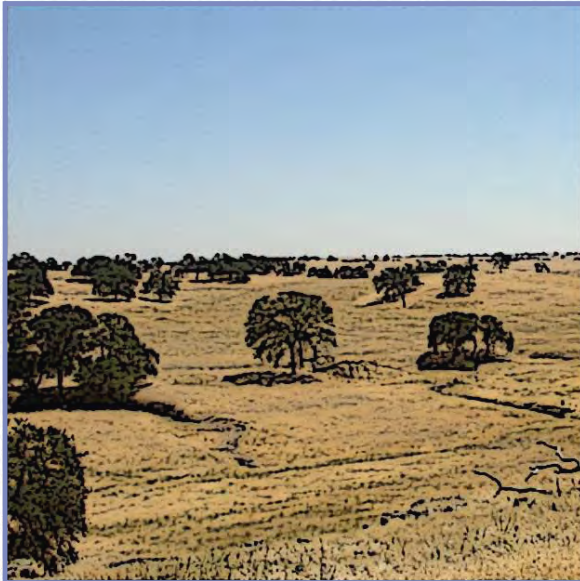


The Distribution, Abundance, and Habitat Associations of Swainson's Hawk (*Buteo swainsoni*) in South Sacramento County

April 2007



Prepared for:



City of Elk Grove
8401 Laguna Palms Way
Elk Grove, California 95758

Prepared by:

ESTEP



*Environmental
Consulting*

**The Distribution, Abundance, and Habitat Associations
of the
Swainson's Hawk (*Buteo swainsoni*)
in South Sacramento County**

Prepared for:

City of Elk Grove
8401 Laguna Palms Way
Elk Grove, CA 95758
Contact: Taro Echiburú
(916) 478-3619

Prepared by:

Estep Environmental Consulting
3202 Spinning Rod Way
Sacramento, CA 95833
Contact: Jim Estep
(916) 921-2515

April 2007

Table of Contents

	Executive Summary	
1.0	Introduction.....	1
1.1	Historical Background.....	1
1.1.1	Statewide.....	1
1.1.2	City of Elk Grove.....	2
1.2	Regulatory Background.....	3
1.3	Purpose.....	3
2.0	Monitoring and Management of Swainson’s Hawk Populations in the Central Valley.....	5
2.1	Monitoring of Populations.....	5
2.2	Population Declines and Management Issues.....	6
2.3	Current Management Strategies.....	7
2.3.1	Regional Conservation Plans.....	7
2.3.2	DFG Guidelines.....	8
2.3.3	Mitigation Banking.....	8
2.3.4	Local Fees and Ordinances.....	9
3.0	Description of Study Area.....	10
4.0	Description of the Species.....	13
4.1	Distinguishing Characteristics (Plumage and Morphology).....	13
4.2	Life History.....	15
4.2.1	Range and Populations.....	15
4.2.2	Habitats and Habitat Use.....	17
4.2.3	Breeding Season Phenology.....	20
5.0	Methods.....	22
5.1	Assessment of Populations.....	22
5.2	Distribution of Nesting and Foraging Habitats.....	24
6.0	Results.....	25
6.1	Distribution, Abundance, and Habitat Associations.....	26
6.1.1	Distribution and Abundance.....	26
6.1.2	Habitat Associations.....	27
6.1.3	Relationship between Distribution and Habitat Associations.....	34
6.1.4	Reproduction.....	35
6.2	Distribution and Abundance of other Raptor Species.....	36
6.2.1	Red-shouldered Hawk.....	37
6.2.2	White-tailed Kite.....	37
6.6.3	Great-horned Owl.....	37
6.6.4	Red-tailed Hawk.....	38
7.0	Mitigation and Conservation Strategy for the City of Elk Grove.....	43
7.1	Selection Criteria.....	43
7.1.1	Location with the Study Area.....	44
7.1.2	Onsite Habitat Value.....	45
7.1.3	Offsite Habitat Value.....	45

7.1.4	Proximity to Other Conservation Sites.....	45
7.1.5	Proximity to Existing or Potential Urban Areas.....	45
8.0	Literature Cited.....	47
Appendix A.	Individual Quadrangle Maps with Territory Locations.....	51
Table A-1.	Swainson’s Hawk Data.....	52
Table A-2.	Other Nesting Raptor Data.....	53

List of Figures

Figure 1. Regional Location Map.....	Follows Page 10
Figure 2. Study Area Map.....	Follows Page 10
Figure 3. Generalized Land Use Zones.....	Follows Page 10
Figure 4. Historic and Current Distribution of the Swainson’s Hawk in California.....	Page 15
Figure 5. Distribution of the Swainson’s Hawk in the Central Valley of California.....	Page 16
Figure 6. Swainson’s Hawk Territory Locations.....	Follows Page 26
Figure 7. Land Use/Cover Types.....	Follows Page 27
Figure 8. Swainson’s Hawk Nesting Habitat.....	Follows Page 31
Figure 9. Swainson’s Hawk Nesting Territories relative to Land Use/Cover Types.....	Follows Page 34
Figure 10. Raptor Territory Locations.....	Follows Page 36
Figure 11. Swainson’s Hawk and Red-tailed Hawk Territory Locations.....	Follows Page 38

List of Color Plates

Plate 1. Adult Swainson's Hawk.....	Page 1
Plate 2. Cultivated fields, irrigated pasture, and wetlands on Sherman Island.....	Page 11
Plate 3. Corn and alfalfa fields on Grand Island.....	Page 11
Plate 4. Uncultivated grasslands on Valensin Ranch.....	Page 11
Plate 5. Cultivated field along Deer Creek.....	Page 11
Plate 6. Uncultivated grasslands.....	Page 12
Plate 7. Uncultivated grasslands/savannah.....	Page 12
Plate 8. Swainson's Hawk in flight.....	Page 13
Plate 9. Light morph adult Swainson's Hawk.....	Page 14
Plate 10. Rufous morph adult Swainson's Hawk.....	Page 14
Plate 11. Dark morph adult Swainson's Hawk.....	Page 14
Plate 12. Intermediate morph adult Swainson's Hawk.....	Page 14
Plate 13. Typical Swainson's Hawk riparian nesting and agricultural foraging habitat.....	Page 17
Plate 14. Valley oak riparian nesting habitat.....	Page 18
Plate 15. Valley oak nest tree.....	Page 18
Plate 16. Nest in cottonwood tree.....	Page 18
Plate 17. Nest in eucalyptus tree.....	Page 18
Plate 18. Typical Swainson's Hawk nest.....	Page 18
Plate 19. Swainson's Hawk nest with eggs.....	Page 21
Plate 20. Nestling Swainson's Hawks.....	Page 21
Plate 21. Five-week-old nestlings.....	Page 21
Plate 22. Nearly-fledged Swainson's Hawks.....	Page 21
Plate 23. Corn field on Grand Island.....	Page 29
Plate 24. Tomato field just east of the Sacramento River.....	Page 29
Plate 25. Irrigated pasture just west of Interstate 5.....	Page 29
Plate 26. Alfalfa field just east of Interstate 5.....	Page 29
Plate 27. Uncultivated grassland on Valensin Ranch.....	Page 29
Plate 28. Uncultivated grassland on Howard Ranch.....	Page 29
Plate 29. Riparian habitat along Laguna Creek.....	Page 32
Plate 30. Roadside tree row near Galt – site of SA-65.....	Page 32
Plate 31. Isolated valley oak tree south of Grant Line Rd – site of SA-31..	Page 32
Plate 32. Cottonwood grove near Meiss Road – site of SA-15.....	Page 32
Plate 33. Farmyard nesting habitat near Twin Cities Rd – site of SA-63...	Page 32
Plate 34. Riparian habitat along Cosumnes River – site of SA-47.....	Page 32

List of Tables

Table 1. Survey and Monitoring Studies of Swainson’s Hawks in the Central Valley.....	Page 6
Table 2. Local HCPs/NCCPs completed or in progress.....	Page 8
Table 3. Local Agency Fee Programs for Swainson’s Hawk Habitat Conservation.....	Page 9
Table 4. Relative Ranking of the Five Primary Foraging cover Types in South Sacramento County.....	Page 19
Table 5. Activity Data for Swainson’s Hawk Territories in the South Sacramento County Study Area, 2006.....	Page 26
Table 6. Number of Swainson’s Hawk Territories within each Geographic Zone.....	Page 27
Table 7. Territory Density in the South Sacramento Study Area Relative to other Geographic Areas.....	Page 27
Table 8. Relative Abundance of Land Cover Type Acreages in the Study Area.....	Page 28
Table 9. Land Use/Habitat Associations of Swainson’s Hawk Territories in the South Sacramento County Study Area.....	Page 30
Table 10. Nesting Habitat Associations of Swainson’s Hawk Territories in the South Sacramento County Study Area.....	Page 33
Table 11. Nest Tree Species used by Nesting Swainson’s Hawks in the South Sacramento County Study Area.....	Page 33
Table 12. Swainson’s Hawk Territory Density in the South Sacramento County Study Area.....	Page 34
Table 13. Reproductive Performance of Swainson’s Hawks in the South Sacramento County Study Area, 2006.....	Page 35
Table 14. Reproductive Performance of Swainson’s Hawk Populations in the Central Valley.....	Page 35
Table 15. Comparison of Activity and Reproductive Performance Data For Swainson’s Hawk and Red-tailed Hawk.....	Page 39
Table 16. Comparison of Swainson’s Hawk and Red-tailed Hawk Habitat Associations.....	Page 40
Table 17. Comparison of Swainson’s Hawk and Red-tailed Hawk Nesting Habitat.....	Page 40
Table 18. Comparison of Nest Tree Species used by Swainson’s Hawk and Red-tailed Hawk.....	Page 41
Table 19. Comparison of the Number of Swainson’s Hawk and Red-tailed Hawk Territories with each Geographic Area.....	Page 42

Executive Summary

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. 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. The data from this report provides the City with a more complete understanding of the distribution and abundance of the Swainson's Hawk in south Sacramento County and will further assist the City in establishing criteria for conservation site selection and approval.

A total of 188 active Swainson's Hawk breeding territories were documented during the survey, equating to a territory density of 0.37 breeding territories per square mile. Of these, 126 (67.0%) were confirmed to have nested, and of the active nests, 57 (45.2%) successfully reared young to fledging. Similar to other areas in the Central Valley in 2006, a large proportion of this population did not nest (26.6%) and a large proportion of the active nests were unsuccessful (41.3%). This was attributed primarily to springtime storms including persistent flooding of much of the study area west of State Route 99.

The largest proportion of the breeding territories (55.3%) was associated with an irrigated cropland/irrigated pasture matrix, followed by 20.7% associated with irrigated cropland. Nesting habitat associations indicated that the majority of nesting pairs (68.7%) were associated with riparian habitat (along both natural and artificial channels). Other nesting

habitat associations included farmyards (11.2%), isolated trees (9%) and tree rows (5.3%). The most commonly used nest trees included cottonwood (32.5%) and valley oak (32.5%) followed by the non-native eucalyptus (15.1%). A total of 82 fledged young were recorded equating to 1.46 young per successful nest, which is generally consistent with other past and ongoing studies of Swainson's Hawk in the Central Valley.

Swainson's Hawks were distributed throughout most of the study area; however, the majority of sites (74.5%) were concentrated within the interior portion of the study area between approximately Interstate 5 on the west and Clay Station Road on the east (Interior Zone). This was also the region of the study area that supported the highest value agricultural patterns – a matrix of irrigated cropland and pasturelands – and the greatest amount of potential nesting habitat, and thus was considered the highest priority target area for conservation. The area west of Interstate 5 (Delta Zone) supported fewer nests (20.2%), mostly concentrated along watercourses where patches of riparian habitat continue to exist. Agricultural patterns were considered less suitable than in the Interior Zone and available nesting habitat was scarce throughout much of the area. Thus, while some areas were considered high value, such as immediately west of Interstate 5 (and may be considered high priority conservation sites), overall the Delta Zone was considered a lower priority target area for conservation compared with the Interior Zone. Land use east of Clay Station Road (Eastern Foothill Zone) consisted primarily of open grazed annual grasslands. While suitable habitat for Swainson's Hawks, this area supported fewer nests, probably due to fewer potential nesting trees and lack of microtine prey compared with the interior zone, and was thus considered less appropriate for conservation purposes.

1.0 Introduction

1.1 Historical Background

1.1.1 Statewide

The Swainson's Hawk (*Buteo swainsoni*) (Plate 1) is a state-listed threatened species in California that occurs throughout much of the Central Valley. Reliant on certain types of agricultural land uses and remaining uncultivated grasslands, the largest remaining populations occur in the rapidly urbanizing region that includes Sacramento, Yolo, Solano, and San Joaquin Counties. Because of the inherent conflicts between urbanization, the preservation of agricultural and valley grassland habitats, and compliance with state laws and regulations, addressing land use-related impacts that affect the Swainson's Hawk continues to be a key issue for land use decision-making in the Central Valley.



Plate 1. Adult Swainson's Hawk

In 1994, the California Department of Fish and Game (DFG) took an initial step in addressing the issue of habitat conservation for Swainson's Hawks by issuing guidelines for mitigating development-related impacts (California Department of Fish and Game 1994). Since then, the DFG Swainson's Hawk Mitigation Guidelines have been used by local agencies as a method to mitigate habitat impacts on individual development projects

pursuant to the California Environmental Quality Act (CEQA). In an attempt to standardize mitigation costs for impacts to Swainson's Hawk habitat and consolidate conservation efforts, some local agencies including Sacramento and Yolo Counties, established local ordinances that required payment of mitigation fees. The fees are applied to all development projects that would remove Swainson's Hawk habitat and in order to provide compensation for this loss through acquisition and management of offsite lands.

Concurrent with these activities, larger regional habitat conservation plans were also being considered or developed for lands within the range of the Swainson's Hawk. Driven by the presence of federally listed species, habitat conservation plans (HCPs) are prepared pursuant to Section 10 of the federal Endangered Species Act under consultation with the U.S. Fish and Wildlife Service. State-listed species can be included as 'covered' species in HCPs under agreement and permit authorization of DFG (Section 2081 or 2080.1 of DFG Code). The HCP process can provide a more regional approach to addressing impacts and mitigation and potentially allowing for consolidation of conservation lands and a greater potential for conservation at a regional population level. Several multispecies HCPs have either been completed (e.g., Natomas Basin, San Joaquin County) or are in preparation (e.g., South Sacramento County, Yolo County, Solano County) within the range of the Central Valley population of Swainson's Hawk.

1.1.2 City of Elk Grove

With the incorporation of the City of Elk Grove in 2001, lands within the jurisdiction of the new city were no longer subject to the Sacramento County Swainson's Hawk ordinance. In 2003, the City of Elk Grove established their own City ordinance, began collecting mitigation fees, and began to formulate strategies to mitigate development-related impacts on Swainson's Hawk. While there is no conservation plan in place to direct or consolidate conservation efforts, the City took the preliminary steps to require developers to either pay fees or acquire mitigation lands within a specified area of the county. This mitigation 'receiving' area was designed to ensure compliance with provisions of CEQA that require a nexus between impacts and mitigation, and to begin to consolidate conservation lands in order to address issues of habitat connectivity and regional population stability.

To further support the City's efforts in the selection of appropriate conservation lands, a GIS-based model was developed that modeled Swainson's Hawk habitat suitability in south Sacramento County (Jones & Stokes 2005). The model identified and ranked all areas of south Sacramento County with respect to their suitability for potential conservation based on several model variables. One element of the model was the current nesting distribution of Swainson's Hawk within the study area. Because the model was sensitive to the locations of active nest sites, inaccuracies in the nesting distribution could result in some areas potentially devalued and thus not considered for conservation.

This, along with the interest on the part of the City, Sacramento County, and DFG to have an accurate baseline nesting distribution of Swainson's Hawks in south Sacramento County resulted in the request to fund a baseline survey and habitat evaluation of the area. Thus, on February 22, 2006, the Elk Grove City Council approved a contract to conduct the study that is summarized in this report.

1.2 Regulatory Background

The Swainson's Hawk was listed as a state-threatened species by the California Fish and Game Commission in 1983 largely as a result of a statewide survey conducted in the late 1970s that estimated a population decline of greater than 90% (Bloom 1980). Species that are listed as threatened or endangered receive protection under the provisions of the California Endangered Species Act (CESA) (Section 2050 of the Fish and Game Code), and related Fish and Game Code Sections, including Section 2080 that prohibits the "take" of any threatened or endangered species. Take is defined in Section 86 as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill."

While not specifically defined in the definition of take, loss of essential habitat can result in the direct or indirect loss of breeding territories and reproductive potential leading to further population declines, and thus can potentially be included in the definition of take. However, most habitat-related impacts on the Swainson's Hawk are addressed through CEQA.

CEQA defines the significance of an impact on a state-listed species based on the following:

- Appendix G of the State CEQA guidelines states that a biological resource impact is considered significant (before considering offsetting mitigation measures) if the lead agency determines that project implementation would result in "substantial adverse effects, either directly or through habitat modifications, on any species identified as being a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFG or USFWS"; and
- CEQA Section 15065 (Mandatory Findings of Significance), a biological resource impact is considered significant if the project has the potential to "substantially reduce the number or restrict the range of an endangered, rare or threatened species".

It has been pursuant to both the CESA and CEQA processes that mitigation and management, including the development of regional strategies, have been developed to address land use issues related to Swainson's Hawk conservation.

1.3 Purpose

The purpose of this study is several-fold and includes:

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

2.0 Monitoring and Management of Swainson's Hawk Populations in the Central Valley

2.1 Monitoring of Populations

Data have been collected on the distribution and abundance of Swainson's Hawk in the Central Valley since the late 1970s. Bloom (1980) conducted the initial statewide survey that described a 90% reduction in the historic population and led to the state-listing of the species. At this time, the statewide estimate of breeding pairs was 375. Beginning in the early 1980s, long-term monitoring of selected survey sites was conducted to assess population trends. In 1988, DFG conducted a second and more intensive statewide survey, which recalibrated the statewide estimate to 550 breeding pairs. Neither the initial Bloom (1980) or 1988 statewide surveys were conducted using a standardized survey protocol that would lend itself to statistical analysis sufficient to reliably estimate population size. Thus, it was acknowledged that these early statewide estimates were not necessarily an accurate estimate of the statewide population and were cautiously used to describe the status of the species. The survey efforts were, however, important in establishing the current distribution of the species in California.

Since the mid-1980s, several survey and long-term monitoring efforts have been conducted in the Central Valley, particularly in Yolo, Solano, Sacramento, and San Joaquin Counties. These studies have provided additional information on distribution and abundance of the species, as well as providing additional life history data on the Central Valley population. Some of these efforts are listed below in Table 1.

As a result of these efforts and the increasing understanding of Swainson's Hawk distribution and abundance in the Central Valley, but in the absence of any statistically-based analysis, the Swainson's Hawk Technical Advisory Committee – an ad hoc group of researchers that conducts and facilitates research on the Swainson's Hawk and advises DFG and local jurisdictions regarding Swainson's Hawk ecology – provided a new estimated population range. It was estimated that there are between 700 and 1,000 breeding pairs in the state with approximately 90% of these in the Central Valley.

In an effort to more conclusively estimate the population size, a comprehensive, standardized, statistically-based statewide survey effort was begun in 2005 (Anderson et al. 2006). Using a standardized sampling approach across the current range of the species in California, the resulting population estimate, which should be available in early 2007, is expected to more accurately reflect the total number of breeding pairs in the Central Valley and throughout California.

Table 1. Survey and Monitoring Studies of Swainson’s Hawks in the Central Valley.

Researcher or Project	Date	Location	Purpose
Bloom	1980	Statewide	Statewide survey to estimate population
Schlorff/Estep - DFG	1984 - 1988	Yolo, Sacramento, and San Joaquin Counties	Population trends
Estep - DFG	1987-89	Yolo, Sacramento, and San Joaquin Counties	Foraging ranges, nest site selection, habitat associations
Estep population study	1986-2006	Yolo County	Long-term population monitoring
Estep - DFG	1988	Statewide	Statewide survey to estimate population
Jones & Stokes	1990	San Joaquin County	Development of county-wide conservation plan
Babcock	1995	Yolo County	Home ranges and habitat associations/use
England et al.	1995	Yolo, Sacramento, and San Joaquin Counties	Nest site selection/reproduction of urban nesting pairs.
Holt	1990s	City of Stockton	Monitoring of urban nesting pairs
England	1990s	UC Davis campus – Putah Creek	Monitoring of local population
Bradbury – CA Dept of Water Resources	2000s	Sacramento-San Joaquin Delta	Long-term population monitoring/impact avoidance
Natomas Basin HCP	1999-2006	Natomas Basin	Compliance biological monitoring
San Joaquin County HCP	1990s	San Joaquin County	Distribution/abundance surveys for HCP development
Solano County HCP	2000s	Solano County	Distribution/abundance surveys for HCP development
South Sacramento County HCP	2000s	South Sacramento County	Distribution/abundance surveys for HCP development
Gifford - DFG	2002 - 2003	Multi-county survey	Distribution/abundance surveys – estimate regional population
Swolsgard – CA Dept of Parks and Recreation	2002-2004	Northeastern San Joaquin County	Habitat use study
Anderson et al.	2005-06	Statewide	Statewide survey to estimate population.

2.2 Population Declines and Management Issues

Initial population declines of Swainson’s Hawk in California were attributed to loss of habitat from urbanization and conversion of native habitats to agriculture. Urbanization, agricultural conversion, channelization of watercourses and other factors have reduced the extent of nesting habitat (e.g., riparian forests, oak woodland) and foraging habitat, primarily native grasslands. As a result, the species is no longer found in southern California (with the exception of a few known nest sites in the Mojave Desert) or in coastal valleys. The species has persisted, however, in the much of the Central Valley,

particularly in the southern Sacramento and northern San Joaquin Valleys. While intensively farmed for over 100 years, much of this area retains a relative abundance of nesting habitat – narrow riparian corridors along rivers and streams, remnant oak groves and trees, roadside trees – and an agricultural pattern that is conducive to Swainson’s Hawk foraging. Thus, the species is relatively common in the central portion of the Central Valley and perhaps on a local basis - even more common than it was historically.

However, this area appears to support a disproportionate percentage of the Central Valley population. While the breeding range extends to the northern and southern extent of the Central Valley, the majority of the population resides between Stanislaus County on the south and Butte County on the north. Within this area, the largest number of breeding pairs and the highest breeding densities are found in Yolo, Sacramento, Solano, and San Joaquin Counties.

Each of these counties has also been subject to largest amount of urban growth relative to the rest of the Central Valley. This has obvious implications related to conflicts between urban expansion and sustainability of the Swainson’s Hawk population.

Within this ‘effective’ range of the Swainson’s Hawk in the Central Valley, there are two primary issues that influence management and long-term sustainability of the species, 1) permanent loss of habitat from continuing urbanization; and 2) temporary, but long term loss of habitat from conversion to unsuitable crop patterns, such as vineyards. In addition, there are other issues that can influence management of this species, including:

- difficulty managing a species that occurs almost entirely on private lands;
- loss and lack of regeneration of valley oak and other native trees;
- loss of riparian vegetation from levee projects, agricultural practices, and local development along watercourses; and
- conflicts with management of other species with different habitat needs.

2.3 Current Management Strategies

2.3.1 Regional Conservation Plans

Because the Swainson’s Hawk occurs across large agricultural landscapes in the Central Valley, regional conservation planning designed to accommodate both urban growth and habitat conservation was initially explored as a concept that could be developed and implemented by local agencies (Estep and Teresa 1992). However, with several federally listed species also occurring within the range of the Swainson’s Hawk, local agencies also found a need for a federal incidental take permit through the development of Habitat Conservation Plans (HCP) pursuant to Section 10 of the federal Endangered Species Act. In addition, a similar state planning tool, the Natural Community Conservation Plan (NCCP) also provides local agencies a means of addressing conservation of habitats and

sensitive species at a landscape level. Several cities and counties have or are undergoing the development of multi-species HCPs and/or NCCPs with the intent of planning for both urban development and protection of resources, including Swainson’s Hawk habitat. Table 2 lists the HCPs and HCP/NCCPs that are permitted or in plan development within this geographic area.

Table 2. Local HCPs/NCCPs completed or in progress.

Plan	Geographic Area	Status
Natomas Basin HCP	Natomas Basin (portions of Sacramento and Sutter County)	10a(1)(B) permit re-issued in 2003
San Joaquin County HCP	San Joaquin County	10a(1)(B) permit issued in 2001
Yolo County HCP/NCCP	Central Valley portion of Yolo County	In Plan Development
South Sacramento County HCP	South Sacramento County, south of Highway 50, not including Delta	In Plan Development
Solano County HCP/NCCP	Solano County	In Plan Development

2.3.2 DFG Guidelines

In 1994, DFG issued guidelines for assessing and mitigating impacts on Swainson’s Hawk for use by local agencies during CEQA review. These guidelines (California Department of Fish and Game 1994) have been referred to extensively throughout the DFG’s Region 2 as a means for local agencies to mitigate impacts on Swainson’s Hawk. The guidelines rely on a compensation ratio for loss of foraging habitat based on proximity to known nest sites. While not unreasonable in concept, application of the guidelines is problematic for two major reasons: 1) acquiring suitable compensation land with approval of DFG is uncertain due to escalating land values, the difficulties establishing conservation easements on agricultural lands, and responsibility for long-term management; and 2) the guidelines do not provide an approach to consolidation of compensation lands potentially reducing their value over the long term as neighboring land uses change.

2.3.3 Mitigation Banking

To some extent, mitigation banking has helped to resolve the two issues noted above pertaining to use of the DFG guidelines. Mitigation banks have prior approval by DFG based on their suitability to provide high value Swainson’s Hawk habitat; long term management is provided by the operator as dictated through conservation easements approved by DFG; and depending on their size can consolidate compensation into larger blocks of suitable habitat. However, there are few mitigation banks that provide credit for Swainson’s Hawk habitat. This is due in part to the escalating value of agricultural lands and the relatively low return on minimally improved agricultural lands compared

with specific habitat types for other sensitive species (e.g., vernal pools and other wetlands).

2.3.4 Local Fees and Ordinances

Some local agencies have established programs to mitigate development-related impacts on Swainson’s Hawk habitat. This is usually done by requiring fees or compensation lands before grading permits are issued, and are often established through the local ordinance process. This process is often used in the absence of a regional plan or as a precursor to development of a more comprehensive conservation planning process. Fees are usually calculated based on a 1:1 replacement ratio. In some cases because of the difficulty and cost associated with land acquisition, applicants are required to find and acquire compensation land themselves. For example, the City of Elk Grove allows the applicant to pay a fee for compensation totaling less than 40 acres; but for compensation totaling more than 40 acres, the applicant is responsible for direct land preservation. Table 3 shows the existing local fee programs.

Table 3. Local Agency Fee Programs for Swainson’s Hawk Habitat Conservation.

Local Agency	Instrument	Amount
Yolo County JPA	Interim Fee - agreement between Yolo HCP/NCCP Joint Powers Authority and DFG	\$4,900 per acre
Sacramento County	Ordinance	\$18,375 per acre (\$16,000 land acquisition fee plus \$2,375 land management fee)
City of Elk Grove	Ordinance	\$18,325 per acre (\$15,950 land acquisition fee plus \$2,375 land management fee)
City of Rancho Cordova	Ordinance - pending	Undetermined

3.0 Description of Study Area

Sacramento County is a relatively large county located in the mid-section of the Central Valley, east of the Sacramento-San Joaquin River Delta (Figure 1). The study area incorporates the majority of south Sacramento County, south of the Cities of Sacramento and Elk Grove, with the county line serving as the east, west, and southern borders (Figure 2). The study area encompasses approximately 323,000 acres (130,713 ha) or 505 square miles (1,308 sq km).

Following the county line, the Sacramento River, Sutter Slough, and Steamboat Slough form the western border of the study area; the San Joaquin and Mokelumne Rivers and Dry Creek form the southern border; and the eastern border is a north-south line not defined by topographical or geographic features. The northern border, from west to east, is formed by Hood-Franklin Road, Bilby Road, Grant Line Road, Bradshaw Road, and State Route 16 (Figure 2).

The study area can also be generally characterized according to three geographic units, 1) Delta Zone – defined using the line that specifies the Primary Delta Zone, which generally corresponds with the location of Interstate 5 (Delta Protection Commission 1995), 2) Interior Zone – defined by the Primary Delta line on the west and Clay Station and Dillard Roads on the east (which conforms approximately to the 100-foot elevational contour), and 3) the Eastern Foothills Zone – defined as all lands east of Clay Station and Dillard Roads (the approximately 100-foot contour) (Figure 3).

Prior to agricultural conversion, these geographic units consisted of a variety of native communities. The Delta zone was expansive marshland subject to tidal influence (Delta Protection Commission 1995, Lund et al. 2007). The interior zone was a complex of native grasslands, wetlands, oak savannahs and woodlands, and wide bands of oak and cottonwood-dominated riparian forest along the Sacramento, San Joaquin, Mokelumne, and Cosumnes Rivers; Dry, Deer, and Laguna Creeks; and numerous smaller creeks and sloughs (McPherson and Luttinger 1998). Beginning in the mid-1800s, these native habitats were being converted to agriculture. The Delta was drained and levied and converted primarily to irrigated cropland (California Department of Water Resources 1995, Lund et al. 2007). The interior zone was leveled and converted to irrigated cropland and pastureland. Wetlands were drained and cultivated and the extensive riparian forests were gradually removed to their current extent consisting of relatively narrow riparian corridors (Katibah 1984). The eastern foothill zone was used primarily for cattle grazing and thus retains much of its original topography, woodlands, and savannahs; however, the native grasslands have been largely replaced by nonnative annual grasslands.

Today, each of these geographic zones can also be described according to three generalized land use patterns. Most of the Delta Zone is characterized by intensively-farmed irrigated cropland and relatively few trees; and irrigated pasturelands and

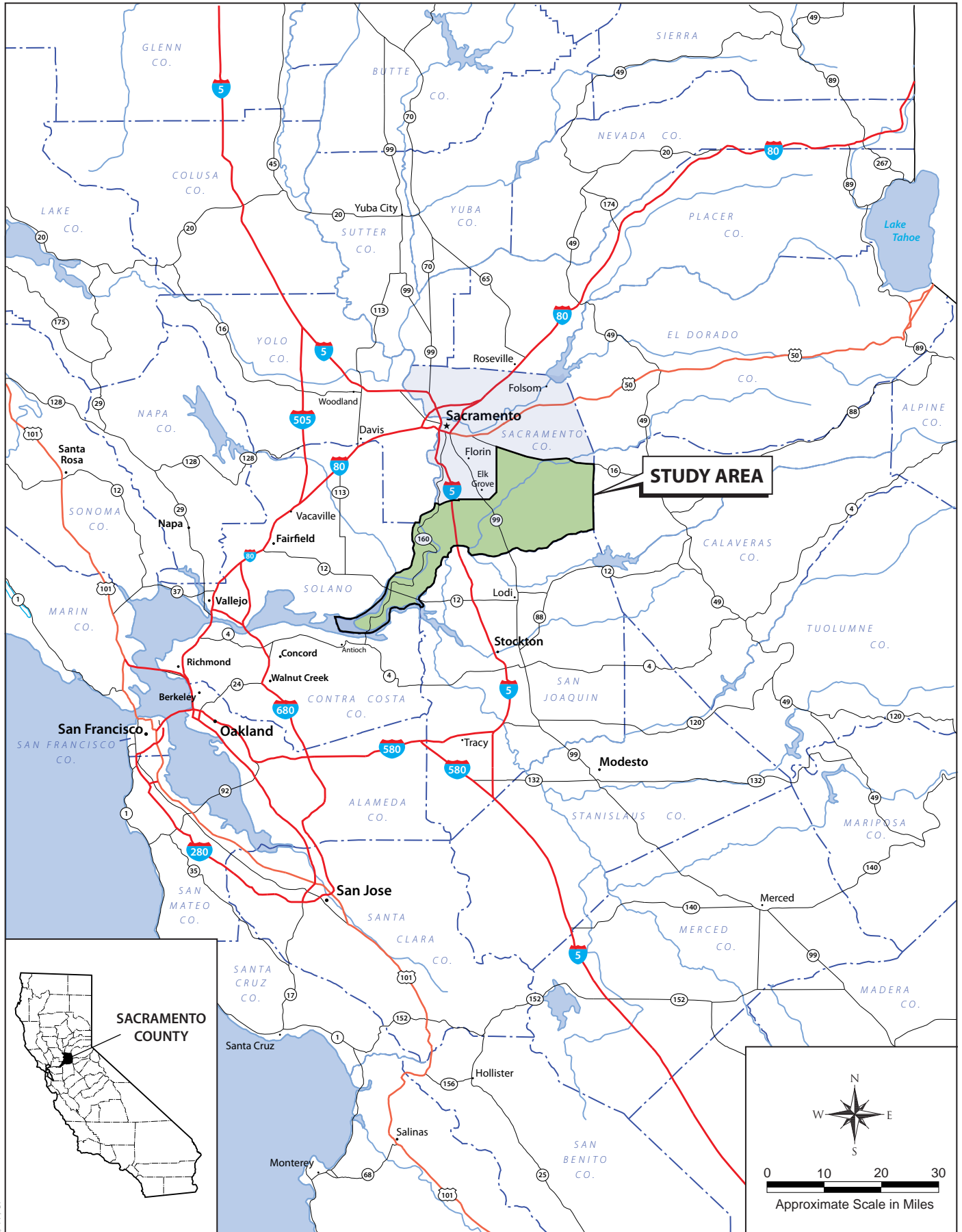


Figure 1
Regional Location Map



LEGEND

— Study Area Boundary

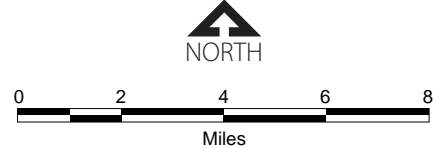
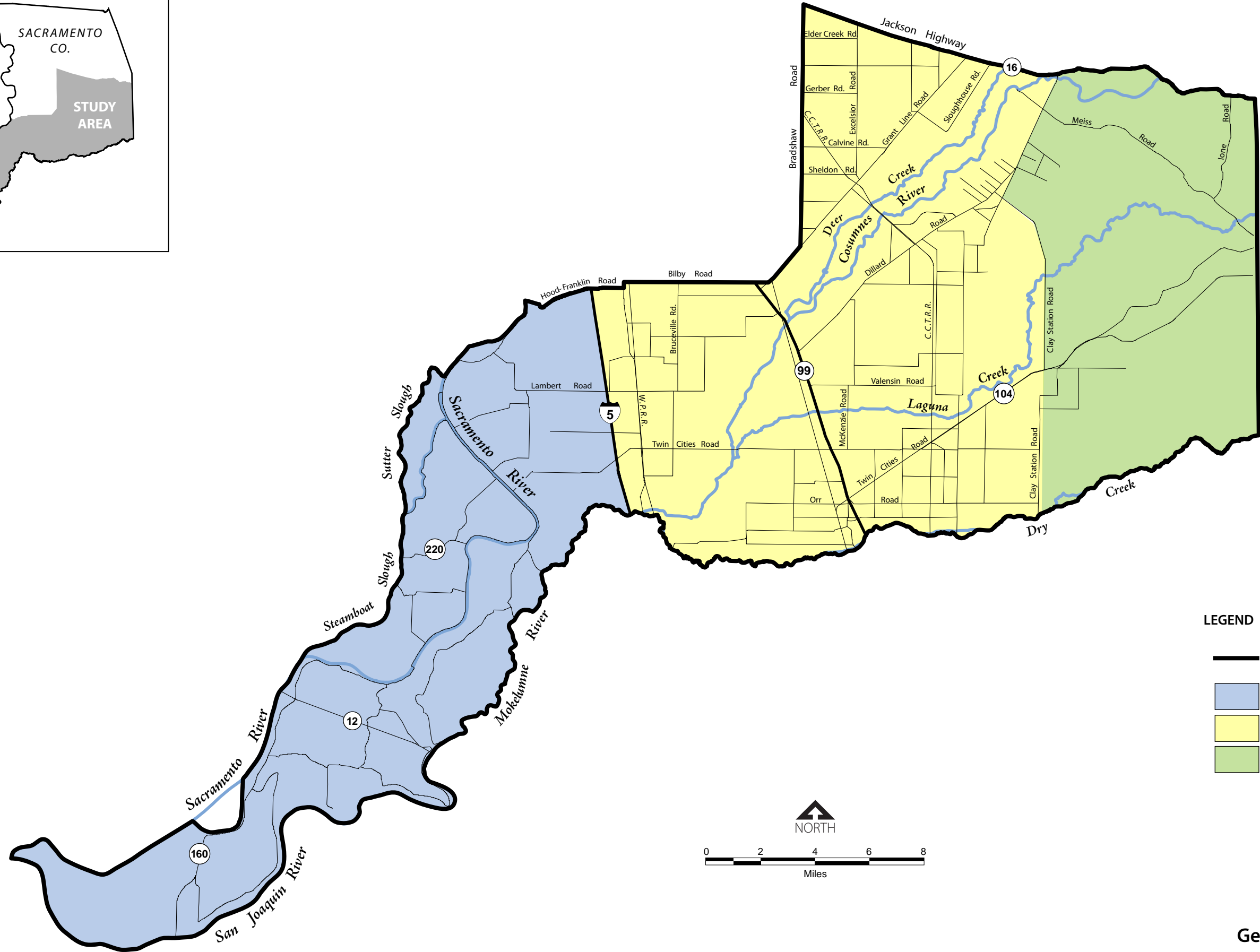






Figure 2
South Sacramento County
Swainson's Hawk Study Area



LEGEND

-  South Sacramento County Study Area Boundary
-  Delta Zone
-  Interior Zone
-  Eastern Foothill Zone

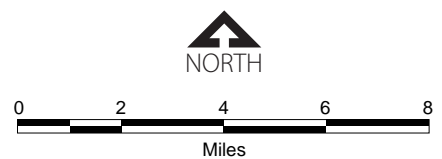


Figure 3
Generalized Land Use Zones

wetlands in the southwest corner of the Delta Zone (Plates 2 and 3). The Interior Zone is characterized by a mix of irrigated cropland and irrigated pastures, a few remnant patches of uncultivated non-irrigated grassland (primarily associated with the Cosumnes River-Deer Creek watershed), and numerous native trees – primarily in riparian forests along the Cosumnes River-Deer Creek corridor, Dry Creek, and Laguna Creek (Plates 4 and 5). The Eastern Foothill Zone is characterized primarily as open grazed annual grassland, oak savannah, and patches of blue oak woodland on the eastern edge – but also includes some irrigated pasture and irrigated cropland along the western and southern edges (Plates 6 and 7).

Currently, most of the study area continues to be farmed or grazed as described above. Some areas, however, have been subject to increasing urbanization, both high density residential development occurring mainly on the southern edge of Sacramento and Elk Grove and in the City of Galt, and low density rural ranchette development in areas east of Galt and near Wilton south of the Cosumnes River.



Plate 2. Cultivated fields, irrigated pasture, and wetlands on Sherman Island, southwest Sacramento County



Plate 3. Corn and alfalfa fields on Grand Island, southwest Sacramento County



Plate 4. Uncultivated grasslands on Valensin Ranch, south of Cosumnes River, east of State Route 99



Plate 5. Cultivated field along Deer Creek, east of State Route 99.



Plate 6. Uncultivated grasslands - looking east along Meiss Road in eastern Sacramento County.



Plate 7. Uncultivated grassland/savannah – looking southeast on Howard Ranch in southeastern Sacramento County

4.0 Description of the Species

4.1 Distinguishing Characteristics (Plumage and Morphology)

Swainson's Hawk is a medium-sized *buteo* with an overall body size similar to the Red-tailed Hawk, the species for which it is most often confused in the Central Valley. However, with its more streamlined body shape and longer wings, the Swainson's Hawk is designed for soaring and is most often observed in flight, compared with the more robust Red-tailed Hawk, which is often observed perching.

As with most raptors, males are smaller than females. Using data from the Central Valley population, mean weight in males is 701.7g (range = 600 to 860g, N = 55), and mean wing length is 123.1 cm (range = 111.0 to 128.0, N=47); female mean weight is 954.9g (range = 820 to 1,130g, N=49), and mean wing length is 132.6 cm (range=126.0 to 139.7 cm, N=43) (Anderson and Estep unpublished data). While somewhat smaller than range-wide estimates, size difference between sexes is generally consistent with other parts of the species range (England et al 1997).

The Swainson's Hawk is characterized by its long, narrow, and tapered wings held in flight in a slight dihedral shape (Plate 8). The body size is somewhat smaller, thinner, and less robust than other *buteos*, although the wings are at least as long as other *buteos*. This body and wing shape allows for efficient soaring flight and aerial maneuverability, important for foraging, which Swainson's Hawks do primarily from the wing, and during inter-specific territorial interactions.



Plate 8. Swainson's Hawk in Flight.

There are three definitive plumage morphs: light, rufous, and dark (Plates 9 through 11). However, there are numerous intermediate variations between these plumage morphs. The two most distinguishing plumage characteristics are a dark breast band and the contrasting darker flight feathers and lighter wing linings on the underwings giving most individuals a distinctive bicolored underwing pattern. These characteristics are most pronounced in lighter morph birds and become less so as the plumage darkens, and are indistinguishable in the definitive dark morph, which is completely melanistic. All three definitive plumage morphs are present in the Central Valley with a relatively large proportion of the population categorized as intermediate morph, with varying amounts of streaking or coloration in the belly and wing linings (Plate 12).



Plate 9. Light Morph Adult Swainson's Hawk

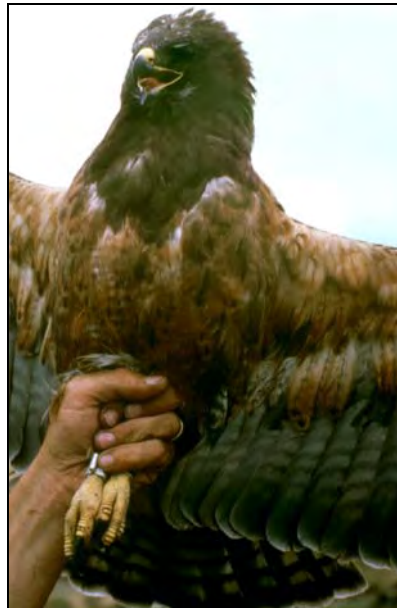


Plate 10. Rufous Morph Adult Swainson's Hawk



Plate 11. Dark Morph Adult Swainson's Hawk



Plate 12. Intermediate Morph Adult Swainson's Hawk

4.2 Life History

4.2.1 Range and Populations

Swainson's Hawk inhabits grassland plains and agricultural regions of western North America during the breeding season and winters in grassland and agricultural regions from Central Mexico to southern South America (England et al. 1997; Bradbury et al. in preparation). Early accounts described Swainson's Hawk as one of the most common raptors in the state, occurring throughout much of lowland California (Sharp 1902). Since the mid-1800s, the native habitats that supported the species have undergone a gradual conversion to agricultural uses. Today, native grassland habitats are virtually nonexistent in the state, and only remnants of the once vast riparian forests and oak woodlands still exist (Katibah 1983). This habitat loss has caused a substantial reduction in the breeding range and in the size of the breeding population in California (Bloom 1980; England et al. 1997) (Figure 4). Swainson's Hawks are also sensitive to habitat fragmentation. Foraging use declines as suitable foraging patch size decreases even though suitable prey conditions may exist (Estep and Teresa 1992). However, Swainson's Hawks are also known to re-inhabit dense urban areas to nest if suitable nesting trees are present and suitable foraging habitat exists within 3.2 kilometers (2 miles) of the nest (England et al. 1995). The most recent statewide population estimate is between 700 and 1,000 breeding pairs (Swainson's Hawk Technical Advisory Committee file data), which is less than 10% of the historic population (Bloom 1980). This estimate is currently being revised based on the results of a statewide survey conducted in 2005 and 2006 (Anderson et al. 2006) and will be available in early 2007.

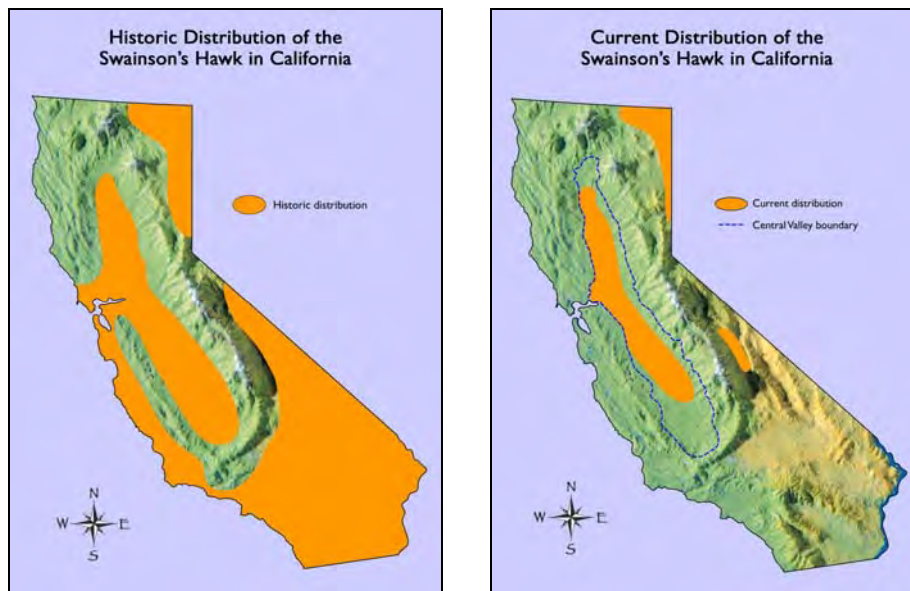


Figure 4. Historic and current distribution of the Swainson's Hawk in California.

The Central Valley population (currently estimated at between 600 and 900 breeding pairs) extends from Tehama County south to Tulare and Kings Counties. The optimum foraging and nesting habitat conditions in portions of Yolo, Solano, Sacramento, and San Joaquin Counties support the bulk of this Central Valley population (Estep 1989, Estep in prep., Anderson et al. 2006) (Figure 5). The Central Valley is surrounded by mountains—the Sierra Nevada on the east and the Cascade Range on the north—that geographically isolate it from the rest of the species' range. Extensive banding (Anderson, Bloom, Estep, Woodbridge unpublished data) suggests that no movement occurs between the Central Valley breeding population and other populations. Results of satellite radio telemetry studies of migratory patterns further indicate little to no interaction between the Central Valley population and other populations of Swainson's Hawks (Bradbury et al. in preparation).

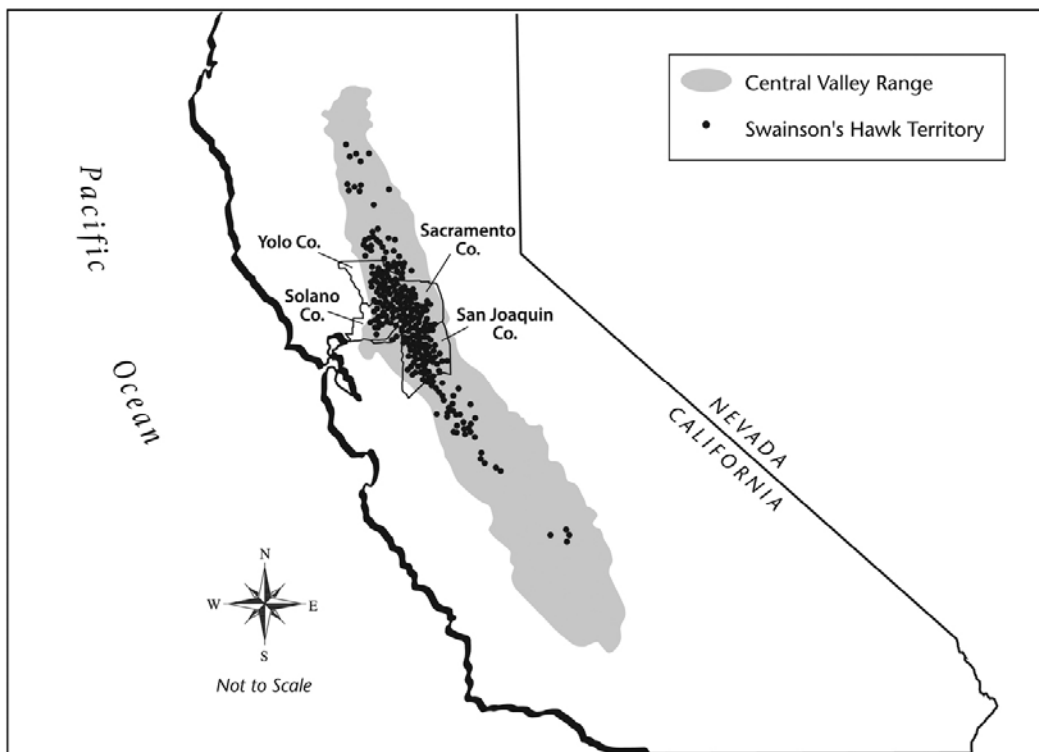


Figure 5. Distribution of the Swainson's Hawk in the Central Valley of California

Despite the loss of native habitats in the Central Valley, Swainson's Hawks appear to have adapted relatively well to certain types of agricultural patterns in areas where suitable nesting habitat remains (Plate 13). However, nesting habitat for Swainson's Hawks continues to decline in the Central Valley because of flood control projects, agricultural practices, and urban expansion.



Plate 13. Typical Swainson's Hawk riparian nesting and agricultural foraging habitat in the Central Valley.

4.2.2 Habitats and Habitat Use

Nesting

Swainson's Hawks usually nest in large native trees such as valley oak (*Quercus lobata*), cottonwood (*Populus fremontia*), walnut (*Juglans juglans*), and willow (*Salix* spp.), and occasionally in nonnative trees, such as eucalyptus (*Eucalyptus* spp.) (Plates 14 through 17). Nests occur in riparian woodlands, roadside trees, trees along field borders, isolated trees, small groves, and on the edges of remnant oak woodlands. Stringers of remnant riparian forest along drainages contain the majority of known nests in the Central Valley (Estep 1984; Schlorff and Bloom 1984; England et al. 1997). However, this is a function of nest tree availability rather than dependence on riparian forest. Nests are usually constructed as high as possible in the tree, providing protection to the nest as well as visibility from it (Plate 18).

Nesting pairs are highly traditional in their use of nesting territories and nesting trees. Many nest sites in the Central Valley have been occupied annually since 1979 and banding studies conducted since 1986 confirm a high degree of nest and mate fidelity (Estep in preparation).



Plate 14. Valley Oak Riparian Nesting Habitat



Plate 15. Valley Oak Nest Tree



Plate 16. Nest in Cottonwood Tree



Plate 17. Nest in Eucalyptus Tree



Plate 18. Typical Swainson's Hawk Nest

Foraging

In the Central Valley, Swainson's Hawks feed primarily on small rodents, usually in large fields that support low vegetative cover (to provide access to the ground) and high densities of prey (Bechard 1982; Estep 1989). These habitats include hay fields, grain crops, certain row crops, and lightly grazed pasturelands. Fields lacking adequate prey populations (e.g., flooded rice fields) or those that are inaccessible to foraging birds (e.g., vineyards and orchards) are rarely used (Estep 1989; Babcock 1995, Swolsgard 2003). Urban expansion and conversion to unsuitable crop types (e.g., vineyards and orchards) are responsible for a continuing reduction of available Swainson's hawk foraging habitat in the Central Valley.

Meadow vole (*Microtus californicus*) is the principal prey item taken by Swainson's Hawks in the Central Valley (Estep 1989). Pocket gopher (*Thomomys bottae*) is also an important prey item. Other small rodents, including deer mouse (*Peromyscus californicus*) and house mouse (*Mus musculus*) are also taken, along with a variety of small birds, reptiles, and insects.

Foraging habitat value is a function of patch size (i.e., Swainson's Hawk is sensitive to fragmented landscapes; use will decline as suitable patch size decreases), prey accessibility (i.e., the ability of hawks to access prey depending on the vegetative structure), and prey availability (i.e., the abundance of prey populations in a field). In the Central Valley, agricultural land use or specific crop type determine the foraging value of a field at any given time. Cover types were evaluated by Estep (1989) and ranked based on these factors. However, suitability ranking is based on a variety of site-specific issues and at a landscape level should be characterized only on a general basis. On a site-specific level – important for land management purposes to maximize foraging value – individual cover types can be assessed based on site-specific and management conditions.

A relative ranking of agricultural foraging habitat suitability for South Sacramento County was developed during preparation of the Swainson's Hawk habitat suitability model prepared for the City of Elk Grove (Jones & Stokes 2005) (Table 4).

Table 4. Relative Ranking of the Five Primary Foraging Cover Types in South Sacramento County (Jones & Stokes 2005)

Ranking	Cover Type
1	Alfalfa
2	Other Hay Crops
3	Irrigated Pasture
4	Row and Grain Crops
5	Annual Grassland

These rankings do not necessarily suggest that lower ranking cover types do not provide important habitat value. For example, annual grasslands are ranked relatively low primarily because they support lower prey densities. However, while fewer nesting Swainson's Hawk are associated with this type, annual grassland is the principal foraging cover type for some nesting pairs.

Hay crops, particularly alfalfa, provide the highest value because of the low vegetation structure (high prey accessibility), relatively large prey populations (high prey availability), and because farming operations (e.g., weekly irrigation and monthly mowing during the growing season) enhances prey accessibility. Most row and grain crops are planted in winter or spring and have foraging value while the vegetation remains low, but become less suitable as vegetative cover and density increases. During harvest, vegetation cover is eliminated while prey populations are highest, significantly enhancing their suitability during this period. Some crop types, such as rice, orchards, and vineyards, provide little to no value because of reduced accessibility and relatively low prey populations.

Foraging Ranges

Foraging range sizes are highly variable depending on cover type, and fluctuate seasonally and annually with changes in vegetation structure (e.g., growth, harvest) (Estep 1989). Foraging ranges of Central Valley Swainson's Hawks range from 830 to 21,543 acres (336 to 8,718 ha) (Estep 1989, Babcock 1995). Swainson's Hawks regularly forage across a very large landscape compared with most raptor species. Data from Estep (1989) and England et al. (1995) indicate that it remains energetically feasible for Swainson's Hawks to successfully reproduce when food resources are limited around the nest and large foraging ranges are required.

4.2.3 Breeding Season Phenology

Swainson's Hawks arrive at the breeding grounds from early March to early April. Breeding pairs immediately begin constructing new nests or repairing old ones. Eggs are usually laid in mid- to late April, and incubation continues until mid-May when young begin to hatch. The brooding period typically continues through early to mid-July when young begin to fledge (England et al. 1997). Studies conducted in the Sacramento Valley indicate that one or two—and occasionally three—young typically fledge from successful nests, with an average of 1.4–1.8 young per successful nest (Estep in preparation) (Plates 19 through 22). After fledging, young remain near the nest and are dependent on the adults for about 4 weeks, after which they permanently leave the breeding territory (Anderson et al. in progress). By mid-August, breeding territories are no longer defended and Swainson's Hawks begin to form communal groups. These groups begin their fall migration from late August to mid-September.



Plate 19. Swainson's Hawk Nest with Eggs

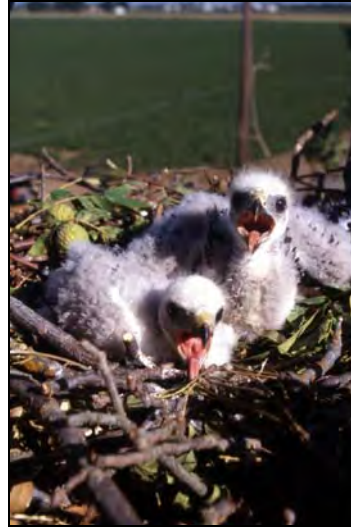


Plate 20. Nestling Swainson's Hawks



Plate 21. Five-Week-Old Nestlings



Plate 22. Nearly Fledged Swainson's Hawks

Central Valley Swainson's Hawks winter primarily in Central Mexico and, to a lesser extent, throughout portions of Central and South America (Bradbury et al. in preparation). This differs from what is known about the migratory pattern and wintering grounds of Swainson's Hawk populations outside of the Central Valley, most of which take a different migratory route and winter entirely in southern South America, with the largest wintering populations known to occur in northern Argentina (England et al 1997).

5.0 Methods

5.1 Assessment of Populations

The goal of the nesting raptor 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 of Swainson's Hawk, including Red-tailed Hawk, Red-shouldered Hawk, White-tailed Kite, and Great-horned Owl. The intent was to generally indicate how these species were distributed across the landscape and to compare particularly the differences in distribution and habitat use between Swainson's Hawk and Red-tailed Hawk.

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. The study area was divided into three blocks: all lands east of State Route 99; lands west of State Route 99 and south of Lambert Road between Interstate 5 and State Route 99; and lands north of Lambert Road between Interstate 5 and State Route 99. Three surveyors, Jim Estep, Waldo Holt, and Mike Bradbury, conducted the surveys.

Surveys were conducted by systematically driving all available roads within the study 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 in July 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 territories were visited on multiple occasions over the course of each survey phase in order to collect the necessary data.

Activity data were recorded based on the following definitions:

- An active territory is defined as a nesting area that may contain multiple alternate nest sites that was occupied by a pair of potentially breeding 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.
- 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 active nest with unknown reproductive outcome is defined as an active nest for which subsequent surveys were unable to confirm the reproductive status of the nest.
- An active territory with unknown nesting attempt is defined as an active territory for which subsequent surveys were unable to confirm the presence or absence of an active nest.
- A non-nesting territory is defined as an active territory for which subsequent surveys confirmed the absence of an active nest.

Each active territory was characterized with respect to overall habitat conditions and availability, land use patterns, and potential threats. Each active nest site was characterized with respect to nesting habitat type and condition, tree species, and estimated tree and nest height.

5.2 Distribution of Nesting and Foraging Habitats

The distribution and characterization of land uses and habitat types throughout the study area were initially mapped from 2004 aerial photographs and updated through ground truthing conducted during the survey.

For purposes of this study, foraging habitat associations were assessed on the basis of broad land use categories rather than the specific cover types listed in Table 5. The agricultural crop pattern mosaic is dynamic in the study area and throughout the Sacramento Valley and is subject to change annually and seasonally. Therefore, with the exception of perennial crop types (e.g., vineyards and orchards), specific agricultural crop types were grouped into broad categories that represent long-term land use patterns in the study area and that were used to characterize relative habitat suitability at the landscape level (Estep 1989, Babcock 1995, Jones & Stokes 2005). As a result, land use/cover type categories in the study area include the following:

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

Land use cover type acreages were estimated to provide a relative abundance of the nine cover types and the distribution and abundance of Swainson's Hawk and other raptor species was analyzed with respect to these broad habitat associations. Habitat associations were also evaluated on the basis of nest site selection by assigning a cover type category based on the dominant land uses in the immediate vicinity of each nesting territory. While Swainson's Hawks typically use a much larger foraging area (Estep 1989, Babcock 1995), the purpose of this exercise was to characterize habitat associations with respect to nest site selection, and thus a ½ mile radius was used to determine habitat associations in the immediate vicinity of each nesting territory.

The data collected during this survey and assessment were not subjected to statistical analysis for purposes of analyzing habitat use preferences or differences between data sets. The data were used solely to report and describe the nesting distribution and habitat associations of Swainson's Hawk and other raptors in south Sacramento County.

6.0 Results

Note on Issues Affecting Nesting Activity in 2006. Early-season rains and flooding, particularly throughout much of the interior portion of the study area, may have been the primary factor that resulted in an unusually large percentage of the breeding population not nesting in 2006. Flood waters occurred in many portions of the study area throughout much of April, and may have affected the distribution of prey populations, particularly California vole (*Microtus californicus*), the principal prey item of Swainson's Hawk. Populations of other species, mainly those that also depend on microtus prey, such as White-tailed Kite (*Elanus leucurus*) and Northern Harrier (*Circus cyaneus*), were also noticeably absent from large portions of the study area where they would typically be expected to occur. While speculative, it is assumed that widespread flooding and the effects on rodent populations was the primary factor responsible for the absence or lack of reproduction of these species in the study area.

Swainson's Hawk is highly traditional to its nesting territory and it is common for some pairs to not nest in some years while still occupying their nesting territory during the breeding season (England et al. 1997, Estep in prep). While the 2006 season is considered extreme in this regard, many Swainson's Hawk breeding pairs in the study area continued to occupy nesting territories throughout most or all of the breeding season, and many pairs established nests later in the season than is typical as flood waters receded and rodent populations reestablished. Thus, while the number of non-nesting pairs was likely much higher than is typical, sufficient data were collected to provide a reasonable representation of the distribution, abundance, habitat associations, and reproductive potential of this population.

Note on Issues Affecting Survey Access in 2006. The majority of the study area was surveyed according to the methods described above. There were, however, some areas for which access was either not granted by private landowners or that were subject to an inordinate amount of landowner contact that it reduced survey efficiency. There were also areas that were inaccessible for much of the early part of the nesting season due to flooding. Most inaccessible areas were surveyed from public roads sufficient to determine territory activity; however, some of these areas could not be surveyed sufficiently to determine nesting status and were thus recorded as Active Territories with Unknown Nesting. Areas that were considered inaccessible and thus were inadequately surveyed to determine nesting status included portions of the Dry Creek drainage and the Cosumnes River basin west of Interstate 5 and east of Wilton Road.

6.1 Distribution, Abundance, and Habitat Associations of Swainson’s Hawk

6.1.1 Distribution and Abundance

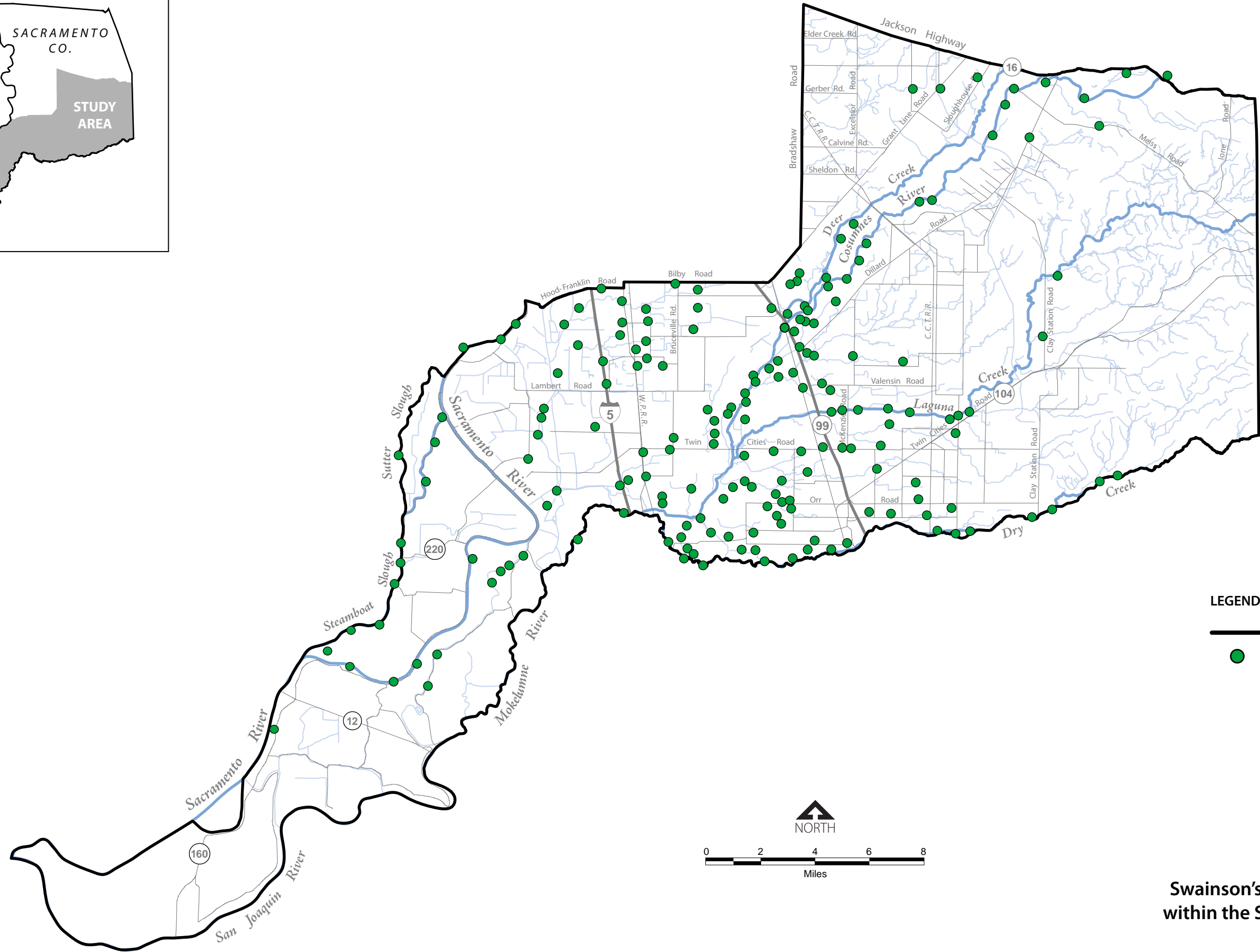
Figure 6 illustrates the distribution of Swainson’s Hawk territories in the study area in 2006. Table A-1 (Appendix A) provides the location, activity, habitat association, and reproductive data for each territory. Table 5 summarizes activity data.

Table 5. Activity Data for Swainson’s Hawk Territories in the South Sacramento County Study Area, 2006.

	Number	Percent of Total Active Territories	Percent of Total Active Nests
Active Territories	188		
Not Nesting (NN)	50	26.6	
Unknown Nesting (UN)	12	6.4	
Active Nests (S, U, UO)	126	67.0	
Successful Nests (S)	57		45.2
Unsuccessful Nests (U)	52		41.3
Unknown Outcome (UO)	17		13.5
Total		100	100

A total of 188 active Swainson’s Hawk territories were identified. Of these, 126 (67.0%) were confirmed to have nested (i.e., active nest), and of the active nests, 57 (45.2%) successfully reared young to fledging. As noted above, a large proportion of this population (i.e., active territories) did not nest (26.6%) and a large proportion of the active nests were unsuccessful (41.3%) (Table 5). While weather conditions, prey populations, and other factors influence activity and nesting success on an annual basis within Swainson’s Hawk populations, these numbers are substantially higher than is typically reported in the Central Valley (Estep in preparation). Nonetheless, Swainson’s Hawks occupied nesting territories (nesting and non-nesting pairs) across the landscape and in sufficient numbers to evaluate the nesting distribution relative to general land use patterns.

Swainson’s Hawks were distributed across the study area (Figure 6); however, the largest concentrations were in the interior of the study area with smaller numbers toward the eastern foothills and southeast into the Delta. Table 6 indicates the number of territories within each of the three geographic zones (Figure 3).



- LEGEND**
- Study Area Boundary
 - Swainson's Hawk Nest Site

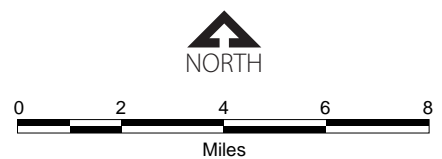


Figure 6
Swainson's Hawk Territory Locations
within the South Sacramento County
Study Area

Table 6. Number of Swainson’s Hawk Territories within each Geographic Zone.

Geographic Zone	Number of Territories	Percent of Total
Delta Zone	38	20.2
Interior Zone	140	74.5
Eastern Foothills Zone	10	5.3

While there is variability based on geographic zone (See Below), territory density, based on the number of territories per square mile, across the study area was 0.37 territories per square mile (0.96 per sq km). While lower than in some other Central Valley locations, such as portions of Yolo County, this is an exceptionally high density compared with other portions of the species’ breeding range (Table 7). It indicates the value of the agricultural habitats within this region to Swainson’s Hawks and the importance of the ‘core’ Central Valley population (Yolo, Solano, Sacramento, and San Joaquin Counties).

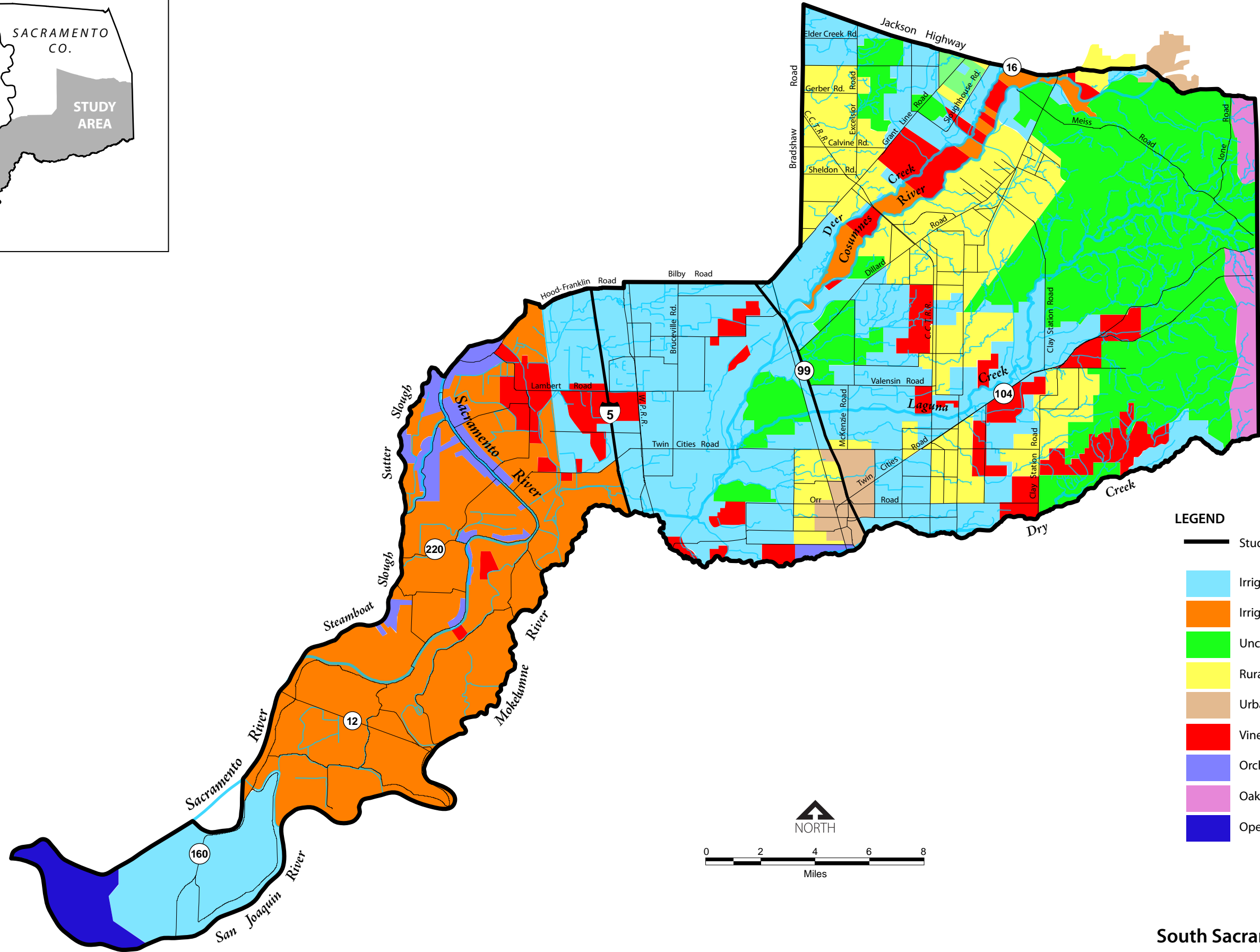
Table 7. Territory Density in the South Sacramento Study Area Relative to other Geographic Areas.

Location	Territory Density (Territories per sq mi [km])	Source
Yolo County	0.58 (1.50)	Estep in preparation
South Sacramento County	0.37 (0.96)	This study
Butte Valley	0.14 (0.37)	Woodbridge et al. 1995
Alberta, Canada	0.09 (0.23)	Schmutz 1987
New Mexico	0.07 (0.17)	Bednarz et al. 1990

6.1.2 Habitat Associations

Foraging Habitat

Figure 7 illustrates the distribution of land use cover types across the study area. Table 8 indicates the relative abundance (based on a rough estimate of acreage) of each of the nine cover types in the study area. A total of nine land use cover types were mapped. Six of these (Vineyards, Orchards, Oak Woodlands, Rural Residential, Urban, and Open Water) were included because they represent distinct land uses that provide little to no suitable Swainson’s Hawk foraging habitat. Vineyards and orchards are perennial crop types that, while potentially converted back to a suitable foraging habitat and thus having potential value for conservation purposes, are considered unsuitable habitat areas for at least relatively long periods of time. Both high density urban areas and lower density rural residential areas are considered unsuitable habitat areas, and while some rural residential areas may receive low-level use by Swainson’s Hawks, these areas are also not appropriate for conservation purposes. Oak woodlands occur in the extreme eastern portion of the study area and while having potential value as nesting sites, do not provide suitable foraging habitat for Swainson’s Hawks.



- LEGEND**
- Study Area Boundary
 - Irrigated Cropland/Irrigated Pasture
 - Irrigated Cropland
 - Uncultivated Grassland
 - Rural Residential
 - Urban
 - Vineyard
 - Orchard
 - Oak Savannah/Oak Woodland
 - Open Water/Permanent Marsh

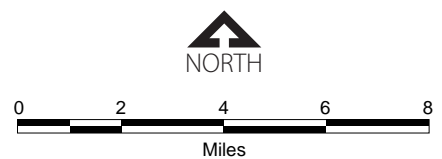


Figure 7
Land Use within the
South Sacramento County Study Area

Table 8. Relative Abundance of Land Cover Type Acreages in the Study Area.

Cover Type	Estimated Acres	Percent of Total
Irrigated Cropland/Pasture	110,000	34.0
Uncultivated Grassland	79,000	24.5
Irrigated Cropland	78,000	24.1
Rural Residential	40,000	12.4
Urban	5,000	1.5
Open Water/marsh	5,000	1.5
Oak Woodland	3,000	0.9
Vineyard	2,000	0.6
Orchard	1,000	0.3
Total	323,000	100

Within the study area, land uses considered suitable for Swainson's Hawk foraging include grasslands, pasturelands, and cultivated farmlands (Estep 1989, Babcock 1995, England et al. 1997). A variety of specific cover types are included within cultivated farmlands; however, for purposes of characterizing Swainson's Hawk habitat at the landscape level, specific cover types were grouped into the following three categories:

- **Irrigated Cropland.** This type is defined as areas that are dominated by crop patterns that involve annual cultivation (Plates 23 and 24). Approximately 25% of the study consists of this cover type (Table 8). Most of these lands occur in the Delta portion of the study area, where the dominant crop type is corn, but also includes rotation to tomatoes, sunflowers, and other crop types. A small percentage of the landscape is also in alfalfa most years (Figure 7).
- **Irrigated Cropland/Irrigated Pastureland.** This type is defined as areas that are dominated by a mixture of irrigated croplands (as defined above) and a large percentage of irrigated pasture (Plates 25 and 26). Approximately 34% of the study area consists of this cover type (Table 8). The pastures are often grazed and/or regularly cut for hay. Relatively large amounts of alfalfa and other hay crops also occur. Most of these lands occur in the central portion of the study area from approximately Snodgrass Slough on the west to Clay Station Road on the east (Figure 7).
- **Uncultivated Grasslands.** This type is defined as uncultivated annual grassland habitat that is regularly or irregularly grazed by livestock and that has retained most topographical and other natural features (e.g., vernal pools and swales, native oak trees, etc.) (Plates 27 and 28). Approximately 24% of the study area consists of this cover type (Table 8). The eastern portion of the study area, primarily east of Clay Station Road, consists of this type along with several other large blocks in the central portion of the study area including north of Grant Line Road and south of the Cosumnes River on both sides of State Route 99 (Figure 7).

Approximately 83% of the study area consists of these suitable land uses (Table 8).



Plate 23. Corn field on Grand Island, southwestern Sacramento County



Plate 24. Tomato field just east of the Sacramento River



Plate 25. Irrigated pasture just west of Interstate 5



Plate 26. Alfalfa field east of Interstate 5.



Plate 27. Uncultivated grassland on Valensin Ranch, south of Cosumnes River



Plate 28. Uncultivated grassland on Howard Ranch, southeastern Sacramento County

Not unexpectedly, these three types also generally correspond with the three geographic zones described earlier. The interior zone is the most diverse with respect to the three habitat categories, and includes blocks of uncultivated grasslands and areas traditionally restricted to irrigated cropland (i.e., Cosumnes River Basin east of State Route 99). However, the majority of the area is a mixture of irrigated cropland and irrigated pasture. The majority of urban and rural residential development also occurs within the interior zone.

Figure 7 indicates that the Delta region is primarily cultivated cropland. This is also the area where virtually all of the orchards and a relatively large percentage of the vineyards occur. The dominant crop type in this region is corn, which is considered only marginally suitable for Swainson’s Hawk foraging. However, there are smaller amounts of other crop types, some irrigated pasture (particularly in the extreme southwest corner of the county), and traditionally some alfalfa.

The eastern foothills consist primarily of uncultivated grazed grassland. Much of the area is relatively intact and unbroken by other land uses. However, portions of the area have been cultivated, particularly lands associated with the Cosumnes River – Deer Creek corridor, Laguna Creek, and Dry Creek (Figure 7).

Table 9 indicates the general habitat associations of each of the 188 Swainson’s Hawk territories. Habitat associations were assigned based on the dominant land uses in the immediate vicinity of the nesting territory within an approximately ½ mile radius area. In addition to the three broad foraging habitat types (Irrigated Cropland, Irrigated Pasture, and Uncultivated Grasslands), urban and rural residential categories were also included.

Table 9. Land Use/Habitat Associations of Swainson’s Hawk Territories in the South Sacramento County Study Area, 2006.

Habitat Association	Number of Territories	Percent of Total
IC/IP	104	55.3
IC	39	20.7
IC/UG	17	9.0
IC/IP/RR	14	7.4
UG	5	2.7
IC/IP/UG	5	2.7
IC/IP/UG/RR	2	1.1
IC/Ur	1	0.5
UG/Ur	1	0.5
Total	188	100

IC = Irrigated Cropland
 IP = Irrigated Pasture
 UG = Uncultivated Grassland
 Ur = Urban
 RR = Rural Residential

The majority of territories (55.3%) were associated with the Irrigated Cropland/Irrigated Pasture land use – primarily in the Interior zone. Nearly 21% were associated with the Irrigated Cropland - all of which are within the Delta zone. Only five of the territories were considered to be exclusively associated with uncultivated grasslands. The remaining territories within the eastern foothills zone were associated with a mix of land uses. Sixteen territories were associated with rural residential development; however, only two were associated with more dense urban areas.

Nesting Habitat

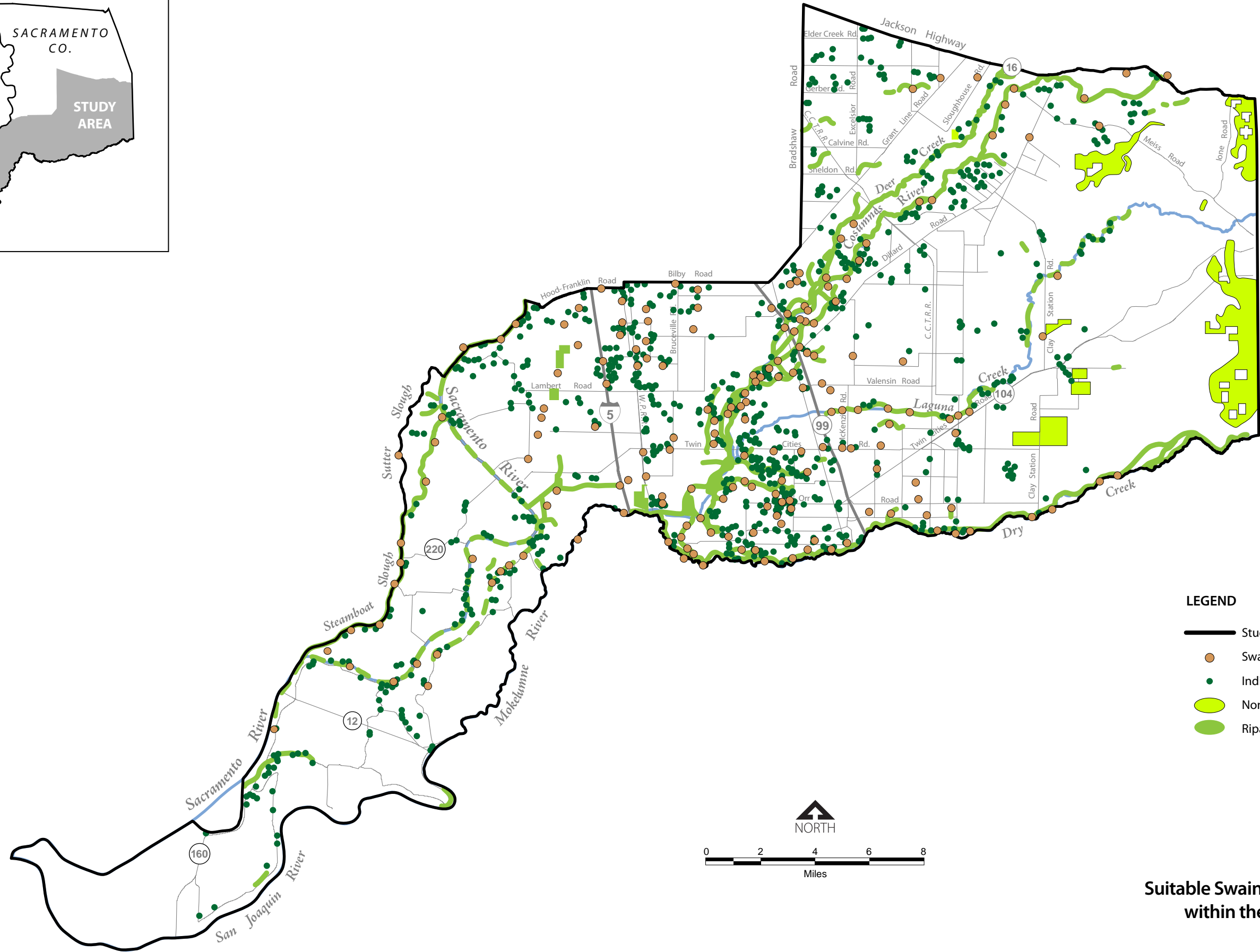
Figure 8 illustrates the general distribution of potential Swainson's Hawk nesting habitat throughout the study area. The Cosumnes River – Deer Creek corridor represent the most significant riparian habitat corridor in the study area. Other drainages, such as Laguna Creek, Dry Creek, Snodgrass Slough, and Lost Slough, represent smaller but extremely important riparian corridors. Other important potential nesting habitat includes isolated trees, trees along roadsides, windbreaks, or other tree rows, and trees associated with farmyards (Figure 8) (Plates 29 through 34).

Figure 8 indicates that largest proportion of potential nesting habitat occurs in the interior zone. This area is characterized by several significant riparian corridors, numerous farmsteads with native and nonnative trees along roadsides and farmyards, and many isolated trees that are remnant of long-removed oak groves.






Many of the watercourses in the Delta region, including the Mokelumne River and the Sacramento River, have been largely denuded for flood control purposes, and while there remains some suitable riparian habitat along these drainages and associated sloughs, available nesting habitat is significantly less than that found in the interior region (Figure 8).

The eastern foothills region is characterized by narrow riparian corridors along Laguna Creek and Dry Creek, and native oak savannah and woodland near the eastern county border (Figure 8). There are also large open grassland areas that do not support any trees.

Table 10 indicates the nesting habitat associations of each Swainson's Hawk territory in the study area. The majority (68.7% [including riparian habitat along both natural and channelized watercourses]) were associated with riparian habitats. This is consistent with other findings in the Central Valley (Estep 1989, Schlorff and Bloom 1984); but is considered a function of nesting habitat availability rather than a preference for riparian habitat. Also typical of other studies in the Central Valley is the association with farmyards (11.2%), isolated trees (9%) and tree rows (5.3%). Few oak and cottonwood groves exist within the study area, but are probably used in proportion to their availability. Eucalyptus groves are more common and are used with increasing frequency in the study area and elsewhere in the Central Valley (Figure 8).



LEGEND

-  Study Area Boundary
-  Swainson's Hawk Nest Site
-  Individual Trees, Tree Row, or Group of Trees
-  Non-Riparian Woodlands
-  Riparian Woodland - Mature Woodland

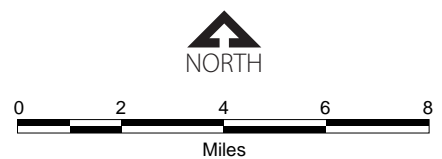


Figure 8
Suitable Swainson's Hawk Nesting Habitat
within the South Sacramento County
Study Area



Plate 29. Riparian habitat along Laguna Creek.



Plate 30. Roadside tree row near Galt; site of SA-65.



Plate 31. Isolated valley oak tree south of Grant Line Road; site of SA-31



Plate 32. Cottonwood grove near Meiss Road; site of SA-15.



Plate 33. Farmyard nesting habitat near Twin Cities Road, site of SA-63



Plate 34. Riparian habitat along Cosummes River, site of SA-47

Table 10. Nesting Habitat Associations of Swainson’s Hawk Territories in the South Sacramento County Study Area, 2006.

Nesting Habitat Type	Number of Territories	Percent of Total
Riparian	118	62.8
Farmyard	21	11.2
Isolated Tree	17	9.0
Channelized Riparian	11	5.9
Tree Row	10	5.3
Eucalyptus Grove	6	3.2
Oak Grove	2	1.1
Cemetery	2	1.1
Cottonwood Grove	1	0.5
Total	188	100

Table 11 indicates the tree species used by nesting Swainson’s Hawks within the study area. Cottonwood (*Populus fremontii*) and valley oak (*Quercus lobata*) were equally used and were the most commonly used nest tree species. This is also consistent with other Central Valley populations (Estep 1989, Estep in preparation, Jones & Stokes 2006). As noted above, eucalyptus trees (*Eucalyptus* sp.) are also commonly used by nesting Swainson’s Hawks and possibly increasing in use. While the two most common native species (cottonwood and valley oak) remain the most commonly used nest tree species, Table 11 indicates that a variety of other trees species can be used by Swainson’s Hawks, including several species not native to the Central Valley. While cottonwood and valley oaks may not be used disproportionately relative to their availability, they are likely selected over most other species due to their size and structure.

Table 11. Nest Tree Species used by Nesting Swainson’s Hawks in the South Sacramento County Study Area, 2006.

Tree Species	Number of Active Nest Sites	Percent of Total
Cottonwood	41	32.5
Valley Oak	41	32.5
Eucalyptus	19	15.1
Willow	14	11.1
Walnut	3	2.4
Locust	2	1.6
Pine	2	1.6
Deodor Cedar	1	0.8
Redwood	1	0.8
Sycamore	1	0.8
Alder	1	0.8
Total	126	100

6.1.3 Relationship Between Distribution and Habitat Associations

Figure 9 illustrates the distribution of Swainson’s Hawk territories relative to the distribution of nesting and foraging habitat in the study area. These relationships suggest the influence of land use, crop patterns, prey populations, and nesting habitat on Swainson’s Hawk use and distribution.

As noted earlier, the interior zone consists of a more diverse land use pattern, a combination of annually cultivated habitats and irregularly cultivated pasturelands. This combination includes lands with variable prey resources (but with seasonally large and accessible prey populations) due to agricultural practices (e.g., harvesting, disking, mowing, etc.) and lands with more stable prey resources (but lower prey populations) such as irrigated pastures due to the lack of regular cultivation. The interior zone also includes some uncultivated grassland, another source of relatively stable prey populations, and the largest amount of potential nesting habitat among the three geographic zones.

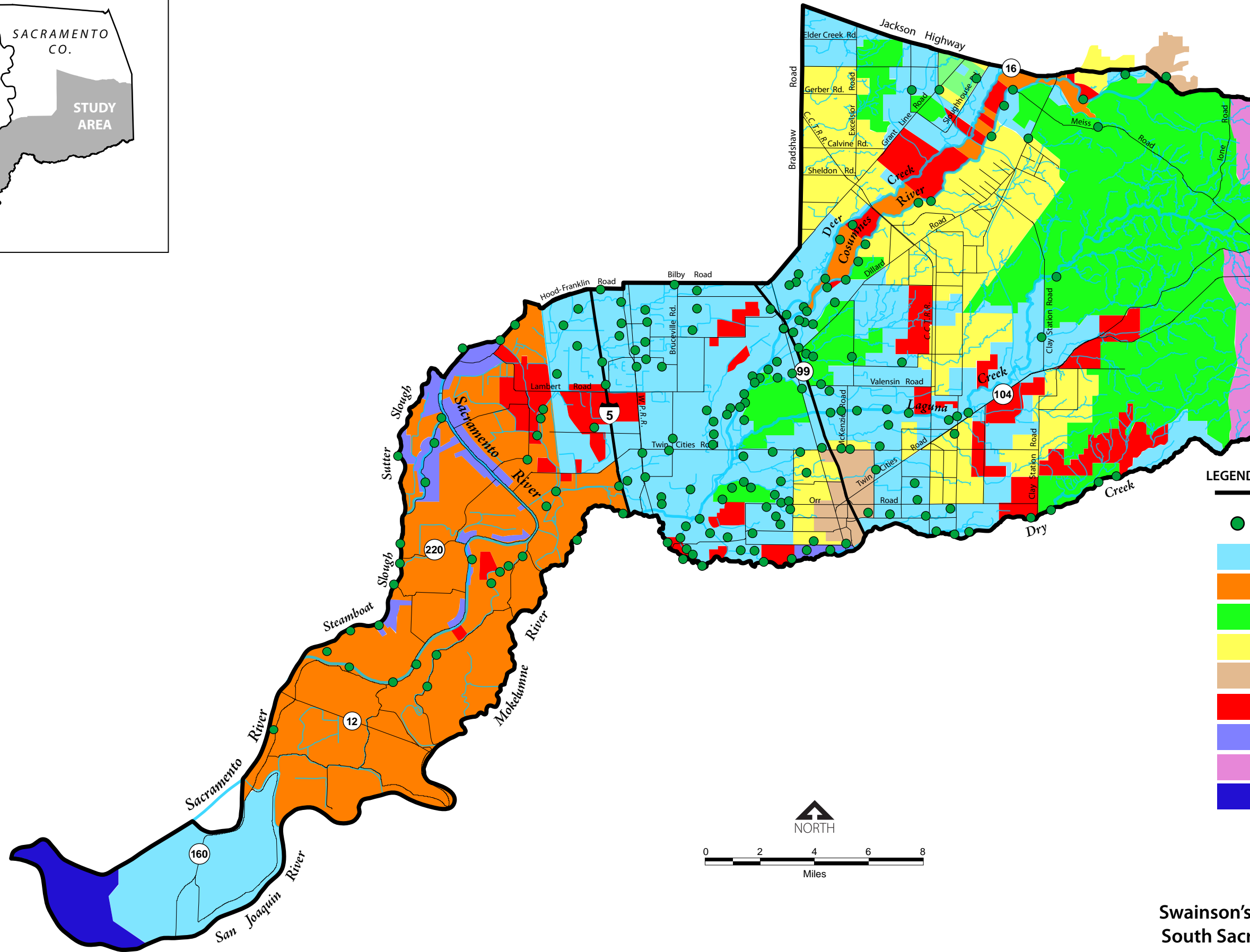
As a result of these factors, the interior zone is occupied by a large proportion of the Swainson’s Hawk population in the study area (74.5%). Habitat conditions in the interior zone also support a greater number of Swainson’s Hawk per area (i.e., territory density) (Table 12).

Table 12. Swainson’s Hawk Territory Density (Territories per square mile) in the South Sacramento County Study Area, 2006.

	Number of Territories	Number of Acres	Number of Square Miles	Territories per Square Mile
Delta Zone	38	91,000	142	0.27
Interior Zone	140	161,000	252	0.56
Foothills Zone	10	71,000	111	0.09

The Delta zone supports a significant, but smaller proportion of the study area population (20.2%). Figure 8 indicates that Swainson’s Hawk territories are distributed in this area largely based on remaining patches of riparian nesting habitat. Compared with the interior zone, the Delta zone is nearly all irrigated croplands and does not receive the benefit of stable prey populations that irrigated pasture and uncultivated grasslands provide. In addition, because the major crop type is traditionally corn, much of the Delta zone is only marginally suitable for foraging most of the breeding season. Because of limited nesting habitat and marginal foraging habitat throughout much of the area (with the exception of the area between Snodgrass Slough and Interstate 5), the Delta zone supports a fewer number of nesting Swainson’s Hawks and less territory density than the interior zone (Table 12).

Because much of the eastern foothills zone is uncultivated and does not undergo annual or seasonal changes similar to the interior and Delta zones, prey populations are more



- LEGEND**
- Study Area Boundary
 - Swainson's Hawk Nest Site
 - Irrigated Cropland/Irrigated Pasture
 - Irrigated Cropland
 - Uncultivated Grassland
 - Rural Residential
 - Urban
 - Vineyard
 - Orchard
 - Oak Savannah/Oak Woodland
 - Open Water/Permanent Marsh

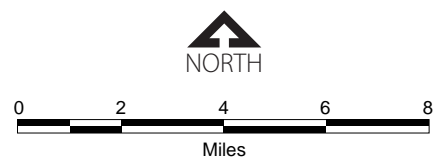


Figure 9
Land Use and
Swainson's Hawk Nest Sites within the
South Sacramento County Study Area

4/17/07

predictable and stable. However, prey populations are also probably less than in cultivated areas, particularly those species potentially taken by foraging Swainson’s Hawks. Availability of nest trees is also less than in the interior zone. As a result, the number of Swainson’s Hawk territories in the eastern foothill zone is less than the Delta and interior zones and the nesting density is substantially lower (Table 12).

6.1.4 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 13.

Table 13. Reproductive Performance of Swainson’s Hawks in the South Sacramento Study Area, 2006.

Active Nests (S, U, UO)	126	
Successful Nests (S)	57	
Unsuccessful Nests (U)	52	
Unknown Outcome (UO)	17	
Total Number of Young		83
Number of Young per Nesting Attempt (S+U)		0.76
Number of Young per Successful Nest		1.46

A total of 83 fledged young were recorded. This equates to 1.46 young per successful nest, which is generally consistent with other past and ongoing studies of Swainson’s Hawk in the Central Valley (Estep in preparation, Jones & Stokes 2006). Because of the unusually high number of unsuccessful nests in 2006, the total number of young per nesting attempt (successful plus unsuccessful nests) was substantially lower than is typically reported. Still, on the basis of successful nests, reproduction of this Swainson’s Hawk population is typical of other Central Valley locals (Table 14).

Table 14. Reproductive Performance of Swainson’s Hawk Populations in the Central Valley.

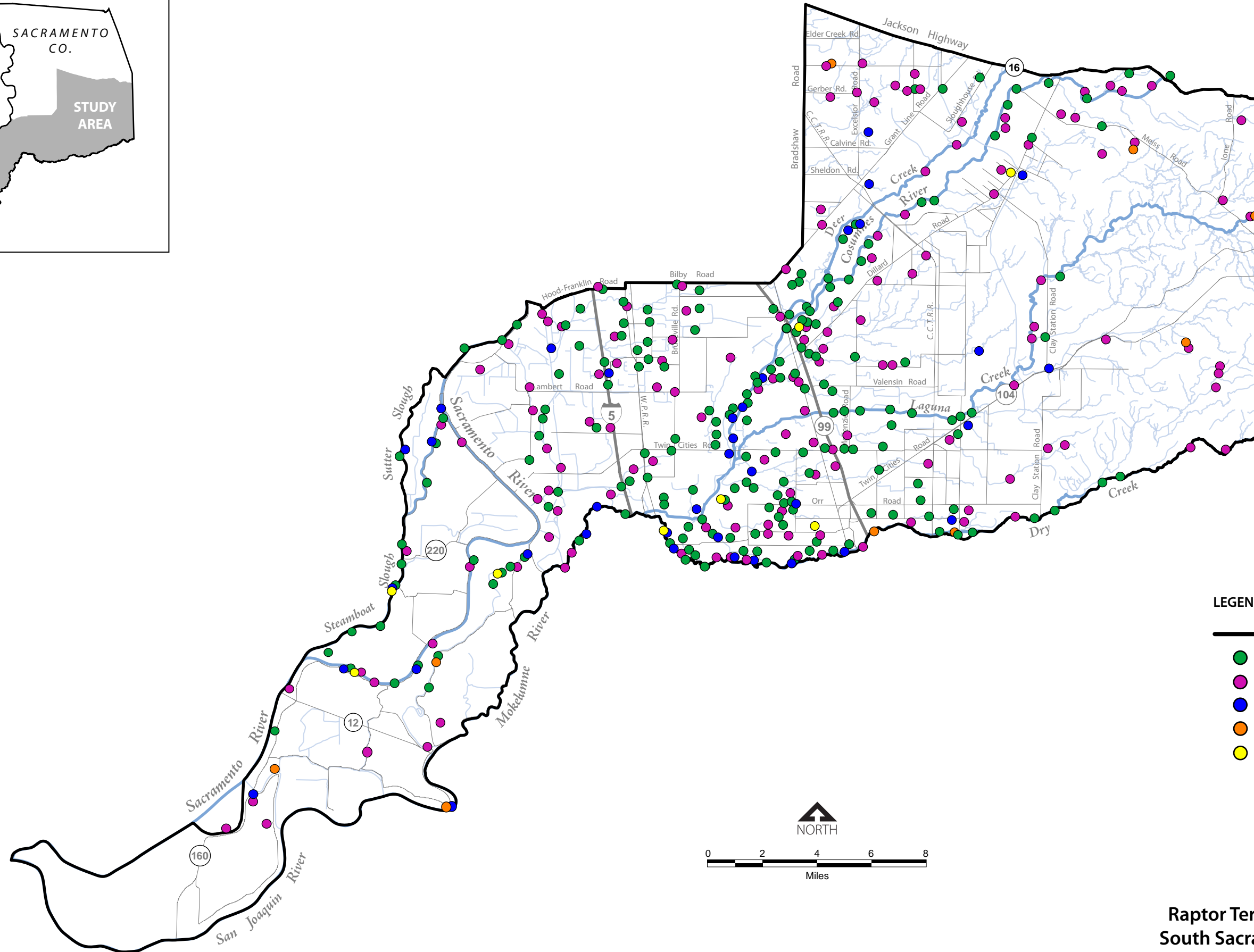
Location	Years of Study	Young per Nesting Attempt	Young per Successful Nest	Source
South Sacramento County	1	0.76	1.46	This study
Yolo County	15	1.16	1.49	Estep (in prep)
Natomas Basin	7	1.21	1.65	Jones & Stokes (2006)
Rancho Cordova	1	1.20	1.33	EEC (2006)

6.2 Distribution and Abundance of Other Surveyed Raptor Species

Several other species compete with Swainson's Hawk for nesting and food resources that can affect distribution, abundance, and reproductive performance. Interspecific competition for nesting and food resources is a normal ecological process in raptor communities that influences local and regional population structure (Newton 1979, Rothfels and Lein 1983, Thurow and White 1983, Janes 1984, Hansen and Flake 1995). However, in an environment with depleting or uncertain resources, such as much of the study area, these interactions can have a greater negative affect on some raptor populations. This can be particularly important to Swainson's Hawks because spring arrival onto breeding territories is later than other raptor species. Other raptor species, particularly Red-tailed Hawk, White-tailed Kite, and Great-horned Owl sometimes occupy traditional Swainson's Hawk nesting areas prior to the arrival of Swainson's Hawks. This can result in aggressive territorial interactions with variable results depending on the species involved. For example, White-tailed Kites are often displaced from traditional Swainson's Hawk nesting areas by late-arriving Swainson's Hawks leading to poor kite nesting success (Erichsen 1995). Conversely, Red-tailed Hawks and Great-horned Owls are rarely displaced resulting in the selection of alternative nesting sites by the returning Swainson's Hawk pair or occasionally resulting in the temporary or permanent abandonment of Swainson's Hawk nesting territories (Estep in prep.). However, other studies have shown that while nest sites were not relinquished, Red-tailed Hawks forfeited portions of their breeding territories to late-arriving Swainson's Hawks, potentially affecting the reproductive success of the Red-tailed Hawk pair (Janes 1994, Hansen and Flake 1995). Over time, as nesting and food resources are reduced due to urbanization or other factors, local or regional Swainson's Hawk and other raptor populations could be negatively affected as a result of both habitat loss and increased interspecific competition.

In addition, evaluation of the distribution and habitat relationships of other species – particularly Red-tailed Hawk – can reveal differences in habitat relationships and use at a landscape level that may be helpful in assessing different geographic areas with respect to their suitability for species conservation. In other words, certain areas may be more suitable for Red-tailed Hawk than for Swainson's Hawk, and thus would not be considered high priority conservation areas for Swainson's Hawk.

Figure 10 illustrates the distribution and abundance of other surveyed raptor species in the study area in 2006. Red-tailed Hawk, the most abundant nesting buteo in the Central Valley, occurred throughout the study area and sufficient information was gathered to make comparisons with Swainson's Hawks regarding distribution and habitat associations (See Below). Data were collected on several other species including Red-shouldered Hawk, White-tailed Kite, and Great-horned Owl that compete with Swainson's Hawks for nesting or food resources and influence Swainson's Hawk nesting distribution. Table A-2 provides the location, activity, habitat association, and



LEGEND

-  Study Area Boundary
-  Swainson's Hawk Nest Site
-  Red-Tailed Hawk Nest Site
-  Red-Shouldered Hawk Nest Site
-  Great-Horned Owl Nest Site
-  White-Tailed Kite Nest Site

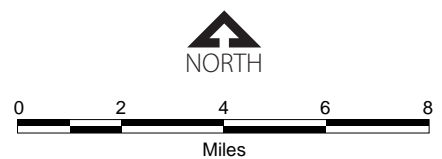


Figure 10
Raptor Territory Locations within the
South Sacramento County Study Area

reproductive data for Red-tailed Hawk, Red-shouldered Hawk, White-tailed Kite, and Great-horned Owl.

6.2.1 Red-shouldered Hawk

Red-shouldered Hawks typically nest in wooded areas, primarily riparian habitats, and were found throughout most of the Delta and interior zones of the study area. This species usually does not nest in open grassland habitats or savannahs, and thus none were found in the eastern foothill zone (Figure 10). Foraging primarily on passerine birds, Red-shouldered Hawks are fairly common in riparian forests, but are also found with increasing frequency in eucalyptus groves. A total of 40 Red-shouldered Hawk nesting territories were located during surveys, 29 (72.5%) of these were associated with riparian habitats and eight (20%) were associated with eucalyptus groves or eucalyptus tree rows (Figure 10, Table A-2). Of the 40 active territories, twenty-one nests were located. Red-shouldered Hawk competes with Swainson's Hawk for nesting sites, but to a much lesser extent for food resources.

6.2.2 White-tailed Kite

Nesting White-tailed Kites were uncommon in the study area in 2006 compared with most years. The principal prey of the White-tailed Kite is the meadow vole (Warner and Rudd 1975, Dunk 1995), and as noted above the early season weather conditions and its affect on prey populations may have reduced available prey for White-tailed Kite and thus negatively influenced nesting activity. Only eight White-tailed Kite territories were documented during surveys (Figure 10, Table A-2). While there are no data available to compare this with past years, anecdotal data suggests that the species is typically found in much greater abundance throughout the study area. White-tailed Kites nest in a variety of wooded habitats, including riparian woodlands, oak woodlands, and oak savannah. They can be found in narrow channelized riparian habitats and occasionally in roadside trees or tree rows. White-tailed Kite competes with Swainson's Hawk for nesting sites and food resources (Erichsen 1995). Like Swainson's Hawk, California vole is the principal prey item for White-tailed Kite. While the presence of White-tailed Kite can influence the distribution and nesting activity of Swainson's Hawk, there are data that suggest that the opposite scenario is more likely and that Swainson's Hawk is relatively successful at dislodging White-tailed Kite from nest sites and forcing them to renest elsewhere (Erichsen 1995).

6.2.3 Great-horned Owl

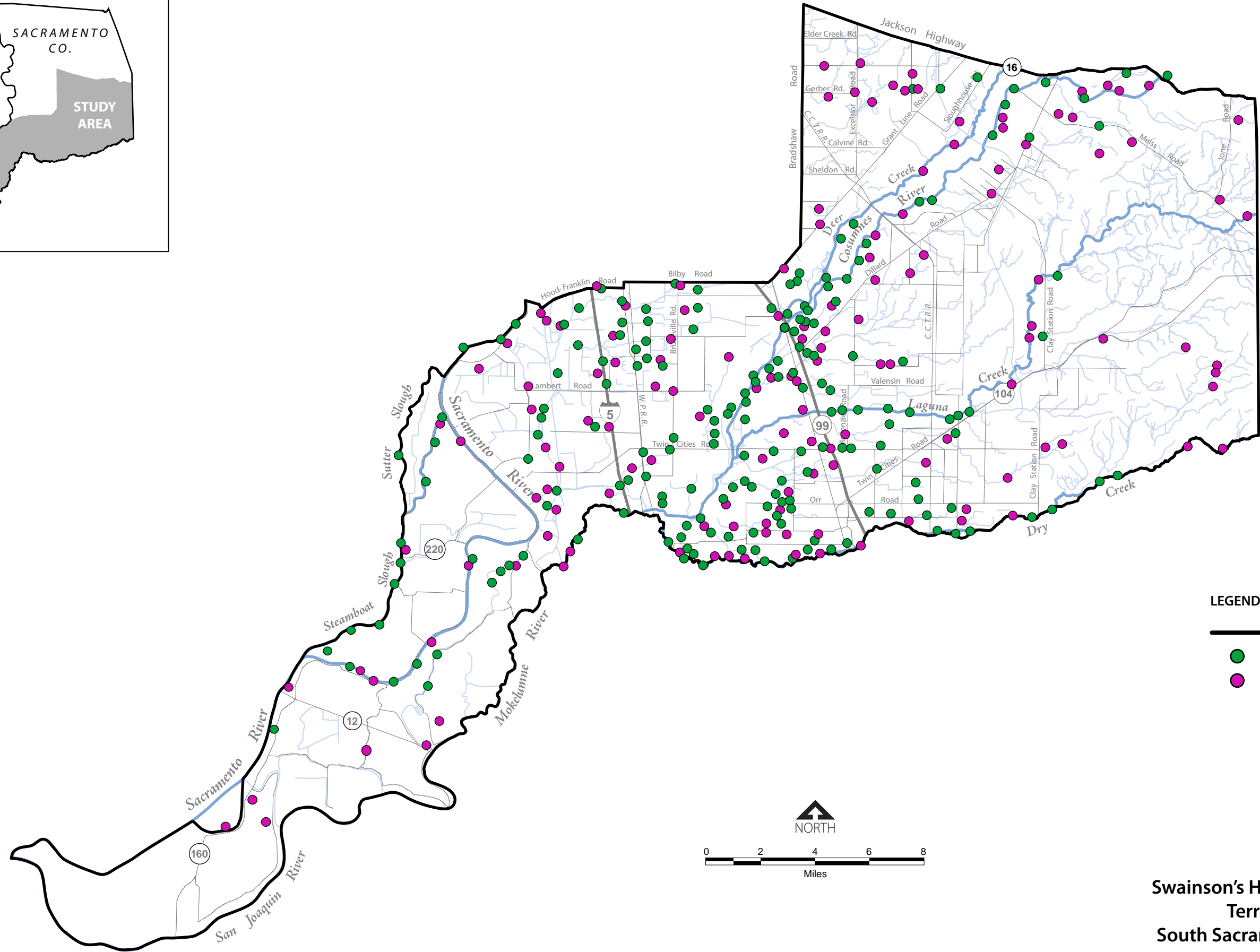
Great-horned Owl was also included in the survey because it can have a more significant local influence on Swainson's Hawk nesting distribution and success compared with Red-shouldered Hawk and White-tailed Kite. Great-horned Owls do not typically construct their own nest, but instead occupy the nests of other stick-nest-build raptors (Johnsgard 1998). Because they nest earlier in the season than most other raptors (often




initiating nesting as early as January), their nesting cycle is well underway by the time Swainson's Hawks arrive onto their breeding territories. Great-horned Owls often occupy Swainson's Hawk nests, and Swainson's Hawks are usually unsuccessful at dislodging Great-horned Owls from their nest once they arrive onto the breeding territory (Estep pers observation). This can result in the Swainson's Hawk pair not nesting or causes them to construct a nest in an alternative and potentially less desirable location. Great-horned Owls also prey on Swainson's Hawk young, so proximity to an owl nest can also influence Swainson's Hawk productivity. Only 12 Great-horned Owl nests were detected during surveys of the study area (Figure 10, Table A-2). While weather and prey conditions probably affected Great-horned Owl activity as it did most other raptor species, this is most likely a significant underestimate of the Great-horned Owl nesting population within the study area in 2006. Great-horned Owls can be quite secretive and difficult to detect in woodland habitats and thus many active sites were probably undetected, particularly in riparian areas for which access was limited. This species will nest in most woodland habitats, including riparian woodlands and oak woodlands. It will also nest in isolated trees, tree rows, and eucalyptus groves.

6.2.4 Red-tailed Hawk

Among the species surveyed, Red-tailed Hawk may influence the distribution and abundance of Swainson's Hawk more than any other species in the study area (Rothfels and Lein 1983, Janes 1984, Bechard et al. 1990, Janes 1995, Hansen and Flake 1995). Territorial competition influences Red-tailed Hawk and Swainson's Hawk territory occupancy and reproductive performance depending on specific habitat elements (Janes 1984, 1994). Red-tailed Hawk is of similar size and uses similar nesting and foraging habitat. More of a generalist with respect to foraging habitat, prey species, and foraging behavior, the Red-tailed Hawk uses a variety of nesting and foraging habitats and occupies all portions of the study area. A total of 150 Red-tailed hawk nesting territories were recorded during surveys (Figure 10, Table A-2). Figure 11 illustrates the distribution of Swainson's Hawk and Red-tailed Hawk territories in the study area in 2006.

Red-tailed Hawk is distributed somewhat more evenly across the study area landscape compared with Swainson's Hawk. With a more diverse diet and the ability to capture small rodent prey (e.g., microtus and other mice) and larger prey, such as black-tailed jackrabbit (*Lepus californicus*) and California ground squirrel (*Spermophilus beechii*), the Red-tailed Hawk can more effectively utilize the uncultivated grassland habitats in the eastern foothill zone where these species are more common. Bechard et al. (1990) showed that Swainson's Hawk and Red-tailed Hawk in Washington State selected nesting areas based on specific habitat parameters (e.g., distance to water, distance to human disturbance, nest tree diameter, foraging habitat type) that resulted in a relatively clear partitioning of the available landscape. While habitat partitioning also occurs in the study area and the Sacramento Valley in general, the data presented here indicate that Swainson's Hawks appear to be more restrictive in their selection of nest areas than Red-tailed Hawks. Because of this – and because of their earlier nest initiation, Red-tailed Hawks occasionally occupy traditional Swainson's Hawk nesting territories, which in



- LEGEND**
-  Study Area Boundary
 -  Swainson's Hawk Nest Site
 -  Red-Tailed Hawk Nest Site

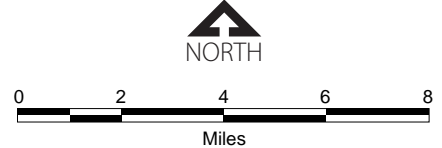


Figure 11
Swainson's Hawk and Red-tailed Hawk
Territory Locations within the
South Sacramento County Study Area

some cases has resulted in the permanent abandonment of Swainson's Hawk nesting territories (Estep in preparation.).

Activity and Reproduction

Table 15 indicates that Red-tailed Hawks were not subject to the effects of early season flooding as were Swainson's Hawks. While nesting was undetermined at 22% of the active territories, there were no territories that were confirmed as not nesting. Also, few active Red-tailed Hawk nests were unsuccessful (3.4%) compared to Swainson's Hawk (41.6%). Reproductive performance was also greater in Red-tailed Hawks.

Table 15. Comparison of Activity and Reproductive Performance Data for Swainson's Hawk and Red-tailed Hawk in the South Sacramento Study Area, 2006.

	Swainson's Hawk			Red-tailed Hawk		
	Number	Percent of Total Active Territories	Percent of Total Active Nests	Number	Percent of Total Active Territories	Percent of Total Active Nests
Active Territories	188			150		
Not Nesting (NN)	50	26.6		0	0	
Unknown Nesting (UN)	12	6.4		33	22.0	
Active Nests (S, U, UO)	126	67.0		117	78.0	
Successful Nests (S)	57		45.2	57		48.7
Unsuccessful Nests (U)	52		41.3	4		3.4
Unknown Outcome (UO)	17		13.5	56		47.9
Total number of Young	83			108		
Young per nesting attempt	0.76			1.77		
Young per Successful Nest	1.46			1.89		
Total		100	100		100	100

Habitat Associations

Table 16 compares the habitat associations between Swainson's Hawk and Red-tailed Hawk and indicates a greater association with uncultivated grassland habitat, but a somewhat similar association with irrigated cropland and irrigated pasture habitats.

Table 16. Comparison of Swainson’s Hawk and Red-tailed Hawk Habitat Associations in the South Sacramento County Study Area, 2006.

Habitat Association	Swainson’s Hawk		Red-tailed Hawk	
	Number of Territories	Percent of Total	Number of Territories	Percent of Total
IC/IP	104	55.3	62	41.3
IC	39	20.7	22	14.7
IC/UG	17	9.0	0	0
IC/IP/RR	14	7.4	11	7.3
UG	5	2.7	17	11.3
IC/IP/UG	5	2.7	19	12.7
IC/IP/UG/RR	2	1.1	7	4.7
IC/Ur	1	0.5	0	0
UG/Ur	1	0.5	0	0
IC/RR	0	0	1	0.7
IP/UG	0	0	1	0.7
IP/RR	0	0	1	0.7
Total	188	100	150	100

IC = Irrigated Cropland RR = Rural Residential
 IP = Irrigated Pasture Ur = Urban
 UG = Uncultivated Grassland

Table 17 compares nesting habitat type of Swainson’s Hawk and Red-tailed Hawk in the study area. Both species use a variety of nesting habitat types, but riparian habitat is the predominant type. As noted above, this is likely more a function of availability than preference. The data also suggest that Swainson’s Hawks are more tolerant of human disturbances by occupying a greater proportion of farmyard nest sites (11.2%) compared with Red-tailed Hawk (4.0%).

Table 17. Comparison of Swainson’s Hawk and Red-tailed Hawk Nesting Habitat in the South Sacramento County Study Area.

Nesting Habitat Type	Swainson’s Hawk		Red-tailed Hawk	
	Number of Territories	Percent of Total	Number of Territories	Percent of Total
Riparian	118	62.8	75	50.0
Farmyard	21	11.2	6	4.0
Isolated Tree	17	9.0	28	18.7
Channelized Riparian	11	5.9	8	5.3
Tree Row	10	5.3	14	9.3
Eucalyptus Grove	6	3.2	6	4.0
Oak Grove	2	1.1	6	4.0
Cemetery	2	1.1	0	0
Cottonwood Grove	1	0.5	3	2.0
Oak Savannah	0	0	3	2.0
Artificial Structures	0	0	1	0.7
Total	188	100	150	100

Table 18 compares nest tree species used by Swainson’s hawk and Red-tailed Hawk in the study area. Both species select nest tree species similarly; however there is a greater use of valley oak by Red-tailed Hawk, possibly due in part to the Red-tailed Hawk’s larger nest and need for a more secure or substantial substrate.

Table 18. Comparison of Nest Tree Species used by Swainson’s Hawks and Red-tailed Hawks in the South Sacramento County Study Area, 2006.

Tree Species	Swainson’s Hawk		Red-tailed Hawk	
	Number of Active Nest Sites	Percent of Total	Number of Active Nest Sites	Percent of Total
Cottonwood	41	32.5	33	28.2
Valley Oak	41	32.5	50	42.7
Eucalyptus	19	15.1	20	17.1
Willow	14	11.1	5	4.3
Walnut	3	2.4	1	0.9
Locust	2	1.6	1	0.9
Pine	2	1.6	0	0
Deodor Cedar	1	0.8	0	0
Redwood	1	0.8	0	0
Sycamore	1	0.8	1	0.9
Alder	1	0.8	1	0.9
Blue Oak	0	0	3	2.6
Olive	0	0	1	0.9
Electrical Tower	0	0	1	0.9
Total	126	100	117	100

Overall, Red-tailed Hawk is distributed more evenly across the landscape than Swainson’s Hawk (Figure 11). Table 19 compares the number of Swainson’s Hawk and Red-tailed Hawk territories within the three geographic zones. Swainson’s Hawk is largely confined to cultivated habitats in the interior and Delta Zones and is found in the eastern foothill zone in less frequency than Red-tailed Hawk. There are several possible reasons for this, including:

- Swainson’s Hawk preference for cultivated habitats due to larger concentrations and availability of microtine prey;
- Competition with Red-tailed Hawk for limited nest sites throughout much of the eastern foothill zone; and
- The wider range of prey species that can be utilized by Red-tailed Hawk, including black-tailed jackrabbits and ground squirrels that are commonly found in the eastern foothill zone.

This does not diminish the value of the eastern foothill zone for Swainson’s Hawks, but rather only helps to explain the distribution and abundance of Swainson’s Hawk in the

eastern foothill grassland zone relative to the interior of the study area and throughout the Sacramento Valley.

Still, these data suggest that Swainson’s Hawk and Red-tailed Hawk habitat selection and use is similar in the interior and Delta zones, but that Red-tailed Hawks are more inclined to select nesting territories in the eastern foothill zone than Swainson’s Hawks. Therefore, in general the eastern foothill zone would not be considered a high priority area for Swainson’s Hawk habitat conservation compared with the interior and Delta zones.

Table 19. Comparison of the Number of Swainson’s Hawk and Red-tailed Hawk Territories within Each Geographic Zone.

Geographic Zone	Swainson’s Hawk		Red-tailed Hawk	
	Number of Territories	Percent of Total	Number of Territories	Percent of Total
Delta Zone	38	20.2	34	22.7
Interior Zone	140	74.5	95	63.3
Eastern Foothill Zone	10	5.3	21	14.0

7.0 Mitigation and Conservation Strategy for the City of Elk Grove

The City of Elk Grove has been actively developing a conservation strategy for the Swainson's Hawk. The City instituted an ordinance in 2003 that requires mitigation for losses of Swainson's Hawk habitat due to urbanization. Consistent with most HCPs and other mitigation programs in the Central Valley, a 1:1 compensation ratio is required under the ordinance. This means that for each acre of land that is converted to other uses, the applicant must compensate through the fee-based program or through direct acquisition, one acre of replacement land that is considered suitable for the Swainson's Hawk. Conservation is achieved through management of suitable habitat values on compensation lands in perpetuity.

The City has also developed a process through which potential conservation lands are evaluated and approved. The City has established a preliminary zone within the study area that is considered suitable for compensation. If a property occurs within this zone, the next step is the preparation of a suitability assessment that addresses several habitat suitability criteria.

The data from this report provides the City with a more complete understanding of the distribution and abundance of the Swainson's Hawk in south Sacramento County and will further assist the City in establishing criteria for conservation site selection and approval.

7.1 Selection Criteria

Selection of conservation sites should be based on an assessment of the following five primary criteria:

- Location within the study area (based on distribution and abundance and habitat parameters used in this study)
- Onsite habitat value
- Offsite habitat value
- Proximity to other conservation sites
- Proximity to existing or potential conservation areas

Each is discussed briefly below.

7.1.1 Location within the Study Area

The data presented here provide the basis for establishing a broad geographic prioritization of potential conservation areas based on relative habitat value throughout the study area. Based on the distribution of land use/cover types and the distribution and abundance of Swainson's Hawks in the study area, the Interior Zone may be considered as the highest priority area for conservation. Similarly, the Delta Zone would be considered the second priority area for conservation, followed by the eastern foothill zone as the third priority area.

Note that this criterion provides only a general geographic prioritization, and does not suggest that all lands within a zone are suitable. Further refinement is necessary to ensure that high priority conservation areas are appropriately identified. For example, the portion of the Interior Zone north of Grant Line Road may be inappropriate for conservation due to the potential for urbanization, the relative lack of Swainson's Hawk use of the area (Figure 9), and the extent of existing rural residential development. In addition, lands in the eastern portion of the Interior Zone south of Dillard Road support fewer nesting Swainson's Hawks than do areas further west. This is due in part to the extent of rural residential development and unsuitable cover types (vineyards). Thus, the potential conservation area within the Interior Zone could be refined to include lands bordered by I-5 on the west, Hood-Franklin and Grant Line Road (or the Elk Grove planning area boundary) on the north, Dry Creek and the Galt planning area boundary on the south, and Alta Mesa Road on the east.

Likewise, within the Delta Zone there is relatively little Swainson's Hawk use south of State Route 12. Only one nesting territory was identified in this area (Figure 9). Thus, only a portion of the Delta Zone (north of State Route 12) should be considered appropriate for conservation on the basis of this criterion.

In addition, there are other issues within the Delta Zone that the City should consider, including the potential for long-term or permanent land use changes due to flooding. While mostly still within the primary Delta Zone, lands between I-5 and Snodgrass Slough may have a significantly less chance of flooding and permanent conversion from a suitable agricultural landscape compared with lands further south. In fact, lands between I-5 and the Sacramento River may be considered appropriate for long-term conservation relative to portions of the Delta further to the south. Contiguity of conservation lands in this area with the Stone Lakes National Wildlife Refuge on the north and the Cosumnes River Preserve on the south may also provide value and should be considered in the decision-making process. Still, with current speculation and concern regarding the future status of the Delta (Lund et al. 2007), the City should further investigate the long-term potential for conservation within this zone with respect to the potential for flooding. The potential conservation area within the Delta Zone should be refined based on this investigation, but potentially could be restricted to lands between I-5 and Snodgrass Slough or I-5 and the Sacramento River.

The Eastern Foothill Zone may be inappropriate to be considered a priority conservation area. This area supports few Swainson's Hawk nesting pairs and is more conducive to Red-tailed Hawk nesting. The area could be considered appropriate for in-kind mitigation for Swainson's Hawks. In other words, the area is appropriate to mitigate losses of Swainson's Hawk habitat that occurs within Eastern Foothill Zone. However, this area is outside the Elk Grove planning area and thus there is no potential for in-kind mitigation or compensation.

7.1.2 Onsite Habitat Value

Potential conservation sites should be evaluated based on existing habitat value and the potential for enhancing habitat value through management. Ideally, conservation lands should optimize value for Swainson's Hawks while maintaining agricultural productivity and long-term sustainability. Cover types should provide high value Swainson's Hawk foraging habitat but should be permitted to occasionally rotate into less desirable cover types to maintain agricultural productivity. It is important to note that conservation lands should only be a relatively small proportion of the landscape. In order to realistically sustain Swainson's Hawk populations in the study area and elsewhere in the Central Valley, a viable and productive agricultural landscape must be retained and be sustainable into the future. Conservation lands alone will not successfully sustain the existing Swainson's Hawk population.

7.1.3 Offsite Habitat Value

The status of adjacent lands is also an important consideration in the selection of conservation sites. A conservation site surrounded by urbanization or unsuitable agricultural patterns provides limited value. Conservation lands should be selected in areas that are not subject to urbanization and in areas that optimize the potential for long-term retention of large unbroken agricultural or rangeland landscapes.

7.1.4 Proximity to Other Conservation Sites

To maximize potential value of conservation sites, the City should also consider opportunities for consolidation of conservation sites or contiguity with other conservation areas, such as the Cosumnes River Preserve, Stone Lakes National Wildlife Refuge, or other mitigation properties.

7.1.5 Proximity to Existing or Potential Urban Areas

In some cases, habitat value and the potential for Swainson's Hawk nesting declines as disturbances increase near urban areas. Equally important in selecting suitable conservation sites is the location of potentially urbanizing areas, including lands within the urban limit boundaries or the general plan areas of cities. In the absence of

commitments from the local jurisdiction regarding land conservation, lands within or near urban limit boundaries or general plan areas with a high potential for development should not be considered high priority Swainson's Hawk conservation sites.

8.0 Literature Cited

- Anderson, D. A., J. Dinsdale, and J. A. Estep. In progress. Movements, Behavior, and Post-Fledging Dependency of Juvenile Swainson's Hawks in the Central Valley of California.
- Anderson, D, R. Anderson, M. Bradbury, C. Chun, J. Dinsdale, J. Estep, K. Fein, and R. Schlorff. 2006. California Swainson's Hawk inventory: 2005-2006; 2005 Progress Report. California Department of Fish and Game, Resource Assessment Program, Sacramento, CA.
- Babcock, K. W. 1995. Home Range and Habitat Use of Breeding Swainson's Hawks in the Sacramento Valley of California. *Journal of Raptor Research* 29:193-197.
- Bechard, M. J. 1982. Effect of Vegetative Cover on Foraging Site Selection by Swainson's Hawk. *Condor* 84:153-159.
- Bechard, M.J., R.L. Knight, D.G. Smith, and R.E. Fitzner. 1990. Nest sites and habitats of sympatric hawks (*Buteo* spp.) in Washington. *J. Field Ornithol.* 61(2): 159-170.
- Bednarz, J.C. T. Hayden, and T. Fischer. 1990. The raptor and raven community of the Los Medanos area in southeastern New Mexico: a unique and significant resource. *N.Y. State Mus. Bull.* 471: 92-101.
- Bloom, P. H. 1980. The Status of the Swainson's Hawk in California. California Department of Fish and Game, Nongame Wildlife Investigations. Project Report W-54-R-12, Sacramento, California.
- Bradbury, M., J. A. Estep, and D. Anderson. In preparation. Migratory Patterns and Wintering Range of the Central Valley Swainson's Hawk.
- California Department of Water Resources. 1995. Sacramento-San Joaquin Delta Atlas: California Department of Water Resources, Sacramento, CA 121 pp.
- Dunk, J. R. 1995. White-tailed kite (*Elanus leucurus*). In *The Birds of North America*, No. 178 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.
- England, A. S., J. A. Estep, and W. Holt. 1995. Nest-Site Selection and Reproductive Performance of Urban-Nesting Swainson's Hawks in the Central Valley of California. *Journal of Raptor Research* 29(3):179-186.

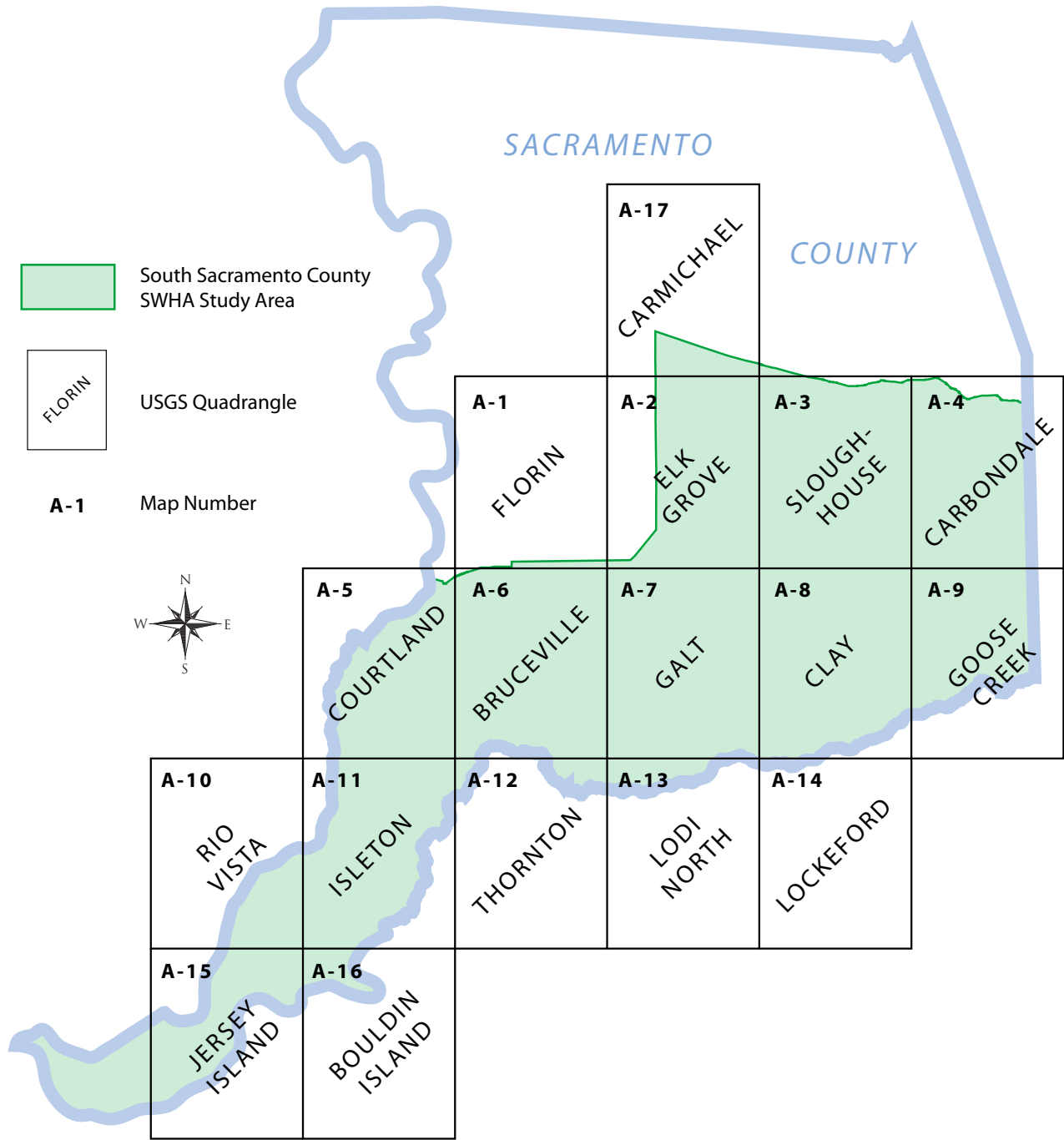
- England, A. S., M. J. Bechard, and C. S. Houston. 1997. Swainson's Hawk (*Buteo swainsoni*). In A. Poole and F. Gill (eds.), *The Birds of North America*, No. 265. Philadelphia, PA: The Academy of Natural Sciences and Washington, DC: The American Ornithologists' Union.
- Erichsen, A. L. 1995. The White-tailed kite (*Elanus leucurus*): nesting success and seasonal habitat selection in an agricultural landscape. Thesis. University of California at Davis, Davis, California.
- Estep, J. A. 1984. Diurnal Raptor Eyrie Monitoring Program. California Department of Fish and Game, Nongame Wildlife Investigations. Project Report W-65-R-1, Job No. II-2.0. Sacramento, CA.
- . 1989. Biology, Movements, and Habitat Relationships of the Swainson's Hawk in the Central Valley of California, 1986–1987. California Department of Fish and Game, Nongame Bird and Mammal Section, Sacramento, CA.
- . In preparation. Ecology of the Swainson's Hawk in the Central Valley of California.
- Estep, J. A., and S. Teresa. 1992. Regional conservation planning for the Swainson's hawk (*Buteo swainsoni*) in the Central Valley of California. Pages 775–789 in D. R. McCullough and R. H. Barrett (eds), *Wildlife 2001: Populations*. New York: Elsevier Applied Science.
- Estep Environmental Consulting. 2006. The Distribution, Abundance, and Habitat Associations of the Swainson's Hawk (*Buteo swainsoni*) in the Rancho Cordova Planning Area. Prepared for the City of Rancho Cordova, CA.
- Hansen, R.W. and L.D. Flake. 1995. ecological relationships between nesting Swainson's and Red-tailed Hawks in Southeastern Idaho. *J. Raptor Res.* 29(3): 166-171.
- Janes, S.W. 1984. Influences of territory composition and interspecific competition on Red-tailed Hawk reproductive success. *Ecology* 65: 862-870.
- Janes, S.W. 1994. Partial loss of Red-tailed Hawk territories to Swainson's Hawks: relations to habitat. *The Condor* 96:52-57.
- Johnsgard, P.A. 1988. North American owls. Smithsonian Institution Press, Washington, DC.
- Jones & Stokes. 2005. Modeling Swainson's Hawk habitat suitability in south Sacramento County. Prepared for the City of Elk Grove, February 2005.

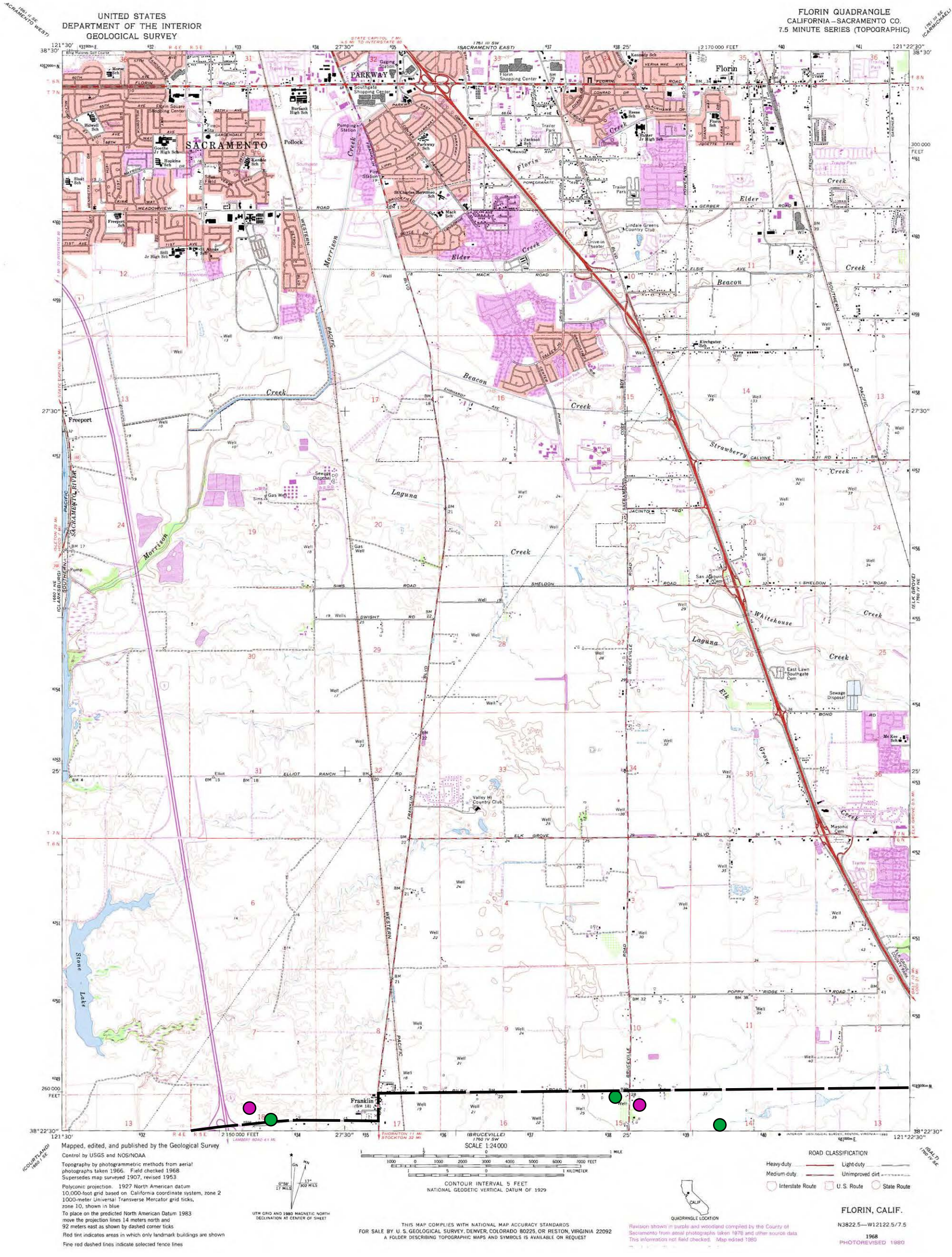
- Jones & Stokes. 2006. Biological effectiveness monitoring for the Natomas Basin Habitat Conservation Plan Area – 2005 annual survey results. (J&S 04002.04) Prepared for the Natomas Basin Conservancy, Sacramento, CA.
- Katibah, E. F. 1983. A brief history of riparian forests in the Central Valley of California. Pages 23–29 in R. E. Warner, and K. M. Hendrix (eds), California Riparian Systems: Ecology, Conservation, and Productive Management. Berkeley, CA: University of California Press.
- Lund, J., E. Hanak, W. Fleenor, R. Howitt, J. Mount, and P. Moyle. 2007. Envisioning futures for the Sacramento-San Joaquin Delta. Public Policy Institute of California. San Francisco, CA.
- McPherson, E.G. and N. Luttinger. 1998. From nature to nurture: the history of Sacramento's urban forest. *Journal of Arboriculture* 24(2):72-88.
- Rothfels, M. and M.R. Lein. 1983. Territoriality in sympatric populations of red-tailed and Swainson's hawks. *Can. J. Zool.* (61): 60-63.
- Schlorff, R., and P. H. Bloom. 1984. Importance of Riparian Systems to Nesting Swainson's Hawks in the Central Valley of California. Pages 612–618 in R. E. Warner, and K. M. Hendrix (eds), California Riparian Systems: Ecology, Conservation, and Productive Management. Berkeley, CA: University of California Press.
- Schumtz, J.K. 1984. Ferruginous and Swainson's Hawk abundance and distribution in relation to land use in southeastern Alberta. *Journal of Wildlife Management* 48(4): 1180-1187.
- Schmutz, J.K. 1987. The effect of agriculture on Ferruginous and Swainson's Hawks. *Journal of Range Management* 40(5): 438-440.
- Sharp, C. S. 1902. Nesting of Swainson's Hawk. *Condor* 4:116–118.
- Swolsgard, C.A. 2004. Nesting density and habitat use of Swainson's Hawk in a vineyard landscape in northern San Joaquin County, California. Masters Thesis, California State University, Sacramento, 196 pp.
- Thurrow, T.L. and C.M. White. Nest site relationship between the Ferruginous Hawk and Swainson's Hawk. *J. Field Ornithol.* 54(4): 401-406.
- Warner, J. S., and R. L. Rudd. 1975. Hunting by the white-tailed kite (*Elanus leucurus*). *Condor* 77:226-230.
- Woodbridge, B. 1991. Habitat selection by nesting Swainson's Hawks: a hierarchical approach. M.S. thesis, Oregon State University., Corvallis.

Woodbridge, B., K.K. Finley, and P.H. Bloom. 1995. Reproductive performance, age structure, and natal dispersal of Swainson's hawks in the butte Valley, California. *J. Raptor Res.* 29:187-192.

Appendix A. Individual Quadrangle Maps with Territory Locations

APPENDIX A Index Map

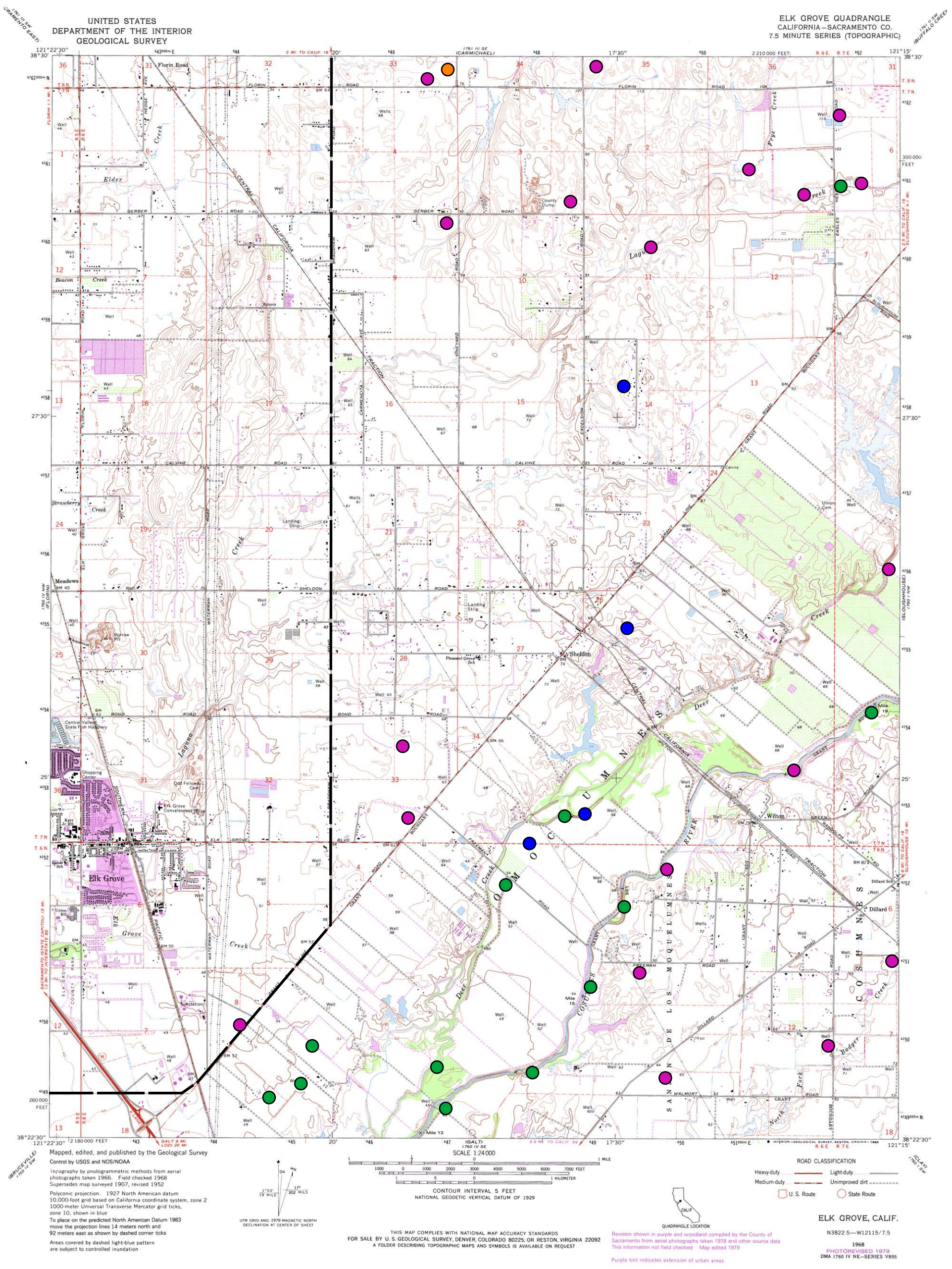




LEGEND

- Swainson's hawk
- Great-horned owl
- Red-tailed hawk
- White-tailed kite
- Red-shouldered hawk
- Study Area Boundary

Exhibit A-1
Raptor Nest Sites within the Florin, CA, 7.5' U.S.G.S. Quadrangle



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

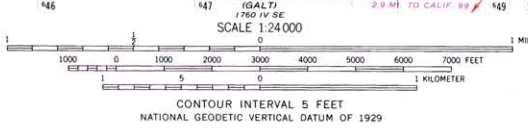
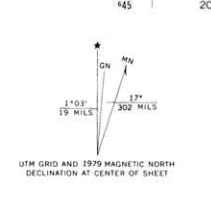
Maped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial
photographs taken 1956. Field checked 1958
Supersedes map surveyed 1907, revised 1952

Polycyclic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 2
1000-meter Universal Transverse Mercator grid ticks,
zone 10, shown in blue

To place on the predicted North American Datum 1983
move the projection lines 14 meters north and
92 meters east as shown by dashed corner ticks

Areas covered by dashed light-blue pattern
are subject to controlled inundation



ROAD CLASSIFICATION
Heavy-duty ——— Light-duty ———
Medium-duty ——— Unimproved dirt ———
U.S. Route ——— State Route ———

ELK GROVE, CALIF.
N3822.5-W12115.7.5
1968
PHOTOREVISED 1979
DMA 1760 IV NE-SERIES V895

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225 OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

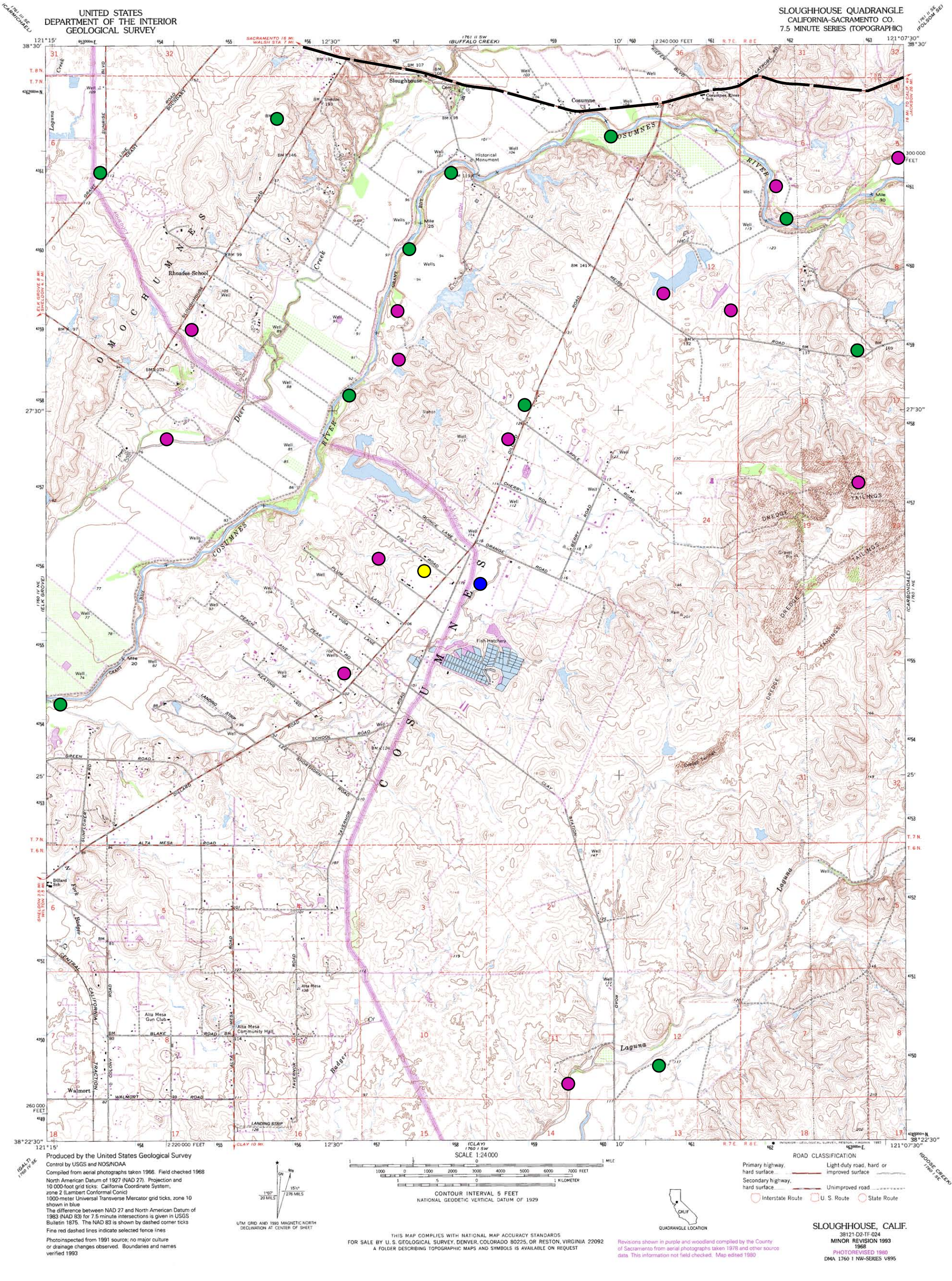
Revision shown in purple and woodland compiled by the County of
Sacramento from aerial photographs taken 1978 and other source data
This information not field checked. Map edited 1979

Purple tint indicates extension of urban areas

LEGEND

- Swainson's hawk
- Red-tailed hawk
- Red-shouldered hawk
- White-tailed kite
- Great-horned owl
- Study Area Boundary

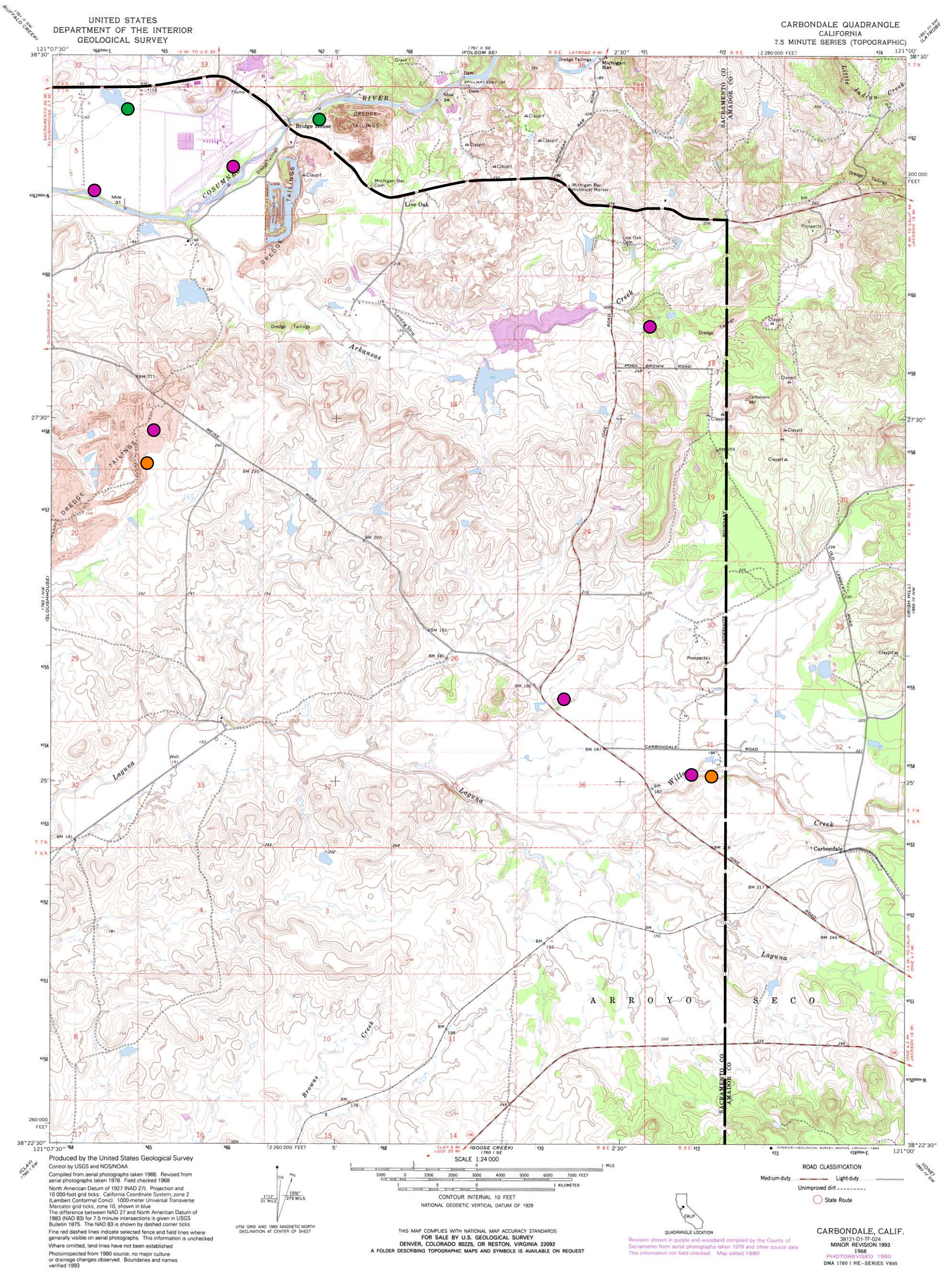
Exhibit A-2
Raptor Nest Sites within the Elk Grove, CA, 7.5' U.S.G.S. Quadrangle



LEGEND

- Swainson's hawk
- White-tailed kite
- Red-tailed hawk
- Great-horned owl
- Red-shouldered hawk
- Study Area Boundary

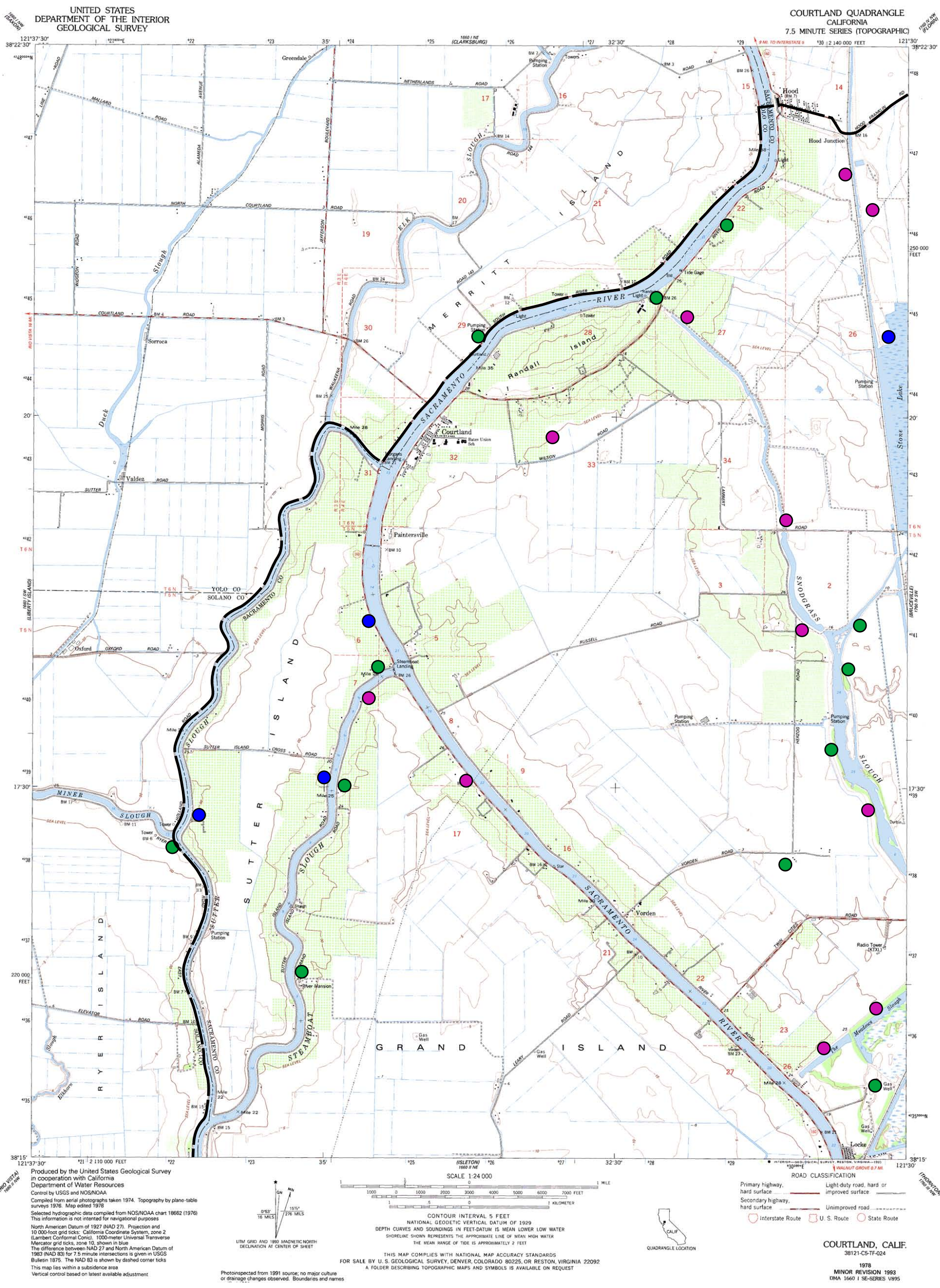
Exhibit A-3
Raptor Nest Sites within the Sloughhouse, CA, 7.5' U.S.G.S. Quadrangle



LEGEND

- Swainson's hawk
- White-tailed kite
- Red-tailed hawk
- Great-horned owl
- Red-shouldered hawk
- Study Area Boundary

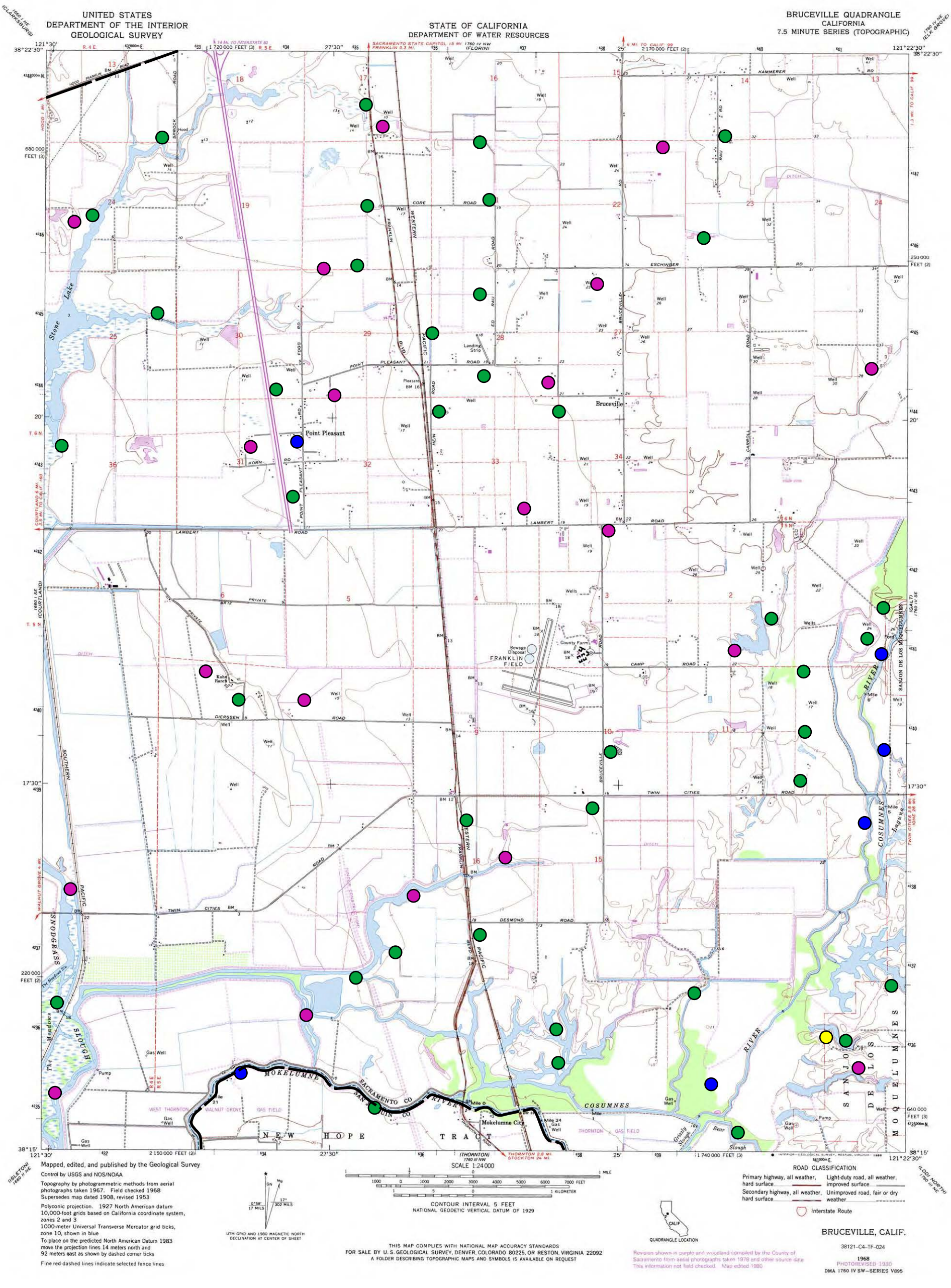
Exhibit A-4
Raptor Nest Sites within the Carbondale, CA, 7.5' U.S.G.S. Quadrangle



LEGEND

- Swainson's hawk
- White-tailed kite
- Red-tailed hawk
- Great-horned owl
- Red-shouldered hawk
- Study Area Boundary

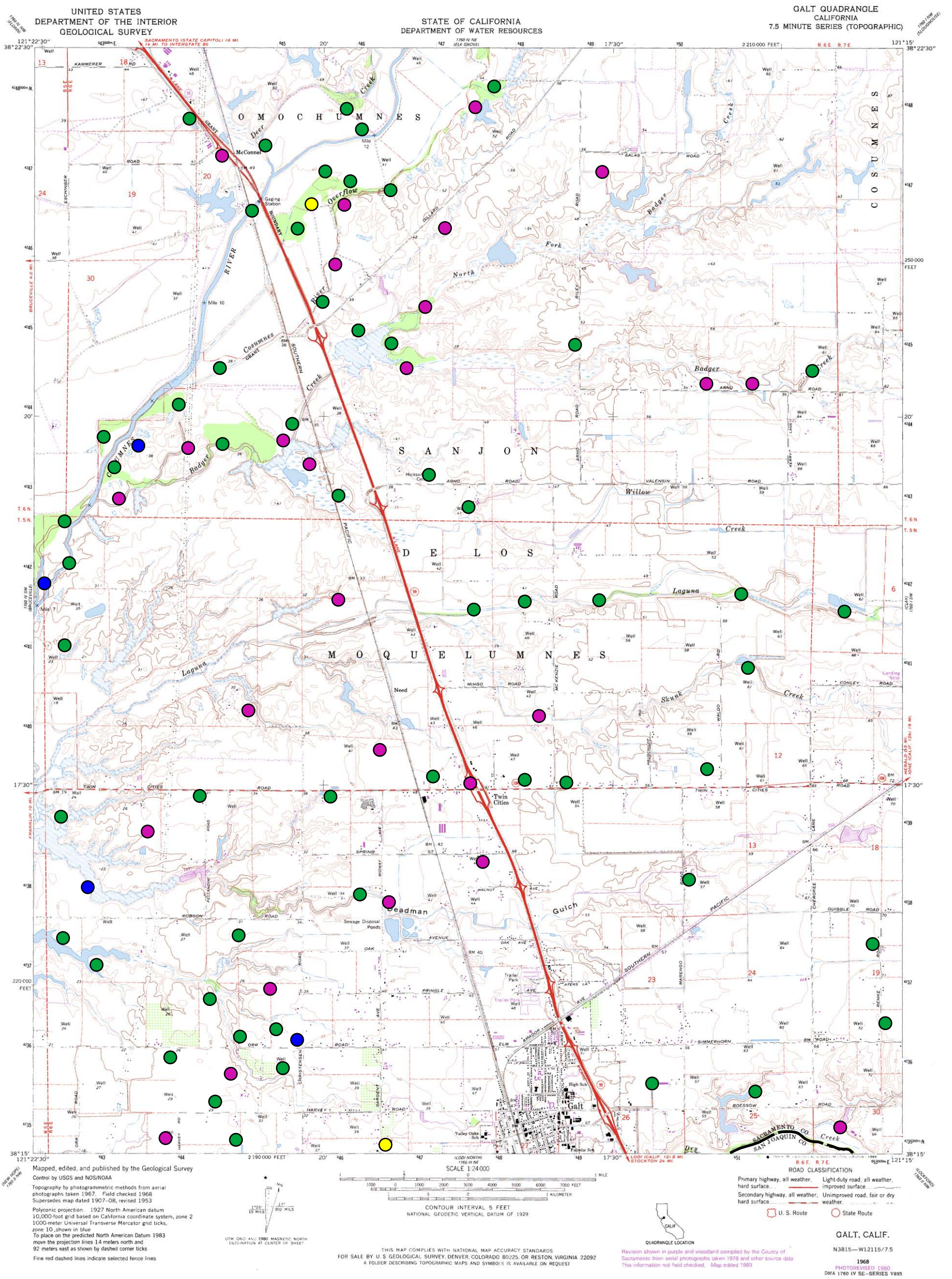
Exhibit A-5
Raptor Nest Sites within the Courtland, CA, 7.5' U.S.G.S. Quadrangle



LEGEND

- Swainson's hawk
- White-tailed kite
- Red-tailed hawk
- Great-horned owl
- Red-shouldered hawk
- Study Area Boundary

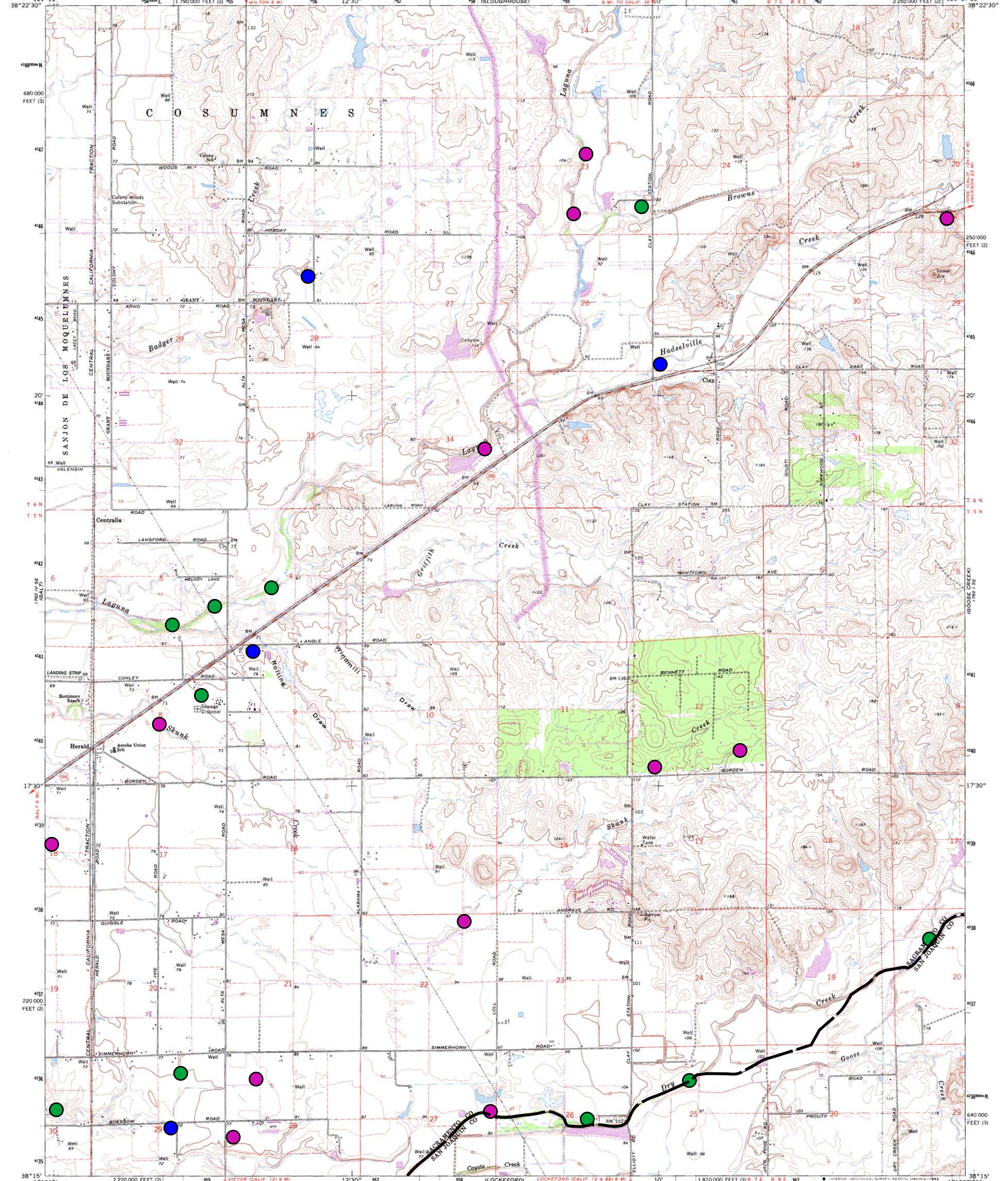
Exhibit A-6
Raptor Nest Sites within the Bruceville, CA, 7.5' U.S.G.S. Quadrangle



LEGEND

- Swainson's hawk
- Red-tailed hawk
- Red-shouldered hawk
- White-tailed kite
- Great-horned owl
- Study Area Boundary

Exhibit A-7
Raptor Nest Sites within the Galt, CA, 7.5' U.S.G.S. Quadrangle



Produced by the United States Geological Survey in cooperation with the California Department of Water Resources. Control by USGS and NOS/NOAA. Compiled from aerial photographs taken 1967. Field checked 1968. Revised from aerial photographs taken 1990. North American Datum of 1927 (NAD 27). Projection and 10,000-foot grid ticks: California Coordinate System, zones 2 and 3 (Lambert Conformal Conic). 1000-meter Universal Transverse Mercator grid ticks, zone 10, shown in blue. The difference between NAD 27 and North American Datum of 1983 (NAD 83) for 7.5 minute intersections is given in USGS Bulletin 1875. The NAD 83 is shown by dashed corner ticks. Photoinspected from 1991 source, no major culture or drainage changes observed. Boundaries and names verified 1993.

SCALE 1:24,000
 NATIONAL GEODETIC VERTICAL DATUM OF 1929
 CONTOUR INTERVAL 5 FEET

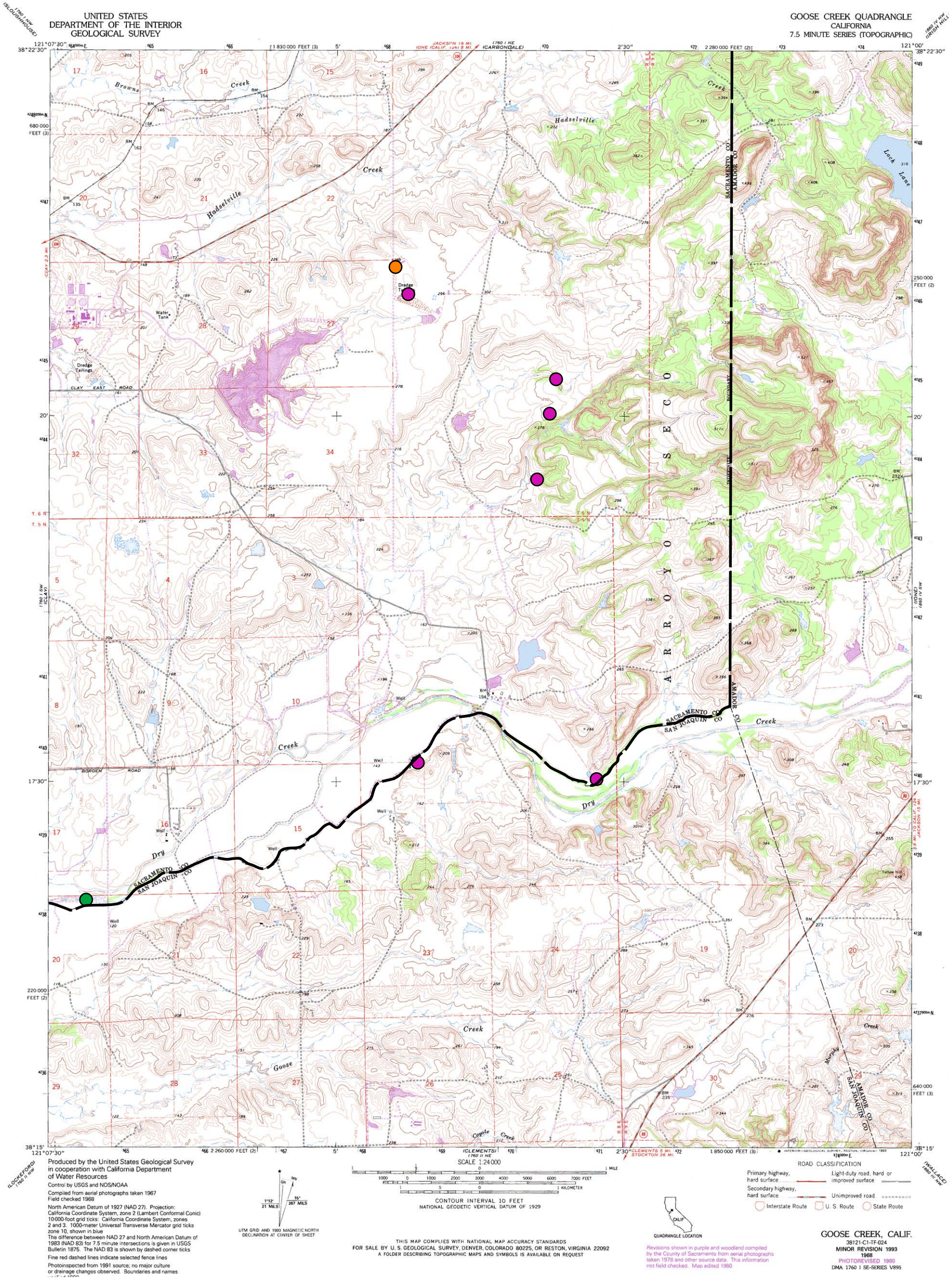
ROAD CLASSIFICATION
 Primary highway, hard surface — Light-duty road, hard or improved surface
 Secondary highway, hard surface — Unimproved road
 Interstate Route — U.S. Route — State Route

CLAY, CALIF.
 3812-C2-TP-024
 MINOR REVISION 1993
 1968
 PHOTO REVISION 1980
 DMA 1760 I SW-SERIES 1995

LEGEND

- Swainson's hawk
- White-tailed kite
- Red-tailed hawk
- Great-horned owl
- Red-shouldered hawk
- Study Area Boundary

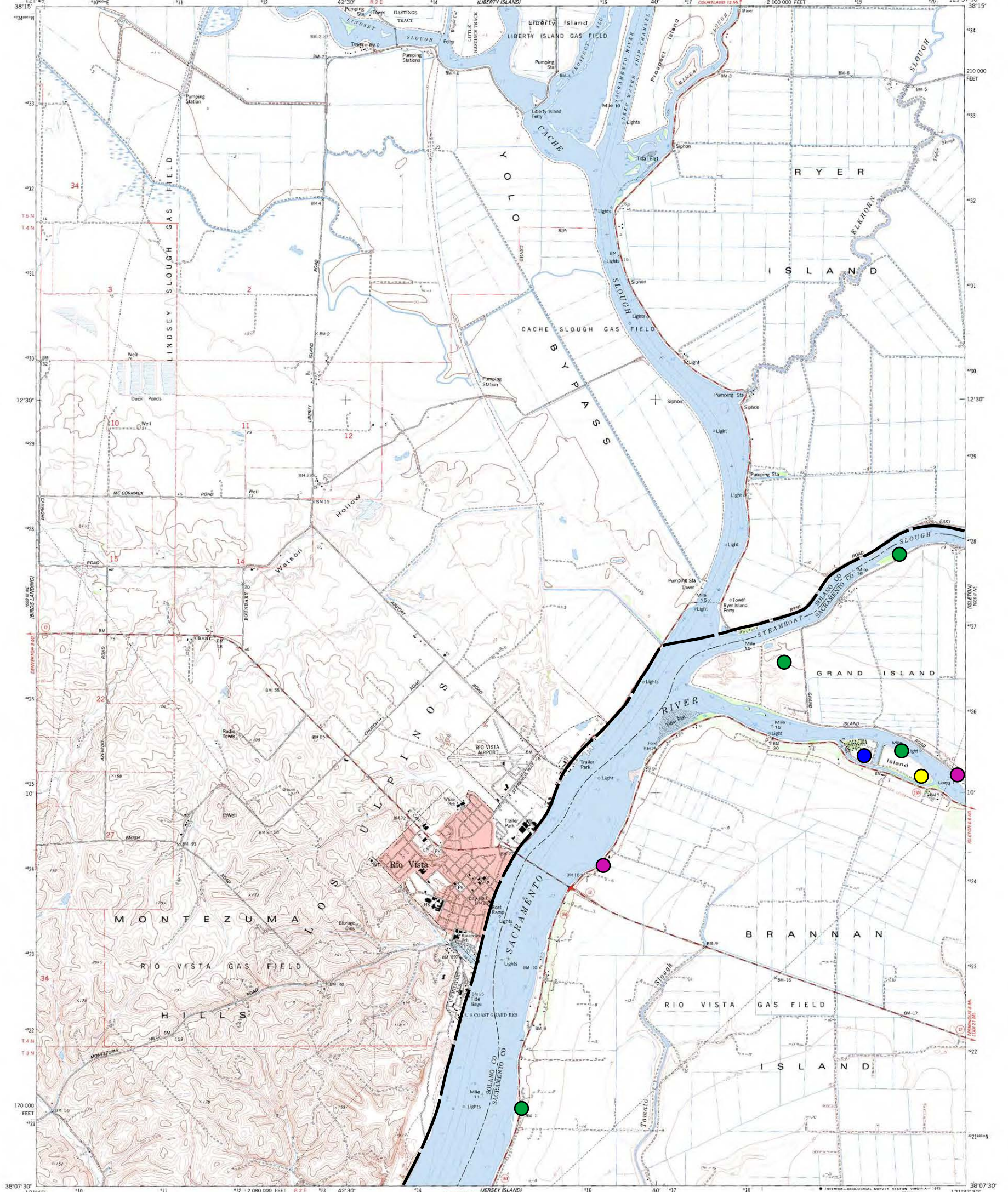
Exhibit A-8
 Raptor Nest Sites within the Clay, CA, 7.5' U.S.G.S. Quadrangle



LEGEND

- Swainson's hawk
- White-tailed kite
- Red-tailed hawk
- Great-horned owl
- Red-shouldered hawk
- Study Area Boundary

Exhibit A-9
Raptor Nest Sites within the Goose Creek, CA, 7.5' U.S.G.S. Quadrangle



Produced by the United States Geological Survey in cooperation with California Department of Water Resources. Control by USGS and NOS/NOAA. Compiled from aerial photographs taken 1974. Topography by plane-table surveys 1976. Map edited 1978. Selected hydrographic data compiled from NOS/NOAA charts 1861 and 1862 (1976). This information is not intended for navigational purposes. North American Datum of 1927 (NAD 27). Projection and 10 000-foot grid ticks: California Coordinate System, zone 2 (Lambert Conformal Conic). 1000-meter Universal Transverse Mercator grid ticks, zone 10 shown in blue. The difference between NAD 27 and North American Datum of 1983 (NAD 83) for 7.5 minute intersections is given in USGS Bulletin 1875. The NAD 83 is shown by dashed corner ticks. Red tint indicates areas in which only landmark buildings are shown.

UTM GRID AND 1989 MAGNETIC NORTH DECLINATIONS AT CENTER OF SHEET. Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is un-checked. This map lies within a subsidence area. Vertical control based on latest available adjustment. Note: Bypass area subject to inundation during periods of high water.

CONTOUR INTERVAL 10 FEET! DOTTED LINES REPRESENT 5-FOOT CONTOURS. NATIONAL GEODETIC VERTICAL DATUM OF 1929. DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER. SHOULDERLINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER. THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE. THE MEAN RANGE OF TIDE IS APPROXIMATELY 2 FEET.

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS FOR SALE BY U.S. GEOLOGICAL SURVEY. DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092. A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST.

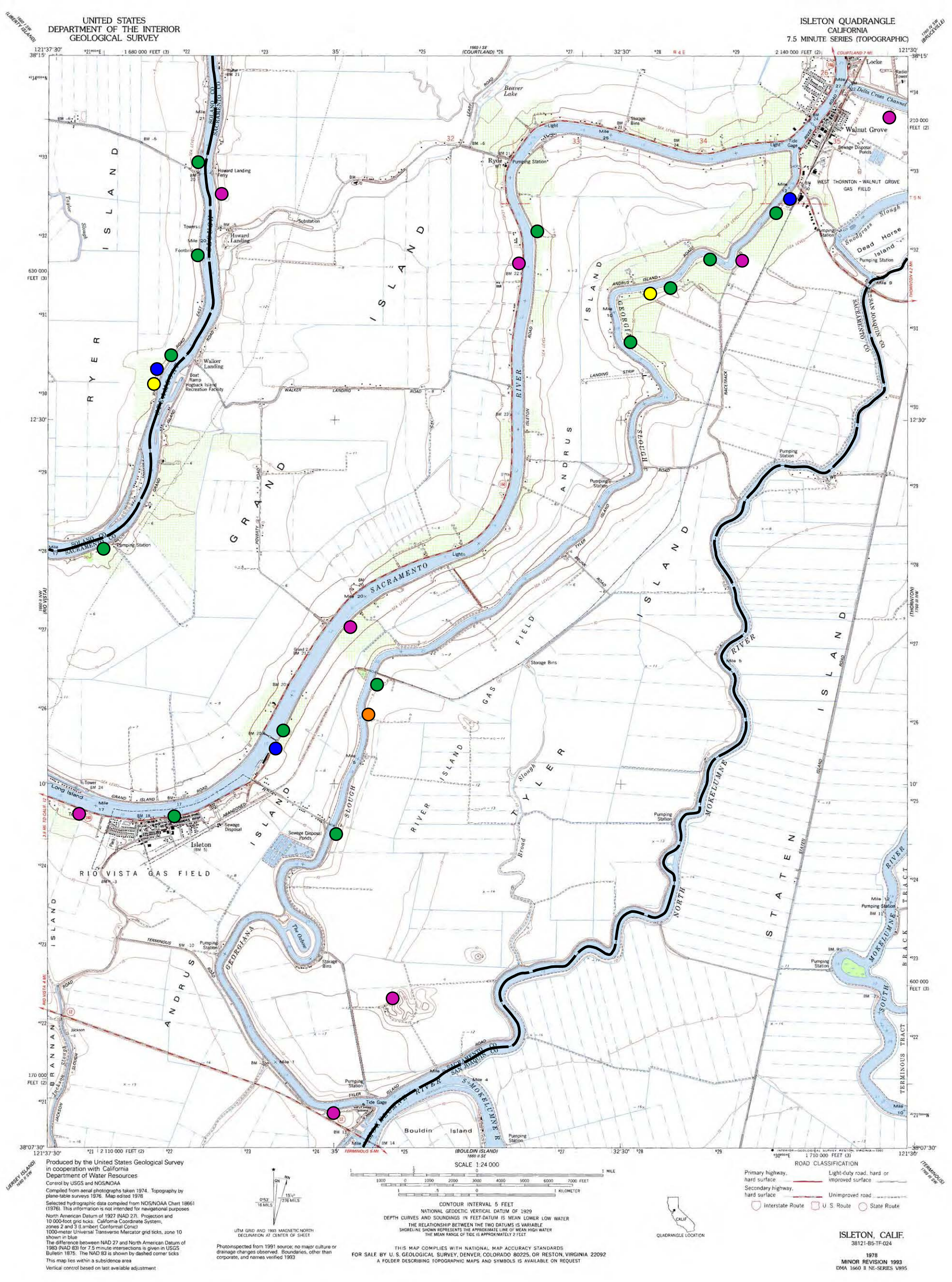
ROAD CLASSIFICATION: Primary highway, hard surface; Secondary highway, hard surface; Light-duty road, hard or improved surface; Unimproved road. Interstate Route; U.S. Route; State Route.

QUADRANGLE LOCATION: RIO VISTA, CALIF. 38121-86-TF-024. 1978. MINOR REVISION 1993. DMA 1660 II NW-SERIES V895.

LEGEND

- Swainson's hawk
- Red-tailed hawk
- Red-shouldered hawk
- White-tailed kite
- Great-horned owl
- Study Area Boundary

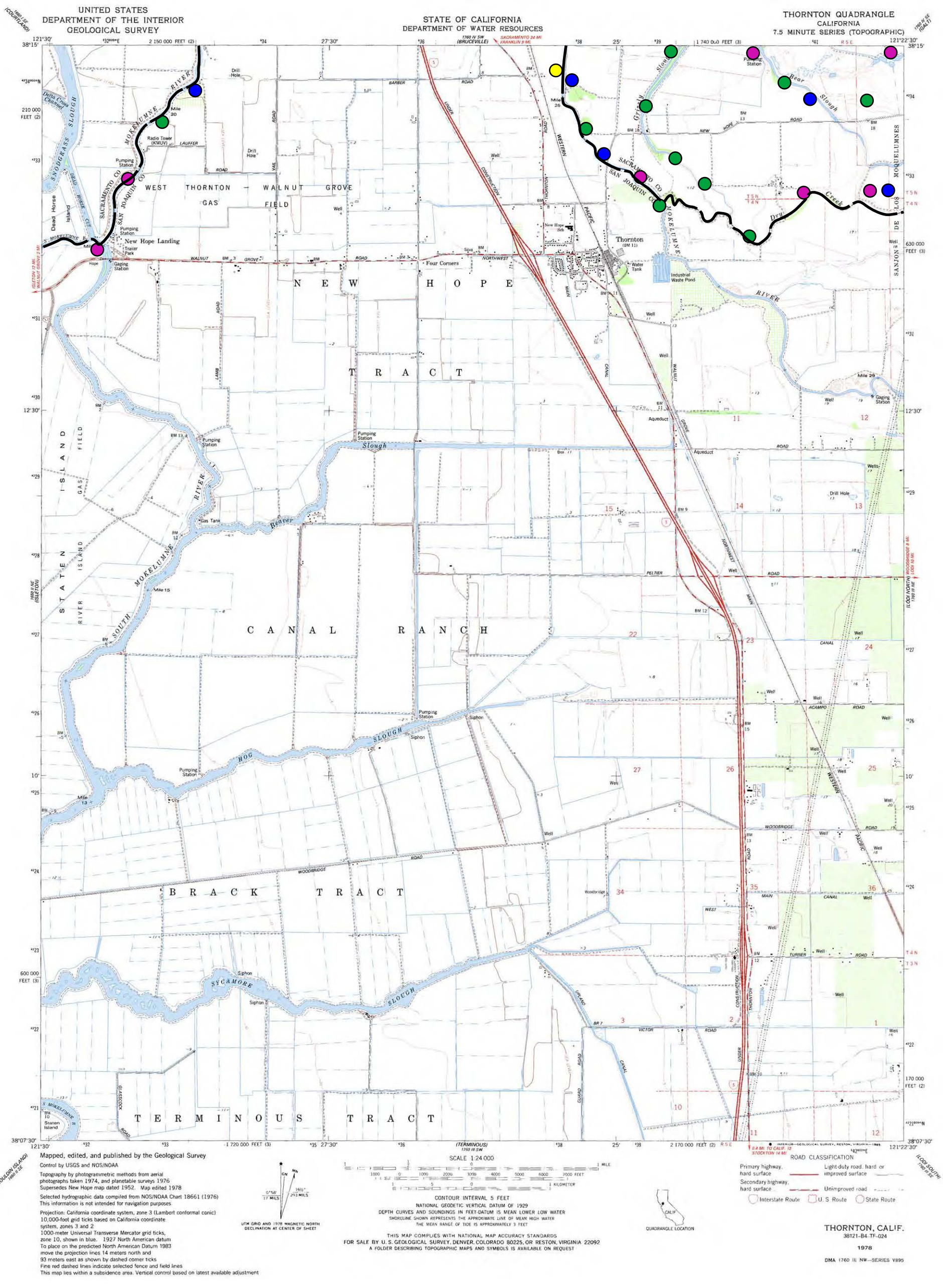
Exhibit A-10
 Raptor Nest Sites within the Rio Vista, CA, 7.5' U.S.G.S. Quadrangle



LEGEND

- Swainson's hawk
- White-tailed kite
- Red-tailed hawk
- Great-horned owl
- Red-shouldered hawk
- Study Area Boundary

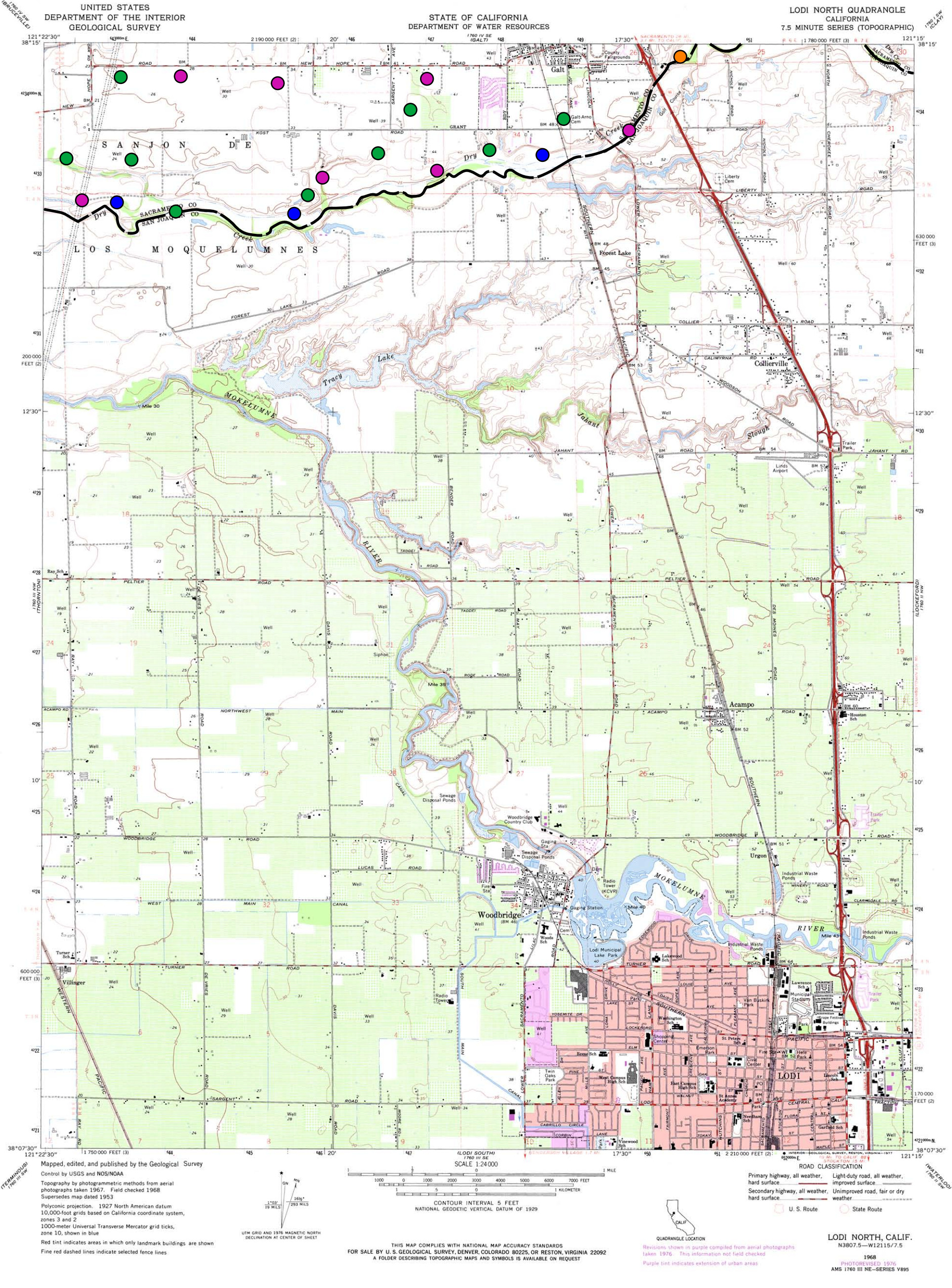
Exhibit A-11
Raptor Nest Sites within the Isleton, CA, 7.5' U.S.G.S. Quadrangle



LEGEND

- Swainson's hawk
- White-tailed kite
- Red-tailed hawk
- Great-horned owl
- Red-shouldered hawk
- Study Area Boundary

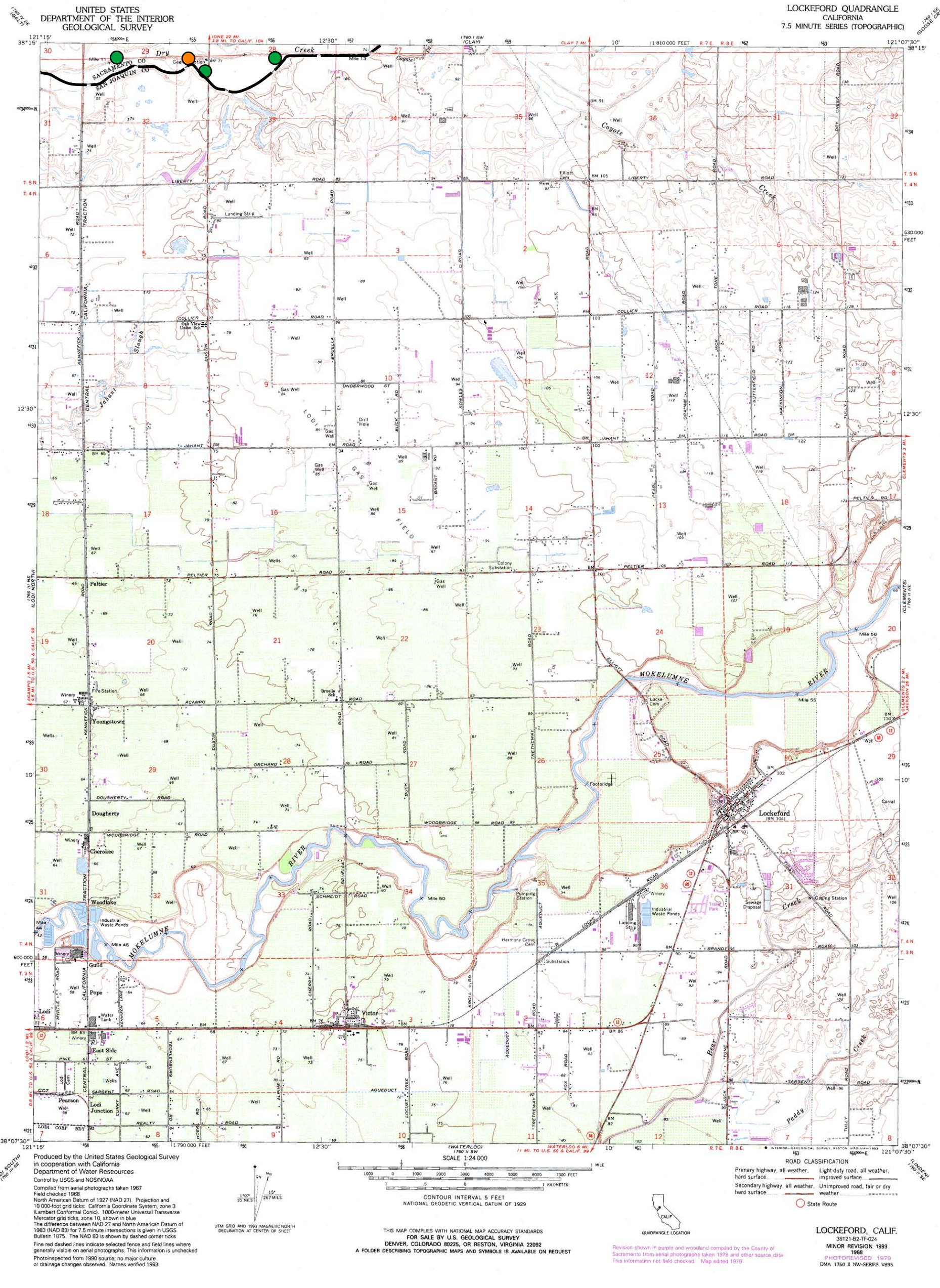
Exhibit A-12
Raptor Nest Sites within the Thornton, CA, 7.5' U.S.G.S. Quadrangle



LEGEND

- Swainson's hawk
- White-tailed kite
- Red-tailed hawk
- Great-horned owl
- Red-shouldered hawk
- Study Area Boundary

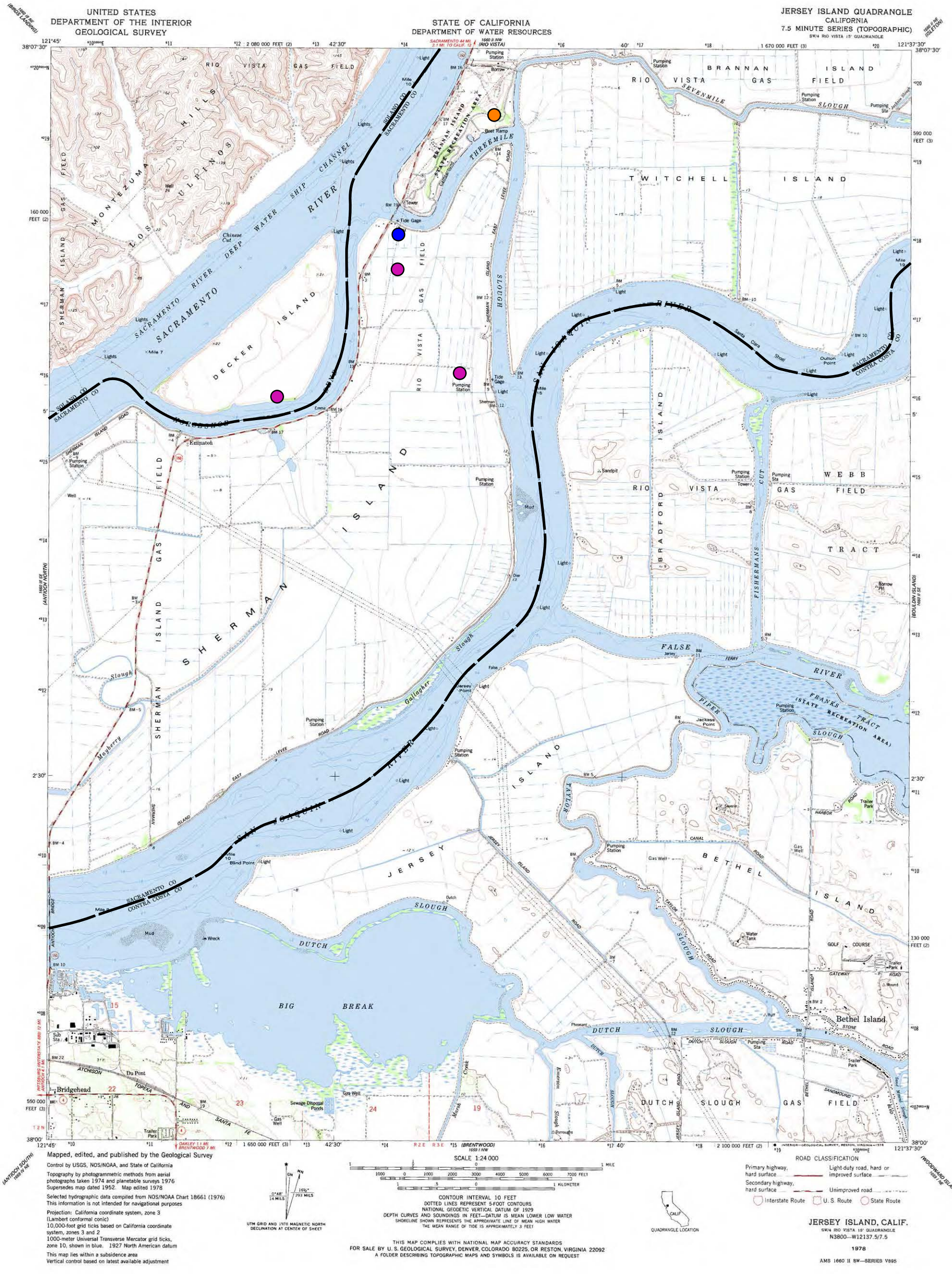
Exhibit A-13
Raptor Nest Sites within the Lodi North, CA, 7.5' U.S.G.S. Quadrangle



LEGEND

- Swainson's hawk
- White-tailed kite
- Red-tailed hawk
- Great-horned owl
- Red-shouldered hawk
- Study Area Boundary

Exhibit A-14
Raptor Nest Sites within the Lockeford, CA, 7.5' U.S.G.S. Quadrangle



Mapped, edited, and published by the Geological Survey
 Control by USGS, NOS/NOAA, and State of California
 Topography by photogrammetric methods from aerial
 photographs taken 1974 and planimetric surveys 1976
 Supersedes map dated 1952. Map edited 1978
 Selected hydrographic data compiled from NOS/NOAA Chart 18661 (1976)
 This information is not intended for navigational purposes
 Projection: California coordinate system, zone 3
 (Lambert conformal conic)
 10,000-foot grid ticks based on California coordinate
 system, zones 3 and 2
 1000-meter Universal Transverse Mercator grid ticks,
 zone 10, shown in blue. 1927 North American datum
 This map lies within a subsidence area
 Vertical control based on latest available adjustment

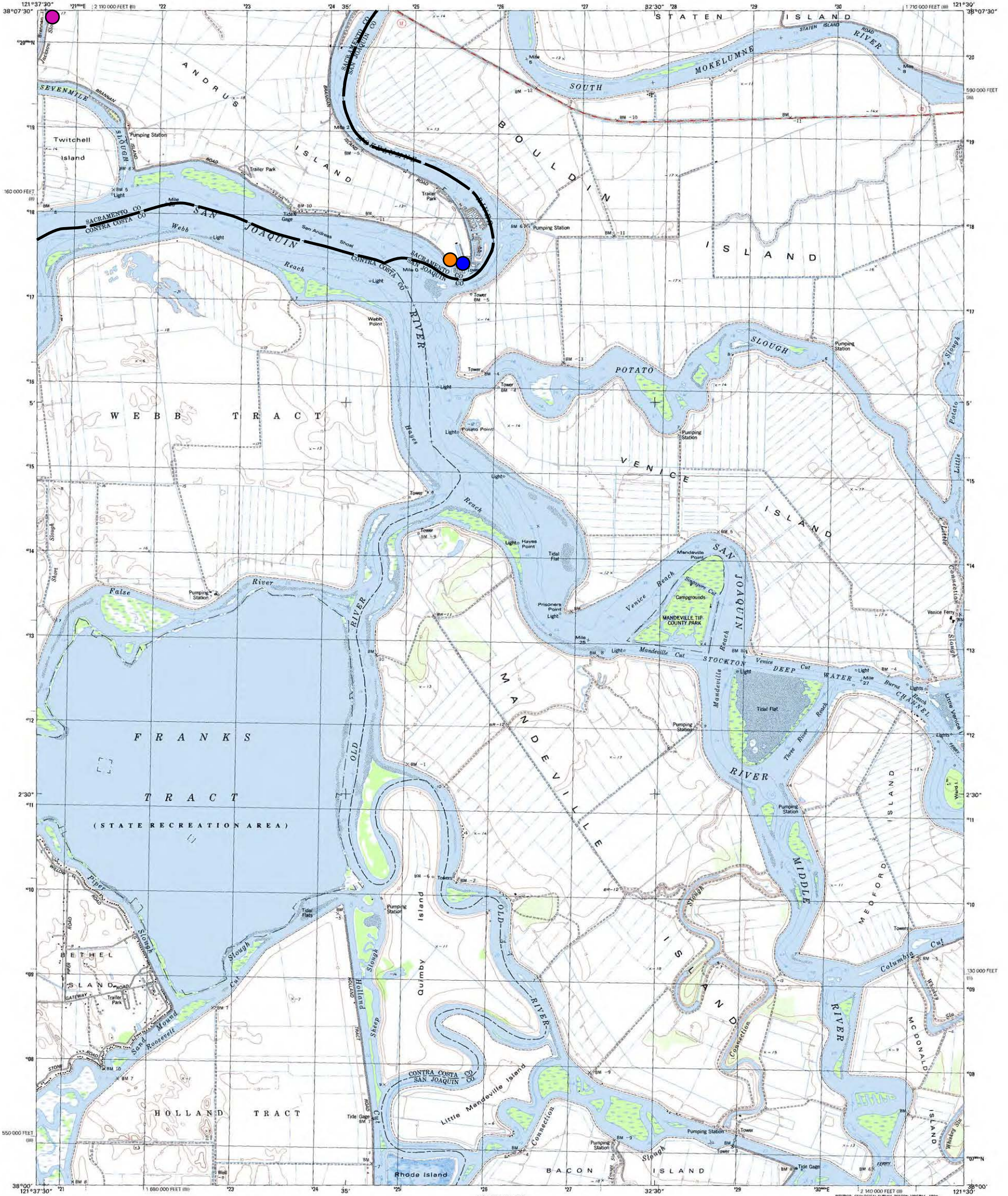
SCALE 1:24,000
 1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
 1 1/2 3 4 5 6 7 8 9 10 KILOMETER
 CONTOUR INTERVAL 10 FEET
 DOTTED LINES REPRESENT 5-FOOT CONTOURS
 NATIONAL GEODETIC VERTICAL DATUM OF 1929
 DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER
 SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
 THE MEAN RANGE OF TIDE IS APPROXIMATELY 3 FEET
 THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
 FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
 Primary highway, hard surface
 Secondary highway, hard surface
 Interstate Route
 U.S. Route
 State Route
 Light duty road, hard or improved surface
 Unimproved road
 U.S. Route
 State Route
 JERSEY ISLAND, CALIF.
 SW4 RIO VISTA 15' QUADRANGLE
 N3800—W12137.5/7.5
 1978
 AMS 1060 II SW—SERIES V895

LEGEND

- Swainson's hawk
- White-tailed kite
- Red-tailed hawk
- Great-horned owl
- Red-shouldered hawk
- Study Area Boundary

Exhibit A-15
Raptor Nest Sites within the Jersey Island, CA, 7.5' U.S.G.S. Quadrangle



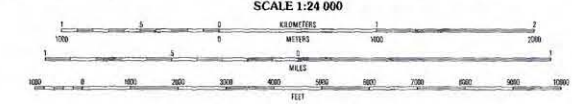
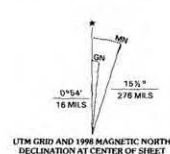
Produced by the United States Geological Survey in cooperation with California Department of Water Resources. Derived from imagery dated 1974. Photomicrocopy using imagery dated 1997; no major culture or drainage changes observed. FLS and survey control current as of 1976. Boundaries verified 1996.

Selected hydrographic data compiled from NOS/NOAA Charts 18661 (1976). This information is not intended for navigational purposes.

North American Datum of 1927 (NAD 27). Projection and 1000-meter grid: Universal Transverse Mercator, zone 10 10 000-foot ticks: California Coordinate System of 1927 (zones 3 and 2).

North American Datum of 1983 (NAD 83) is shown by dashed corner ticks. The values of the shift between NAD 27 and NAD 83 for 7.5-minute intersections are obtainable from National Geodetic Survey NADCON software.

There may be private inholdings within the boundaries of the National or State reservations shown on this map. This map lies within a subsidence area. Vertical control based on latest available adjustment.



SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
 NATIONAL GEODETIC VERTICAL DATUM OF 1929
 TO CONVERT FROM FEET TO METERS, MULTIPLY BY 0.3048
 DEPTH CURVES AND SOUNDINGS IN FEET-DATUM IS MEAN LOWER LOW WATER
 SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
 THE MEAN RANGE OF TIDE IS APPROXIMATELY 3 FEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
 FOR SALE BY U.S. GEOLOGICAL SURVEY, P.O. BOX 25286, DENVER, COLORADO 80225
 A 504 DEDICATED TOPOGRAPHIC MAP AND SYMBOLS IN AN A4 M F 100 REFINED

ROAD CLASSIFICATION

Primary highway: solid line with double red dashes
 Secondary highway: solid line with single red dashes
 hard surface: solid line
 Light-duty road, hard or improved surface: dashed line
 Unimproved road: dotted line

Interstate Route: red shield
 U.S. Route: white shield with red border
 State Route: white shield with black border

QUADRANGLE LOCATION

1	2	3
4	5	6
7	8	

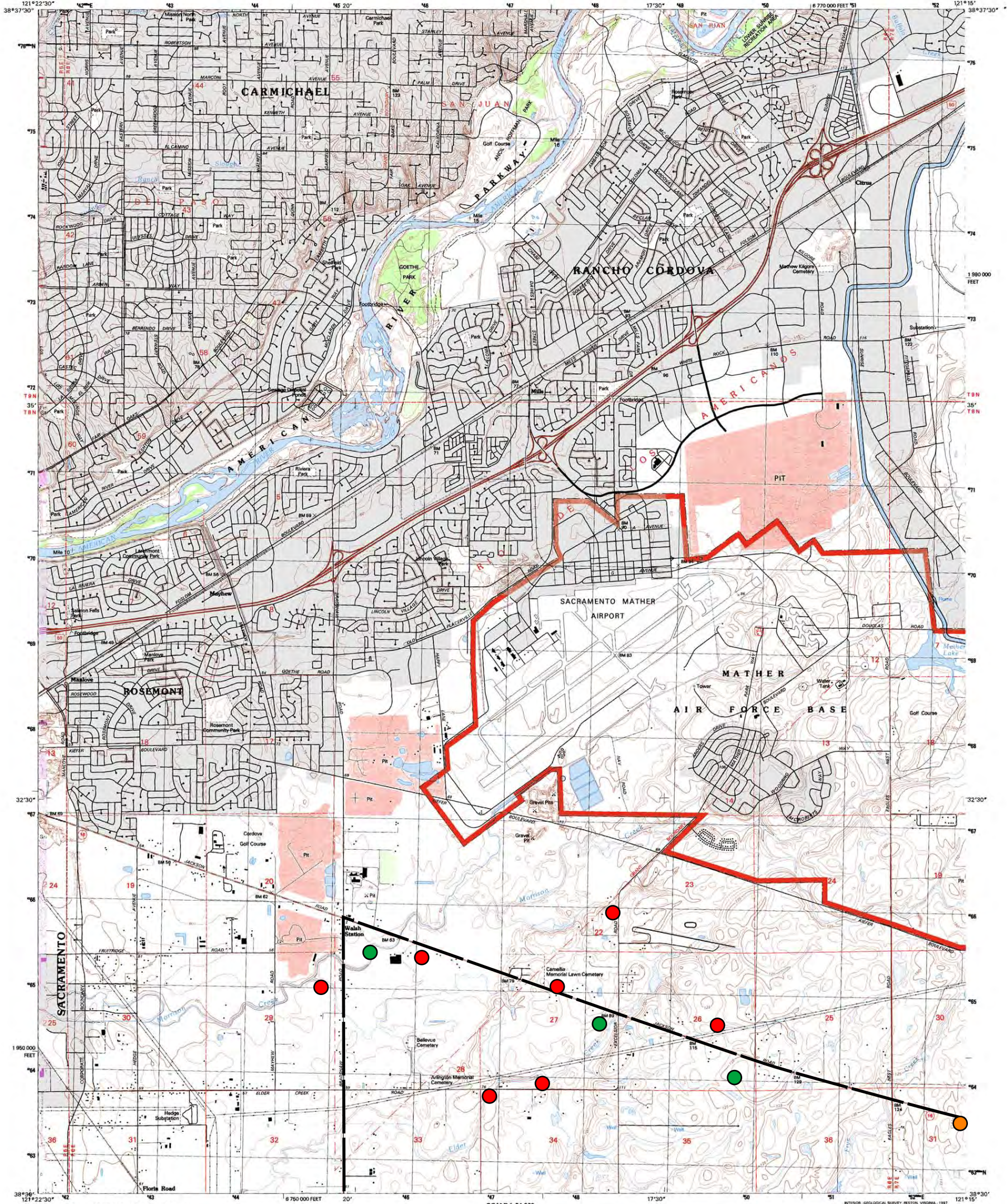
ADJOINING 7.5' QUADRANGLE NAMES

- Blue Vista
- Belton
- Thurston
- Jenny Island
- Trentwood
- Blackwood
- Blackwood Island
- Hulk

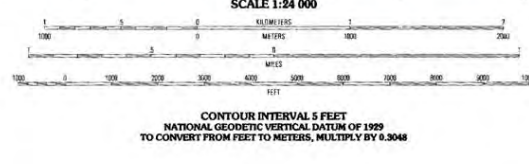
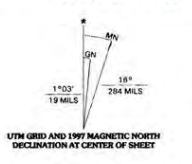
BOULDIN ISLAND, CA
 1997
 NIMA 1640 SE-SERIES V895

- LEGEND**
- Swainson's hawk
 - Red-tailed hawk
 - Red-shouldered hawk
 - White-tailed kite
 - Great-horned owl
 - Study Area Boundary

Exhibit A-16
Raptor Nest Sites within the Bouldin Island, CA, 7.5' U.S.G.S. Quadrangle



Produced by the United States Geological Survey
Topography compiled 1948. Planimetry derived from imagery
taken 1992. Public Land Survey System current as of 1967
Survey Control current as of 1948. Contours that conflict
with updated major features are dashed.
North American Datum of 1983 (NAD 83). Projection and
1000-meter grid: Universal Transverse Mercator, zone 10
10 000-foot ticks: California Coordinate System of 1983 (zone 2)
North American Datum of 1927 (NAD 27) is shown by dashed
corner ticks. The values of the shift between NAD 83 and
NAD 27 for 7.5-minute intersections are obtainable from
National Geographic Survey NADCON software.
There may be private landholdings within the boundaries of the
National or State reservations shown on this map.
Dotted land lines established by private surveys.



ROAD CLASSIFICATION

Primary highway	Light-duty road, hard or
hard surface	improved surface
Secondary highway	Unimproved road
hard surface	Unimproved road
Interstate Route	U.S. Route
	State Route

QUADRANGLE LOCATION

1	2	3
4	5	6
7	8	

ADJOINING 7.5' QUADRANGLE NAMES

1	2	3
4	5	6
7	8	

1 Bu. Lake
2 Citrus Heights
3 Folsom
4 Sacramento East
5 Bufile Creek
6 Florin
7 Elk Grove
8 Sloughhouse

THIS MAP CONFORMS WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, P.O. BOX 25286, DENVER, COLORADO 80225
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CARMICHAEL, CA
1992
DMA 1761 III SE-SERIES V895

LEGEND

- Red-tailed hawk
- Swainson's hawk
- Red-shouldered hawk
- Great-horned owl
- White-tailed kite

Exhibit A-17
Raptor Nest Sites within the Carmichael, CA, 7.5' U.S.G.S. Quadrangle

Table A-1. Swainson's Hawk Data

Table A-1. Swainson's Hawk Nesting Territories in South Sacramento County, 2006.

Territory Number	Quad Map	Location	UTM easting-northing	Status	Nesting Habitat	Nest Tree Species	Land Use Association	Number of Young
SA-1	Clay	Clay Station Rd.	660050-4246479	UO	Tree Row	Eucalyptus	GAG	
SA-2	Clay	Laguna Creek	654472-4241338	S	Riparian	Valley Oak	IC-IP	1
SA-3	Clay	Laguna Creek	655000-4241541	S	Riparian	Valley Oak	IC-IP	2
SA-4	Clay	Laguna Creek	655722-4241856	S	Riparian	Valley Oak	IC-IP	1
SA-5	Clay	SR104 @ Alta Mesa	655726-4241805	U	Isolated Tree	Cottonwood	C-IP-RR	0
SA-6	Clay	Herald @ Beossow	653242-4235525	S	Riparian	Cottonwood	IC-IP	1
SA-7	Clay	Simmerhorn @ Ivie	654710-4236149	S	Riparian	Cottonwood	IC-IP	2
SA-8	Clay	Dry Creek	660699-4236606	UO	Riparian	Cottonwood	IC-IP	
SA-9	Clay	Dry Creek	659384-4235553	S	Riparian	Cottonwood	IC-IP	1
SA-10	Clay	Dry Creek	663682-4237875	UO	Riparian	Valley Oak	IC-IP-GAG	
SA-11	Sloughhouse	Sunrise @ Grant Line	653338-4260919	NN	Eucalypt Grove		IP-GAG-IC-RR	
SA-12	Sloughhouse	Sloughhouse Road	655527-4261676	S	Isolated Tree	Eucalyptus	GAG	1
SA-13	Sloughhouse	Cosumnes River	657696-4261011	UN	Riparian		IC-GAG	
SA-14	Sloughhouse	Cosumnes River	659774-4261594	UN	Riparian		IC-GAG	
SA-15	Sloughhouse	Cosumnes River	662111-4260554	S	Riparian	Cottonwood	IC-GAG	1
SA-16	Sloughhouse	Meiss Road	663046-4258838	U	Small Grove	Cottonwood	GAG	0
SA-17	Sloughhouse	Dillard Road	658814-4258006	NN	Isolated Tree		GAG-IP-IC-RR	
SA-18	Sloughhouse	Cosumnes River	657260-4260044	UN	Riparian		IC-GAG	
SA-19	Sloughhouse	Cosumnes River	656483-4258026	UN	Riparian		IC-GAG	
SA-20	Sloughhouse	Cosumnes River	652775-4254201	UN	Riparian		IC-IP	
SA-21	Sloughhouse	Laguna Creek	660674-4250046	S	Riparian	Cottonwood	GAG	1
SA-22	Elk Grove	Laguna Creek	651890-4260909	S	Riparian	Valley Oak	IC-IP	1
SA-23	Elk Grove	Cosumnes River	652373-4254111	UN	Riparian		IC-IP	
SA-24	Elk Grove	Deer Creek	648482-4252785	NN	Riparian		IC-IP	
SA-25	Elk Grove	Deer Creek	647669-4251754	UN	Riparian		IC-IP	
SA-26	Elk Grove	Cosumnes River	649305-4251576	NN	Riparian		IC-GAG	
SA-27	Elk Grove	Cosumnes River	648833-4250479	S	Riparian	Cottonwood	IC-GAG	2
SA-28	Elk Grove	Cosumnes River	648081-4249413	U	Riparian	Cottonwood	IC-IP	0
SA-29	Elk Grove	Deer Creek	646862-4249474	NN	Riparian		IC-IP	
SA-30	Elk Grove	Cosumnes River	647004-4248946	S	Riparian	Cottonwood	IC-GAG	1
SA-31	Elk Grove	SE of Grant Line Road	645287-4249764	UO	Isolated Tree	Valley Oak	IP-IC	

SA-32	Elk Grove	SE of Grant Line Road	645165-4249256	S	Isolated Tree	Valley Oak	IP-IC	1
SA-33	Elk Grove	SE of Grant Line Road	644774-4249017	UO	Isolated Tree	Valley Oak	IP-IC	
SA-34	Carbondale	Cosumnes River	666949-4262024	S	Riparian		R-GAG	2
SA-35	Carbondale	Jackson Highway	664490-4262065	UO	Riparian	Cottonwood	GAG-IC	
SA-36	Carmichael	Morrison Creek	645555-4265221	S	Riparian	Valley Oak	RR-IC-IP	2
SA-37	Carmichael	Elder Creek	648131-4264560	NN	Farmstead		RR-IC-IP	
SA-38	Carmichael	Jackson Highway	649807-4263792	S	Riparian	Willow	IP-IC-RR	1
SA-39	Lockeford	Dry Creek	654008-4234545	UN	Riparian		IC-IP	
SA-40	Lockeford	Dry Creek	655059-4234620	S	Riparian	Cottonwood	IC-IP	1
SA-41	Lockeford	Dry Creek	656029-4234717	UN	Riparian		IC-IP	
SA-42	Galt	Deer Creek	644813-4247358	NN	Riparian		IC-IP	
SA-43	Galt	Deer Creek	645834-4247830	S	Riparian	Valley Oak	IC-IP	1
SA-44	Galt	Cosumnes River	646154-4247444	NN	Riparian		IC-IP	
SA-45	Galt	Cosumnes River	645331-4246256	U	Riparian	Valley Oak	IC-IP	0
SA-46	Galt	Cosumnes River	645610-4246957	S	Riparian	Valley Oak	IC-IP	2
SA-47	Galt	Cosumnes River	645854-4246860	NN	Riparian		IC-IP	
SA-48	Galt	Cosumnes River	646474-4246793	S	Riparian	Valley Oak	IC-GAG	1
SA-49	Galt	Cosumnes River	647734-4248077	NN	Riparian		IC-GAG	
SA-50	Galt	Cosumnes River	645570-4245354	NN	Riparian		IC-IP	
SA-51	Galt	Badger Creek	646068-4244937	U	Isolated Tree	Valley Oak	GAG-IC	0
SA-52	Galt	Badger Creek	646449-4244749	U	Riparian	Valley Oak	GAG-IC	0
SA-53	Galt	Riley Road	648852-4244830	S	Farmstead	Eucalyptus	GAG	
SA-54	Galt	Hicksville Cemetery	647054-4243224	U	Cemetery	Locust	IC-GAG	0
SA-55	Galt	Arno Road	647562-4242807	UO	Farmstead	Eucalyptus	IC-GAG	
SA-56	Galt	Badger Creek	651778-4244544	U	Farmstead	Eucalyptus	IC-GAG	
SA-57	Galt	Laguna Creek	647521-4241460	S	Riparian	Valley Oak	IC-IP	2
SA-58	Galt	Laguna Creek	648212-4241612	S	Riparian	Valley Oak	IC-IP	3
SA-59	Galt	Laguna Creek	649269-4241663	S	Riparian	Valley Oak	IC-IP	1
SA-60	Galt	Laguna Creek	650910-4241834	UO	Riparian	Valley Oak	IC-IP	
SA-61	Galt	Laguna Creek	652332-4241570	UO	Riparian	Valley Oak	IC-IP	
SA-62	Galt	Skunk Creek	650991-4240884	U	Riparian	Willow	IC-IP	0
SA-63	Galt	Waldo Road	650569-4235968	S	Tree Row	Eucalyptus	IC-IP	2
SA-64	Galt	Twin Cities Road	648745-4239344	S	Farmstead	Eucalyptus	RR-IC-IP	1
SA-65	Galt	Twin Cities Road	648328-4239345	U	Farmstead	Eucalyptus	RR-IC-IP	0
SA-66	Galt	Marengo Road	650335-4238197	U	Tree Row	Eucalyptus	RR-IC-IP	0

SA-67	Galt	Boessow @ Marengo	649954-4235595	U	Isolated Tree	Cottonwood	IC-IP-RR	0
SA-68	Galt	Boessow Road	651209-4235509	U	Riparian	Willow	IC-IP-RR	0
SA-69	Galt	Renke @ Quiggle	652850-4236379	S	Tree Row	Cottonwood	IC-IP-RR	2
SA-70	Galt	Renke @ Simmerhorn	652723-4237405	S	Roadside Tree	Willow	IC-IP-RR	1
SA-71	Galt	Hwy 99 @ Eschinger	643980-4247604	U	Roadside Tree	Eucalyptus	IP-IC	0
SA-72	Galt	Cosumnes River	644651-4246431	UN	Riparian		IP-IC	
SA-73	Galt	Badger Creek	645342-4243769	U	Riparian	Valley Oak	IP-IC	0
SA-74	Galt	Hwy 99 @ Arno Road	645901-4242768	S	Tree Row	Valley Oak	IP-IC-GAG	1
SA-75	Galt	Cosumnes River	642889-4243586	UN	Riparian		IP-IC	
SA-76	Galt	Cosumnes River	642950-4243073	UN	Riparian		IP-IC	
SA-77	Galt	Cosumnes River OF	644352-4244433	NN	Riparian		IP-IC	
SA-78	Galt	Cosumnes River	643814-4244027	NN	Riparian		IP-IC	
SA-79	Galt	Badger Creek	644352-4243514	U	Riparian	Valley Oak	IP-IC-GAG	0
SA-80	Galt	Cosumnes River	642452-4242573	NN	Riparian		IP-IC	
SA-81	Galt	Cosumnes River	642406-4241938	NN	Riparian		IP-IC-GAG	
SA-82	Galt	W. of Cosumnes River	642477-4240892	U	Riparian	Walnut	IP-IC-GAG	0
SA-83	Galt	Twin Cities-Laguna Cr.	642462-4238737	NN	Riparian		IP-IC	
SA-84	Galt	Twin Cities-Pellandini	644215-4239122	U	Farmstead	Ornamental Pine	IP-IC	0
SA-85	Galt	Twin Cities-Midway	645846-4239142	U	Farmstead	Eucalyptus	IP-IC	0
SA-86	Galt	Twin Cities-W of 99	647096-4239366	NN	Farmstead		IP-IC-RR	
SA-87	Galt	Pellandini Ranch	642468-4237268	U	Riparian	Valley Oak	IP-IC	0
SA-88	Galt	Orr Ranch	642895-4236968	NN	Riparian		IP-IC	
SA-89	Galt	Robson Road	644729-4237254	U	Isolated Tree	Valley Oak	IP-IC	0
SA-90	Galt	Deadman Gulch	646228-4237904	U	Farmstead	Valley Oak	IP-IC	0
SA-91	Galt	East of Orr Ranch	644394-4236614	NN	Riparian		IP-IC	
SA-92	Galt	Deadman SI-Orr Road	644699-4236086	U	Riparian	Cottonwood	IP-IC	0
SA-93	Galt	Orr Rd @ Christiansen	645197-4236132	U	Tree Row	Eucalyptus	IP-IC	0
SA-94	Galt	S. of Orr Road	645288-4235715	U	Grove	Valley Oak	IP-IC	0
SA-95	Galt	W. of Orr Road	643942-4235858	UO	Isolated Tree	Valley Oak	IP-IC	
SA-96	Galt	N. of Harvey Road	644526-4235289	U	Isolated Tree	Valley Oak	IP-IC	0
SA-97	Galt	S. of Harvey Road	644760-4234781	NN	Isolated Tree		IP-IC	
SA-98	Lodi North	New Hope @ Orr Road	643109-4234197	U	farmstead	Walnut	IP-IC	0
SA-99	Lodi North	SW Kost/New Hope	642459-4233105	NN	Oak Grove		IP-IC	
SA-100	Lodi North	SE Kost/New Hope	643287-4233100	U	Isolated Tree	Valley Oak	IP-IC	
SA-101	Lodi North	Dry Creek	643886-4232501	U	Riparian	Cottonwood	IP-IC	0

SA-102	Lodi North	Dry Creek	645512-4232708	NN	Riparian		IP-IC	
SA-103	Lodi North	S of Sargent @ Kost	646437-4233307	U	Riparian	Cottonwood	IP-IC	0
SA-104	Lodi North	NE of Sargent @ Kost	646752-4233805	NN	Eucalypt Grove	Eucalyptus	IP-IC	
SA-105	Lodi North	Dry Creek	647793-4233322	NN	Riparian		IP-IC	
SA-106	Lodi North	Galt Cemetery	648768-4233764	S	Cemetery	Deodor Cedar	IP-IC-RR	1
SA-107	Bruceville	Franklin, So of HF	635042-4247663	U	Riparian	Willow	IP-IC	0
SA-108	Bruceville	N of Core and Ed Rau	636656-4247172	NN	Channelized Rip.		IP-IC	
SA-109	Bruceville	Rau, S of Kammerer	639586-4247490	S	Farmyard	Eucalyptus	IP-IC	1
SA-110	Bruceville	Franklin @ Core	635228-4246453	S	Channelized Rip.	Willow	IP-IC	1
SA-111	Bruceville	Core and Ed Rau	636748-4246741	S	Channelized Rip.	Cottonwood	IP-IC	1
SA-112	Bruceville	NW Eschinger/Carroll	639404-4246105	NN	Channelized Rip.		IP-IC	
SA-113	Bruceville	No of Point Pleasant	635056-4245756	U	Channelized Rip.	Cottonwood	IP-IC	0
SA-114	Bruceville	Eschinger @ Ed Rau	636459-4245322	U	Channelized Rip.	Willow	IP-IC	0
SA-115	Bruceville	Franklin @ Pt Pleasant	635955-4245420	U	Channlized Rip.	Willow	IP-IC	
SA-116	Bruceville	Pt Pleasant @ Ed Rau	636696-4244337	S	Isolated Tree	Willow	IP-IC	2
SA-117	Bruceville	Hein Road	636045-4243788	U	Tree Row	Walnut	IP-IC	0
SA-118	Bruceville	Pt Pleasant/Bruceville	637841-4244084	S	Channelized Rip.	Valley Oak	IP-IC	2
SA-119	Bruceville	I-5 @ Lambert Road	634274-4242713	S	Tree Row	Eucalyptus	IP-IC-RR	1
SA-120	Bruceville	Sprock Road	632560-4247189	S	Farmstead-Rip.	Willow	IP-IC	2
SA-121	Bruceville	South Stone Lake	631642-4246107	U	Riparian	Cottonwood	IP-IC	0
SA-122	Bruceville	South Stone Lake	632504-4244983	NN	Riparian		IP-IC	
SA-123	Bruceville	South Stone Lake	631306-4243353	S	Riparian	Willow	IP-IC	2
SA-124	Bruceville	Dierssen Road	633708-4240108	NN	Farmstead		IP-IC	
SA-125	Bruceville	NE of Camp Road	640338-4241231	NN	Riparian		IP-IC	
SA-126	Bruceville	Cosumnes River	641806-4241562	NN	Riparian		IP-IC	
SA-127	Bruceville	East of Camp Road	640800-4240643	NN	Riparian		IP-IC	
SA-128	Bruceville	Cosumnes River	641638-4241193	NN	Riparian		IP-IC	
SA-129	Bruceville	TNC Denier	640811-4239851	S	Riparian	Valley Oak	IP-IC	2
SA-130	Bruceville	TNC Denier	640754-4239220	U	Riparian	Valley Oak	IP-IC	0
SA-131	Bruceville	Bruceville/Twin Cities	638316-4239576	U	Farmstead	Locust	IP-IC	0
SA-132	Bruceville	Bruceville/Twin Cities	638137-4238926	U	Riparian	Willow	IP-IC	0
SA-133	Bruceville	Franklin/Twin Cities	636532-4238692	U	Channelized Rip.	Willow	IP-IC	0
SA-134	Bruceville	Snodgrass Slough	631381-4236228	U	Riparian	Cottonwood	IP-IC	0
SA-135	Bruceville	Lost Slough/West I-5	635164-4236686	U	Riparian	Alder	IP-IC	0
SA-136	Bruceville	Lost Slough/East I-5	635636-4236981	S	Riparian	Valley Oak	IP-IC	1

SA-137	Bruceville	Franklin/Desmond	636698-4237159	U	Channelized Rip.	Valley Oak	IP-IC	0
SA-138	Bruceville	Cosumnes Preserve	637734-4236036	NN	Riparian		IP-IC	
SA-139	Bruceville	Cosumnes Preserve	637780-4235609	U	Riparian	Valley Oak	IP-IC	0
SA-140	Bruceville	Cosumnes Preserve	639573-4236610	U	Riparian	Valley Oak	IP-IC	0
SA-141	Bruceville	Bear Slough	640132-4234827	NN	Riparian		IP-IC	
SA-142	Bruceville	South of Orr Ranch	641443-4235960	NN	Riparian		IP-IC	
SA-143	Bruceville	Orr Ranch West	641987-4236697	NN	Riparian		IP-IC	
SA-144	Bruceville	Mokelumne River	635449-4235041	S	Riparian	Cottonwood	IC	2
SA-145	Bruceville	I-5 @ Point Pleasant	633981-4244016	S	Isolated Tree	Cottonwood	IC-IP	2
SA-146	Florin	Hood-Franklin @ I-5	633578-4248392	NN	Farmyard		IP-IC	
SA-147	Florin	Bruceville and Bilby	638149-4248828	NN	Farmyard		IP-IC	
SA-148	Florin	Rau and Kammerer	639475-4248410	UO	Channelized Rip.	Cottonwood	IP-IC	
SA-149	Courtland	Sacramento River	628801-4246065	U	Farmstead	Eucalyptus	IC	0
SA-150	Courtland	Sacramento River	627962-4245102	U	Farmstead	Redwood	IC	0
SA-151	Courtland	Sacramento River	625788-4244593	U	Farmstead	Cottonwood	IC	0
SA-152	Courtland	S. Stone Lake Drain	630517-4241037	NN	Riparian		IC	
SA-153	Courtland	Snodgrass Slough	630350-4240463	UO	Riparian	Cottonwood	IC	
SA-154	Courtland	Snodgrass Slough	630279-4239559	UO	Riparian	Cottonwood	IC	
SA-155	Courtland	Vorden Road	629746-4238030	NN	Farmstead		IC	
SA-156	Courtland	Delta Meadows	630701-4235288	NN	Riparian		IC	
SA-157	Courtland	Steamboat Slough	624554-4240230	NN	Riparian		IC	
SA-158	Courtland	Steamboat Slough	624098-4239017	S	Farmstead	Ornamental Pine	IC	1
SA-159	Courtland	Sutter Slough	622112-4238122	U	Riparian	Cottonwood	IC	0
SA-160	Courtland	Steamboat Slough	623635-4236496	UO	Eucalypt Grove	Eucalyptus	IC	
SA-161	Isleton	Steamboat Slough	622264-4232824	S	Riparian	Cottonwood	IC	2
SA-162	Isleton	Steamboat Slough	622293-4231703	S	Riparian	Cottonwood	IC	2
SA-163	Isleton	Steamboat Slough	621877-4230467	NN	Riparian		IC	
SA-164	Isleton	Steamboat Slough	621181-4228018	S	Eucalypt Grove	Eucalyptus	IC	2
SA-165	Isleton	Sacramento River	626530-4234026	U	Riparian	Cottonwood	IC	0
SA-166	Isleton	Georgiana Slough	629649-4232457	S	Riparian	Cottonwood	IC	1
SA-167	Isleton	Georgiana Slough	628704-4231822	S	Riparian	Willow	IC	2
SA-168	Isleton	Georgiana Slough	628257-4231460	S	Riparian	Cottonwood	IC	2
SA-169	Isleton	Georgiana Slough	627749-4230667	S	Riparian	Cottonwood	IC	1
SA-170	Isleton	Georgiana Slough	624574-4226289	S	Riparian	Cottonwood	IC	1
SA-171	Isleton	Sacramento River	623406-4225649	UO	Eucalypt Grove	Eucalyptus	IC	

SA-172	Isleton	Sacramento River	622044-4224592	S	Urban-Riparian	Valley Oak	IC-R	2
SA-173	Isleton	Georgiana Slough	624117-4224460	S	Riparian	Cottonwood	IC	2
SA-174	Thornton	Mokelumne River	632727-4233483	S	Riparian	Cottonwood	IC	1
SA-175	Thornton	Grizzly Slough	639270-4234397	NN	Riparian		IC	
SA-176	Thornton	Grizzly Slough	638879-4233732	NN	Riparian		IC	
SA-177	Thornton	Mokelumne River	638142-4233427	U	Riparian	Valley Oak	IC	0
SA-178	Thornton	Grizzly Slough	639326-4233087	NN	Riparian		IC	
SA-179	Thornton	Grizzly Slough	639630-4232803	NN	Riparian		IC	
SA-180	Thornton	Mokelumne River	639127-4232544	UO	Riparian	Cottonwood	IC	
SA-181	Thornton	Dry Creek	640315-4232077	NN	Riparian		IC	
SA-182	Thornton	Bear Slough	640752-4234098	U	Riparian	Cottonwood	IC	
SA-183	Thornton	New Hope	641661-4233864	S	Isolated Tree	Valley Oak	IC	1
SA-184	Rio Vista	Steamboat Slough	619664-4227806	S	Riparian	Sycamore	IC	1
SA-185	Rio Vista	Grand Island	618268-4226537	S	Isolated Tree	Cottonwood	IC	3
SA-186	Rio Vista	Sacramento River	619593-4225491	NN	Riparian		IC	
SA-187	Rio Vista	Sacramento River	615239-4221285	NN	Eucalypt Grove		IC	
SA-188	Goose Cr.	Dry Creek	664810-4238165	UO	Riparian	Valley Oak	GAG-IC	

S = Successful Nest (young produced)

U = Unsuccessful Nest (no young produced - nesting attempt *Abandoned* prior to nest initiation or nest *Failed* following nest initiation)

UO = Active nest but unknown reproductive outcome

UN = Active Territory but unknown if nesting attempt was made

NN = Active Territory but nest not constructed

IC = Irrigated Cropland

IP = Irrigated Pasture

GAG = Grazed Annual Grassland

RR = Rural Residential

R = Residential

Table A-2. Other Nesting Raptor Data

Table A-2. Other Raptor Species Nesting Territories in South Sacramento County, 2006.

	Quad Map	Location	Status	Nesting Habitat	Nest Tree Species	Land Use Association	Number of Young
RTHA-1	Clay	Laguna Creek	UO	Riparian	Valley Oak	GAG	
RTHA-2	Clay	Laguna Creek	S	Riparian	Valley Oak	GAG	2
RTHA-3	Clay	Rancho Seco	S	Isolated Tree	Cottonwood	GAG-IC	2
RTHA-4	Clay	Laguna Creek	S	Riparian	Valley Oak	GAG-IC	2
RTHA-5	Clay	Skunk Creek	U	Riparian	Cottonwood	IC-IP	0
RTHA-6	Clay	Borden @ Herald	UO	Isolated Tree	Cottonwood	IC-IP	
RTHA-7	Clay	Skunk Creek	S	Riparian	Valley Oak	IC-IP	1
RTHA-8	Clay	Borden @ Clay Station	S	Eucalyptus Grove	Eucalyptus	IC-IP-GAG	2
RTHA-9	Clay	Borden @ Clay Station	UO	Eucalyptus Grove	Eucalyptus	IC-IP-GAG	
RTHA-10	Clay	Simmerhorn @ Alta Mesa	S	Cottonwood Grove	Cottonwood	IC-IP	3
RTHA-11	Clay	Alta Mesa @ Boessow	S	Isolated Tree	Valley Oak	IC-IP	2
RTHA-12	Clay	Dry Creek	S	Riparian	Cottonwood	IC-IP	2
RTHA-13	Sloughhouse	Sloughhouse Road	S	Riparian	Valley Oak	IC-IP-GAG	2
RTHA-14	Sloughhouse	Deer Creek	S	Riparian	Cottonwood	IP-IC	2
RTHA-15	Sloughhouse	Cosumnes River	S	Riparian	Valley Oak	IP-IC	2
RTHA-16	Sloughhouse	Cosumnes River	U	Riparian	Cottonwood	IP-IC	0
RTHA-17	Sloughhouse	Meiss Road	S	Isolated Tree	Valley Oak	GAG	2
RTHA-18	Sloughhouse	Meiss Road	S	Isolated Tree	Valley Oak	GAG	3
RTHA-19	Sloughhouse	Cosumnes River	S	Riparian	Valley Oak	IP-IC	2
RTHA-20	Sloughhouse	Cosumnes River	S	Riparian	Valley Oak	IP-IC-GAG	1
RTHA-21	Sloughhouse	Apple @ Dillard	S	Oak Grove	Valley Oak	IP-IC-GAG-RR	2
RTHA-22	Sloughhouse	South of Meiss Road	S	Oak Savannah	Valley Oak	GAG	2
RTHA-23	Sloughhouse	Fig @ Dillard	S	Riparian	Valley Oak	IP-IC-RR	2
RTHA-24	Sloughhouse	Pear @ Dillard	S	Isolated Tree	Valley Oak	IP-IC-GAG-RR	1
RTHA-25	Sloughhouse	Laguna Creek	UO	Riparian	Valley Oak	GAG	
RTHA-26	Elk Grove	Florin @ Knox	S	Isolated Tree	Cottonwood	IP-IC-GAG-RR	2
RTHA-27	Elk Grove	Florin @ Excelsior	S	Isolated Tree	Eucalyptus	IP-IC-GAG-RR	1
RTHA-28	Elk Grove	Florin @ Eagles Nest	U	Tree Row	Cottonwood	IP-IC-GAG	0
RTHA-29	Elk Grove	Gerber @ Vineyard	UO	Isolated Tree	Eucalyptus	IP-IC-GAG-RR	
RTHA-30	Elk Grove	Gerber @ Excelsior	S	Isolated Tree	Cottonwood	IP-IC-GAG-RR	2
RTHA-31	Elk Grove	Laguna Creek	UO	Riparian	Valley Oak	GAG-IP-IC	

RTHA-32	Elk Grove	Frye Creek	UO	Riparian	Valley Oak	GAG-IP-IC	
RTHA-33	Elk Grove	Laguna Creek	S	Riparian	Willow	IP-IC-GAG	2
RTHA-34	Elk Grove	Laguna Creek	S	Riparian	Cottonwood	IP-IC-GAG	3
RTHA-35	Elk Grove	Bond @ Bader	S	Eucalyptus Grove	Eucalyptus	IP-IC-RR	2
RTHA-36	Elk Grove	Grant Line @ Elk Grove	S	Eucalyptus Grove	Eucalyptus	IP-IC-RR	1
RTHA-37	Elk Grove	Cosumnes River	S	Riparian	Cottonwood	IP-IC	2
RTHA-38	Elk Grove	Freeman @ Gay	S	Isolated Tree	Valley Oak	GAG-IC-IP-RR	3
RTHA-39	Elk Grove	Haggie Road	S	Isolated Tree	Valley Oak	IC-IP-RR	2
RTHA-40	Elk Grove	Davis Road	S	Tree Row	Eucalyptus	RR-IC-IP	3
RTHA-41	Elk Grove	Dillard @ Walmart	S	Isolated Tree	Valley Oak	IC-IP-GAG	1
RTHA-42	Elk Grove	Grant Line @ Mosher	S	Tree Row	Eucalyptus	IC-IP-RR	2
RTHA-43	Elk Grove	Deer Creek	UO	Riparian	Valley Oak	IC-IP	
RTHA-44	Elk Grove	Cosumnes River	UO	Riparian	Valley Oak	IC-IP	
RTHA-45	Carbondale	Cosumnes River	UO	Riparian	Cottonwood	IC-IP-GAG	
RTHA-46	Carbondale	Cosumnes River	S	Riparian	Cottonwood	IC-IP-GAG	2
RTHA-47	Carbondale	Meiss Road	S	Oak Grove	Valley Oak	GAG	2
RTHA-48	Carbondale	Ione Road	S	Riparian	Valley Oak	GAG	2
RTHA-49	Carbondale	Willow Creek	S	Riparian	Valley Oak	GAG-IP	2
RTHA-50	Carmichael	Jackson Hwy @ Hedge	S	Isolated Tree	Cottonwood	IP-RR	2
RTHA-51	Carmichael	Morrison Creek	S	Riparian	Walnut	IP-IC-RR	2
RTHA-52	Carmichael	Bradshaw @ Morrison Creek	UO	Tree Row	Eucalyptus	IP-IC-RR	
RTHA-53	Carmichael	Jackson Hwy @ Morrison Cr	S	Isolated Tree	Cottonwood	IP-IC-RR	3
RTHA-54	Carmichael	Elder Creek	S	Riparian	Cottonwood	IP-IC	2
RTHA-55	Carmichael	Elder Creek	S	Riparian	Willow	IP-IC	1
RTHA-56	Carmichael	Jackson Hwy @ Excelsior	S	Tree Row	Locust	IP-IC-GAG	2
RTHA-57	Goose Creek	Howard Ranch	S	Cottonwood Grove	Cottonwood	GAG	2
RTHA-58	Goose Creek	Howard Ranch	UO	Oak Grove	Blue Oak	GAG	
RTHA-59	Goose Creek	Howard Ranch	UO	Oak Savannah	Blue Oak	GAG	
RTHA-60	Goose Creek	Howard Ranch	UO	Oak Savannah	Blue Oak	GAG	
RTHA-61	Goose Creek	Dry Creek	UO	Riparian	Valley Oak	GAG-IC	
RTHA-62	Goose Creek	Dry Creek	UO	Riparian	Valley Oak	GAG-IC	
RTHA-63	Galt	Cosumnes Overflow	S	Riparian	Valley Oak	GAG-IC	1
RTHA-64	Galt	Cosumnes Overflow	S	Riparian	Valley Oak	GAG-IC	2
RTHA-65	Galt	Cosumnes Overflow	S	Riparian	Valley Oak	GAG-IC	2
RTHA-66	Galt	Valensin/south of Dillard	S	Isolated Tree	Valley Oak	GAG	1

RTHA-67	Galt	Riley @ Salas	S	Isolated Tree	Valley Oak	GAG	2
RTHA-68	Galt	Badger Creek	S	Riparian	Valley Oak	GAG	2
RTHA-69	Galt	Badger Creek	U	Riparian	Valley Oak	GAG	0
RTHA-70	Galt	Arno Road	S	Tree Row	Eucalyptus	GAG-IP-IC	1
RTHA-71	Galt	Arno Road	S	Tree Row	Eucalyptus	GAG-IP-IC	1
RTHA-72	Galt	Skunk Creek	S	Riparian	Willow	IP-IC-GAG	2
RTHA-73	Galt	Dry Creek	UO	Riparian	Cottonwood	IP-IC	
RTHA-74	Galt	Cosumnes River	UO	Oak Grove	Valley Oak	IP-IC-GAG	
RTHA-75	Galt	Badger Creek	UO	Riparian	Valley Oak	IP-IC-GAG	
RTHA-76	Galt	Laguna Creek	UO	Riparian	Cottonwood	IP-IC-GAG	
RTHA-77	Galt	North of Twin Cities Road	UO	Oak Grove	Valley Oak	GAG	
RTHA-78	Galt	South of Twin Cities Road	UO	Riparian	Valley Oak	GAG-IC	
RTHA-79	Galt	Twin Cities @ SP RR	UN	Channelized Rip.		GAG-IC	
RTHA-80	Galt	Twin Cities @ Hwy 99	S	Eucalyptus Grove	Eucalyptus	IC-IP-RR	2
RTHA-81	Galt	Spring Street	UO	Channelized Rip.	Eucalyptus	IC-IP	
RTHA-82	Galt	Deadman Gulch	UN	Riparian		IC-IP	
RTHA-83	Galt	Christensen Road	UO	Tree Row	Eucalyptus	IC-IP	
RTHA-84	Galt	South of Orr Road	UN	Channelized Rip.		IC-IP	
RTHA-85	Galt	Harvey @ Valley Tree	UO	Isolated Tree	Valley Oak	IC-IP	
RTHA-86	Galt	Hwy 99 @ Eschinger	UO	Tree Row	Eucalyptus	IC-IP	
RTHA-87	Galt	Badger Creek – W of Hwy 99	UO	Riparian	Valley Oak	IC-IP	
RTHA-88	Galt	Badger Creek – Cosumnes R.	UO	Riparian	Willow	IC-IP	
RTHA-89	Bruceville	Franklin – north of Core	UN	Tree Row		IC-IP	
RTHA-90	Bruceville	NW of Kammerer @ Rau	UO	Channelized Rip.	Cottonwood	IC-IP	
RTHA-91	Bruceville	SW of Kammerer @ Rau	UN	Isolated Tree		IC-IP	
RTHA-92	Bruceville	SW of Bruceville @ Eschinger	UO	Isolated Tree	Valley Oak	IC-IP	
RTHA-93	Bruceville	SW of Core and Franklin	UN	Channelized Rip.		IC-IP	
RTHA-94	Bruceville	SE of Fogg and Pt Pleasant	UO	Farmyard	Valley Oak	IC-IP	
RTHA-95	Bruceville	Pt Pleasant, W of Bruceville	UO	Isolated Tree	Valley Oak	IC-IP	
RTHA-96	Bruceville	Lambert, W of Bruceville	UO	Farmyard	V. Oak	IC-IP	
RTHA-97	Bruceville	Lambert, E of Bruceville	UO	Farmyard	Eucalyptus	IC-IP	
RTHA-98	Bruceville	E of Carroll, S of Eschinger	UO	Farmyard	Cottonwood	IC-IP	
RTHA-99	Bruceville	Schmidt Ln	UO	Farmyard	Sycamore	IC-IP	
RTHA-100	Bruceville	Stone Lake	UO	Tree Row	Olive	IC-IP	
RTHA-101	Bruceville	N of Dierssen	UN	Tree Row		IC-IP	

RTHA-102	Bruceville	I-5 @ Dierssen	UO	Channelized Rip.	Cottonwood	IC-IP	
RTHA-103	Bruceville	S of Twin Cities, E of Franklin	UO	Riparian	Valley Oak	IC-IP	
RTHA-104	Bruceville	S of Twin Cities, W Franklin	UN	Riparian		IC-IP	
RTHA-105	Bruceville	Snodgrass Slough	UO	Riparian	Cottonwood	IC-IP	
RTHA-106	Bruceville	N Mokelumne R, E of I-5	UO	Riparian	Cottonwood	IC-IP	
RTHA-107	Bruceville	E of Cosumnes River	UN	Isolated Tree		IC-IP	
RTHA-108	Bruceville	Snodgrass Slough	S	Riparian	Alder	IC	2
RTHA-109	Bruceville	NE of Camp Road	UO	Riparian	Valley Oak	IC-IP	
RTHA-110	Florin	Hood Franklin @ I-5	UO	Isolated Tree	Valley Oak	IC-IP	
RTHA-111	Florin	Bilby @ Bruceville	UO	Tree Row	Valley Oak	IC-IP	
RTHA-112	Lodi North	New Hope, E of Orr	UO	Isolated Tree	Eucalyptus	IC-IP	
RTHA-113	Lodi North	New Hope, W of Christensen	UN	Isolated Tree		IC-IP	
RTHA-114	Lodi North	New Hope, E of Sargent	UO	Tree Row	Eucalyptus	IC-IP-RR	
RTHA-115	Lodi North	Dry Creek	UN	Riparian		IC-IP	
RTHA-116	Lodi North	Dry Creek	UN	Riparian		IC-IP	
RTHA-117	Lodi North	N of Dry Creek	UN	Channelized Rip.		IC-IP	
RTHA-118	Lodi North	Dry Creek	UN	Riparian		IC-IP	
RTHA-119	Courtland	S of Hood Junction	UN	Riparian		IC-IP	
RTHA-120	Courtland	N of Stone Lake	UN	Isolated Tree		IC-IP	
RTHA-121	Courtland	Snodgrass Slough	UO	Riparian	Cottonwood	IC-IP	
RTHA-122	Courtland	Snodgrass Slough	S	Riparian	Cottonwood	IC-IP	1
RTHA-123	Courtland	Snodgrass Slough	UO	Oak Grove	Valley Oak	IC-IP	
RTHA-124	Courtland	Steamboat Slough	UO	Riparian	Valley Oak	IC-IP	
RTHA-125	Courtland	Sacramento River	S	Farmyard	Eucalyptus	IC-IP	2
RTHA-126	Courtland	Snodgrass Slough	UN	Riparian		IC-IP	
RTHA-127	Courtland	The Meadows Slough	UO	Riparian	Cottonwood	IC-IP	
RTHA-128	Courtland	The Meadows Slough	UO	Riparian	Cottonwood	IC-IP	
RTHA-129	Courtland	East of Courtland	UO	Isolated Tree	Cottonwood	IC	
RTHA-130	Isleton	Steamboat Slough	UO	Riparian	Cottonwood	IC	
RTHA-131	Isleton	Sacramento River	UN	Riparian		IC	
RTHA-132	Isleton	Georgiana Slough	UO	Riparian	Cottonwood	IC	
RTHA-133	Isleton	Delta Cross Channel	UN	Channelized Rip.		IC	
RTHA-134	Isleton	Sacramento River	UN	Riparian		IC	
RTHA-135	Isleton	Sacramento River	UN	Riparian		IC-RR	
RTHA-136	Isleton	N of Mokelumne River	UO	Eucalyptus Grove	Eucalyptus	IC	

RTHA-137	Isleton	Georgiana Slough	UN	Riparian		IC	
RTHA-138	Thornton	Bear Slough	UN	Riparian		IC	
RTHA-139	Thornton	E of Bear Slough	UN	Riparian		IC	
RTHA-140	Thornton	Mokelumne River	UN	Riparian		IC	
RTHA-141	Thornton	Dry Creek	UN	Riparian		IC	
RTHA-142	Thornton	Dry Creek	UN	Riparian		IC	
RTHA-143	Thornton	Mokelumne River	UN	Riparian		IC	
RTHA-144	Thornton	Mokelumne River	S	Artificial	Electrical Tower	IC	2
RTHA-145	Rio Vista	Sacramento River	UN	Riparian		IC	
RTHA-146	Rio Vista	Sacramento River	UN	Riparian		IC	
RTHA-147	Jersey Island	Decker Island	UN	Riparian		IC	
RTHA-148	Jersey Island	Sherman Island	UO	Isolated Tree	Willow	IC	
RTHA-149	Jersey Island	3-mile SI @ San Joaquin R.	UO	Cottonwood Grove	Cottonwood	IC	
RTHA-150	Bouldin Is.	Jackson Slough	UN	Riparian		IC	
RSHA-1	Clay	Hobday @ Alta Mesa	S	Tree Row	Eucalyptus	RR-IP-IC	1
RSHA-2	Clay	Hadselville Creek	S	Riparian	Cottonwood	IP-IC-GAG	1
RSHA-3	Clay	Hwy 104 @ Angle	S	Tree Row	Eucalyptus	IP-IC	1
RSHA-4	Clay	Boessow @ Alta Mesa	S	Isolated Tree	Eucalyptus	IP-IC	3
RSHA-5	Sloughhouse	Tavernor @ Orange	S	Riparian	Valley Oak	IP-IC-GAG-RR	1
RSHA-6	Elk Grove	Excelsior @ Dierks	UO	Eucalyptus Grove	Eucalyptus	RR-IP-IC-GAG	
RSHA-7	Elk Grove	Grant Line @ Mooney	UO	Tree Row	Eucalyptus	RR-IP-IC	
RSHA-8	Elk Grove	Deer Creek	UO	Riparian	Valley Oak	IP-IC	
RSHA-9	Elk Grove	East of Deer Creek	UO	Tree Row	Walnut	IC-IP	
RSHA-10	Galt	Cosumnes Overflow	S	Riparian	Valley Oak	GAG-IC	2
RSHA-11	Galt	Arno Road	UO	Tree Row	Eucalyptus	GAG-IC	
RSHA-12	Galt	E. of Cosumnes River	UN	Riparian		GAG-IC-IP	
RSHA-13	Galt	Badger Creek	UN	Oak Woodland		GAG-IC-IP	
RSHA-14	Galt	Cosumnes River	UN	Riparian		GAG-IC-IP	
RSHA-15	Galt	SW Twin Cities - Pellandini	UO	Riparian	Valley Oak	IC-IP	
RSHA-16	Galt	Orr @ Christensen	UN	Tree Row		IC-IP	
RSHA-17	Bruceville	Cosumnes River	UN	Riparian		IC-IP	
RSHA-18	Bruceville	Cosumnes River	UN	Riparian		IC-IP	
RSHA-19	Bruceville	Cosumnes River	UN	Riparian		IC-IP	
RSHA-20	Bruceville	Cosumnes River	UN	Riparian		IC-IP	
RSHA-21	Bruceville	Mokelumne River	UN	Riparian		IC-IP	

RSHA-22	Bruceville	Korn @ Point Pleasant	UO	Tree Row	Eucalyptus	IC-IP	
RSHA-23	Lodi North	Dry Creek	UN	Riparian		IC-IP	
RSHA-24	Lodi North	Dry Creek	UN	Riparian		IC-IP	
RSHA-25	Lodi North	Dry Creek	UN	Riparian		IC-IP	
RSHA-26	Courtland	Sacramento River	UN	Riparian		IC-IP	
RSHA-27	Courtland	Sutter Slough	UN	Riparian		IC-IP	
RSHA-28	Courtland	Steamboat Slough	UN	Riparian		IC-IP	
RSHA-29	Courtland	Stone Lake	UN	Riparian		IC-IP	
RSHA-30	Isleton	Steamboat Slough	UO	Riparian	Cottonwood	IC	
RSHA-31	Isleton	Georgiana Slough	UO	Riparian	Cottonwood	IC	
RSHA-32	Isleton	Sacramento River	UO	Riparian	Eucalyptus	IC	
RSHA-33	Rio Vista	Sacramento River	UN	Riparian		IC	
RSHA-34	Jersey Island	3-mile Slough-Sherman Is.	UO	Riparian	Cottonwood	IC	
RSHA-35	Bouldin Is.	Korth's Marina-Andrus Is.	UO	Eucalyptus Grove	Eucalyptus	IC	
RSHA-36	Thornton	Mokelumne River	UO	Riparian	Valley Oak	IC	
RSHA-37	Thornton	Mokelumne River	UN	Riparian		IC	
RSHA-38	Thornton	Bear Slough	UN	Riparian		IC	
RSHA-39	Thornton	S. of Bear Slough	UO	Channelized Rip.	Cottonwood	IC-IP	
RSHA-40	Thornton	Mokelumne River	UO	Riparian	Cottonwood	IC	
GHOW-1	Clay	Laguna Creek	S	Riparian	Valley Oak	IP-IC	3
GHOW-2	Elk Grove	Florin and Knox	S	Isolated Tree	Cottonwood	IP-IC	3
GHOW-3	Carbondale	Meiss Road	S	Oak Grove	Valley Oak	GAG	3
GHOW-4	Carbondale	Willow Creek	S	Riparian	Valley Oak	GAG-IP	3
GHOW-5	Carmichael	Jackson Hwy @ Eagles Nest	S	Isolated Tree	Eucalyptus	GAG-IP-IC	2
GHOW-6	Lockeford	Dry Creek	S	Riparian	Valley Oak	IP-IC	3
GHOW-7	Goose Creek	Howard Ranch	UO	Cottonwood Grove	Cottonwood	GAG	
GHOW-8	Florin	Bilby @ Bruceville	UN	Tree Row	Valley Oak	IP-IC	2
GHOW-9	Lodi North	Dry Creek	S	Riparian	Valley Oak	IP-IC	3
GHOW-10	Isleton	Georgiana Slough	S	Riparian	Cottonwood	IC	2
GHOW-11	Bouldin Is.	Korth's Marina-Andrus Is.	UO	Eucalyptus Grove	Eucalyptus	IC	
GHOW-12	Jersey Island	Brannan Island Park	UN			IC	
WTKI-1	Sloughhouse	Fig @ Dillard	UO	Oak Grove	Valley Oak	IP-IC-RR	
WTKI-2	Galt	Cosumnes Overflow	UO	Riparian	Valley Oak	IP-IC-GAG	
WTKI-3	Galt	S of Harvey and Sargent	UN	Tree Row		IP-IC-RR	
WTKI-4	Bruceville	E of Cosumnes, N of Orr	UN	Riparian		IP-IC	

WTKI-5	Isleton	Steamboat Slough	UO	Riparian	Cottonwood	IC	
WTKI-6	Isleton	Georgiana Slough	UO	Riparian	Cottonwood	IC	
WTKI-7	Rio Vista	Sacramento River	UN	Riparian		IC	
WTKI-8	Thornton	Mokelumne River	UN	Riparian		IC-IP	

S = Successful Nest (young produced)

U = Unsuccessful Nest (no young produced - nesting attempt *Abandoned* prior to nest initiation or nest *Failed* following nest initiation)

UO = Active nest but unknown reproductive outcome

UN = Active Territory but unknown if nesting attempt was made

NN = Active Territory but nest not constructed

IC = Irrigated Cropland

IP = Irrigated Pasture

GAG = Grazed Annual Grassland

RR = Rural Residential

R = Residential