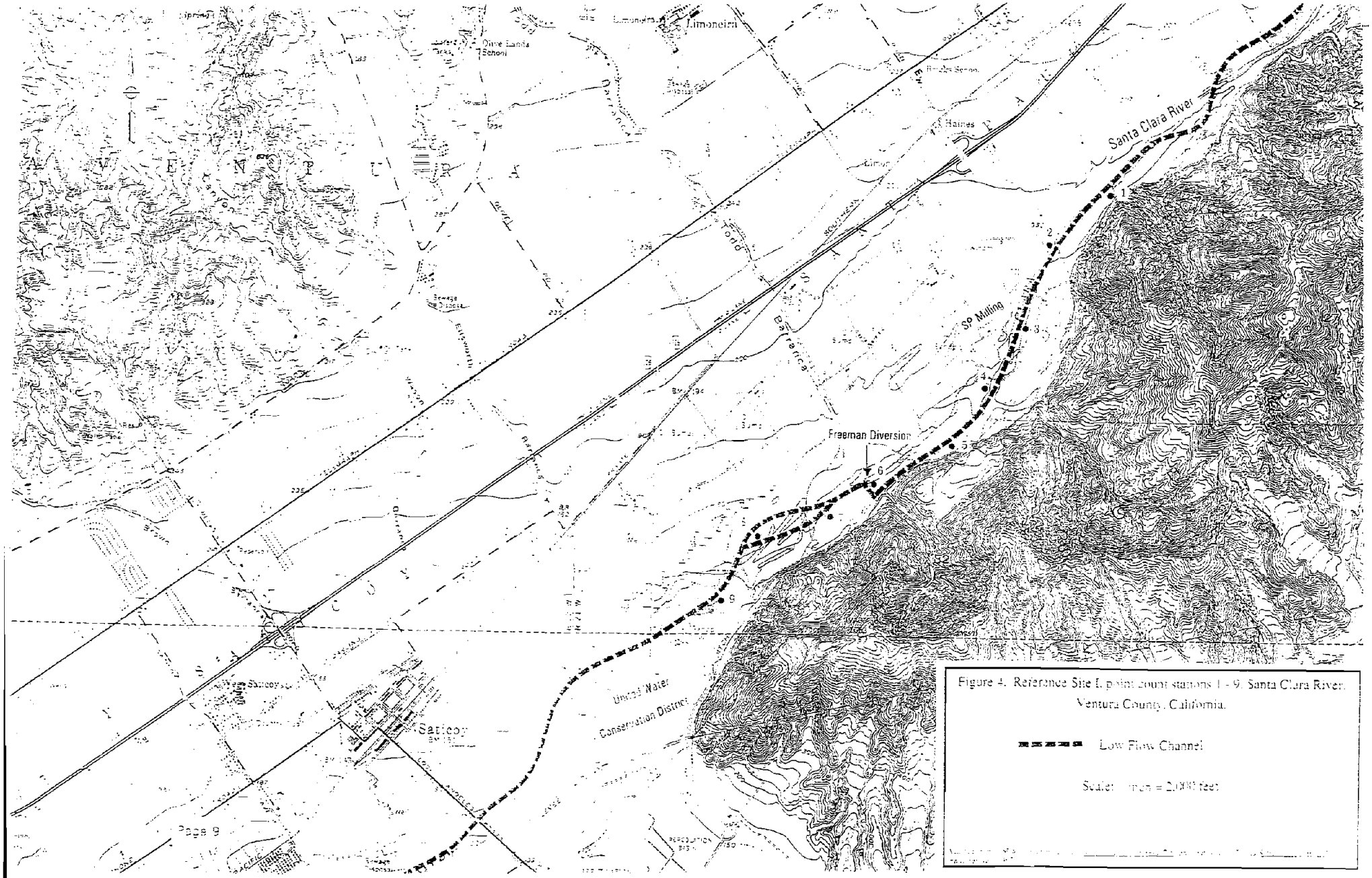

Figure 4. Reference Site E, point count stations 1 - 9, Santa Clara River, Ventura County, California.

Low Flow Channel

Scale: 1 inch = 2,000 feet

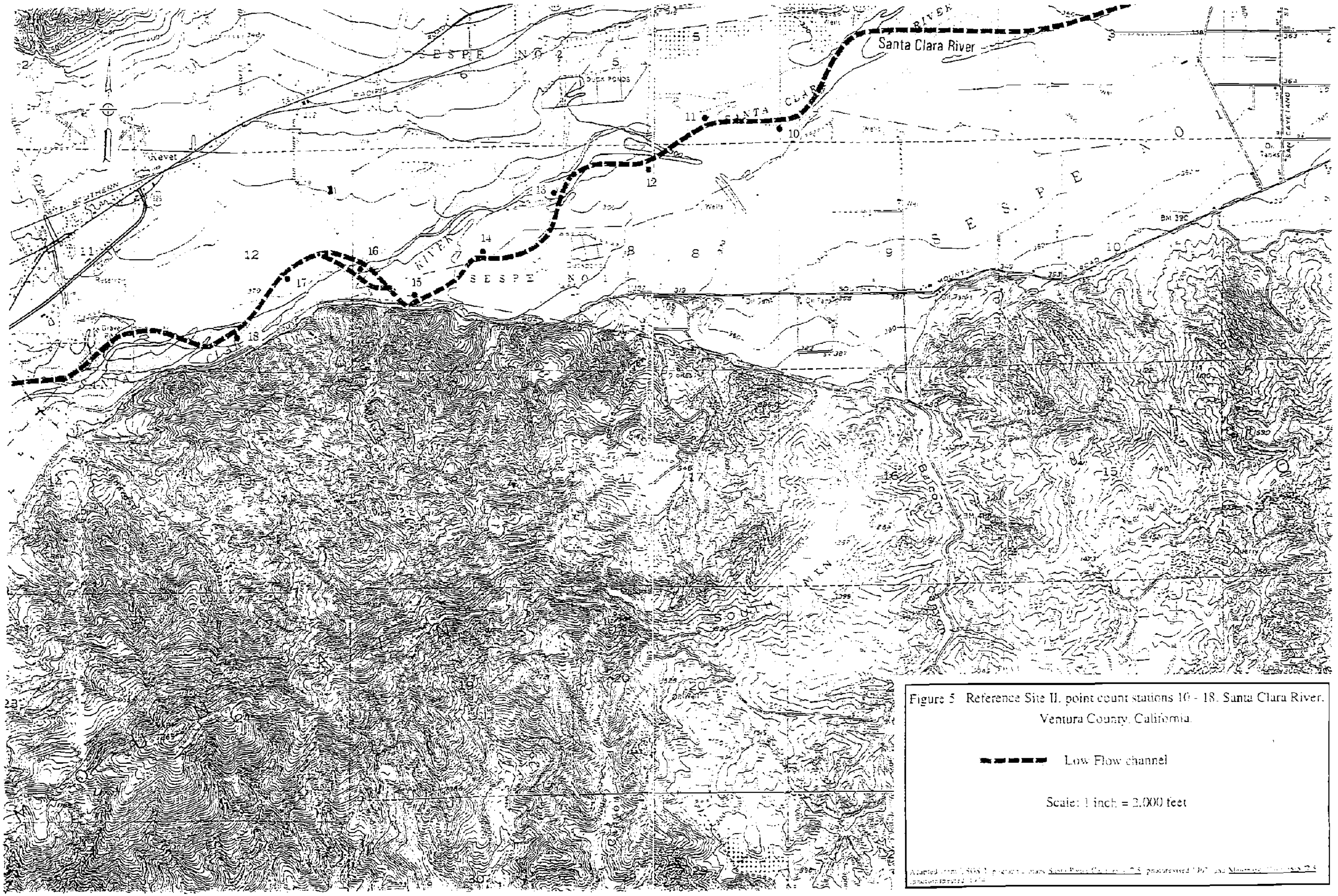

Figure 5 Reference Site II, point count stations 10 - 18, Santa Clara River, Ventura County, California.

Low Flow channel

Scale: 1 inch = 2,000 feet

Figure 6. Relative abundance of waterbirds along the study area.

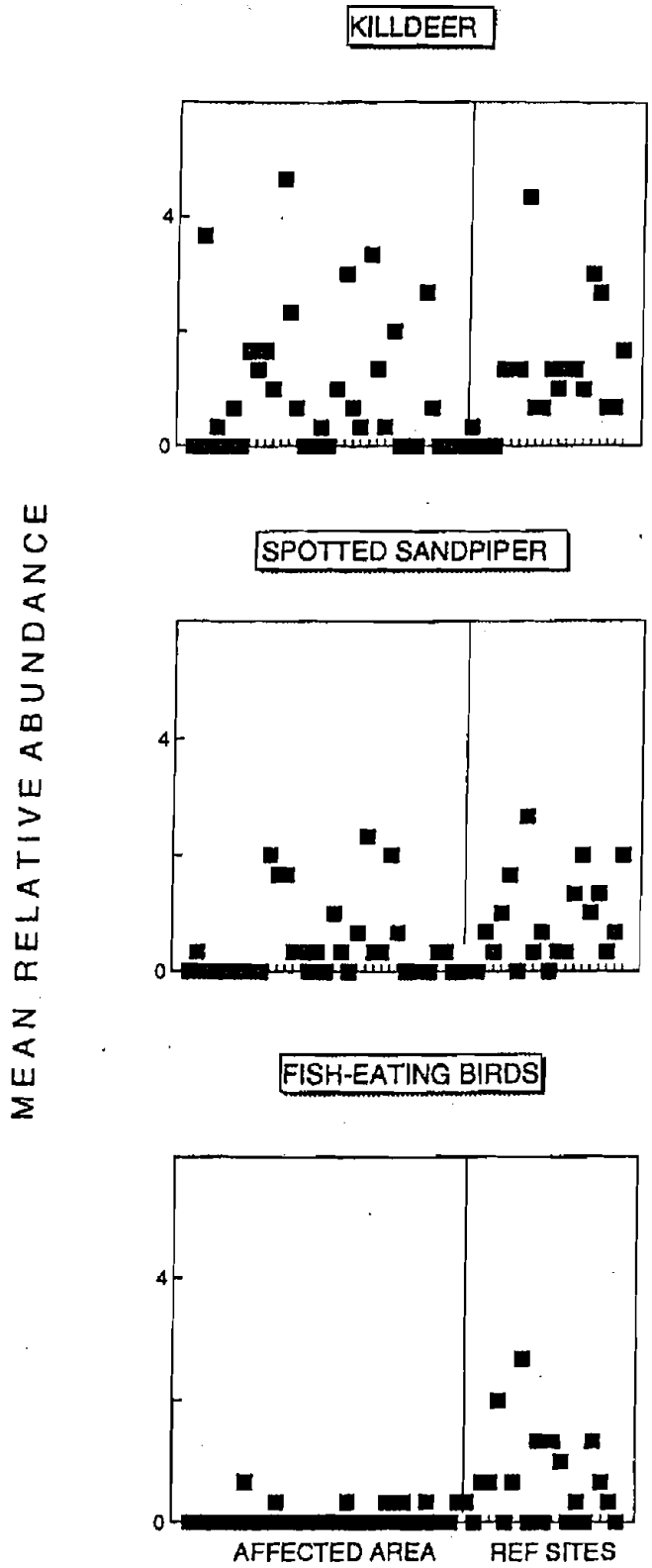

TABLE I. Comparison of mean species richness and relative mean abundance of points per section within study area (Standard deviation in parenthesis).

	AFFECTED AREA (SECTION)					REFERENCE SITE				
	1	2	3	4	Total	I	II	Total	P[1]	
Relative Abundance	26.78(7.00)	37.56(8.66)	26.93(4.37)	36.19(31.66)	31.86(16.97)	50.04(18.05)	51.70(20.35)	50.87(18.68)	0.001	*
Richness	23.78(4.94)	29.22(3.73)	28.22(4.24)	23.33(4.58)	26.14(4.97)	32.67(4.15)	31.78(4.52)	32.22(4.24)	0.000	*
Total:	57	57	65	55	77	37	70	73		

1. Two Sample T-test of Affected area versus Reference site: ns -- not significant, * -- significant.

TABLE II. Mean relative abundance of the three most common species and water-related species in the study area (Standard deviation in Parenthesis).

	AFFECTED AREA (SECTION)					REFERENCE SITE				
	1	2	3	4	Total	I	II	Total	P[1]	
Abundant Species										
Common Yellowthroat	0.59(0.68)	0.44(0.64)	0.48(0.47)	0.67(0.47)	0.55(0.56)	1.41(0.95)	1.96(0.63)	1.68(0.84)	0.000	*
Song Sparrow	2.04(0.82)	1.81(0.76)	1.22(0.73)	2.41(0.97)	1.87(0.90)	2.22(1.08)	2.41(0.94)	2.31(0.97)	0.12	ns
House Finch	2.18(1.65)	1.52(1.30)	0.67(0.83)	1.26(0.46)	1.41(1.24)	1.41(1.31)	0.63(0.96)	1.02(1.18)	0.27	ns
Water-related Species										
Killdeer	1.04(1.21)	1.11(1.53)	1.22(1.28)	0.41(0.88)	0.94(1.23)	1.22(1.29)	1.48(0.84)	1.35(1.06)	0.22	ns
Spotted Sandpiper	0.04(0.11)	0.81(0.79)	0.74(0.84)	0.07(0.15)	0.42(0.67)	0.81(0.87)	1.04(0.68)	0.92(0.76)	0.022	*
Fisheaters[2]	0.07(0.22)	0.04(0.11)	0.11(0.17)	0.11(0.17)	0.08(0.17)	0.89(0.94)	0.56(0.55)	0.72(0.77)	0.028	*

1. Two Sample T-Test of Affected Area versus Reference site: ns -- not significant, * -- significant.
2. Fisheaters = Great Egret, Great-blue Heron, Black-crowned Night-heron, and Belted Kingfisher.

spotted sandpiper, and even stronger for the combined fish-eating species. This relationship holds true for the reference sites since they are both located downstream and are farthest from the affected area. A regression analysis revealed that distance from the oil spill origin was a significant factor in explaining the relative abundance of these species; however, the percent explained (r^2-adjusted) was very small (spotted sandpiper= 0.153 + 0.124 Points, r^2-adjusted=6.7%, P=0.033; fish-eaters= -0.20 + 0.142 Points, r^2-adjusted=18.3%, P=0.001).

General Surveys

Species detected during general surveys that were not detected during point counts are also listed in Appendix A. A total of 85 species were detected throughout the study area. Of these, nine additional species (representing about 10% of the total) were detected between points during the general surveys.

Productivity data were not collected in a consistent manner and with comparable effort, and therefore is difficult to analyze statistically. Highly detectable species such as the waterbirds may yield more reliable data. Thus, it is interesting to note that this year most species appeared to have bred on both the affected area and reference sites. One juvenile black-crowned night-heron was found in section 3 (affected area) and reference site I (this species was not found in 1994). Spotted sandpiper and killdeer nests were also found in each area, however, no fledglings were found (many were observed in 1994). This may have been due to late floods, and less intensive survey effort.

Sensitive Species Surveys

No yellow-billed cuckoos were located during 1995 surveys. Only two willow flycatchers were detected during this year's surveys. Both were non-singing individuals found near Salt Creek, in the affected area. Because neither was observed on subsequent site visits, we presumed that they were unpaired and transient.

Least Bell's vireos were found at one location within the affected area (Salt Creek; Figure 7), and at the two reference sites (Figures 8 and 9). General population and productivity parameters for all vireo sites are presented in Tables III an IV. Due to budget constraints, less effort was made in 1995 than in 1994 to determine banded status of adult vireos. In 1994, at least 16 reference site and at least 4 affected area vireos were found that had been banded along the Santa Clara River in either 1992 or 1993 (Labinger et al. 1994).

Affected Area. In 1995, we found only two male and two female least Bell's vireos at the Salt Creek location, compared to the 4 pairs located there in 1994. No vireos were found at Las Brisas where there had been a pair present in 1994. We did note that in 1995 only one

TABLE III. Least Bell's Vireo territories, adults, juveniles and nests in affected and reference areas on Santa Clara River, Los Angeles and Ventura Counties, California, during 1995.

	Affected Area			Reference Site	
Attribute[1]	Chiquito	Salt Creek	Las Brisas	I	II
Territories	0	2	0	15	9
Males	0	2	0	15	8
Females	0	2	0	13	7
Known Pairs	0	2	0	14	8
Successful Pairs	0	2	0	14	6
Vireo Young	0	9	0	60	19
Nesting attempts	0	3	0	21	11
Nests successful	0	3	0	18	6
Unknown outcome	0	0	0	0	0
Nests parasitized	0	0	0	0	0
Cowbird fledglings	0	0	0	0	0
Productivity					
A. (young/all pairs)	0	4.5	0	4.3	2.4
B. ("/successful pairs)	0	4.5	0	4.3	3.2

[1] Includes fledglings observed in area where nests were not found and thus nesting presumed.

2. Productivity figures are minimal since young seen does not include all probable fledglings.

TABLE V. Plant species used by least Bell's vireos for nest support in affected and reference areas on Santa Clara River, Ventura and Los Angeles Counties, California, during 1995.

		Nests in Affected Area		Nests in Reference Sites	
Scientific Name[1]	Common Name	Successful	Failed	Successful	Failed[2]
Atriplex lentiformis	Salt Brush	1	0	0	0
Baccharis salicifolia	Mulefat	1	0	2	1
Brassica sp.	Mustard sp.	0	0	0	1
Populus trichocarpa	Horseweed	0	0	1	0
Salix exigua	Narrowleaf Willow	0	0	2	3
Salix laevigata	Red Willow	0	0	2	1
Salix lasiandra	Yellow Willow	0	0	3	2
Salix sp.	unidentified willow	0	0	1	0
Toxicodendron sp.	Poison Oak	0	0	1	0
Totals	8 known species	2	0	12	8

1. Nomenclature follows Munz (1974) and Smith (1976).
2. Included among the known failed nests are two found after their use, which appeared to have failed given the absence of feather sheathing in the nests. Because they were in actively defended territories, they were considered failures due to predation.

adult in the affected area had been banded in a previous year. At least three nests were built, and were known to have fledged young, each of which was apparently not parasitized, in contrast to 1994 when most nests found in the area were parasitized or raised cowbirds. As a result, in 1995, at least 9 young fledged from 3 nests, compared to only 3 young fledged from 2 of 9 nests found in the entire affected area in 1994 (Labinger et al. 1994). Seven of the 1995 young were banded as nestlings.

Reference Sites. Of 23 males at the two reference sites, 15 were at Reference Site I and at least 8 were at Reference Site II. Of 20 females at the reference sites, 13 were at Reference Site I and 7 were at Reference Site II. Productivity at Reference Site II was lower than at either Reference Site I or in the affected area, apparently the result of greater nest predation. No vireos were parasitized in the reference sites or in the affected area during the 1995 study.

In addition, one male, banded as a nestling on the San Luis Rey River, San Diego County, in 1993 (Kus, pers. comm.) was present near Saticoy (Reference Site I), near where from 1991-94 two San Diego County vireos were observed (Greaves, unpubl. data). In 1995, we banded as many nestlings and recent fledglings as practicable in both reference and affected area sites. Only one adult (the San Diego male at Reference Site I) was caught to obtain its band number and determine its origin.

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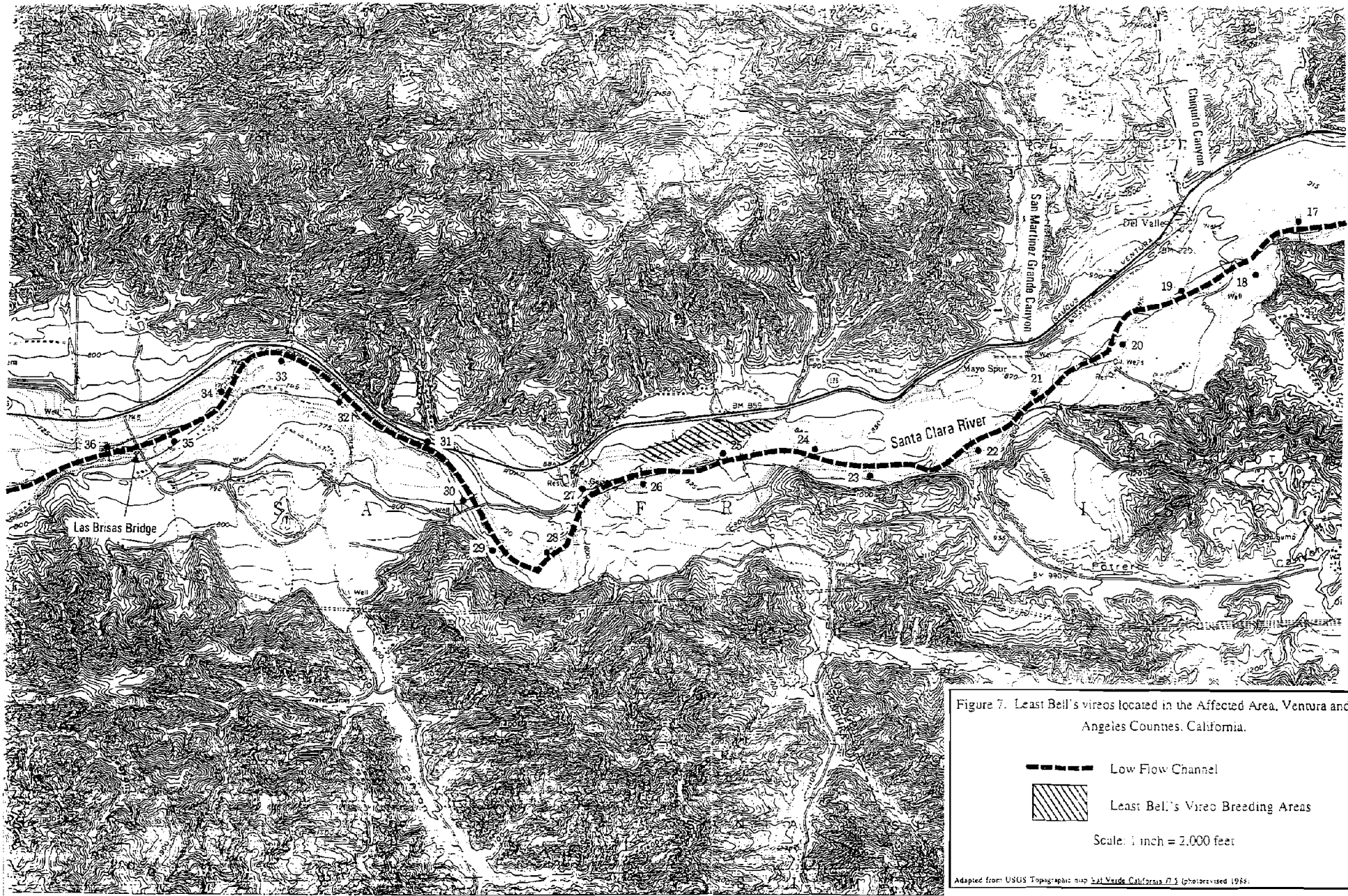

Figure 7. Least Bell's vireos located in the Affected Area, Ventura and Los Angeles Counties, California.

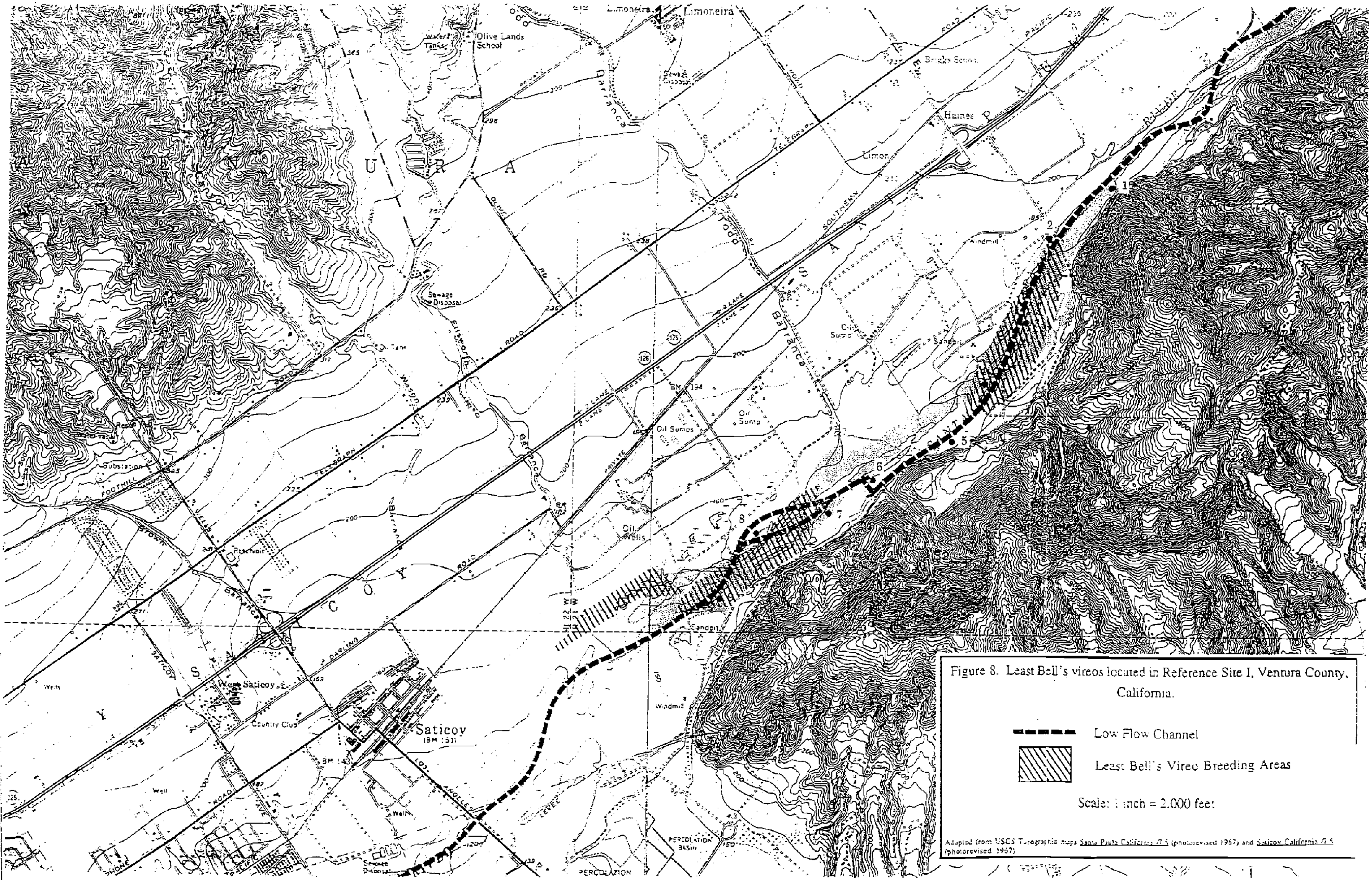

Figure 8. Least Bell's vireos located in Reference Site I, Ventura County, California.

Adapted from USGS Topographic maps Santa Paula California 7.5 (photorevised 1967) and Saticoy California 7.5 (photorevised 1967)

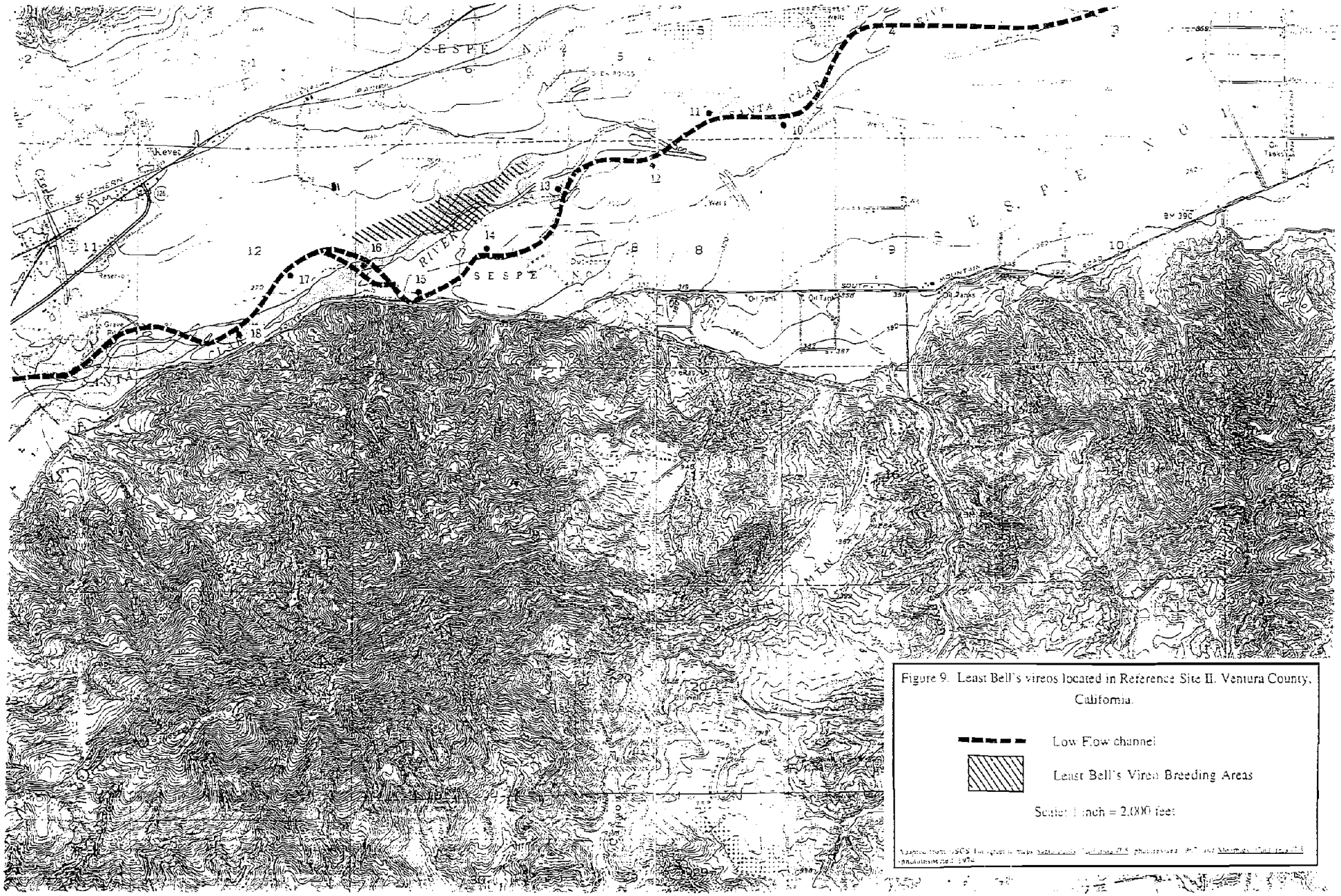

Figure 9. Least Bell's vireos located in Reference Site II, Ventura County, California.

APPENDIX A. Mean relative abundance of bird species detected during 1995 surveys along the affected area and reference sites (mean in bold, standard error in normal font; species detected not during a point count are noted with " * ").

	AFFECTED AREA (SECTIONS)								REFERENCE SITES			
SPECIES	1		2		3		4		I		II	
Allen's Hummingbird	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04
American Crow	**1.67**	0.73	**0.93**	0.25	**1.11**	0.46	**1.26**	0.36	**0.85**	0.17	**0.11**	0.06
American Goldfinch	**0.19**	0.19	**0.00**	0.00	**0.04**	0.04	**0.04**	0.04	**0.06**	0.03	**0.07**	0.05
American Kestrel	**0.00**	0.00	**0.07**	0.05	**0.04**	0.04	**0.00**	0.00	**0.02**	0.01	**0.04**	0.04
American Robin	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.01**	0.01	**0.00**	0.00
American Wigeon									*			
Anna's Hummingbird	**0.26**	0.11	**0.07**	0.05	**0.04**	0.04	**0.19**	0.13	**0.11**	0.03	**0.30**	0.10
Ash-throated Flycatcher	**0.52**	0.15	**0.70**	0.18	**1.07**	0.23	**1.15**	0.24	**0.53**	0.14	**0.37**	0.14
Barn Swallow	**0.04**	0.04	**0.11**	0.11	**0.00**	0.00	**0.00**	0.00	**0.04**	0.02	**0.48**	0.24
Black-chinned Hummingbird	**0.04**	0.04	**0.00**	0.00	**0.07**	0.07	**0.00**	0.00	**0.03**	0.01	**0.00**	0.00
Black-crowned Night-heron	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.01**	0.01	**0.07**	0.07
Black-necked Stilt											*	
Belted Kingfisher	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.07**	0.05	**0.02**	0.01	**0.19**	0.08
Least Bell's Vireo	**0.00**	0.00	**0.00**	0.00	**0.11**	0.08	**0.00**	0.00	**0.02**	0.02	**0.85**	0.27
Bewick's Wren	**1.67**	0.23	**1.30**	0.14	**1.15**	0.19	**1.11**	0.22	**0.75**	0.22	**1.48**	0.22
Blue-gray Gnatcatcher	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.01**	0.01	**0.00**	0.00
Brown-headed Cowbird	**1.04**	0.52	**0.52**	0.15	**0.56**	0.18	**0.37**	0.22	**0.44**	0.10	**0.11**	0.08
Black-headed Grosbeak	**0.78**	0.22	**0.89**	0.22	**1.52**	0.20	**0.89**	0.15	**0.61**	0.17	**1.63**	0.13
Blue Grosbeak	**0.15**	0.11	**0.41**	0.13	**0.37**	0.19	**0.07**	0.05	**0.19**	0.05	**0.56**	0.21
Black Phoebe	**0.37**	0.12	**0.19**	0.13	**0.63**	0.16	**0.59**	0.16	**0.29**	0.07	**0.74**	0.18
Brewer's Blackbird	**0.37**	0.23	**0.00**	0.00	**0.15**	0.15	**0.00**	0.00	**0.11**	0.05	**4.04**	2.34
Bushtit	**0.59**	0.31	**0.78**	0.38	**0.04**	0.04	**0.41**	0.18	**0.34**	0.09	**0.85**	0.39
Cassin's Kingbird	**0.00**	0.00	**0.04**	0.04	**0.07**	0.07	**0.00**	0.00	**0.03**	0.01	**0.19**	0.10
California Quail	**0.81**	0.32	**0.85**	0.18	**0.48**	0.18	**0.15**	0.11	**0.39**	0.11	**1.30**	0.29
California Thrasher	**0.19**	0.08	**0.37**	0.13	**0.37**	0.10	**0.11**	0.08	**0.18**	0.04	**0.07**	0.05
California towhee	**0.26**	0.12	**1.07**	0.25	**0.63**	0.20	**0.48**	0.22	**0.40**	0.11	**0.26**	0.14
Chipping Sparrow	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Cinnamon Teal	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Cliff Swallow	**0.26**	0.26	**7.33**	2.16	**0.59**	0.22	**13.70**	9.76	**4.29**	1.87	**8.81**	3.48
Cooper's Hawk	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.01**	0.01	**0.00**	0.00
Costa's Hummingbird	**0.00**	0.00	**0.22**	0.08	**0.22**	0.10	**0.56**	0.21	**0.17**	0.06	**0.33**	0.15
Common Raven	**1.44**	0.55	**1.52**	0.83	**1.78**	0.76	**0.33**	0.15	**0.92**	0.21	**0.52**	0.19
Common Yellow-throat	**0.59**	0.23	**0.44**	0.22	**0.48**	0.16	**0.67**	0.16	**0.37**	0.07	**1.41**	0.32
Downy Woodpecker	**0.59**	0.18	**0.26**	0.09	**0.15**	0.08	**0.30**	0.09	**0.22**	0.06	**0.37**	0.10
European Starling	**1.30**	0.90	**1.00**	0.50	**0.89**	0.61	**0.22**	0.11	**0.69**	0.14	**0.74**	0.38
Gadwall									*			
Great-blue Heron	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.22**	0.10
Great-horned Owl	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Great Egret	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.00**	0.00	**0.01**	0.01	**0.00**	0.00
Green Heron	**0.07**	0.07	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.03**	0.01	**0.41**	0.23
Greater Roadrunner	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04
Greater Yellowlegs									*		*	
Hairy Woodpecker	**0.37**	0.12	**0.04**	0.04	**0.11**	0.11	**0.22**	0.11	**0.14**	0.04	**0.15**	0.08
Horned Lark			*						*			
House Finch	**2.19**	0.55	**1.52**	0.43	**0.67**	0.28	**1.26**	0.15	**0.88**	0.25	**1.41**	0.44
House Wren	**0.22**	0.11	**0.56**	0.20	**0.04**	0.04	**0.11**	0.08	**0.17**	0.06	**0.00**	0.00
Hutton's Vireo	**0.04**	0.04	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.01**	0.01	**0.04**	0.04
Killdeer	**1.04**	0.40	**1.11**	0.51	**1.22**	0.43	**0.41**	0.29	**0.68**	0.13	**1.22**	0.43
Lawrence's Goldfinch	**0.07**	0.05	**0.26**	0.15	**0.00**	0.00	**0.00**	0.00	**0.07**	0.03	**0.04**	0.04
Lazuli Bunting	**0.30**	0.14	**0.44**	0.17	**0.67**	0.17	**0.37**	0.15	**0.30**	0.07	**0.30**	0.10
Lark Sparrow	**0.00**	0.00	**0.07**	0.07	**0.00**	0.00	**0.04**	0.04	**0.03**	0.01	**0.00**	0.00
Least Tern									*			
Lesser Goldfinch	**0.37**	0.29	**0.22**	0.11	**0.26**	0.14	**1.52**	0.26	**0.40**	0.16	**1.93**	0.35
Loggerhead Shrike	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Mallard	**0.04**	0.04	**0.19**	0.10	**0.70**	0.47	**0.00**	0.00	**0.19**	0.09	**0.26**	0.12
Mourning Dove	**0.56**	0.22	**0.70**	0.37	**0.41**	0.18	**0.37**	0.17	**0.37**	0.07	**2.33**	0.43
Northern Flicker	**0.07**	0.05	**0.37**	0.17	**0.07**	0.05	**0.07**	0.05	**0.11**	0.04	**0.15**	0.08
Northern Mockingbird	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04
Bullock's Oriole	**0.22**	0.15	**0.22**	0.11	**0.67**	0.39	**0.07**	0.07	**0.24**	0.07	**0.74**	0.17
Northern Rough-wing Swallow	**1.48**	0.54	**2.48**	0.86	**0.89**	0.33	**0.15**	0.08	**0.85**	0.28	**1.30**	0.20
Nuttall's Woodpecker	**0.63**	0.15	**0.96**	0.17	**0.70**	0.13	**0.37**	0.10	**0.40**	0.11	**0.04**	0.04
Orange-crowned Warbler	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.07**	0.05
Phainopepla	**0.00**	0.00	**0.11**	0.08	**0.11**	0.11	**0.26**	0.22	**0.11**	0.03	**0.07**	0.07
Plain Titmouse	**1.07**	0.29	**0.78**	0.24	**0.44**	0.18	**0.41**	0.16	**0.45**	0.11	**0.07**	0.05
Pacific-sloped Flycatcher	**0.04**	0.04	**0.04**	0.04	**0.00**	0.00	**0.04**	0.04	**0.03**	0.01	**0.07**	0.07
Purple Finch	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Rufous-crowned Sparrow	**0.00**	0.00	**0.07**	0.05	**0.00**	0.00	**0.04**	0.04	**0.02**	0.01	**0.00**	0.00
Rock Dove	**0.11**	0.08	**1.33**	0.71	**1.15**	0.65	**1.37**	0.94	**0.79**	0.18	**0.04**	0.04
Red-shouldered Hawk	**0.15**	0.08	**0.30**	0.13	**0.04**	0.04	**0.07**	0.05	**0.11**	0.03	**0.04**	0.04
Red-tailed Hawk	**0.30**	0.12	**0.19**	0.11	**0.15**	0.08	**0.11**	0.06	**0.14**	0.03	**0.56**	0.21
Red-winged Blackbird	**0.48**	0.33	**0.04**	0.04	**0.37**	0.19	**0.15**	0.11	**0.21**	0.06	**2.59**	0.99
Sage Sparrow			*									
Say's Phoebe	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04
Scrub Jay	**0.59**	0.21	**1.04**	0.21	**1.07**	0.23	**0.33**	0.14	**0.48**	0.14	**0.11**	0.08

	AFFECTED AREA (SECTIONS)								REFERENCE SITES			
SPECIES	1		2		3		4		I		II	
Snowy Egret	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.01	0.01	0.00	0.00
Song Sparrow	2.04	0.27	1.81	0.26	1.22	0.24	2.41	0.32	1.07	0.32	2.22	0.36
Solitary Vireo	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.01	0.01	0.00	0.00
Spotted Sandpiper	0.04	0.04	0.81	0.26	0.74	0.28	0.07	0.05	0.29	0.11	0.81	0.29
Spotted towhee	0.63	0.19	1.22	0.21	0.63	0.25	0.74	0.25	0.51	0.13	0.89	0.15
Swainson's thrush	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.05
Tree Swallow	0.04	0.04	0.11	0.08	0.07	0.05	0.00	0.00	0.05	0.01	0.74	0.38
Turkey Vulture	0.04	0.04	0.00	0.00	0.00	0.00	0.04	0.04	0.02	0.01	0.11	0.06
Violet-green Swallow	0.04	0.04	0.30	0.19	0.30	0.13	0.00	0.00	0.12	0.04	0.22	0.11
Warbling Vireo	0.04	0.04	0.00	0.00	0.04	0.04	0.04	0.04	0.03	0.01	0.00	0.00
Western Bluebird	0.19	0.13	0.04	0.04	0.33	0.11	0.11	0.11	0.13	0.03	0.00	0.00
Western Kingbird	0.07	0.07	0.15	0.08	0.07	0.07	0.00	0.00	0.07	0.02	0.07	0.05
Western Meadowlark	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.01	0.01	0.00	0.00
Willow Flycatcher												
Wrentit	0.00	0.00	0.44	0.11	0.33	0.12	0.81	0.19	0.25	0.10	0.30	0.15
White-faced Ibis												
White-tailed Kite	0.04	0.04	0.00	0.00	0.00	0.00	0.11	0.08	0.03	0.01	0.22	0.12
White-throated Swift	0.00	0.00	0.33	0.20	0.19	0.13	0.00	0.00	0.11	0.04	0.00	0.00
Yellow-breasted Chat	0.04	0.04	0.00	0.00	0.19	0.08	0.85	0.35	0.19	0.10	1.70	0.26
Yellow Warbler	0.07	0.05	0.19	0.08	0.30	0.12	0.48	0.19	0.18	0.05	2.48	0.24