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

DRAFT

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Summary

This report presents preliminary results of avian surveys following the January 17, 1994 ARCO/Four Corners oil spill on the Santa Clara River, California. Two reference sites were chosen downstream of the affected area to allow for comparison of bird population parameters with the affected area. Methods used to conduct this preassessment of possible injury to birds include point counts, tape playback surveys, general surveys, and least Bell's vireo monitoring.

Point count data showed that species richness was significantly greater in the reference sites; whereas, total relative abundance of all species was not significantly different between the affected area and reference sites. However, the relative abundance of three species of water-related birds (green heron, killdeer, and spotted sandpiper) was significantly lower in the affected area, and increased with greater distance from the spill origin.

No yellow-billed cuckoos were found during our surveys. Only one southwestern willow flycatcher was found, a singing male observed at a reference site. Least Bell's vireos were present both in the affected area and reference sites, 5 and 20 pairs, respectively. Productivity was significantly lower in the affected area. These results are discussed in relation to available data, sources of error and problems of interpretation.

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 report discusses the results of the preassessment study on birds in the affected area.

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 quality 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) 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 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 over 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) and breeding was documented in 1992 (Holmgren 1992). Several other small populations exist on the lower stretch of the Santa Clara River outside the spill area.

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 nearly 800 pairs presently (USFWS, unpubl. data). This increase apparently is due in part to removal of cowbirds 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, of which the southwestern race (proposed federal listing as Endangered pending) 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 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.

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

The study design is divided into two parts: 1) impacts to the avian community, and 2) impacts to least Bell's vireos. Methods employed in the study include point counts, tape playback surveys, general surveys, and least Bell's vireo monitoring. The project design emphasizes comparisons between points within the spill area, and between the affected area and non affected areas. This approach allows us to test the hypothesis that bird population parameters vary with respect to degree of habitat damage. Testing the validity of this hypothesis forms the basis of a damage assessment (USDI 1994).

SENSITIVE SPECIES ACCOUNTS

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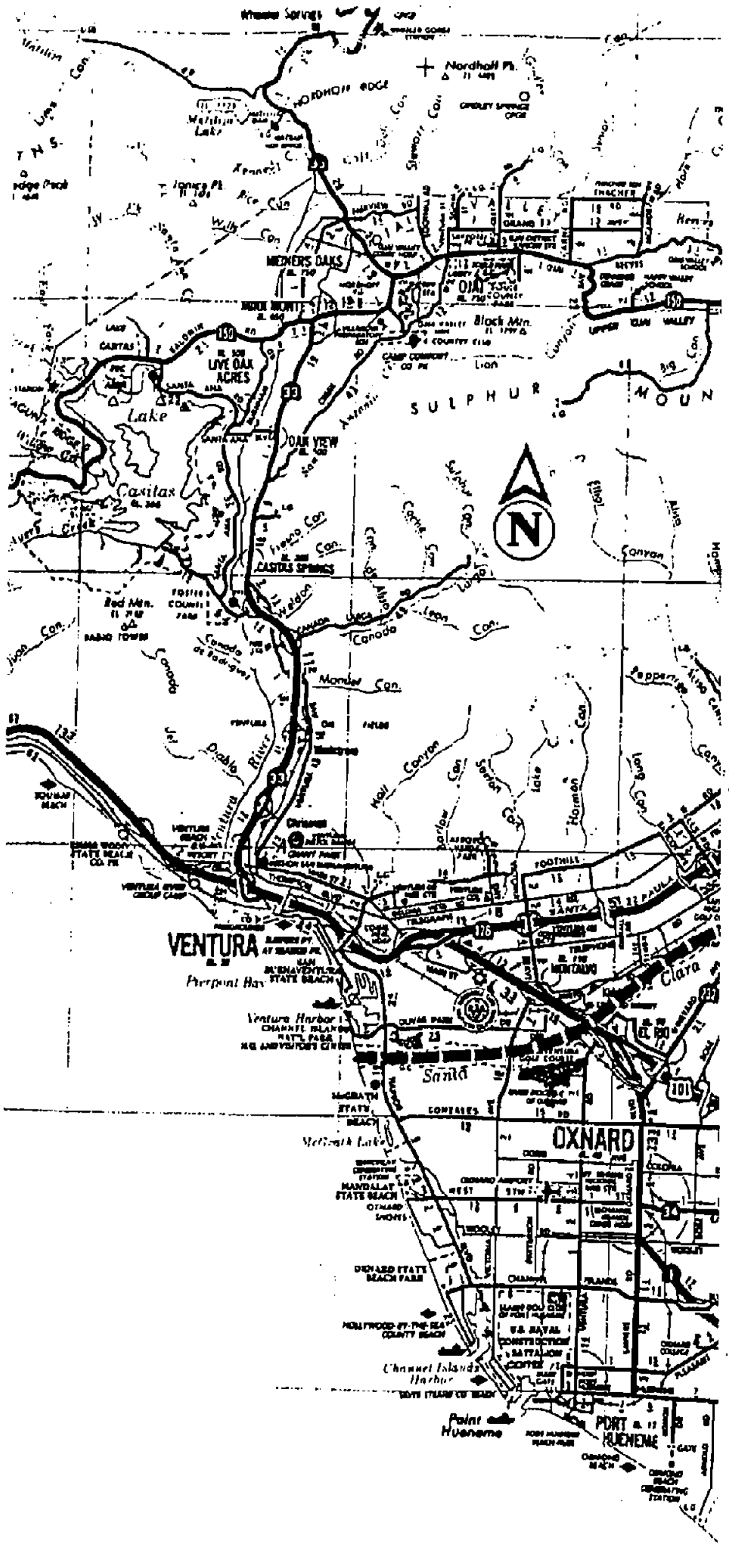
The species arrives in late March through April and departs from late August through September. Nesting usually begins several days after pair formation. Nests are typically placed in the fork of a shrub, small tree or in weeds, suspended within a meter of the ground


Wheeler Springs
Nordhoff Pk.
MEINERS OAKS
OJAI
Black Mtn.
UPPER OJAI VALLEY
LIVE OAK ACRES
Lake
Casitas
OAK VIEW
SULPHUR
MOUN
N
CASITAS SPRINGS
Ventura River
VENTURA
Pierpont Bay
Ventura Harbor
Santa
Clara
OXNARD
McGrath Lake
Channel Islands Harbor
Point Hueneme
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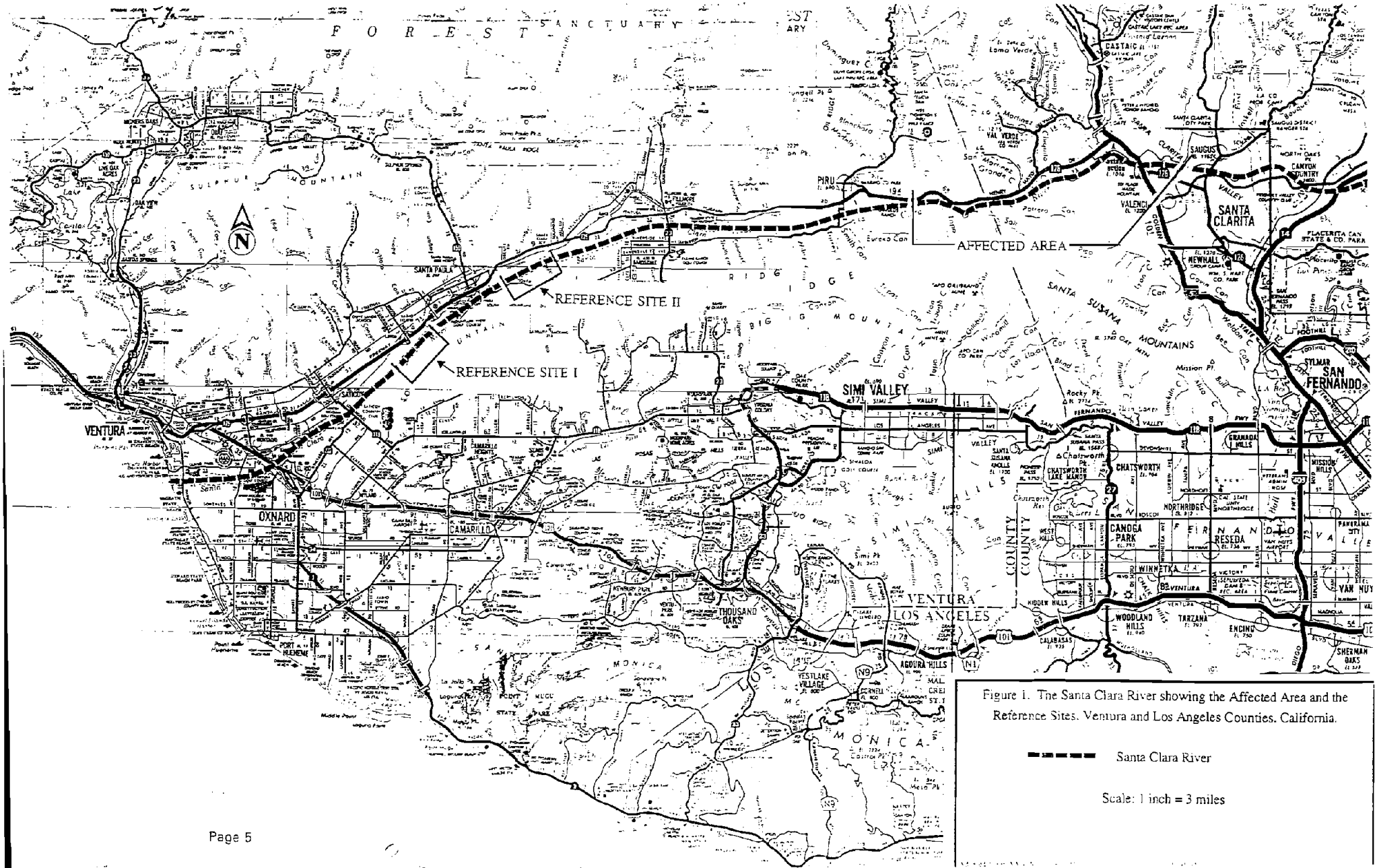


Figure 1. The Santa Clara River showing the Affected Area and the Reference Sites, Ventura and Los Angeles Counties, California.

Santa Clara River

Scale: 1 inch = 3 miles

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 study area within the spill zone. The sites were chosen according to several criteria: 1) vegetation composition is similar to the spill area; 2) both sites support least Bell's vireos, allowing for specific comparisons; and 3) geographically in close proximity and topographically similar (i.e. east-west river flow) to the spill area. No sites were chosen up river from the spill due to the lack of similar habitat. Although the chosen reference sites are located downstream of the spill, the sites should be uncontaminated since the oil was contained by several earthen dams 20 miles upstream.

Data Collection

Point Counts

Point count methodology followed standardized procedures described by Ralph et al (1994). Given the variety of open and closed habitat in the study area, we placed the points 500 m apart as a conservative measure (Verner 1994, pers. comm.). Thus, 36 points were marked out from below McBean Parkway down to Las Brisas. Nine points were placed at each of the two reference sites giving a total of 54 points (Figures 2, 3, 4 and 5). Points were placed on alternating sides of the low flow channel and marked on aerial photos. The low flow channel may have changed course since the oil spill; however, we had no detailed information of the oil flow route or alterations from the clean-up.

Each observer counted birds at nine points per day starting approximately 15 minutes after sunrise and ending within four hours. Birds were categorized by time (0-3, 3-5, 5-10 min) and distance from the observer ($\leq$50, $\geq$50 m, flying). The study area divides into four equal sections of nine points each (36). Together with the two reference sites, a total of six sections were needed to complete one survey. Six days are required to complete all the points (54). Three qualified biologists completed two runs of all 54 points from mid June to mid July (12 days spread over four weeks). The schedule for conducting point counts at the six sections was randomized for each observer. In addition, starting points within each section were alternated so that sections were run in both directions (up and downstream).

General surveys

General surveys were conducted during the playback surveys for sensitive species (see below) while monitoring least Bell's vireos, and after point count mornings. Detailed notes were recorded of species detected, indicating specific location, and behavior, especially in relation to productivity such as nesting, food carrying, feeding fledglings, and territorial disputes.

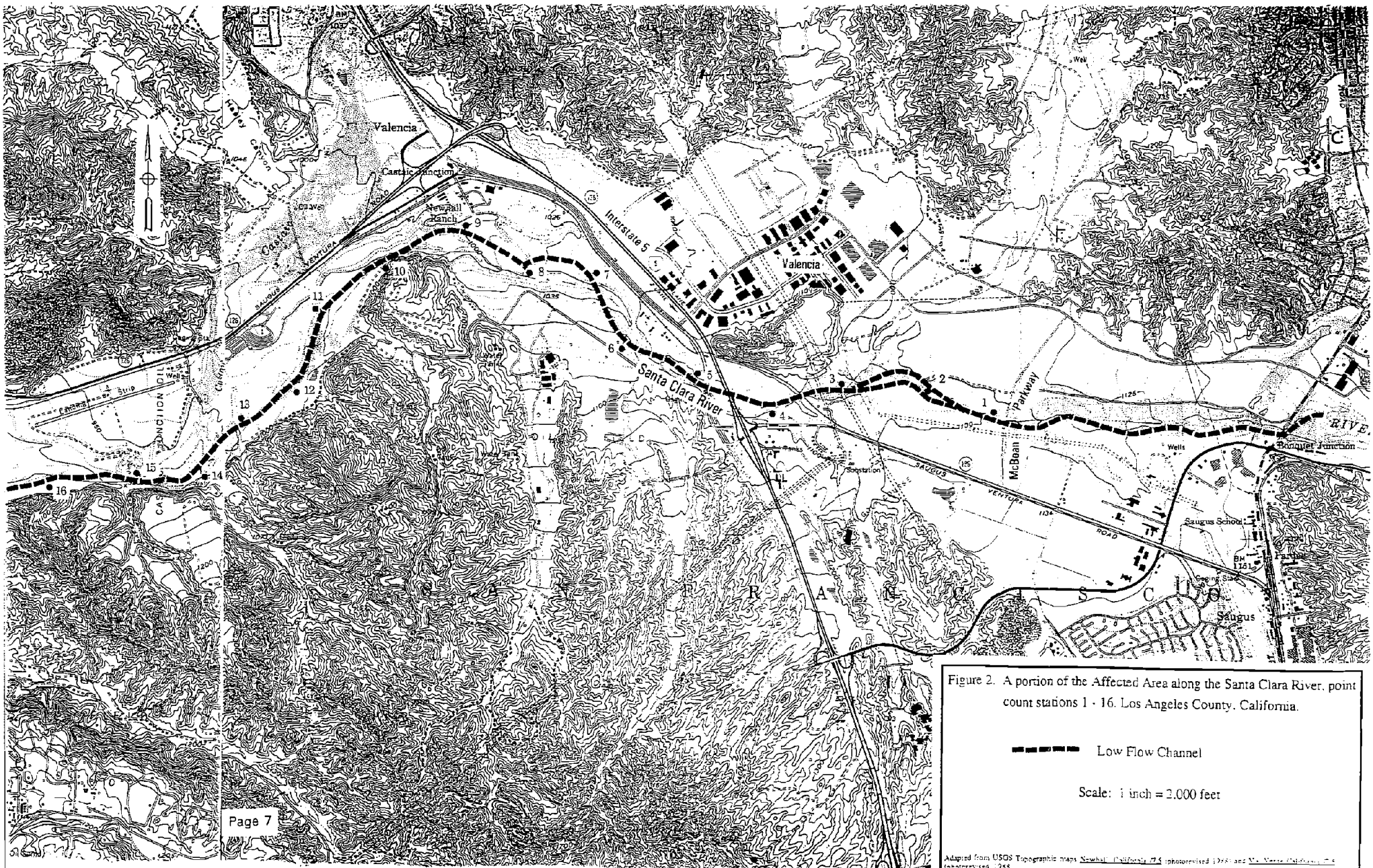


Figure 2. A portion of the Affected Area along the Santa Clara River, point count stations 1 - 16. Los Angeles County, California.

Low Flow Channel

Scale: 1 inch = 2,000 feet

Adapted from USGS Topographic maps Newhall, California 7.5 (photorevised 1988) and Val Verde, California 7.5 (photorevised 1988)

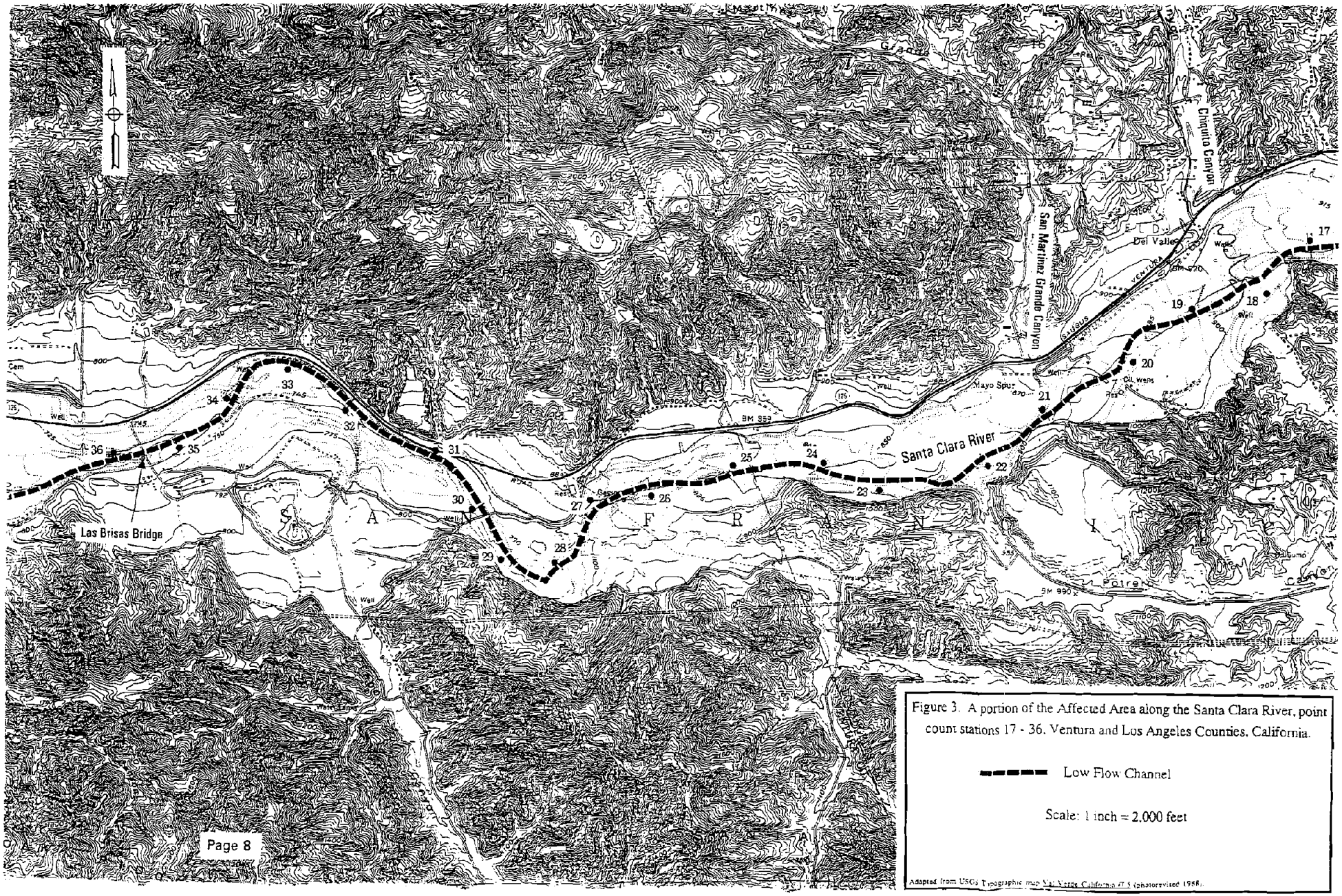


Figure 3. A portion of the Affected Area along the Santa Clara River, point count stations 17 - 36, Ventura and Los Angeles Counties, California.

Low Flow Channel

Scale: 1 inch = 2,000 feet

Adapted from USGS Typographic map Val Verde, California (7.5 photorevised 1988).

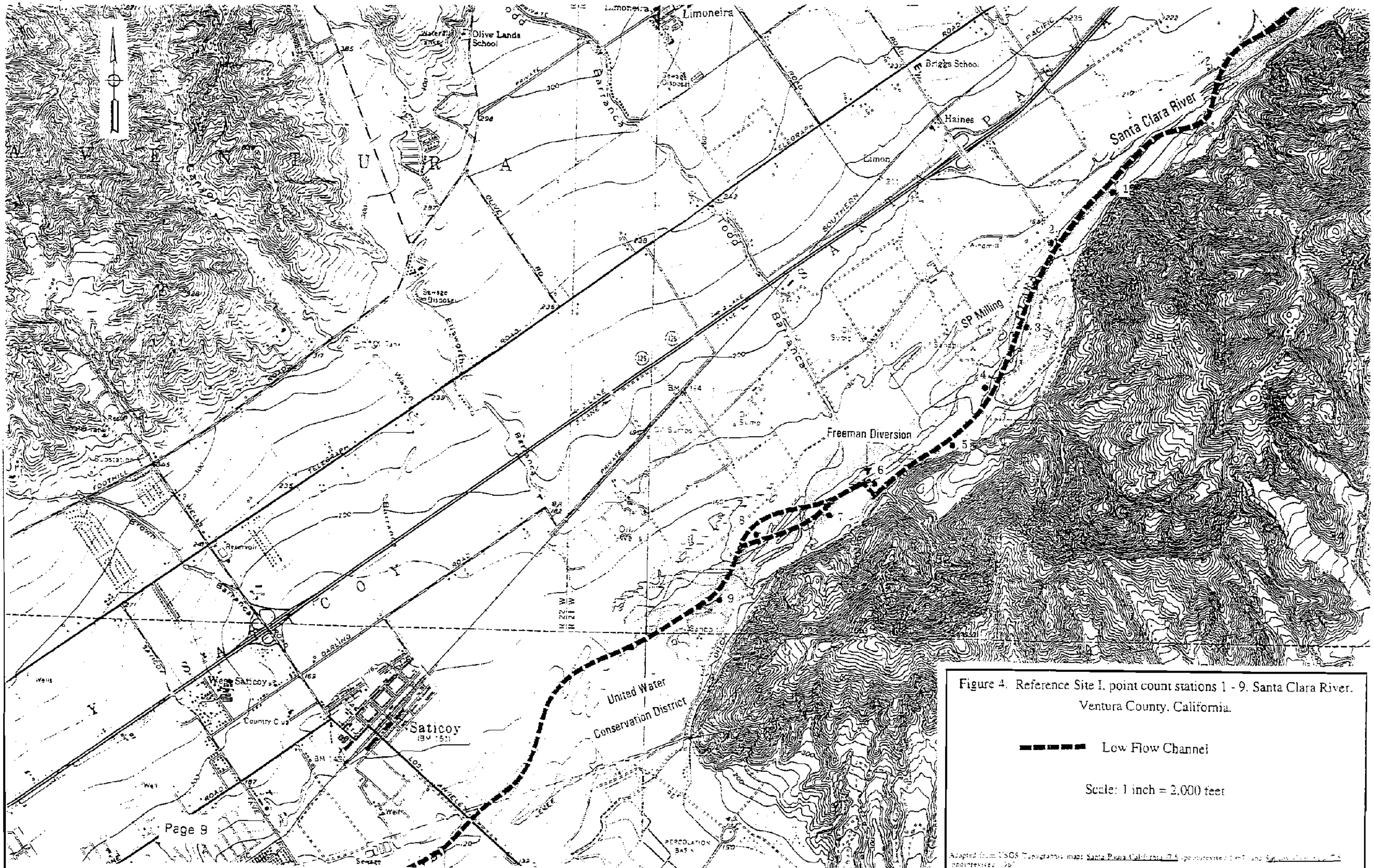


Figure 4. Reference Site I, point count stations 1 - 9, Santa Clara River, Ventura County, California.

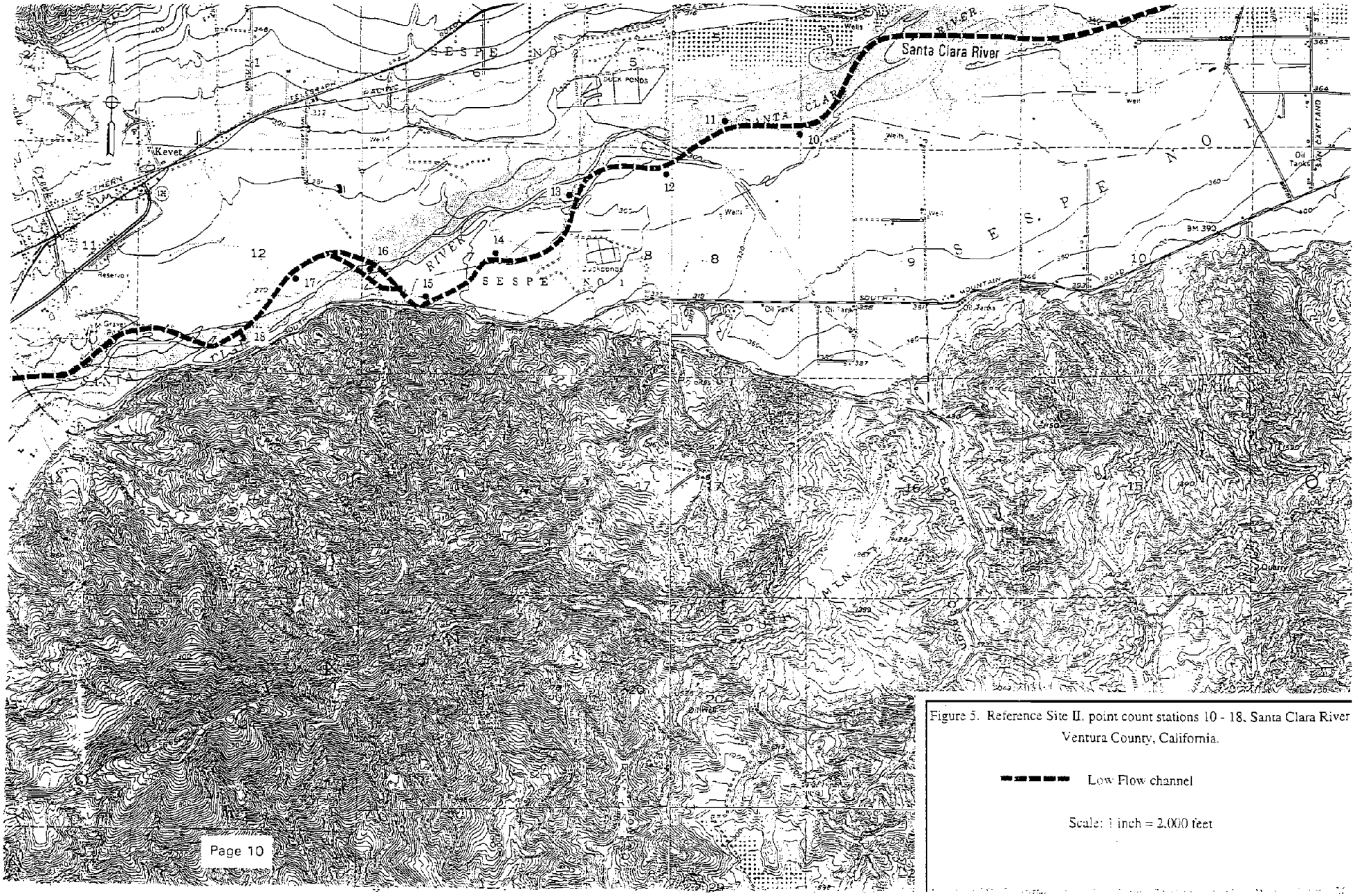


Figure 5. Reference Site II, point count stations 10 - 18, Santa Clara River Ventura County, California.

Low Flow channel

Scale: 1 inch = 2,000 feet

Playback Surveys

Specific surveys were conducted for the least Bell's vireo, southwestern willow flycatcher, and western yellow-billed cuckoo following the US Fish and Wildlife Service Protocol for Surveying Least Bell's Vireos (1994). This involves the use of tape recorded playback songs to illicit responses from wild birds. The location of all individuals detected were marked on an aerial photograph. Intensive follow-up monitoring was conducted for all least Bell's vireos found (see below).

These surveys were conducted during morning hours between 0600 and 1100. All areas with appropriate habitat were surveyed at least three times from 3 June through 31 July.

Least Bell's Vireo Monitoring

All least Bell's vireos found during the course of the project were monitored according to US Fish and Wildlife Protocol (1994). Monitoring included periodic nest checking by Greaves (a qualified and permitted biologist (see Quality Control)) to determine productivity. Nestlings in the affected area were banded with USFWS and color bands.

We collected site-specific data including general habitat type, nest site vegetation, and the occurrence and behavior of brown-headed cowbirds (*Molothrus ater*). All sites were monitored at least once a week from June through the end of July.

Quality Control

All three biologists were familiar with the study area and local avifauna. Labinger and Greaves have at least 10 years and Haupt five years of professional experience in field ornithology including experience with all methods employed here.

Specific training procedures for each method are outlined below. Field data collected from each method was inspected daily by one of the biologists for accuracy and completeness.

Point Counts

The three biologists conducting point counts have excellent hearing and vision and are able to identify virtually all southern California landbirds by sight and song. Each biologist underwent one week of specific training before commencing the point counts. Training included distance estimation and rigorous testing of songs and calls encountered. All three biologists conducted several practice counts together and immediately compared the results to ensure consistency.

General surveys

These surveys do not require specific training. However, all three biologists practiced nest-searching and monitoring together for one week according to techniques described by Ralph et al (1994). These techniques help ensure that all activity near nests will be minimized to reduce observer related predation and disturbance.

Playback Surveys

All personnel have experience with this technique for surveying least Bell's vireos. In addition, two of the biologists have experience surveying for willow flycatcher and yellow-billed cuckoo. The protocol outlined by USFWS for least Bell's vireo (Draft, 1994) was reviewed and practiced in the field. All detections were followed by behavioral observations if possible.

Least Bell's Vireo Monitoring

All of the vireo nest monitoring was conducted by J. Greaves. Greaves has over 15 years experience with least Bell's vireos and is permitted to check nests, and band nestlings and adults. Greaves trained the other two biologists to ensure minimal disturbance to the nest site and birds. Field efforts were coordinated weekly to avoid double coverage of vireo areas.

Statistical Analysis

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

Statistical analysis concentrated mostly on point count data. We calculated the mean relative abundance for each species from the combined data of the three observers. Relative abundance and species richness (number of species) was determined for each point and replicate (survey run). 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 order to determine if data from the two replicates could be pooled, we compared total species richness and mean relative abundance by study area section between the two replicates. No significant difference was found for species richness (T-test, $P=0.34$), and therefore, these data were pooled from the two replicates. In contrast, the mean relative

abundance was significantly lower in the second replicate (T-test, $P<0.05$). This was probably due to seasonality as most birds sing less frequently late in the breeding season. Therefore, we analyzed relative abundance data only from the first replicate.

The scope of this study did not include an exhaustive literature search of historical data for the study area. Much of this information is found in private documents since the affected area is on private property. The information that is available to us can not be used for statistical comparisons due to differences in methodology, but is discussed in light of our findings.

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 does not show a significant difference between the affected and reference areas. However, species richness is significantly greater in the reference sites. In addition, total species richness appears to show a slight positive relationship to sections within the affected area. In other words, the total number of species per point appears to increase downstream from the initial spill area. These data were not tested for significance because of a small sample size.

Relative abundance of the three most abundant species and three water-related 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.

The three water-related species were also examined separately. All three of these species spend a majority of their time on the ground near water foraging and/or nesting, and therefore, were more likely to be directly affected by the oil spill. The mean relative abundance of all three species is significantly greater in the reference sites than in the spill area. Although the difference in green heron is highly significant, it should be noted that the majority of herons were detected in only one of the reference sites.

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. All three species show a positive correlation with distance from the oil spill origin (i.e. upstream, point 1). This relationship holds true for the reference sites since they are both located downstream of

TABLE I. Comparison of species richness and relative mean abundance in study area (Standard error in parenthesis).

	AFFECTED AREA (SECTION)					REFERENCE SITE				
	1	2	3	4	Total	I	II	Total	P[1]	
Relative Abundance	32.00(14.07)	32.81(5.80)	37.04(17.22)	40.63(26.02)	35.62(16.96)	44.59(6.12)	33.11(6.74)	38.85(8.60)	0.452	ns
Richness	32.89(5.37)	36.22(4.06)	37.33(4.33)	36.00(5.15)	35.61(4.85)	41.78(4.18)	35.56(5.03)	38.67(5.51)	0.042	*
Total:	47	51	57	58	72	67	57	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 three water-related species in the study area (Standard error in Parenthesis).

	AFFECTED AREA (SECTION)					REFERENCE SITE				
	1	2	3	4	Total	I	II	Total	P[1]	
Abundant Species										
Common Yellowthroat	1.04(1.19)	0.93(1.04)	0.22(0.29)	1.59(1.14)	0.94(1.06)	1.93(0.78)	3.07(1.13)	2.50(1.11)	0.000	*
Song Sparrow	2.30(0.66)	1.63(0.86)	0.67(0.60)	2.44(1.53)	1.76(1.18)	1.18(0.65)	2.67(0.55)	1.93(0.96)	0.606	ns
House Finch	2.15(1.42)	1.56(2.02)	1.29(1.14)	0.89(0.87)	1.47(1.44)	1.67(1.08)	0.74(1.04)	1.20(1.13)	0.493	ns
Water-related Species										
Green Heron	0.11(0.24)	0.00(0.00)	0.04(0.11)	0.00(0.00)	0.04(0.13)	0.63(0.54)	0.15(0.24)	0.39(0.47)	0.000	*
Killdeer	0.67(0.82)	0.74(0.52)	1.04(0.94)	0.41(0.76)	0.71(0.77)	1.82(1.56)	1.82(1.85)	1.82(1.66)	0.002	*
Spotted Sandpiper	0.15(0.29)	0.30(0.35)	1.15(0.71)	0.78(0.71)	0.59(0.66)	1.15(0.67)	1.30(1.05)	1.22(0.86)	0.004	*

1. One way ANOVA of Affected Area versus Reference site: ns -- not significant, * -- significant.

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 three species; however, the percent explained (r^2-adjusted) was very small (green heron= -0.049 + 0.058 Points, r^2-adjusted=7.2%, P=0.028; killdeer= 0.247 + 0.238 Points, r^2-adjusted=9.1%, P=0.015; spotted sandpiper= 0.010 + 0.226 Points, r^2-adjusted=23.4%, P<0.000).

General Surveys

Species detected during general surveys that were not detected during point counts are also listed in Appendix A. These 10 additional species represent only about 10% of the total number of species detected in the affected area and reference sites.

Productivity data collected during the study are presented in Table III. Since these data were not collected in a consistent manner and with comparable effort, it is difficult to analyze statistically. Highly detectable species such as the waterbirds may yield more reliable data. Thus, it is interesting to note that the only green heron juveniles and nests found were in the reference sites (10 and 2, respectively). The number of juvenile spotted sandpipers in the affected area is 12 compared to 25 in the reference sites. Finally, although fewer great blue herons and great egrets were present in the study area, all juveniles detected were found only in the affected area.

Sensitive Species Surveys

No yellow-billed cuckoos were located during our surveys. Only one male willow flycatcher was found, at Reference site II, and was present from at as early as 08 June to 30 June (present in a location where a male was found in 1993; Haupt, unpubl. data). Neither bird (1993 or 1994) was seen with a female or other member of the species; both were presumed to be unpaired.

Least Bell's vireos were found at three locations within the affected area (Chiquito Canyon, Salt Creek, and Las Brisas; Figure 7) and at the two reference sites (Figures 8 and 9). General population and productivity parameters for all vireo sites are presented in Table IV.

Figure 6. Relative abundance of waterbirds in the study area

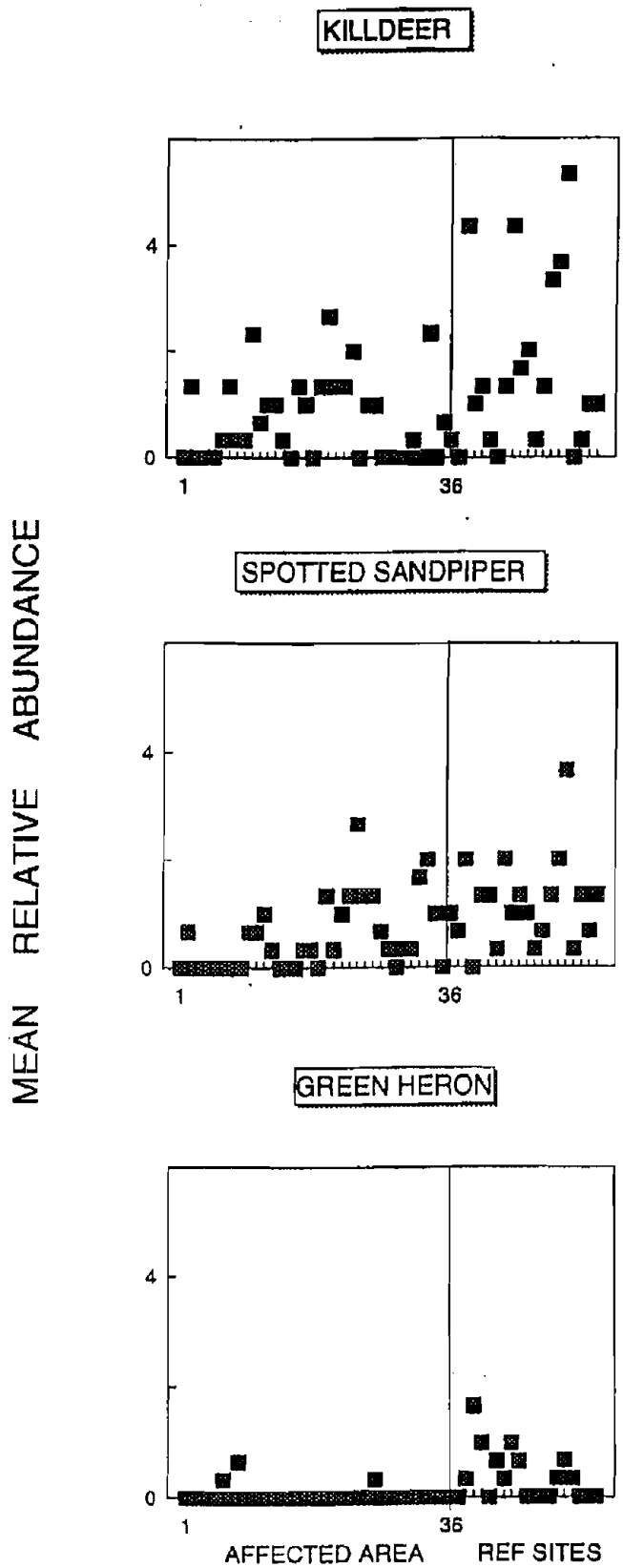


TABLE III. Localities and species of birds displaying behaviors associated with breeding productivity in the study area (See legend below).

	AFFECTED AREA (SECTION)				REFERENCE SITES	
SPECIES	1	2	3	4	I	II
Great Blue Heron	.	.	.	.	3J	1J
Great Egret	.	.	.	.	1J	.
Green Heron	.	.	.	.	4J	6J 2N
Mallard	.	12J	.	14J	.	..
White-tailed Kite	5J	.	.	8J	5J	2J
Cooper's Hawk	4J 1F N .	1F	1F N	.	.	
Red-shouldered Hawk	4J N	1J	.	1J 1F	.	J
Red-tailed Hawk	4J N	2J 1N	3J 1N	3J	3J 1N	1J
American Kestrel	.	J	J N	.	.	F
California Quail	.	J	J	16J	J 1N	1N
Virginia Rail	1J	2J	.	.	.	.
Killdeer	.	J	.	2J	2N	J
Greater Yellowlegs	.	.	.	.	1J	.
Spotted Sandpiper	1N	1J	5J	6J 3N	8J 1N	17J 1N
Mourning Dove	.	.	.	J	.	.
Lesser Nighthawk	1N	.	.	.	1N	1N
Allen's Hummingbird	.	.	1J			
Hummingbird species	.	1J	.	1J	.	.
Belted Kingfisher	.	N	.	.	.	.
Downy Woodpecker	1J	.	.	1J	.	.
Hairy Woodpecker	.2J	.	.	.	.	.
Northern Flicker	.	.	.	J	.	.
Black Phoebe	2J	1N	.	4J	2J	.
Say's Phoebe	.	.	.	.	2J	.
Ash-throated Flycatcher	1J	2J 2F 2N	2J 2F	1J 1F	.	4F 1N
Cassin's Kingbird	.	.	.	.	1J 1F	.
Horned Lark	J	.	.	.	.	.
Tree Swallow	.	1J	.	.	2J	5J
Violet-green Swallow	.	.	14J	9J	.	J
Northern Rough-wing Swallow	8J	J	5J	.	.	J
Cliff Swallow	5J	65J 80N	80J	250N	50J	J
Barn Swallow	1J	.	.	.	.	.
Swallow species	.	.	.	.	.	J
Scrub Jay	3J	2J 1N	.	2J	.	.
American Crow	5J	.	J	3J	.	.

	AFFECTED AREA (SECTION)				REFERENCE SITES	
SPECIES	1	2	3	4	I	II
Common Raven	8J 1F	2J	1J	.	.	4J
Bushtit	J	J	1N	.	.	.
Bewick's Wren	1J 1F	.	.	1J	.	.
House Wren	.	1J	2J	.	.	.
Western Bluebird	4J	7J 1F	6J	1J	.	.
Phainopepla	.	.	1J	2J 2N	.	.
Loggerhead Shrike	.	.	4J	.	.	.
European Starling	.	J	J	1F 1N	J	J
Bell's Vireo	.	.	3J 7N	1N 1N*	33J 13N	17J 11N
Orange-crowned Warbler	.	.	.	1F	.	.
Yellow Warbler	.	1N	.	.	1J	1F
Common Yellowthroat	.	.	.	2J	1J 1N	2J 1J*
Black-headed Grosbeak	1J	.	3J 1F	1J	1J	1N
Blue Grosbeak	.	2J 1F	2J	2J	1F	1J
Lazuli Bunting	.	2J	.	9J 2N*	.	.
Rufous-sided Towhee	.	1F	1N	2J	.	.
California Towhee	1J	.	2J	.	.	.
Rufous-crowned Sparrow	.	1J	.	.	.	.
Lark Sparrow	2J	.	2J	5J	.	.
Song Sparrow	9J 1J*	2J 1F	2J	6J	.	13J 1F
Red-winged Blackbird	J 1J* 1F N	3J	.	3J	.	3J
Tricolored Blackbird	J 3F N (colony)	.	.	.	.	.
Brewer's Blackbird	.	.	1J* 1F	.	.	.
Blackbird species	.	1F	.	.	.	.
Brown-headed Cowbird	2J	.	1J E	J E	.	2J
House Finch	J 1F	.	.	1J*	.	.
Lesser Goldfinch	.	.	.	2J 1N	.	.
Lawrence's Goldfinch	.	.	.	.	.	.
American Goldfinch	1J	.	.	.	.	3J 3N
Red Bishop (exotic)	.	.	.	.	.	.

J -- juvenile(s) present, though not counted
#J -- additive number of juvenile(s) (i.e. 4J = a total of 4 juveniles)
J* -- juvenile brown-headed cowbird coupled with adults of this species
F -- an adult seen carrying food
N -- nest of this species found
E* -- egg(s) of brown-headed cowbird found
E -- brown-headed cowbird egg(s) found in a host's nest

Affected Area. We found five male and at least four female least Bell's vireos at the Salt Creek location. A minimum of seven nests were built, of which at least five were known to contain eggs; each was parasitized with at least one cowbird egg. One of the nests had a cowbird which fledged prior visiting the area (after which the nest was not found). Predation caused two nests to fail and two nests fledged one and two young vireos, each, after removal of the cowbird egg. The three juvenile vireos were banded just prior to fledging in order to assess their movement in subsequent years. Two nests discovered during construction were not seen with eggs on subsequent visits; one of the nests probably contained egg(s), but was later preyed upon. Two females in this area had been banded along the lower Santa Clara River in previous years. However, only one was captured to determine her exact band number and origin. This bird was banded as a nestling in 1992 in Reference Site II (a mile east of the south end of Willard Road near Santa Paula).
One pair of vireos was found upstream of the Las Brisas Bridge. Both the male and female were banded in previous years: the male banded in May 1992 at Reference Site I; the female's origin undetermined. When first found, they were in the early stages of constructing their second nest and/or carrying food to a nearby nest. This nest was found during a later visit, placed in a weed patch that had been partially trampled by one or more humans in recent weeks. Their second nest was located during subsequent visits and was found parasitized, but the clutch was still being brooded. This nest was later preyed upon and the pair apparently left the site and were not found again.

The vireos observed in the Chiquito Canyon area probably had not bred there. Two males were observed on 16 June, but not relocated on subsequent visits. On 27 July, two banded males and a third scolding individual were present. One of these males had a color band similar to the male at Las Brisas (this would be a movement of more than 6 kilometers upstream). Considering this late date, these latter birds may well have been in post breeding dispersal.

Reference Sites. Of the 23 males and 20 females at the two reference sites, 14/13 were at Reference Site I and 9/7 were at Reference Site II. Productivity was significantly higher in both reference sites in comparison to the affected area. No vireos were parasitized during the course of this study in the reference sites. In fact, plotting relative abundance data from the point counts shows much fewer cowbirds in relation to vireos in the reference sites than in the affected area (Figure 10). At least 16 of these vireos were banded along the Santa Clara River in either 1992 or 1993 (Greaves, unpubl. data). In addition, one male and one female, banded as nestlings on the Santa Margarita River, San Diego County, in 1987 and 1990, respectively (Kus, pers. comm.) were present near where they had been observed during each breeding season from 1991 to 1993 (Greaves, unpubl. data). In 1994, we did not band nestlings at either of the reference sites, and caught only one adult to determine its origin.

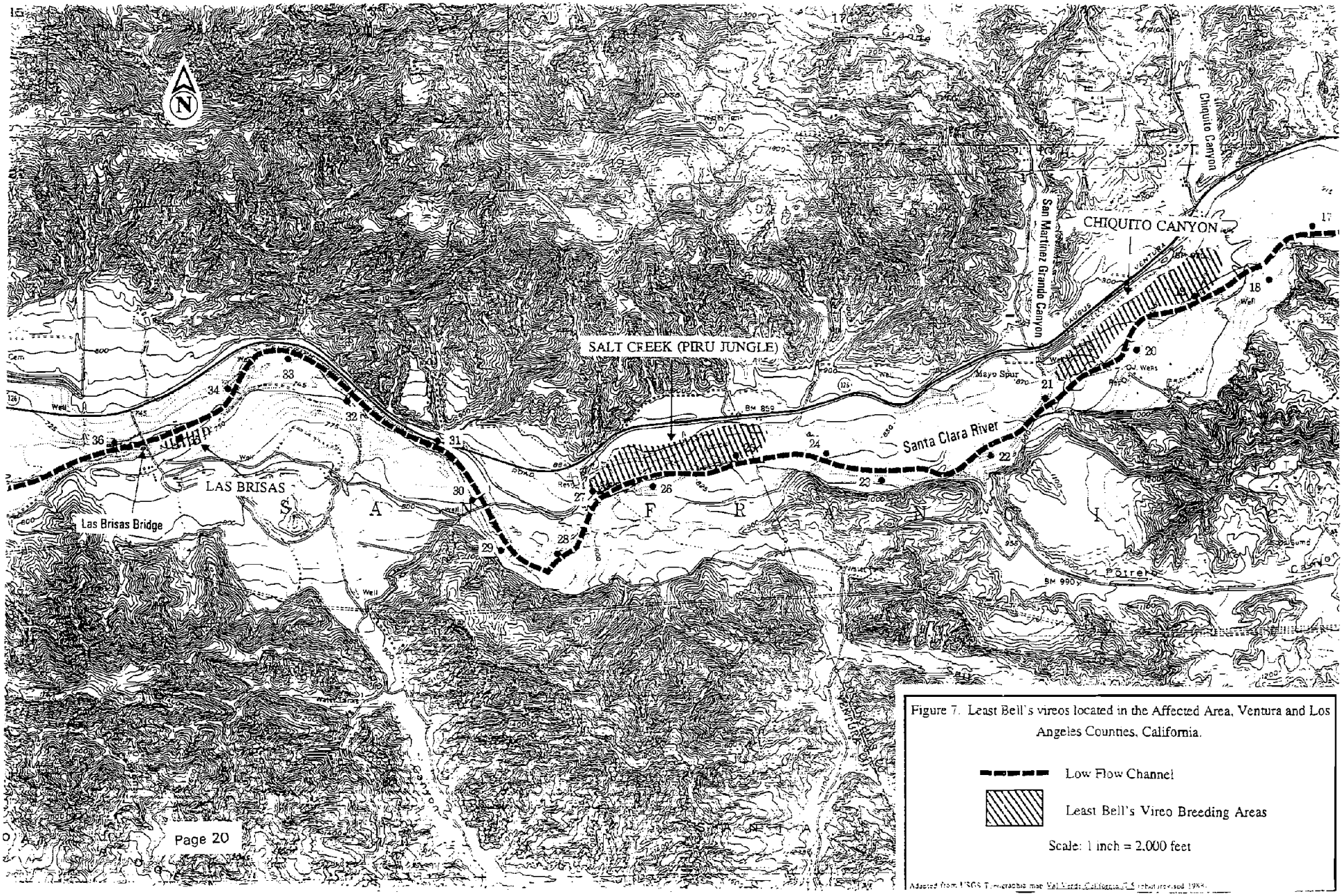


Figure 7. Least Bell's vireos located in the Affected Area, Ventura and Los Angeles Counties, California.

Low Flow Channel

Least Bell's Vireo Breeding Areas

Scale: 1 inch = 2,000 feet

Adapted from USGS Topographic map Val Verde, California 7.5 minute series revised 1988

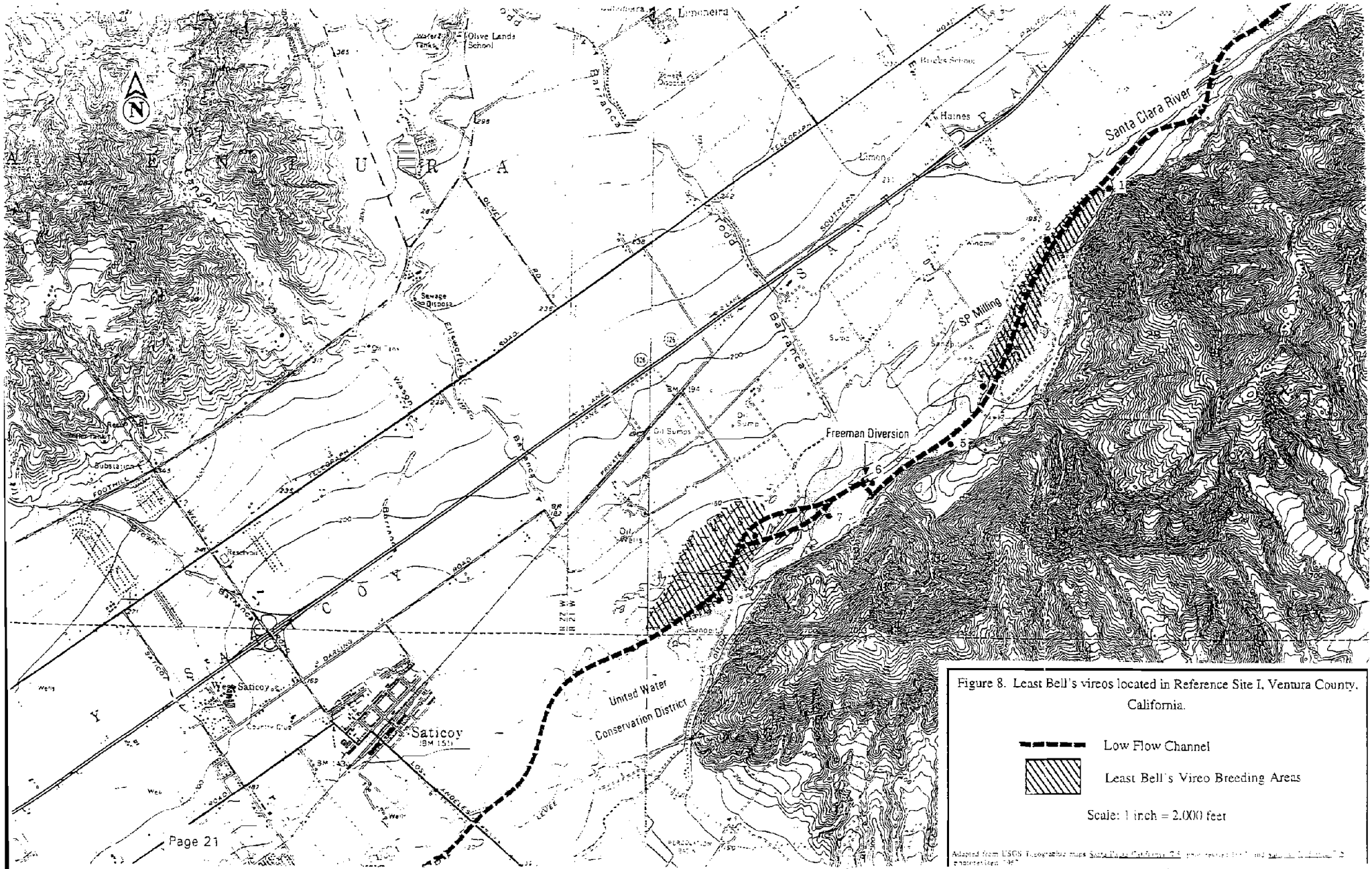


Figure 8. Least Bell's vireos located in Reference Site I, Ventura County, California.

Low Flow Channel

Least Bell's Vireo Breeding Areas

Scale: 1 inch = 2,000 feet

Adapted from USGS Topographic maps Santa Paula, California 7.5 minute series (1967) and Saticoy, California 7.5 minute series (1967)

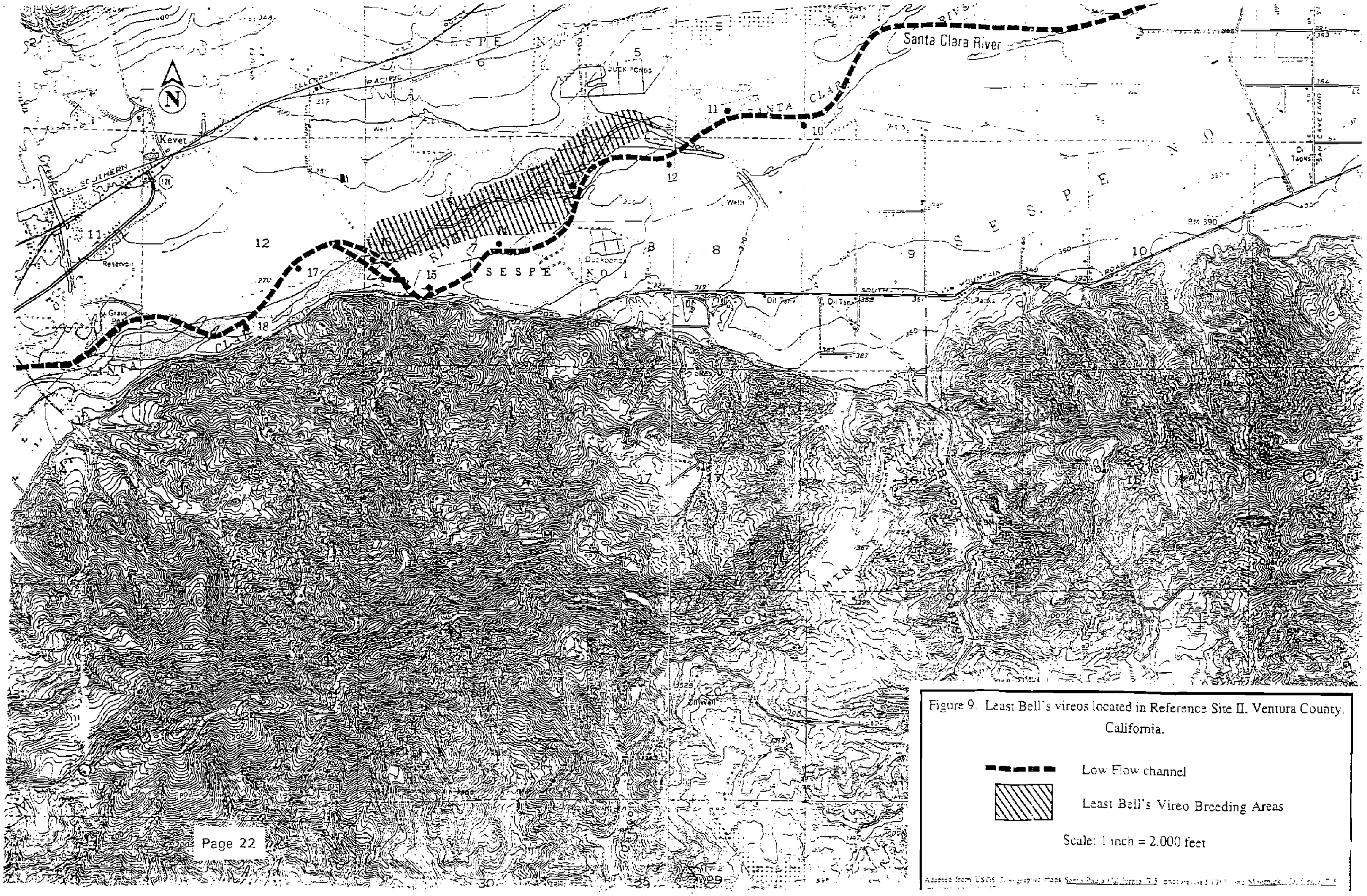


Figure 9. Least Bell's vireos located in Reference Site II. Ventura County, California.

Low Flow channel

Least Bell's Vireo Breeding Areas

Scale: 1 inch = 2,000 feet

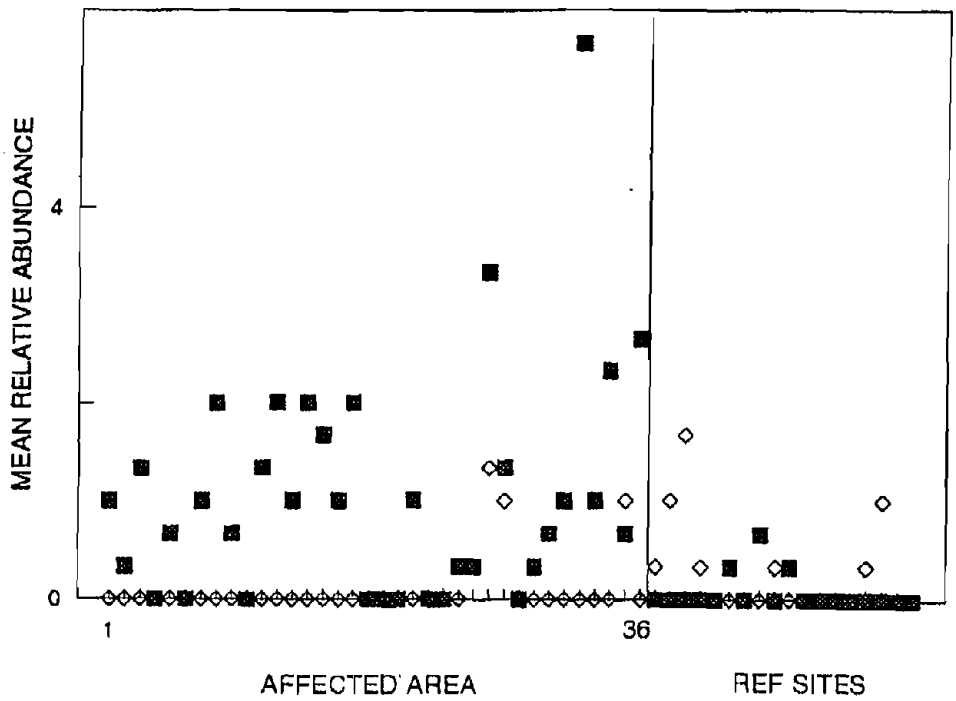
TABLE IV. Least Bell's vireo territories, adults, juveniles and nests in affected and reference areas on Santa Clara River, Los Angeles and Ventura Counties, California

	Affected Area			Reference Site	
Attribute	Chiquito	Salt Creek[1]	Las Brisas	I	II
Territories	3	5	1	14	9
Males	3	5	1	14	9
Females	0	4	1	13	7
Known Pairs	0	4	1	13	7
Vireo fledglings	0	3	0	33	17
Nesting attempts	0	7	2	13	11
Nests successful	0	3	0	9	5
Unknown outcome	0	0	0	4	5
Nests parasitized	0	5	1	0	0
Cowbird fledglings	0	1	0	0	0
Productivity[2]	0.0	0.6	0.0	2.5	2.4

[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.

Figure 10. Mean relative abundance of brown-headed cowbirds (black boxes) and least Bell's vireos (diamonds) in the Affected Area and Reference Sites.



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

	AFFECTED AREA (SECTIONS)								REFERENCE SITES			
SPECIES	1		2		3		4		I		I	
Great Blue Heron	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.00**	0.00	**0.11**	0.06	**0.15**	0.06
Great Egret	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.26**	0.17	**0.07**	0.05
Snowy Egret									**			
Green Heron	**0.11**	0.08	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.63**	0.18	**0.15**	0.08
White-faced Ibis	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.15**	0.15	**0.00**	0.00
Mallard	**0.00**	0.00	**0.00**	0.00	**4.15**	3.02	**0.11**	0.11	**0.07**	0.05	**0.63**	0.22
Cinnamon Teal	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.07**	0.07
Turkey Vulture	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.04**	0.04	**0.11**	0.06	**0.00**	0.00
White-tailed Kite	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.15**	0.08	**0.11**	0.08	**0.33**	0.11
Cooper's Hawk	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00
Red-shouldered Hawk	**0.41**	0.13	**0.19**	0.08	**0.19**	0.11	**0.15**	0.08	**0.00**	0.00	**0.07**	0.05
Red-tailed Hawk	**0.11**	0.08	**0.19**	0.11	**0.19**	0.08	**0.15**	0.11	**0.56**	0.17	**0.07**	0.05
American Kestrel	**0.04**	0.04	**0.04**	0.04	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
California Quail	**0.11**	0.06	**0.26**	0.14	**0.30**	0.07	**0.15**	0.08	**0.41**	0.16	**0.11**	0.06
Virginia Rail	**		**									
Killdeer	**0.67**	0.27	**0.74**	0.17	**1.04**	0.31	**0.41**	0.25	**1.81**	0.52	**1.81**	0.62
Greater Yellowlegs	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.26**	0.17	**0.00**	0.00
Spotted Sandpiper	**0.15**	0.10	**0.30**	0.12	**1.15**	0.24	**0.78**	0.24	**1.15**	0.22	**1.30**	0.35
Western Sandpiper	**											
Least Sandpiper	**										**	
California Gull	*											
Western Gull	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.11**	0.06	**0.00**	0.00
Rock Dove	**1.22**	0.61	**0.81**	0.41	**0.67**	0.44	**1.00**	0.88	**0.00**	0.00	**0.00**	0.00
Mourning Dove	**0.30**	0.12	**0.96**	0.32	**0.30**	0.13	**0.67**	0.33	**4.22**	1.00	**0.70**	0.21
Common Ground-Dove	*								**			
Greater Roadrunner	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.07**	0.07	**0.04**	0.04
Northern Pygmy-Owl			*		**							
Lesser Nighthawk								**				
White-throated Swift	**0.00**	0.00	**0.04**	0.04	**0.07**	0.05	**0.15**	0.15	**0.00**	0.00	**0.26**	0.26
Black-chinned Hummingbird	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00

SPECIES	AFFECTED AREA (SECTIONS) 1		2		3		4		REFERENCE SITES I		I	
Anna's Hummingbird	**0.07**	0.07	**0.15**	0.08	**0.04**	0.04	**0.04**	0.04	**0.15**	0.06	**0.04**	0.04
Costa's Hummingbird	**0.00**	0.00	**0.00**	0.00	**0.11**	0.06	**0.15**	0.08	**0.04**	0.04	**0.00**	0.00
Allen's Hummingbird	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.04**	0.04
Hummingbird species	**0.11**	0.08	**0.15**	0.08	**0.07**	0.05	**0.33**	0.10	**0.15**	0.08	**0.26**	0.15
Belted Kingfisher	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.04**	0.04
Acorn Woodpecker	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.00**	0.00
Nuttall's Woodpecker	**0.48**	0.14	**0.52**	0.11	**0.48**	0.15	**0.70**	0.13	**0.11**	0.06	**0.11**	0.06
Downy Woodpecker	**0.44**	0.16	**0.15**	0.08	**0.11**	0.06	**0.37**	0.09	**0.19**	0.08	**0.11**	0.06
Hairy Woodpecker	**0.07**	0.05	**0.15**	0.08	**0.15**	0.11	**0.19**	0.06	**0.04**	0.04	**0.04**	0.04
Northern Flicker	**0.00**	0.00	**0.59**	0.12	**0.19**	0.08	**0.15**	0.06	**0.04**	0.04	**0.30**	0.26
Woodpecker species	**0.00**	0.00	**0.04**	0.04	**0.04**	0.04	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Western Wood-Pewee							**					
Pacific-slope Flycatcher	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.11**	0.11
Black Phoebe	**0.33**	0.15	**0.41**	0.16	**0.26**	0.11	**0.74**	0.22	**0.70**	0.12	**0.63**	0.12
Say's Pheobe					*				***			
Ash-throated Flycatcher	**0.63**	0.23	**1.11**	0.17	**1.04**	0.25	**0.78**	0.18	**0.41**	0.19	**0.74**	0.23
Cassin's Kingbird	**0.00**	0.00	**0.00**	0.00	**0.15**	0.11	**0.04**	0.04	**0.33**	0.15	**0.00**	0.00
Western Kingbird	**0.07**	0.05	**0.11**	0.08	**0.07**	0.07	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Kingbird species	**0.00**	0.00	**0.11**	0.06	**0.04**	0.04	**0.00**	0.00	**0.11**	0.08	**0.00**	0.00
Horned Lark	*				*				*			
Tree Swallow	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.44**	0.31	**1.22**	0.65
Violet-green Swallow	**0.00**	0.00	**0.63**	0.31	**1.59**	0.50	**0.00**	0.00	**0.30**	0.14	**1.11**	0.34
Northern Rough-wing Swallow	**0.33**	0.43	**1.22**	0.38	**1.78**	0.67	**0.33**	0.24	**1.59**	0.35	**1.41**	1.41
Cliff Swallow	**0.11**	0.08	**2.52**	0.64	**3.41**	0.97	**12.37**	7.53	**5.41**	1.68	**4.41**	0.77
Barn Swallow	**0.04**	0.04	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00
Swallow species	**0.15**	0.11	**0.04**	0.04	**0.00**	0.00	**0.93**	0.93	**0.04**	0.04	**0.00**	0.00
Scrub Jay	**0.56**	0.20	**1.59**	0.26	**0.44**	0.14	**0.59**	0.21	**0.04**	0.04	**0.19**	0.08
American Crow	**2.00**	0.64	**1.93**	0.42	**1.00**	0.45	**1.85**	0.63	**0.04**	0.04	**0.11**	0.11
Common Raven	**0.74**	0.28	**1.30**	0.23	**1.48**	0.43	**0.30**	0.09	**0.30**	0.15	**0.56**	0.12
Plain Titmouse	**0.81**	0.20	**0.63**	0.20	**0.41**	0.09	**0.52**	0.13	**0.04**	0.04	**0.00**	0.00
Bushtit	**2.04**	0.59	**3.04**	1.03	**0.74**	0.22	**1.44**	0.28	**0.96**	0.32	**0.04**	0.04
White-breasted Nuthatch							**					
Bewick's Wren	**1.56**	0.26	**0.89**	0.19	**1.00**	0.11	**0.44**	0.12	**0.96**	0.14	**0.22**	0.10
House Wren	**0.07**	0.05	**0.22**	0.08	**0.11**	0.06	**0.30**	0.14	**0.11**	0.08	**0.11**	0.11

SPECIES	AFFECTED AREA (SECTIONS) 1		2		3		4		REFERENCE SITES I		I	
Wren species	**0.00**	0.00	**0.07**	0.05	**0.00**	0.00	**0.04**	0.04	**0.04**	0.04	**0.00**	0.00
Blue-gray Gnatcatcher							**					
Western Bluebird	**0.04**	0.04	**0.00**	0.00	**0.30**	0.14	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Swainson's Thrush	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.22**	0.12	**0.04**	0.04	**0.26**	0.17
American Robin	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.26**	0.12	**0.00**	0.00	**0.00**	0.00
Wrentit	**0.04**	0.04	**0.56**	0.16	**0.44**	0.18	**0.78**	0.22	**0.37**	0.09	**0.56**	0.19
Northern Mockingbird	**0.04**	0.04	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.11**	0.06	**0.00**	0.00
California Thrasher	**0.41**	0.14	**0.22**	0.12	**0.11**	0.08	**0.04**	0.04	**0.22**	0.08	**0.19**	0.15
Phainopepla	**0.00**	0.00	**0.26**	0.09	**0.44**	0.25	**0.59**	0.55	**0.30**	0.22	**0.00**	0.00
Loggerhead Shrike	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.15**	0.08	**0.07**	0.05
European Starling	**1.52**	0.59	**0.33**	0.19	**1.37**	1.08	**0.26**	0.12	**0.11**	0.11	**0.00**	0.00
Bell's Vireo	**0.00**	0.00	**0.00**	0.00	**0.30**	0.17	**0.11**	0.11	**0.41**	0.19	**0.15**	0.11
Hutton's Vireo	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.07**	0.07	**0.00**	0.00
Warbling Vireo	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.04**	0.04	**0.00**	0.00
Orange-crowned Warbler	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.11**	0.08	**0.04**	0.04	**0.15**	0.11
Yellow Warbler	**0.04**	0.04	**0.04**	0.04	**0.04**	0.04	**0.30**	0.10	**1.81**	0.29	**0.52**	0.24
Common Yellowthroat	**1.04**	0.40	**0.93**	0.35	**0.22**	0.10	**1.59**	0.38	**1.93**	0.26	**3.07**	0.38
Wilson's Warbler	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04
Yellow-breasted Chat	**0.00**	0.00	**0.04**	0.04	**0.15**	0.08	**0.63**	0.29	**1.56**	0.22	**0.85**	0.16
Western Tanager					**							
Black-headed Grosbeak	**0.93**	0.18	**1.15**	0.22	**1.67**	0.30	**0.96**	0.20	**1.22**	0.22	**0.56**	0.15
Blue Grosbeak	**0.59**	0.13	**0.81**	0.17	**0.41**	0.14	**0.37**	0.10	**0.59**	0.12	**0.81**	0.13
Lazuli Bunting	**0.30**	0.10	**0.44**	0.11	**0.41**	0.16	**0.19**	0.15	**0.41**	0.21	**0.81**	0.19
Indigo Bunting	**0.00**	0.00	**0.15**	0.11	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Rufous-sided Towhee	**0.41**	0.13	**0.67**	0.15	**1.19**	0.19	**0.56**	0.25	**0.96**	0.15	**0.85**	0.19
California Towhee	**0.22**	0.10	**0.44**	0.16	**0.67**	0.18	**0.26**	0.13	**0.37**	0.12	**0.26**	0.14
Rufus-crowned Sparrow	**0.00**	0.00	**0.15**	0.11	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.00**	0.00
Lark Sparrow	**0.41**	0.41	**0.00**	0.00	**0.26**	0.13	**0.22**	0.12	**0.00**	0.00	**0.00**	0.00
Song Sparrow	**2.30**	0.22	**1.63**	0.29	**0.67**	0.20	**2.44**	0.51	**1.19**	0.22	**2.67**	0.18
Red-winged Blackbird	**2.41**	1.34	**0.33**	0.18	**1.67**	1.27	**0.48**	0.32	**3.56**	1.44	**1.78**	0.62
Tricolored Blackbird	**2.15**	1.87	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Brewer's Blackbird	**0.00**	0.00	**0.00**	0.00	**0.30**	0.26	**0.00**	0.00	**1.67**	0.78	**0.07**	0.05
Blackbird species	**0.48**	0.29	**0.00**	0.00	**0.00**	0.00	**0.07**	0.07	**0.19**	0.11	**0.15**	0.15
Brown-headed Cowbird	**0.78**	0.22	**1.22**	0.27	**0.70**	0.37	**1.59**	0.59	**0.11**	0.08	**0.04**	0.04

	AFFECTED AREA (SECTIONS)								REFERENCE SITES			
SPECIES	1		2		3		4		I		I	
Hooded Oriole	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Northern Oriole	**0.19**	0.08	**0.15**	0.11	**0.41**	0.17	**0.04**	0.04	**0.74**	0.26	**0.11**	0.08
Oriole species	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.04**	0.04	**0.04**	0.04	**0.00**	0.00
Purple Finch	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.04**	0.04	**0.00**	0.00	**0.07**	0.07
House Finch	**2.15**	0.48	**1.56**	0.67	**1.30**	0.38	**0.89**	0.29	**1.67**	0.36	**0.74**	0.35
Lesser Goldfinch	**0.19**	0.08	**0.93**	0.50	**1.00**	0.40	**2.44**	0.41	**2.11**	0.35	**0.59**	0.25
Lawrence's Goldfinch	**0.00**	0.00	**0.00**	0.00	**0.11**	0.08	**0.00**	0.00	**0.19**	0.10	**0.00**	0.00
American Goldfinch	**0.41**	0.13	**0.04**	0.04	**0.19**	0.08	**0.07**	0.05	**0.30**	0.13	**0.59**	0.15
Goldfinch species	**0.00**	0.00	**0.04**	0.04	**0.04**	0.04	**0.00**	0.00	**0.04**	0.04	**0.07**	0.07
Red Bishop (exotic)							**					

TOTAL SPECIES = 100