

# Monitoring Swainson's Hawk (*Buteo swainsoni*) Nesting Activity in South Sacramento County

## Results of 2008 Surveys

February 2009



*Prepared for:*



*Prepared by:*

**ESTEP**



*Environmental  
Consulting*

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Activity in South Sacramento County**

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## Executive Summary

In 2006, the City of Elk Grove conducted a baseline nesting survey of the state-threatened Swainson's hawk in South Sacramento County. The study was conducted to 1) provide the City with a more complete understanding of the distribution and abundance of the Swainson's hawk in south Sacramento County and 2) to assist the City in establishing criteria for conservation site selection and approval related to its development of a conservation strategy to offset impacts from urbanization within the city limits. The results of the baseline survey are found in Estep (2007).

One of the purposes of the 2006 survey was to establish a baseline from which future monitoring efforts would be compared in order to detect trends in the nesting population over time. This report represents the first of these monitoring surveys.

Three 36-square-mile survey areas were selected from within the 2006 South Sacramento County baseline study area. One survey area was selected from each of the three geographic regions (Delta, Interior, and Eastern) described in the 2006 study (Estep 2007). A census-based survey was conducted for nesting Swainson's and other stick-nest-building raptors using the same techniques and assumptions as the 2006 effort. These data were then compared with the 2006 data to evaluate changes in distribution and abundance of nesting Swainson's hawks.

There were four fewer active nesting territories within the three survey areas in 2008 (37) compared with the 2006 baseline survey (41). Territory density was also slightly less but similar within the combined survey areas (0.34 territories per square mile) to the 2006 baseline survey (0.37 territories per square mile). While there were changes in activity and distribution within each survey area (i.e., some 2006 locations were inactive in 2008 and other locations were new in 2008), the general distribution has not changed significantly since 2006.

A total of 37 fledged young were recorded. This equates to 1.6 young per successful nest, which is higher than that reported for the 2006 baseline survey (1.46 young per successful nest). Nesting and foraging habitat associations were similar to that recorded in 2006. However, the use of eucalyptus trees for nesting increased from 15% to 25%.

Results of the 2008 survey suggest that the distribution and abundance of the South Sacramento County Swainson's hawk nesting population has not changed significantly since the 2006 baseline survey and that differences between the two survey years are likely attributable to local movements of breeding pairs and annual variation in nesting activity. Additional years of monitoring will be required in order to detect trends in the distribution and abundance of this population, to assess the effects of additional urbanization and other land use changes within the study area, and to assess the effectiveness of conservation activities.

## Background

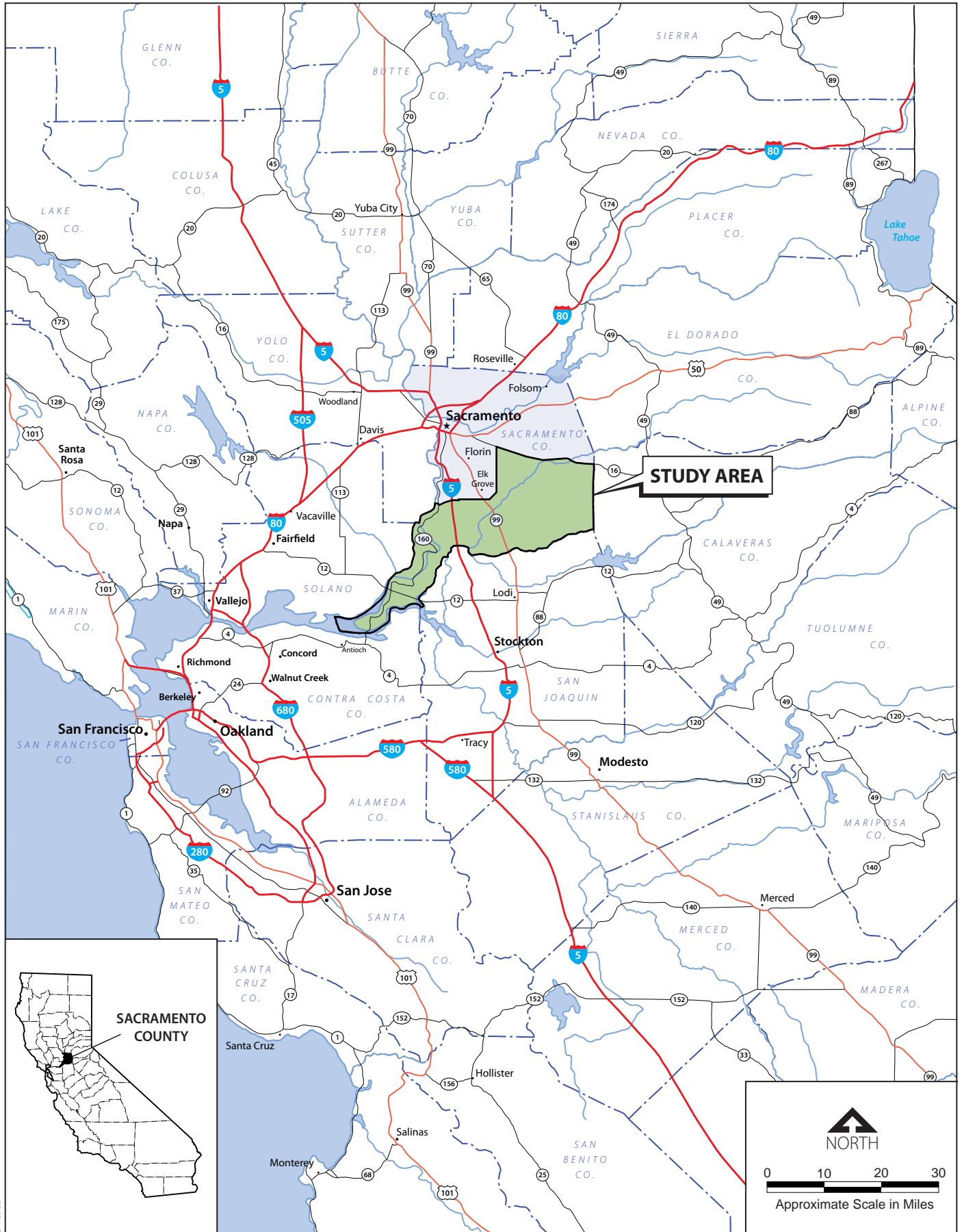
The Swainson's hawk (*Buteo swainsoni*) is a state-listed threatened species in California that occurs throughout much of the Central Valley. The City of Elk Grove (City) is within the region of the Central Valley – which includes Sacramento, Yolo, Solano, and San Joaquin Counties – that supports the largest concentration of nesting Swainson's Hawks in the state. Associated with large, open grassland and agricultural landscapes, the Swainson's hawk is closely tied to an agricultural pattern in the Central Valley that provides high value foraging opportunities. This pattern, an agricultural landscape matrix of hay, grain, and row crops; irrigated pasture; and grazed annual grasslands is characteristic of this region.

The City has been actively developing a conservation strategy for the Swainson's hawk in response to continuing urbanization and the resulting loss of high value agricultural habitats needed to sustain nesting populations – as well as the need for compliance with California Department of Fish and Game (DFG) habitat protection guidelines (California Department of Fish and Game 1994). The City instituted an ordinance in 2003 that requires mitigation for losses of Swainson's hawk habitat due to urbanization. Conservation is achieved through selection of appropriate replacement lands and through management of suitable habitat values on those lands in perpetuity. With the assistance of DFG, the City has taken a landscape approach in their conservation strategy by using various habitat suitability and proximity criteria in the selection of potential conservation sites in an effort to provide meaningful conservation through consolidation of protected habitats and protection of landscape values that focus on sustainability of the breeding population.

In order to evaluate potential conservation lands in the context of a landscape approach to Swainson's hawk population sustainability, the City recognized the need for a comprehensive baseline survey of the nesting population in South Sacramento County (Figure 1). In 2006, the baseline survey was conducted to provide the City with a more complete understanding of the distribution and abundance of the Swainson's hawk in south Sacramento County and to further assist the City in establishing criteria for conservation site selection and approval. The results of the baseline survey are found in Estep (2007).

The purpose of this effort was several-fold and included:

- Determining the distribution and abundance of the Swainson's hawk in South Sacramento County.
- Determining nesting and foraging habitat associations of Swainson's hawk in South Sacramento County.
- Determining the reproductive performance of Swainson's Hawks in South Sacramento County.



**Figure 1**  
**Regional Location Map**

- Providing additional baseline information to assist the City of Elk Grove in the development of their Swainson's hawk conservation strategy.

Conducting a census-level survey, the resulting report characterized the distribution and abundance of Swainson's hawk and other stick-nest building diurnal raptors in south Sacramento County and illustrated the distribution of nesting and foraging habitats throughout the study area (Estep 2007).

The City also recognized the need to continue monitoring this population in order to document trends in distribution and abundance over time and to assess the effectiveness of conservation programs, and thus funded the first systematic monitoring of this population since completion of the baseline survey. The results of this 2008 monitoring effort are described in this report.

The purpose of this report is to present the results of the 2008 monitoring survey and compare and contrast these results with the results of the 2006 baseline survey. Refer to Estep (2007) for information on Swainson's hawk life history, the distribution and characterization of land uses and habitat types, and the abundance and distribution of the nesting Swainson's hawk population within the South Sacramento County study area.

## **Methods**

The general method was to select representative survey areas within the South Sacramento County study area (Estep 2007) and conduct a census-level survey within each survey area. The South Sacramento County study area was characterized by three distinct geographic areas, the Delta Zone (all lands west of Interstate 5), the Interior Zone (lands between Interstate 5 and Clay Station Road), and the Eastern Foothill Zone (lands east of Clay Station Road) (Figure 2). Data were analyzed in the 2007 report according to these geographic zones. Because of the distinct vegetation and topographic characteristics of these geographic zones, they were also used as the basis for selecting survey areas for this monitoring effort.

The survey area consisted of one township-size (36 square mile [93 square kilometer]) block randomly selected from each of the three geographic zones for a total of 108 square miles (280 square kilometers) or 69,120 acres (27,972 hectares). This represents approximately 20 percent of the South Sacramento County study area.

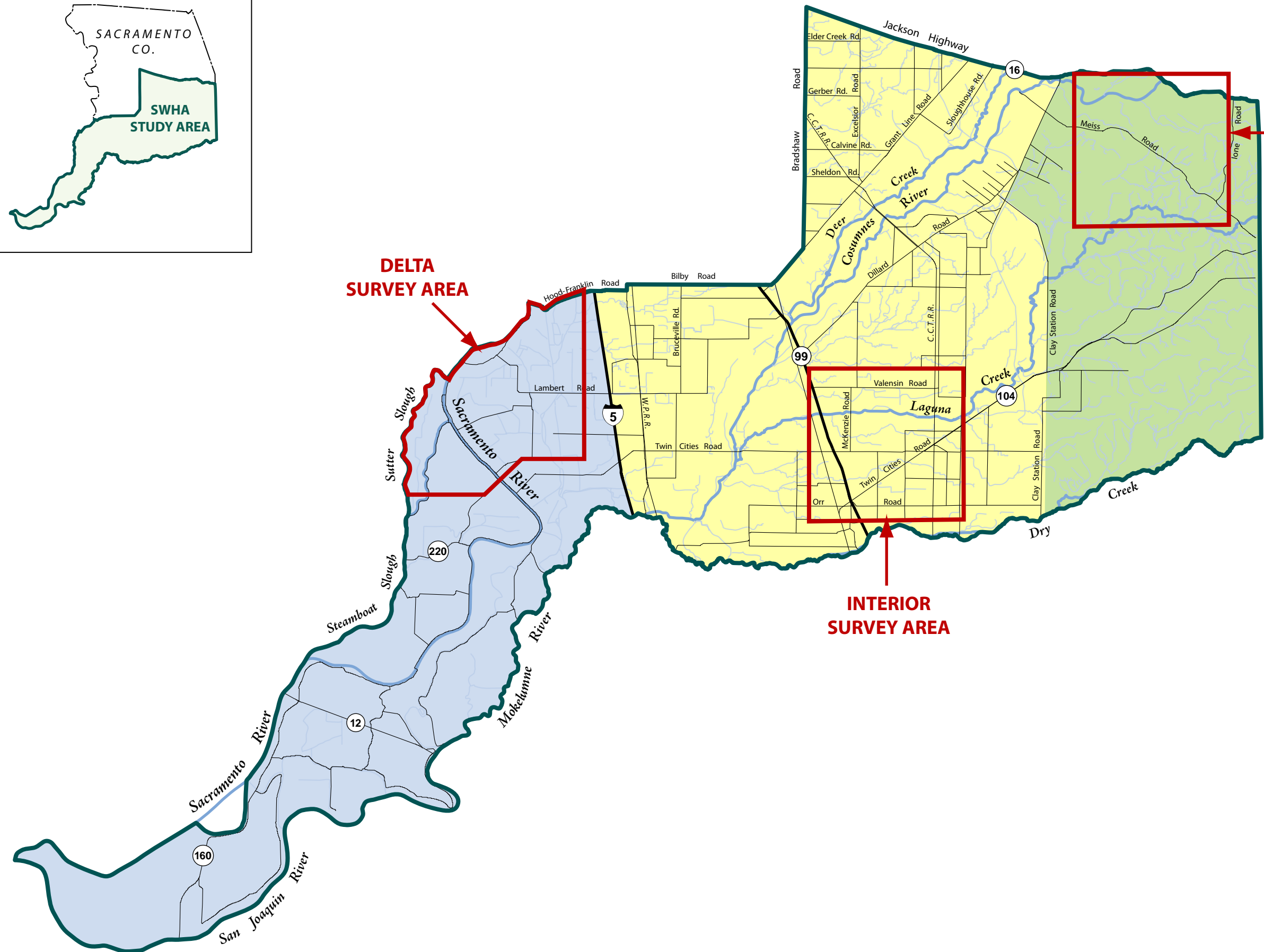
## **Selection of Survey Areas**

Selection of survey areas was determined using the following methods:

1. The objective was to select one 36-square-mile area within each of the three South Sacramento County study area zones (Figure 2). A grid with 1-square-mile cells was placed over the entire South Sacramento County study area. Each cell



**Figure 2**  
**South Sacramento County**  
**Swainson's Hawk Survey Areas,**  
**2008**









**EASTERN SURVEY AREA**


**DELTA SURVEY AREA**

**INTERIOR SURVEY AREA**

**LEGEND**

-  Study Area Boundary
-  2008 Survey Area Boundary
-  Delta Zone
-  Interior Zone
-  Eastern Foothill Zone

  
 NORTH

  
 0 2 4 6 8  
 Miles

- was numbered and one number was randomly selected from each of the geographic zones.
2. The selected number represented the southwest section within the central quadrant of a 36-square-mile township (six by six mile), or roughly the center of the survey area.
  3. While constructing the 36-square-mile survey area from this one-square-mile central cell, if the survey area extended beyond the boundary of either the South Sacramento County study area or the South Sacramento County study area zone (i.e., Delta, Interior, Eastern Foothill) from which it was selected, and if the area outside of the boundary represented less than 10 percent of the entire survey area, then the six by six square-mile configuration would be retained and the area outside of the boundary was included in the survey area. However, if greater than 10 percent was outside of the boundary, then the shape of the survey area would be reconfigured to fit into the study area or study area zone using roads or other geographic features as boundaries to the extent possible – but would still be roughly 36 sq mi.

Using this method, three survey areas were selected (Figure 2). The Delta Survey Area was reconfigured into the South Sacramento County study area as described above. The Interior Survey Area was entirely within the study area and Interior Zone. Less than 10 percent of the Eastern Foothill Survey Area was outside of the study area boundary, and so it was retained within the survey area (Figure 2).

## Surveys

The goal of the survey was to record all active nests within the study area to the extent feasible. While the survey focused primarily on nesting Swainson's hawks, activity and nesting data were also collected on several other species that compete for nesting and/or foraging habitat resources and may influence the distribution and abundance of Swainson's hawk, including red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), white-tailed kite (*Elanus leucurus*), and great-horned owl (*Bubo virginianus*). The intent was to generally indicate how these species were distributed across the landscape.

The survey was designed as a complete census. All potential nesting areas within the study area were surveyed equally according to the protocol described below regardless of past survey effort or existing data on Swainson's hawk nests.

Surveys were conducted by systematically driving all available roads within each survey area. Where roads were not available to drive or where there were no roads to access potential nest trees, the survey was conducted on foot unless access to private property was not granted. All potential nest trees were searched for nests and adult Swainson's Hawks using binoculars and/or a spotting scope. Photographs were taken of each active nest site and surrounding land use.

Surveys were conducted in three phases. Phase one surveys were conducted early in the breeding season (late March to mid-April) to detect Swainson's hawk activity in the vicinity of all suitable nesting habitat. All suitable nesting habitats were checked for the presence of adult Swainson's Hawks and to note all nesting activity and behavior (e.g., nest construction, courtship flights, defensive behavior). Activity was noted and mapped on field maps; locations of active nests were documented on 7.5 minute USGS quadrangle maps and a hand-held GPS unit was used to record latitude-longitude locations of each nest.

Phase two surveys were conducted in mid-May through June to determine if breeding pairs detected during phase one surveys were actively nesting, to detect nest failures, and to resurvey all previously unoccupied potential nesting habitat for active nests. All active nest sites were mapped and characterized with respect to reproductive status and all relevant activities noted.

Phase three surveys were conducted from July through mid-August to determine nesting success. Each active nest was revisited to determine activity and reproductive status and to record the number of fledged young per nest.

Most nesting territories were visited on multiple occasions over the course of each survey phase in order to collect the necessary data.

All suitable nesting habitats were checked for the presence of adult Swainson's hawks and to note all nesting activity and behavior (e.g., nest construction, courtship flights, defensive behavior). All trees were searched for the presence of active nests. Nest site and habitat data were recorded on a standardized field form. Activity was noted and mapped on field maps; locations of active nests were documented on 7.5 minute USGS quadrangle maps and a hand-held GPS unit was used to record latitude-longitude locations of each nest.

Activity data were recorded based on the following definitions:

- An *active nesting territory* is defined as a nesting area that was occupied by a potentially breeding pair of Swainson's hawks throughout all or a significant portion of the breeding season. The location of the nesting territory was based on the location of the nest or if the nest was not located based on the primary area of observed activity within potential nesting habitat.
  - A *non-nesting pair* is defined as an active territory for which subsequent surveys confirmed the absence of an active nest.
  - An *unknown nesting pair* is defined as an active territory for which subsequent surveys were unable to confirm the presence or absence of an active nest.

- An *active nest* is defined as a nest site that is occupied by a breeding pair of Swainson's hawks, regardless of the reproductive outcome (i.e., independent of any reproductive parameter, including egg laying).
  - A *successful nest* is defined as an active nest that produced fledged young.
  - An *unsuccessful nest* is defined as an active nest that did not produce fledged young.
  - An *unknown outcome nest* is defined as an active nest for which subsequent surveys were unable to confirm the reproductive status of the nest.

Each active territory was also characterized with respect to broad habitat associations. The 2006 report identified nine land use/cover type categories that represented long-term land use patterns in the South Sacramento County study area, and were used to characterize relative habitat suitability at the landscape level. To further characterize these habitat associations with respect to nest site selection, a one-half mile radius area around each nest was evaluated according to these broad land use/cover type categories. The categories include the following:

- Irrigated Cropland (includes hay, grain, and row crops)
- Irrigated Cropland/Irrigated Pastureland
- Uncultivated Grassland
- Orchards
- Vineyards
- Oak Woodlands
- Rural Residential (Low Density)
- Urban (High Density)
- Open Water

Of these types, only Irrigated Cropland, Irrigated Pastureland, and Uncultivated Grasslands represent suitable foraging habitat for Swainson's hawk.

Each active nest site was characterized with respect to nesting habitat type and condition, tree species, and estimated tree and nest height. Nesting habitat types identified during the 2006 baseline survey include the following:

- *Riparian*. This includes valley oak, cottonwood, willow-dominated (and in some cases non-native trees [e.g., eucalyptus]) woodland along natural or channelized stream corridors.
- *Isolated Trees*. This includes isolated trees that are not associated with roadsides, residences, or other features.

- *Isolated Roadside Trees.* These are isolated trees found along roadsides, including native trees retained during road construction, ‘volunteer’ trees in road shoulders, and ornamental landscape trees.
- *Roadside Tree Row.* These are roadside trees that have been planted as windbreaks or barriers, but can also be a collection of remnant valley oak or other naturally-occurring trees allowed to grow and mature along the roadside.
- *Tree Row.* These are rows of trees along field borders or rural driveways and were usually planted as windbreaks or for landscaping.
- *Rural Residential.* These are trees that were planted for windbreaks, cover, shade, or ornamentals around rural farmsteads.
- *Groves and Savannahs.* These are small groves of valley oak or cottonwood trees or planted eucalyptus or other non-native trees.
- *Farmyard Trees.* These are trees planted around agricultural farmyards used for equipment staging and shade.

## Results

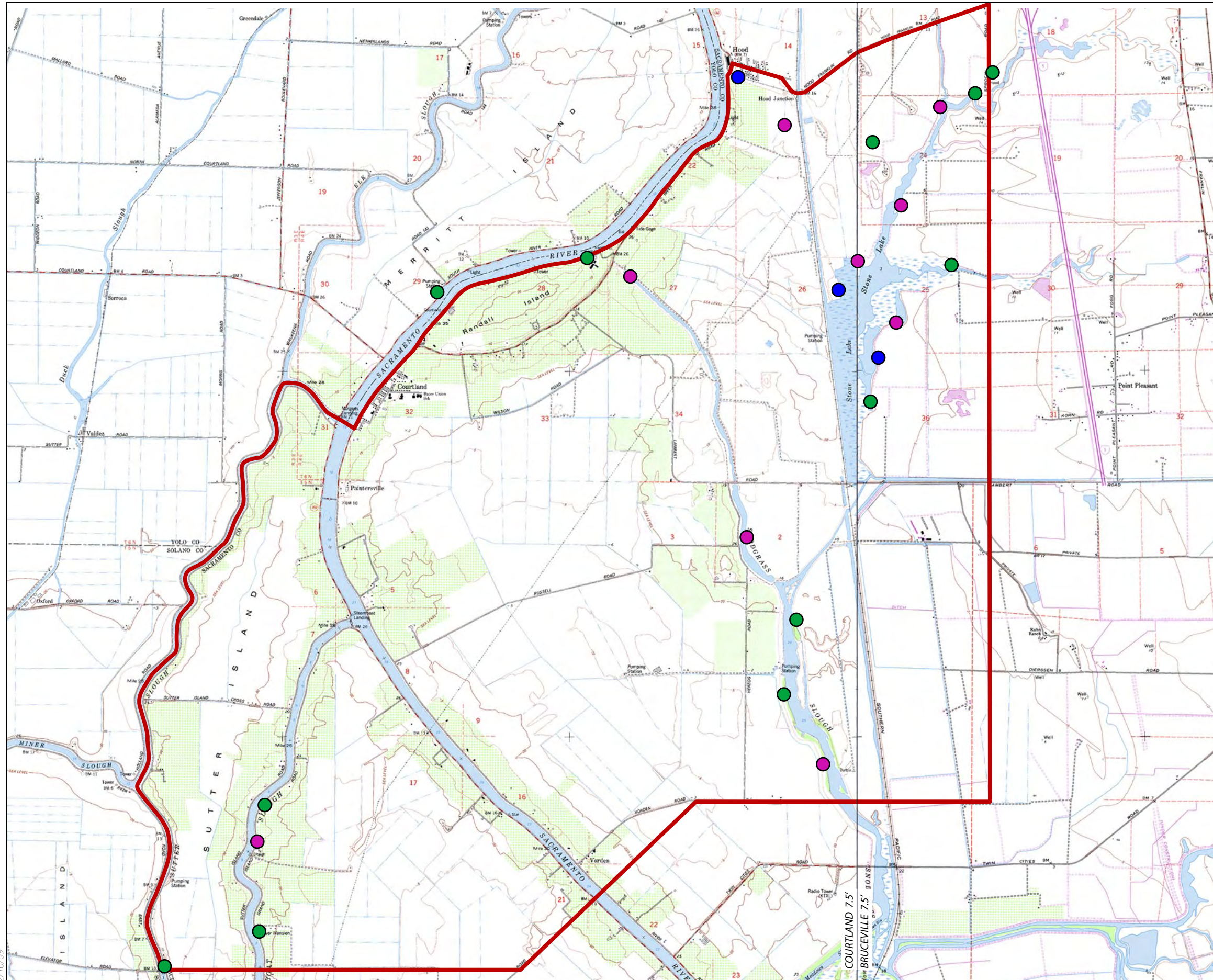
### Description of the Survey Areas

#### Delta Survey Area

The Delta survey area (Figure 3) is within the Delta Zone of the South Sacramento County study area. It is an irregularly-shaped area west of Interstate 5 and south of Hood-Franklin Road. From the northeast corner, the survey area boundary follows Hood-Franklin Road west to the Sacramento River. From that point, the boundary follows the county line southwest along the Sacramento River to Sutter Slough where it continues southward for approximately 0.7 miles before turning eastward. The boundary continues eastward across Steamboat Slough until it reaches Leary Road. The boundary continues northeast along Leary Road to the Sacramento River, then continues across the river to Vorden Road, where it continues eastward for 1.2 miles and then turns due north toward Hood-Franklin Road.

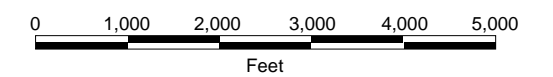
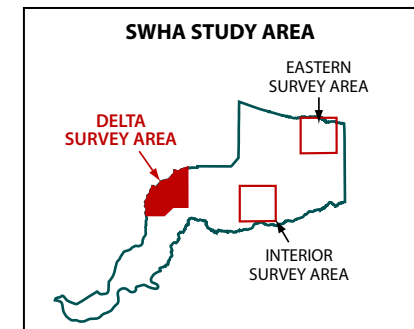
Several large watercourses border or extend through the Delta Survey Area including the Sacramento River, Sutter Slough, Steamboat Slough, Snodgrass Slough, and Stone Lake. The survey area consists primarily of intensively-farmed irrigated croplands, including a variety of annually rotated grain and row crops, alfalfa and other hay crops, vineyards, and orchards, which are common along the edges of the major watercourses (Refer to Estep 2007). The Delta Survey Area supports the highest proportion of orchards and vineyards of the three survey areas. There are also some areas, particularly east of Stone Lake and north of Lambert Road, that consist largely of grazed irrigated pastureland. Other than a very small urban area associated with the town of Hood in the far northwest corner and scattered rural residences, there is no urban development within the Delta Survey Area.

**Figure 3**  
**Delta Survey Area**



**LEGEND**

- 2008 Survey Area Boundary
- Swainson's hawk
- Red-tailed hawk
- Red-shouldered hawk



Base Map: USGS 7.5'-Series Bruceville (1968, PR 1980) and Courtland (1978, Rev. 1993) Quadrangles

With the exception of orchards and vineyards, the Delta Survey Area generally supports high value Swainson's hawk foraging habitat in the form of irrigated croplands and irrigated pasturelands (Plates 1 and 2).

Potential nesting habitat in the Delta Survey Area consists primarily of riparian woodland found along the major watercourses. The most extensive riparian woodlands occur along the edges of Stone Lake and portions of Snodgrass Slough. Additional potential nesting habitat includes roadside trees, trees associated with rural residences and farmyards, trees along fence rows and irrigated ditches, and occasional isolated trees (Plates 3 and 4).



*Plate 1. Irrigated cropland (corn and alfalfa) in the Delta Survey Area.*



*Plate 2. Irrigated pasture in the Delta Survey Area.*



*Plate 3. Riparian along Stone Lake with alfalfa field in foreground.*

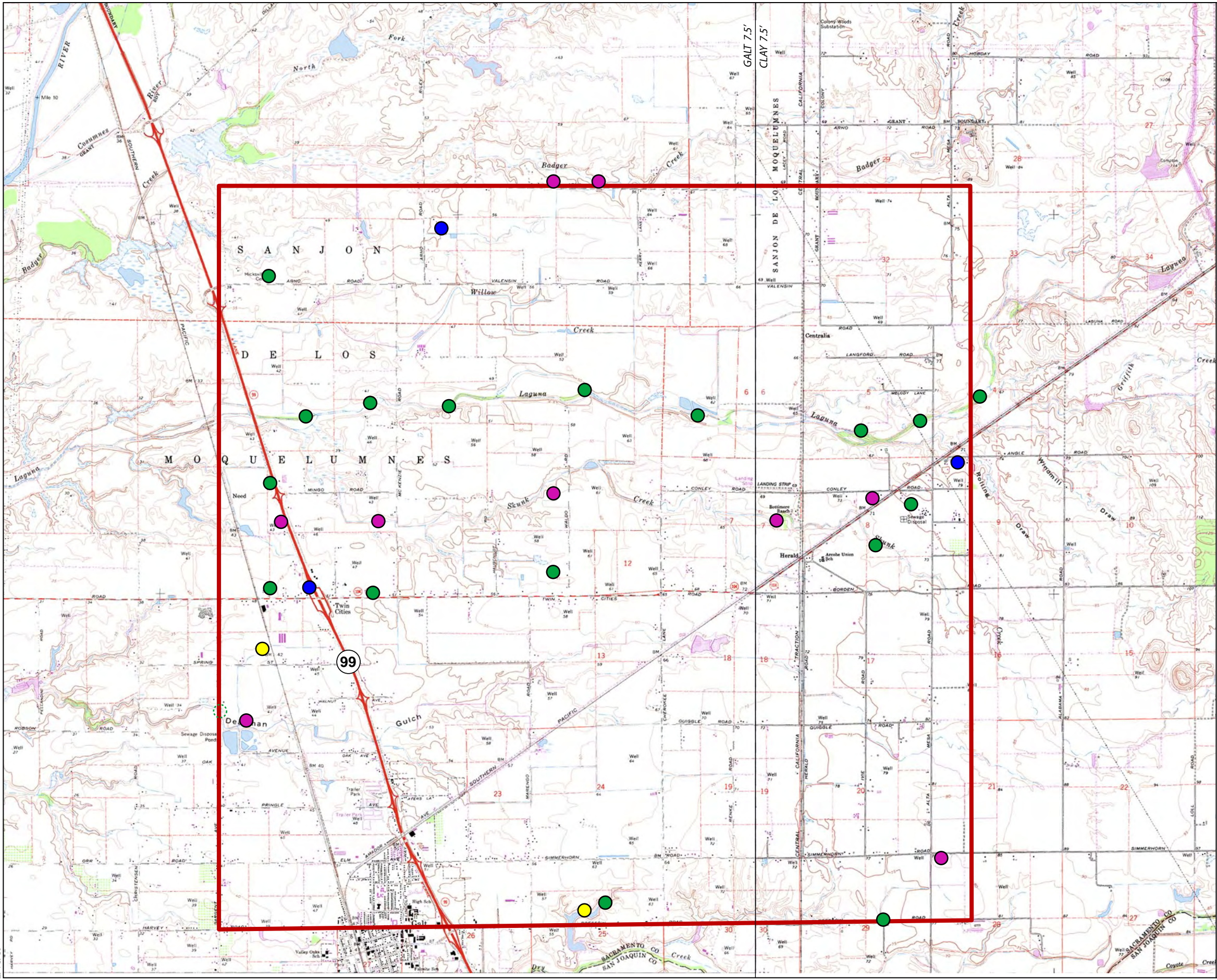


*Plate 4. Eucalyptus tree windbreak in farmyard near Stone Lake.*

### **Interior Survey Area**

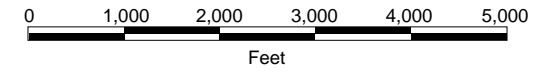
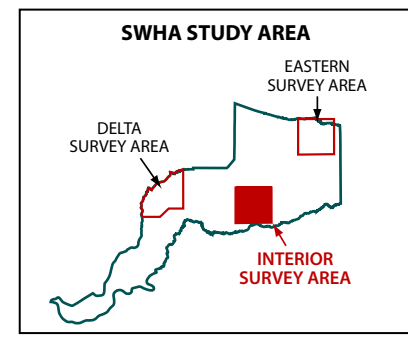
The Interior Survey Area (Figure 4) is within the Interior Zone of the South Sacramento County study area. The survey area is a six-by-six-mile township-sized area in the south-central portion of Sacramento County. The northern boundary is partially defined by Arno Road and extends westward to 0.25 miles east of State Route 99 and eastward to

**Figure 4**  
**Interior Survey Area**



**LEGEND**

- 2008 Survey Area Boundary
- Swainson's hawk
- Red-tailed hawk
- Red-shouldered hawk
- White-tailed kite



Base Map: USGS 7.5'-Series Galt (1968, PR 1980) and Clay (1978, Rev. 1993) Quadrangles



0.25 miles east of Alta Mesa Road. From the southwest corner, the western boundary extends northward along Sargent Avenue and Midway Road. The southern boundary is Harvey Road west of State Route 99 and Boessow Road east of State Route 99, and the eastern boundary extends along a north-south line 0.25 miles east of Alta Mesa Road.

The Interior Survey Area is characterized by a mixture of irrigated croplands and irrigated pasturelands (Plates 5 and 6). This area is less intensively cultivated than the Delta Survey Area, supporting large areas of grazed irrigated pastures as well as numerous smaller irrigated pastures around rural residences. A portion of the northwest corner consists of uncultivated grazed grasslands just south of Badger Creek. Much of the southwest corner is urbanized around the City of Galt, and compared with the Delta and Eastern Foothill Survey Areas, the Interior Survey Area supports a higher density of rural residential development (Refer to Estep 2007). One major watercourse, Laguna Creek, extends east-west through the northern portion of the survey area. Several smaller drainages, including Deadman Gulch and Skunk Creek, also extend through portions of the survey area.

With the exception of the high density urban areas around Galt, much of the area associated with low-density urban areas, and a vineyard near the northeast corner, the entire survey area is considered suitable Swainson's hawk foraging habitat.

Nesting habitat is relatively abundant in the Interior Survey Area compared with the Delta and Eastern Survey Areas. Potential riparian nesting habitat occurs along Laguna Creek and several small drainages. Roadside trees, small groves, and tree rows occur throughout the area (Plates 7 and 8).



*Plate 5. Irrigated cropland in Interior Survey Area.*



*Plate 6. Irrigated pasture in Interior Survey Area.*



*Plate 7. Alfalfa field with row of cottonwood trees along field border south of Simmerhorn Road.*



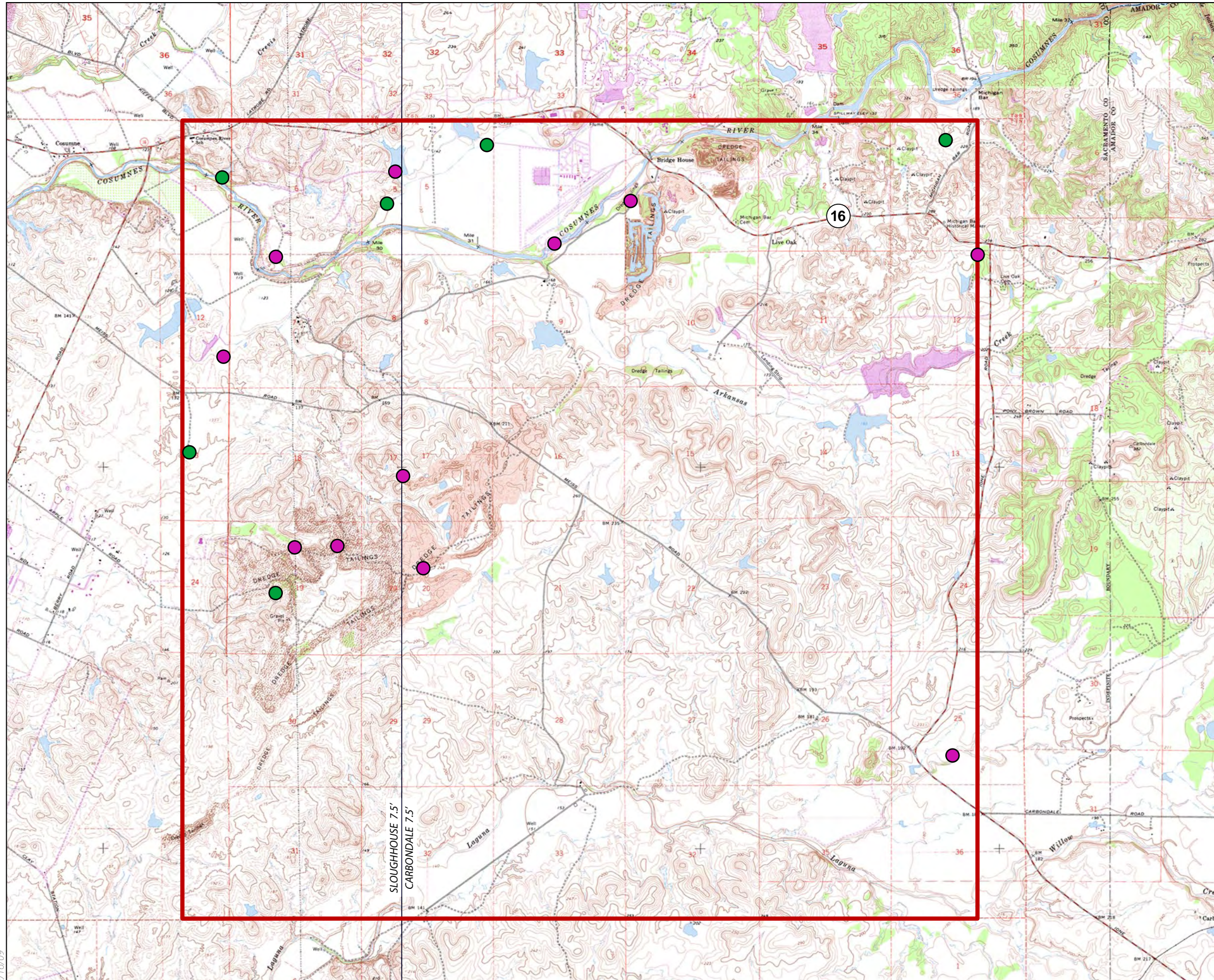
*Plate 8. Roadside eucalyptus tree row along Marengo Road near Galt.*

### **Eastern Survey Area**




The Eastern Survey Area (Figure 5) is within the Eastern Foothill Zone of the South Sacramento County Study Area. It is 36-square-mile block located in the northwest corner of the study area. The northwest corner of the survey area is approximately 0.3 miles northeast of the Highway 16 and Dillard Road intersection. The western border extends 6 miles due south from the northwest corner. The northern border extends roughly along Highway 16, which is the northern border of the South Sacramento County Study Area; but continues north of the highway due eastward to the northeast corner. Thus, a small portion of the survey area (less than 10 percent) is outside of the South Sacramento County Study Area. The northeast corner is at approximately Michigan Bar Road 0.8 miles north of Highway 16. The eastern border generally follows Ione Road to approximately the Laguna Creek/Willow Creek confluence. The southern border extends 6 miles due west from this confluence.

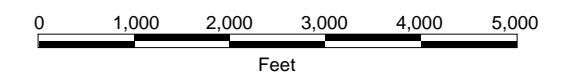
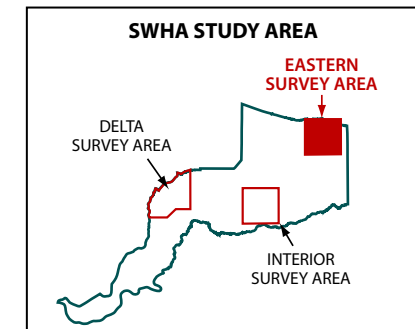
The Eastern Survey Area is characterized primarily by rolling hills with open uncultivated grasslands (Plate 9). The Cosumnes River extends east-west across the northern portion of the survey area and Laguna Creek extends through much of the southern portion of the survey area. Cattle grazing is the principal land use throughout the survey area. However, patches of irrigated croplands occur in the Cosumnes River and Laguna Creek floodplains. A large patch of dredge tailings from early mining activity extends northeast to southwest across the survey area from the Cosumnes River to the southwest corner of the survey area. While the majority of the survey area is open, mostly treeless grassland, cottonwood groves have developed in association with the dredge tailings and scattered valley oak trees occur throughout much of the survey area but primarily in the southeast corner (Plates 10 and 11). In addition, the Cosumnes River supports mature cottonwood/valley oak riparian forest and Laguna Creek supports intermittent trees along its length (Plate 12).

**Figure 5**  
**Eastern Survey Area**



**LEGEND**

-  2008 Survey Area Boundary
-  Swainson's hawk
-  Red-tailed hawk



Base Map: USGS 7.5'-Series Sloughouse (1968, PR 1980)  
and Carbondale (1978, Rev. 1993) Quadrangles



*Plate 9. Uncultivated grasslands along Meiss Road.*



*Plate 10. Uncultivated grasslands with patch of cottonwood trees in dredge tailings.*



*Plate 11. Valley oak savannah in southeast corner of Eastern Survey Area.*



*Plate 12. Patch of cottonwood/oak riparian woodland along Laguna Creek.*

## **Distribution and Abundance**

### **Delta Survey Area**

Figure 3 illustrates the distribution of Swainson's hawk territories in the Delta Survey Area in 2008. Table A-1 (Appendix A) provides the location, activity, habitat association, and reproductive data for each territory. Table 1 summarizes activity data.

A total of 13 active Swainson's hawk territories were identified. All 13 were confirmed to have nested, and of the active nests, ten (76.9%) successfully reared young to fledging. Similar to the 2006 baseline survey, nests were concentrated along the major watercourses, where most of the available nesting habitat exists.

**Table 1. Activity Data for Swainson’s Hawk Nesting Territories within the South Sacramento County Study Area, Delta Survey Area, 2008.**

	Number	Percent of Total Active Territories	Percent of Total Active Nests
Active Territories	13		
Not Nesting (NN)	0		
Unknown Nesting (UN)	0		
Active Nests (S, U, UO)	13	100	
Successful Nests (S)	10		76.9
Unsuccessful Nests (U)	2		15.4
Unknown Outcome (UO)	1		7.7
Total		100	100

Fourteen active territories were identified within the Delta Survey Area during the 2006 baseline survey. Five of these were not active in 2008. Of the 13 active territories identified in 2008, nine were active in 2006 and four were new locations not recorded in 2006.

Territory density was similar within the Delta Survey Area in 2006 (0.39 territories per square mile) and 2008 (0.36 territories per square mile), and was higher than the territory density for the Delta Zone in 2006 (0.27 territories per square mile).

In general, the distribution and abundance of Swainson’s hawks within the Delta Survey Area is similar to 2006 baseline survey. No significant changes have occurred in terms of the distribution and abundance of the species, land uses, or land management.

### Interior Survey Area

Figure 4 illustrates the distribution of Swainson’s hawk territories in the Interior Survey Area in 2008. Table A-2 (Appendix A) provides the location, activity, habitat association, and reproductive data for each territory. Table 2 summarizes activity data.

**Table 2. Activity Data for Swainson’s Hawk Nesting Territories within the South Sacramento County Study Area, Interior Survey Area, 2008.**

	Number	Percent of Total Active Territories	Percent of Total Active Nests
Active Territories	18		
Not Nesting (NN)	0		
Unknown Nesting (UN)	0		
Active Nests (S, U, UO)	18	100	
Successful Nests (S)	13		72.2
Unsuccessful Nests (U)	2		11.1
Unknown Outcome (UO)	3		16.7
Total		100	100

A total of 18 active Swainson’s hawk territories were identified in the Interior Survey Area. All 18 were confirmed to have nested, and of the active nests 13 (72.2%) successfully reared young to fledging. Similar to the 2006 baseline survey, nests were concentrated along Laguna Creek, and along roadsides, tree rows, and isolated trees. The abundance and diversity of nesting habitat is greater in the Interior Survey Area compared with the Delta and Eastern Survey Areas.

Twenty-three active territories were identified within the Interior Survey Area during the 2006 baseline survey. Nine of these were not active in 2008. Of the 18 active territories identified in 2008, 14 were active in 2006 and four were new locations not recorded in 2006.

Territory density was lower within the Interior Survey Area in 2008 (0.50 territories per square mile) than in 2006 (0.64 territories per square mile), but is only slightly lower than the density for the Interior Zone in 2006 (0.56 territories per square mile).

The distribution of Swainson’s hawk territories within the Interior Survey Area is generally similar to 2006 baseline survey; however, the number of active territories declined by 22 percent. Consistent with the 2006 baseline survey results, the Interior Survey Area supported the highest nesting density of the three survey areas. While there has been some additional urban development around the City of Galt and some additional rural development, there have been no significant land use changes within the survey area that could be directly attributed to the reduction in active territories. Instead, differences between these survey results and the 2006 baseline results are likely attributable to local movements of breeding pairs and annual variation in nesting activity.

### Eastern Survey Area

Figure 5 illustrates the distribution of Swainson’s hawk territories in the Eastern Survey Area in 2008. Table A-3 (Appendix A) provides the location, activity, habitat association, and reproductive data for each territory. Table 3 summarizes activity data.

**Table 3. Activity Data for Swainson’s Hawk Nesting Territories within the South Sacramento County Study Area, Eastern Survey Area, 2008.**

	Number	Percent of Total Active Territories	Percent of Total Active Nests
Active Territories	6		
Not Nesting (NN)	0		
Unknown Nesting (UN)	0		
Active Nests (S, U, UO)	6	100	
Successful Nests (S)	5		83.3
Unsuccessful Nests (U)	1		16.7
Unknown Outcome (UO)	0		0.0
Total		100	100

A total of 6 active Swainson’s hawk territories were identified in the Interior Survey Area. All 6 were confirmed to have nested, and of the active nests 5 (83.3%) successfully reared young to fledging. Similar to the 2006 baseline survey, most nests were concentrated along the Cosumnes River floodplain. Four of the six sites were associated with riparian habitat, one in an isolated tree, and one in a cottonwood grove.

Four active territories were identified within the Interior Survey Area during the 2006 baseline survey, three of which were not active in 2008. Of the six active territories identified in 2008, 2 were active in 2006 and four were new locations not recorded in 2006.

Territory density was higher within the Interior Survey Area in 2008 (0.17 territories per square mile) than in 2006 (0.11 territories per square mile), and higher than the density for the Interior Zone in 2006 (0.09 territories per square mile).

While two additional nesting territories were identified in 2008, in general the distribution and abundance of Swainson’s hawks within the Eastern Survey Area is similar to 2006 baseline survey. Also, consistent with the 2006 baseline survey results, the Eastern Survey Area supports the lowest nesting density of the three survey areas. No significant changes have occurred in terms of the distribution and abundance of the species, land uses, or land management.

**Combined Data**

Table 4 summarizes the combined data for the three survey areas. A total of 37 active territories were identified. All 37 were confirmed to have nested, and of the active nests 28 (75.7%) successfully reared young to fledging.

**Table 4. Activity Data for Swainson’s Hawk Territories within the South Sacramento County Study Area; Combined Data for the Delta, Interior, and Eastern Survey Areas, 2008.**

	<b>Number</b>	<b>Percent of Total Active Territories</b>	<b>Percent of Total Active Nests</b>
Active Territories	37		
Not Nesting (NN)	0		
Unknown Nesting (UN)	0		
Active Nests (S, U, UO)	37	100	
Successful Nests (S)	28		75.7
Unsuccessful Nests (U)	5		13.5
Unknown Outcome (UO)	4		10.8
Total		100	100

Territory density was similar within the combined survey areas (0.34 territories per square mile) to the 2006 baseline survey (0.37 territories per square mile). Distribution and abundance has not changed significantly, and observed changes may be attributed to local movements of breeding pairs and annual differences in activity patterns.

## **Habitat Associations**

### **Land Use/Foraging Habitat**

Consistent with the 2006 baseline survey, habitat associations were evaluated on the basis of land use/cover type categories within a one-half mile radius of each nest. This was done to characterize foraging habitat associations in the immediate vicinity of nest sites and to characterize land use patterns associated with nest site selection.

**Delta Survey Area.** The general land use pattern in the Delta Survey Area consists primarily of intensively-farmed irrigated cropland. Irrigated pasturelands occur in the area east of Stone Lake and orchards and vineyards are common along the edges of the major watercourses. Urbanization within the survey area consists of widely scattered rural residences and has little influence on Swainson's hawk distribution and abundance or habitat use. The entire survey area with the exception of orchards, vineyards, and open water areas (i.e., Stone Lake) represent suitable foraging habitat for Swainson's hawks.

All 13 nest sites in the Delta Survey Area were associated with irrigated cropland. Three were also associated with irrigated pasturelands in the vicinity of Stone Lake. Because orchards and vineyards were common along the edges of the major watercourses where most nesting habitat occurs in the Delta Survey Area, seven of the 13 sites were also associated with either orchards or vineyards. One site was associated with a rural residence and one with open water at Stone Lake (Table 5).

**Interior Survey Area.** The general land use pattern in the Interior Survey Area consists predominantly of a mixture of irrigated pastures and irrigated croplands, both considered high value Swainson's hawk foraging habitat types. The extent of irrigated pasturelands intermixed with irrigated farmland in the Interior Zone resulted in these types being combined during the 2006 baseline survey into a single land use/cover type: irrigated cropland/irrigated pastureland. The entire survey area, with the exception of urban areas in and around the City of Galt and some low-density residential areas, and a vineyard near the northeast corner of the survey area, represent suitable foraging habitat for Swainson's hawks.

Sixteen of the eighteen territories in the Interior Survey Area and 51.4 percent of all territories were associated exclusively with the irrigated cropland/irrigated pasture type (Table 5). Two sites were also associated with urban development.

**Eastern Survey Area.** The general land use pattern in the Eastern Survey Area consists predominantly of uncultivated grazed grasslands. Irrigated cropland and irrigated



pastures are restricted mainly to the floodplains of the Cosumnes River in the northern portion of the survey area and Laguna Creek in the southern portion of the survey area. With the exception of a vineyard in the northwest corner of the survey area, the entire survey area is considered suitable Swainson’s hawk foraging habitat.

All six nesting territories in the Eastern Survey Area were associated with uncultivated grasslands, three of which were also associated with irrigated croplands (Table 5).

**Table 5. Land Use/Habitat Associations within a one-half mile radius around Swainson’s Hawk Nest Sites, South Sacramento County Study Area, 2008.**

Habitat Association	Number of Territories				Percent of Total
	Delta	Interior	Eastern	Total	
IC	1			1	2.7
IC/IP	3	16		19	51.4
IC/O	5			5	13.5
IC/V	2			2	5.4
IC/IP/RR	1			1	2.7
IC/IP/U		1		1	2.7
IC/IP/OW	1			1	2.7
IC/IP/RR/U		1		1	2.7
UG			3	3	8.1
UG/IC			2	2	5.4
UG/IC/IP			1	1	2.7
Total	13	18	6	37	100

Key: IC – Irrigated Cropland; IP – Irrigated Pasture; O – Orchard; V – Vineyard; RR – Rural Residential; U – Urban; OW – Open Water; UG – Uncultivated Grassland;

Land use/habitat associations were similar to the results in the 2006 baseline survey, particularly the predominant association with irrigated cropland/irrigated pastureland type (55.3% were associated with this type in 2006 and 51.4% were associated with this type during this survey [Table 5]). Also, the 2006 baseline report did not differentiate orchards and vineyards from irrigated cropland, as is done in Table 5. When these types are combined, the results (21.6%) are also similar to the 2006 baseline report (20.7%).

### Nesting Habitat

Table 6 indicates the nesting habitat associations of each Swainson’s hawk nesting territory. Consistent with the results from the 2006 baseline survey (62.8%), the majority of sites were associated with riparian habitat (55.6%). The associations with other nesting habitat types were also generally similar to the 2006 baseline survey results.

**Table 6. Nesting Habitat Associations of Swainson’s Hawk Territories in the South Sacramento County Study Area, 2008**

Nesting Habitat Type	Number of Territories				Percent of Total
	Delta	Interior	Eastern	Total	
Riparian	7	10	3	20	55.6
Channelized Riparian			1	1	2.8
Roadside Tree	2	1		3	8.3
Roadside Tree Row	2	1		3	8.3
Tree Row	1	2		3	8.3
Isolated Tree		1	1	2	5.6
Rural Residential	1			1	2.8
Mixed Grove		1		1	2.8
Eucalyptus Grove		1		1	2.8
Cottonwood Grove			1	1	2.8
Total	13	17	6	36	100

Table 7 indicates the tree species used by nesting Swainson’s hawks. Consistent with the 2006 baseline survey, cottonwood (27.8%) and valley oak (25.0%) are used predominantly. However, eucalyptus is also an increasingly important nest tree species for Swainson’s hawks comprising 25% of all nest trees (Table 7), compared with 15.1 percent in 2006 (Estep 2007) (Plates 13 through 17).

**Table 7. Nest Tree Species used by Nesting Swainson’s Hawks in the South Sacramento County Study Area, 2008.**

Tree Species	Number of Active Nest Sites				Percent of Total
	Delta	Interior	Eastern	Total	
Cottonwood	6	1	3	10	27.8
Valley Oak	1	7	1	9	25.0
Eucalyptus	3	5	1	9	25.0
Willow	2	2	1	5	13.9
Walnut		1		1	2.8
Locust		1		1	2.8
Redwood	1			1	2.8
Total	13	17	6	36	100



*Plate 13. Nest tree of SWHA D-3, cottonwood tree along tree row, Delta Survey Area.*



*Plate 14. Nest of SWHA D-3, Delta Survey Area.*



*Plate 15. Nest site of SWHA D-2, willow tree in riparian habitat, Delta Survey Area.*



*Plate 16. Nest tree of SWHA I-17, roadside eucalyptus tree, Interior Survey Area.*



*Plate 17. Nest of SWHA E-2, valley oak tree in riparian habitat, Eastern Survey Area.*

## **Reproduction**

Reproductive performance is calculated on the basis of the number of fledged young. While data are collected on the number of nestlings at various ages, these data are inconsistent due to the inability to observe nests sufficiently to confirm the number of nestlings from all nests at various stages of the breeding cycle. Data on the number of eggs per nest are also not calculated because of the risk of nest abandonment during the sensitive incubation phase of the breeding cycle. Reproductive data are presented in Table 8.

A total of 37 fledged young were recorded. This equates to 1.6 young per successful nest, which is higher than that reported for the 2006 baseline survey (1.46 young per successful nest).

**Table 8. Reproductive Performance of Swainson’s Hawks in the South Sacramento County Study Area, 2008.**

	<b>Delta</b>	<b>Interior</b>	<b>Eastern</b>	<b>Total</b>	
Active Nests (S, U, UO)	13	18	6	37	
Successful Nests (S)	10	13	5	28	
Unsuccessful Nests (U)	2	2	1	5	
Unknown Outcome (UO)	1	3	0	4	
Number of Young	16	21	8	45	
Total Number of Young					45
Number of Young per Nesting Attempt (S+U)					1.22
Number of Young per Successful Nest					1.61

### **Distribution and Abundance of Other Nesting Raptors**

Figures 4 through 6 illustrate the locations of other diurnal stick-nest-building raptors in the survey areas. Tables A-4 through A-6 (Appendix A) provides the location, activity, habitat association, and reproductive data for each territory. Distribution and abundance of other raptors is similar to that reported in the 2006 baseline survey. Active sites for red-shouldered hawk, white-tailed kite, and great-horned owl are likely under-reported due to some access restrictions within the survey areas, particularly along riparian corridors where these species are likely to occur and are less detectable from offsite vantage points due to their behavior and concealed nest site locations compared with Swainson’s hawk and red-tailed hawk. Detectability of red-tailed hawk is similar to Swainson’s hawk and the data sets for these species are more comparable and relevant due to similar habitat selection and use between the two species. Consistent with the 2006 baseline report, Table 9 compares combined activity data of Swainson’s hawks and red-tailed hawks in the three survey areas.

Similar to results from the 2006 baseline survey, nesting Swainson’s hawks were more common in the combined survey area than red-tailed hawks by approximately 20 percent; however, red-tailed hawks were more common in the Eastern Survey Area than Swainson’s hawks. Also consistent with the 2006 results, reproductive performance (number of young per successful nest) was higher among red-tailed hawks than Swainson’s hawks.

**Table 9. Comparison of Activity and Reproductive Data for Swainson’s Hawk and Red-tailed Hawk within the South Sacramento County Study Area: Combined Data for the Delta, Interior, and Eastern Survey Areas, 2008.**

	Swainson’s Hawk			Red-tailed Hawk		
	No.	Percent of Active Nesting Territories	Percent of Total Active Nests	No.	Percent of Active Nesting Territories	Percent of Total Active Nests
Active Territories	37			29		
Not Nesting (NN)	0			0	0	
Unknown Nesting (UN)	0			0		
Active Nests (S, U, UO)	37	100		29	100	
Successful Nests (S)	28		75.7	21		72.4
Unsuccessful Nests (U)	5		13.5	2		6.9
Unknown Outcome(UO)	4		10.8	6		20.7
Total number of young	45			39		
Young per nesting attempt	1.22			1.34		
Young per successful nest	1.61			1.86		
Total		100	100		100	100

## Conclusions and Recommendations

Results of the 2008 survey suggest that the distribution and abundance of the South Sacramento County Swainson’s hawk nesting population has not changed significantly since the 2006 baseline survey and that differences between the two survey years are likely attributable to annual variation in nesting activity. Additional years of monitoring will be required in order to detect trends in the distribution and abundance of this population, to assess the effects of additional urbanization and other land use changes within the study area, and to assess the effectiveness of conservation activities.

### Recommendations

1. Continue to monitor the South Sacramento County Swainson’s hawk nesting population sufficient to detect trends in the population and to monitor and assess the effectiveness of conservation activities.
2. Monitor the population according to a consistent time interval and using randomly selected sampling plots stratified by the geographic areas identified in the baseline survey report.
3. Strategize preserve acquisition efforts with the goal of sustaining the existing Swainson’s hawk population levels in South Sacramento County. This requires a broad landscape vision that considers long-term land use patterns, land

- management, and understanding of the species at the site-specific and landscape levels.
4. Consolidate planned urbanization to reduce fragmentation of agricultural landscapes.

## Literature Cited

- California Department of Fish and Game (CDFG). 1994. Staff Report Regarding Mitigation for Impacts to Swainson's Hawks (*Buteo swainsoni*) in the Central Valley of California. California Department of Fish and Game, Sacramento, CA.
- Estep, J.A. 2007. The Distribution, Abundance, and Habitat Associations of the Swainson's Hawk (*Buteo swainsoni*) in South Sacramento County. Prepared by Estep Environmental Consulting for the City of Elk Grove.



## **Appendix A. Swainson's Hawk and Other Raptor Data**

**Table A-1. Swainson's Hawk Nesting Territories within the South Sacramento County Study Area, Delta Survey Area, 2008.**

<b>Territory Number</b>	<b>Quad Map</b>	<b>Location</b>	<b>Lat-long</b>	<b>Status</b>	<b>Nesting Habitat</b>	<b>Nest Tree Species</b>	<b>Land Use Association</b>	<b>Number of Young</b>
SWHA-D1	Bruceville	Sprock Rd at Stone Lake	38 22.012/121 28.912	F	Roadside Tree	Eucalyptus	IC/IP	0
SWHA-D2	Bruceville	W of Sprock Rd at Stone Lake	38 21.872/121 29.038	S	Riparian	Willow	IC/IP/RR	1
SWHA-D3	Bruceville	0.8mi S Hood-Franklin, W of Stone Lake	38 21.559/121 29.915	S	Tree Row	Cottonwood	IC	1
SWHA-D4	Bruceville	Stone Lake, 1mi S of Hood-Franklin	38 21.388/121 29.630	F	Riparian	Cottonwood	IC/IP	0
SWHA-D5	Bruceville	Stone Lake, 2 mi S of Hood-Franklin	38 20.719/121 29.254	S	Riparian	Cottonwood	IC/IP	2
SWHA-D6	Bruceville	Stone Lake, 0.6 mi N of Lambert	38 19.790/121 29.950	S	Riparian	Willow	IC/IP/OW	2
SWHA-D7	Courtland	E side Sacramento R on Randall Island	38 20.804/121 32.237	S	Rural Residential	Redwood	IC/O	2
SWHA-D8	Courtland	W side Sacramento R at County Road 143	38 20.561/121 33.703	UO	Roadside Tree	Cottonwood	IC/O	
SWHA-D9	Courtland	Steamboat Slough, 1.5 mi S of Sacramento R.	38 17.046/121 35.232	S	Roadside Tree Row	Eucalyptus	IC/O	1
SWHA-D10	Courtland	Steamboat Slough, 2.2 mi S of Sacramento R.	38 16.115/121 35.276	S	Roadside Tree Row	Eucalyptus	IC/O	2
SWHA-D11	Courtland	Sutter Slough, 0.7 mi N of Steamboat Slough	38 15.935/121 36.100	S	Riparian	Valley Oak	IC/O	2
SWHA-D12	Courtland	Snodgrass Slough, 1.3 mi N of Twin Cities Rd	38 17.813/121 30.682	S	Riparian	Cottonwood	IC/V	2
SWHA-D13	Courtland	Snodgrass Slough, 2.0 mi N of Twin Cities Rd	38 18.291/121 30.601	S	Riparian	Cottonwood	IC/V	1

Key: S – Successful; F – Failed; UO – Unknown Outcome; IC – Irrigated Cropland; IP – Irrigated Pasture; RR – Rural Residential; OW – Open Water; O – Orchard; V - Vineyard

**Table A-2. Swainson's Hawk Nesting Territories within the South Sacramento County Study Area, Interior Survey Area, 2008.**

<b>Territory Number</b>	<b>Quad Map</b>	<b>Location</b>	<b>Lat-long</b>	<b>Status</b>	<b>Nesting Habitat</b>	<b>Nest Tree Species</b>	<b>Land Use Association</b>	<b>Number of Young</b>
SWHA-I1	Galt	Hicksville Cemetery, Arno Road	38 19.590/121 19.139	S	Grove	Locust	IC/IP	2
SWHA-I2	Galt	Laguna Creek, 0.8mi W of McKenzie Road	38 18.646/121 18.867	S	Riparian	Valley Oak	IC/IP	1
SWHA-I3	Galt	Laguna Creek, 0.3mi W of McKenzie Road	38 18.749/121 18.278	S	Riparian	Valley Oak	IC/IP	2
SWHA-I4	Galt	Laguna Creek, 0.4mi E of McKenzie Road	38 18.722/121 17.638	S	Riparian	Walnut	IC/IP	2
SWHA-I5	Galt	Laguna Creek, 1.5mi E of McKenzie Road	38 18.807/121 16.482	UO	Riparian	Valley Oak	IC/IP	
SWHA-I6	Galt	Laguna Creek, 2.3mi E of McKenzie Road	38 18.655/121 15.547	UO	Riparian	Valley Oak	IC/IP	
SWHA-I7	Galt	W. side of Hwy99 at Mingo Road	38 18.197/121 19.121	S	Roadside Eucalyptus Grove	Eucalyptus	IC/IP	1
SWHA-I8	Galt	0.3mi W Hwy99, 0.1mi N of Twin Cities Rd	38 17.581/121 19.143	S	Tree Row	Eucalyptus Snag	IC/IP/U	2
SWHA-I9	Galt	Twin Cities Road, 0.4mi E of Hwy99	38 17.488/121 18.297	S	Roadside Tree Row	Eucalyptus	IC/IP/RR/U	1
SWHA-I10	Galt	Northwest of Twin Cities and Waldo Road	38 17.573/121 16.736	F	Tree Row	Eucalyptus	IC/IP	0
SWHA-I11	Galt	0.2mi N of Boessow Rd 0.5mi E of Marengo Rd	38 15.438/121 16.333	S	Riparian	Willow	IC/IP	2
SWHA-I12	Clay	Laguna Creek, 0.6mi W of Alta Mesa	38 18.552/121 14.224	S	Riparian	Valley Oak	IC/IP	2
SWHA-I13	Clay	Laguna Creek, 0.1mi W of Alta Mesa	38 18.634/121 13.680	S	Riparian	Valley Oak	IC/IP	1
SWHA-I14	Clay	Laguna Creek, 0.3mi E of Alta Mesa	38 18.749/121 13.270	UO	Riparian	Valley Oak	IC/IP	
SWHA-I15	Clay	SW of Conley Road and Alta Mesa	38 18.059/121 13.796	F	Isolated Tree	Cottonwood	IC/IP	0
SWHA-I16	Clay	Skunk Creek, 0.4mi N of Borden Road	38 17.816/121 14.034	S	Riparian	Willow	IC/IP	2

SWHA-I17	Clay	Boessow Road, 0.4mi W of Alta Mesa	38 15.329/121 13.982	S	Isolated Roadside Tree	Eucalyptus	IC/IP	2
SWHA-I18	Galt	N of Boessow Road, W of Marengo Road	38 15.356/121 17.216	S	Unconfirmed	Unconfirmed	IC/IP	1

Key: S – Successful; F – Failed; UO – Unknown Outcome; IC – Irrigated Cropland; IP – Irrigated Pasture; RR – Rural Residential; U - Urban

**Table A-3. Swainson’s Hawk Nesting Territories within the South Sacramento County Study Area, Eastern Survey Area, 2008.**

<b>Territory Number</b>	<b>Quad Map</b>	<b>Location</b>	<b>Lat-long</b>	<b>Status</b>	<b>Nesting Habitat</b>	<b>Nest Tree Species</b>	<b>Land Use Association</b>	<b>Number of Young</b>
SWHA-E1	Sloughhouse	Cosumnes River, 0.6mi E of Dillard Rd	38 29.373/121 09.044	S	Riparian	Cottonwood	UG/IC	2
SWHA-E2	Sloughhouse	0.2mi S of Hwy 16, 2 mi E of Dillard Rd.	38 29.206/121 07.740	S	Riparian	Valley Oak	UG/IC	2
SWHA-E3	Sloughhouse	0.5mi S of Meiss Rd, 1.3mi E of Dillard Rd	38 27.587/121 09.364	F	Isolated Tree	Eucalyptus	UG	0
SWHA-E4	Sloughhouse	1.4mi S of Meiss Rd, 2.3mi E of Dillard Rd	38 26.658/121 08.593	S	Cottonwood Grove	Cottonwood	UG	2
SWHA-E5	Carbondale	0.2mi S Hwy16, 0.7mi W Lone Pine	38 29.631/121 06.868	S	Channelized Riparian	Cottonwood	UG/IC/IP	1
SWHA-E6	Carbondale	0.2m W Mich.Bar Rd, 0.7mi N Hwy16	38 29.672/121 03.033	S	Riparian	Willow	UG	1

Key: S – Successful; F – Failed; IC – Irrigated Cropland; IP – Irrigated Pasture; UG – Uncultivated Grassland

**Table A-4. Other Raptor Nesting Territories within the South Sacramento Study Area, Delta Survey Area, 2008.**

<b>Territory Number</b>	<b>Quad Map</b>	<b>Location</b>	<b>Lat-long</b>	<b>Status</b>	<b>Nesting Habitat</b>	<b>Nest Tree Species</b>	<b>Land Use Association</b>	<b>Number of Young</b>
RTHA-D1	Bruceville	Stone Lake, 0.4 mi W of Sprock Road	38 21.821/121 29.390	S	Riparian	Cottonwood	IC/IP	1
RTHA-D2	Bruceville	Stone Lake, 1.3 mi S of Hood-Franklin Road	38 21.095/121 29.738	S	Riparian	Cottonwood	IC/IP	2
RTHA-D3	Bruceville	Stone Lake, 1.3 mi N of Lambert Road	38 20.312/121 29.769	S	Riparian	Cottonwood	IC/IP	2
RTHA-D4	Courtland	0.5mi E Sacramento R, 0.3mi S Hood-Franklin	38 21.702/121 30.694	S	Riparian	Cottonwood	IC/IP/O	2
RTHA-D5	Courtland	Snodgrass Slough, 0.3 mi E of Sacramento R.	38 20.637/121 32.055	S	Riparian	Cottonwood	IC/O	2
RTHA-D6	Courtland	Snodgrass Slough, 0.4 mi S of Lambert Road	38 18.878/121 31.021	S	Riparian	Willow	IC/V	2
RTHA-D7	Courtland	Snodgrass Slough, 0.8 mi N of Twin Cities Rd	38 17.309/121 30.329	S	Riparian	Cottonwood	IC	2
RTHA-D8	Courtland	Steamboat Slough, 1.8 mi S of Sacramento R.	38 16.837/121 35.302	S	Roadside Tree Row	Eucalyptus	IC/O	1
RTHA-D9	Bruceville	Stone Lake, 1.8mi N of Lambert Road	38 20.773/121 30.028	S	Riparian	Cottonwood	IC/IP	2
RSHA-D1	Bruceville	Stone Lake, 1.2mi N of Lambert Road	38 20.209/121 29.901	S	Riparian	Cottonwood	IC/IP	2
RSHA-D2	Courtland	0.1mi E Sacramento R, 0.2mi S Hood-Franklin	38 21.992/121 31.066	UO	Riparian	Cottonwood	IC/IP/O	
RSHA-D3	Courtland	Stone Lake, 1.5mi N of Lambert Road	38 20.561/121 30.188	UO	Riparian	Cottonwood	IC	

Key: S – Successful; F – Failed; UO – Unknown Outcome; IC – Irrigated Cropland; IP – Irrigated Pasture; RR – Rural Residential; OW – Open Water; O – Orchard; V - Vineyard

**Table A-5. Other Raptor Nesting Territories within the South Sacramento Study Area, Interior Survey Area, 2008.**

<b>Territory Number</b>	<b>Quad Map</b>	<b>Location</b>	<b>Lat-long</b>	<b>Status</b>	<b>Nesting Habitat</b>	<b>Nest Tree Species</b>	<b>Land Use Association</b>	<b>Number of Young</b>
RTHA-I1	Galt	Arno Road, 0.7mi W of Kerry Lane	38 20.188/121 16.814	S	Roadside Tree Row	Eucalyptus	IP/IC	2
RTHA-I2	Galt	Arno Road, 0.4mi W of Kerry Lane	38 20.188/121 16.389	F	Isolated Roadside Tree	Eucalyptus	IP/IC	0
RTHA-I3	Galt	W. side of Hwy99, 0.2mi S of Mingo Road	38 17.991/121 19.031	S	Isolated Roadside Tree	Eucalyptus	IP/IC	1
RTHA-I4	Galt	Skunk Creek, 0.1mi W of McKenzie Road	38 17.971/121 18.215	S	Riparian	Willow	IP/IC	2
RTHA-I5	Galt	Skunk Creek near Waldo Road	38 18.180/121 16.717	S	Eucalyptus Grove	Eucalyptus	IP/IC	2
RTHA-I6	Galt	Deadman Gulch, 0.2mi E of Midway	38 16.628/121 19.404	S	Riparian	Cottonwood	IP/IC/RR	2
RTHA-I7	Clay	Conley and Twin Cities Road	38 18.112/121 14.086	S	Small Eucalyptus Grove	Eucalyptus	IC/IP	2
RTHA-I8	Clay	0.2mi S of Conley, 1.2mi W of Alta Mesa	38 17.957/121 14.828	UO	Tree Row	Eucalyptus	IC/IP	
RTHA-I9	Clay	Simmerhorn Road at Alta Mesa Road	38 15.775/121 13.568	F	Roadside Tree	Eucalyptus	IC/IP	0
RSHA-I1	Galt	W. side of Hwy99 at Twin Cities Road	38 17.537/121 18.815	S	Eucalyptus Grove	Eucalyptus	IP/IC	3
RSHA-I2	Galt	0.1mi E of Arno Rd, 0.4mi N of Valensin	38 19.848/121 17.708	UO	Tree Row	Eucalyptus	IP/IC	
RSHA-I3	Clay	Angle Road at Twin Cities Road	38 18.420/121 13.285	UO	Tree Row	Eucalyptus	IP/IC/U	
WTKI-I1	Galt	0.1mi N of Spring St, 0.3mi E of Midway	38 17.023/121 19.390	S	Channelized Riparian	Cottonwood	IP/IC/RR	3
WTKI-I2	Galt	0.1mi N of Boessow, 0.4mi E of Marengo	38 15.370/121 16.505	S	Riparian	Willow	IP/IC	3

Key: S – Successful; F – Failed; UO – Unknown Outcome; IC – Irrigated Cropland; IP – Irrigated Pasture; RR – Rural Residential

**Table A-6. Other Raptor Nesting Territories within the South Sacramento Study Area, Eastern Survey Area, 2008.**

<b>Territory Number</b>	<b>Quad Map</b>	<b>Location</b>	<b>Lat-long</b>	<b>Status</b>	<b>Nesting Habitat</b>	<b>Nest Tree Species</b>	<b>Land Use Association</b>	<b>Number of Young</b>
RTHA-E1	Sloughhouse	Cosumnes River, 1.5mi E of Dillard	38 28.795/121 08.508	S	Riparian	Cottonwood	IC/UG	2
RTHA-E2	Sloughhouse	0.4mi S of Hwy16, 2mi E of Dillard Rd	38 29.382/121 07.572	S	Riparian	Valley Oak	UG/IC	2
RTHA-E3	Sloughhouse	0.2mi N of Meiss Rd, 1.3mi E of Dillard	38 28.115/121 09.070	S	Isolated Tree	Valley Oak	UG	2
RTHA-E4	Sloughhouse	1.3mi S of Meiss Rd, 2.5mi E of Dillard	38 26.863/121 08.452	S	Transmission Tower	Artificial	UG	2
RTHA-E5	Sloughhouse	1.2mi S of Meiss Rd, 2.7mi E of Dillard	38 26.957/121 08.154	UO	Cottonwood Grove	Cottonwood	UG	
RTHA-E6	Carbondale	Cosumnes River, 1mi SW of Hwy16	38 28.930/121 06.413	S	Riparian	Cottonwood	UG/IC/IP	2
RTHA-E7	Carbondale	Cosumnes River, 0.3 mi SW of Hwy16	38 29.271/121 05.713	S	Riparian	Cottonwood	UG	2
RTHA-E8	Carbondale	Southwest corner of Hwy 16 at Ione Road	38 28.895/121 02.739	UO	Mixed Woodland	Foothill Pine	UG	
RTHA-E9	Carbondale	0.6mi S of Meiss Rd, 3mi E of Dillard Rd	38 27.373/121 07.375	UO	Cottonwood Grove	Cottonwood	UG	

Key: S – Successful; F – Failed; UO – Unknown Outcome; IC – Irrigated Cropland; IP – Irrigated Pasture; UG – Uncultivated Grassland