Executive Summary

Purpose and Goals

This habitat restoration plan was developed to guide the restoration of natural habitats on the Solano Concrete site near Madison in Yolo County as part of the post-mining reclamation of the site. The project site is approximately 1,828 acres; about 719 acres of the site will be mined over the next 30 years. The area proposed for mining is farmland at this time but historically supported valley oak woodlands and native prairie. Cache Creek, which runs along the northern border of the site, has been channelized in the project area and much of the native vegetation lost through erosion or replaced by non-native weeds.

Reclamation of the project site will be guided by the need to reclaim mined land for commercial farming and wildlife habitat, and to accomplish these goals in a way which creates an integrated, self-sustaining and biologically diverse system. "Biodiversity" connotes a system composed of many separate elements that form a mutually supporting system. Such systems are notable for their resiliency and self-maintenance.

The specific goals of the reclamation plan include the following:

1. Ensure the unmined farmland continues to support agricultural uses.

2. Reclaim as much mined land to agricultural production as the volume, type, and condition of the salvaged topsoil and the groundwater levels will allow, including types of farm production which can be integrated with natural habitat.

3. Reclaim the remaining mined land to natural habitats that are compatible with agricultural production and that increase the biodiversity of the site.

Planning Process

Applying these goals to the project site required a phased planning process. The phases consisted of: (1) identifying the maximum extent of practically reclaimable agricultural land in accordance with County requirements; (2) defining the amount of non-prime soils available for other agricultural uses; (3) siting the most practicable location of each use, including natural habitat areas that could be created between the agricultural lands and Cache Creek; and (4) an assessment of Cache Creek to formulate an appropriate restoration plan.

Defining the Agricultural Resource

In the first phase, the extent of the aggregate resource was mapped. Next, the volume of salvageable topsoil was calculated and compared with the groundwater surveys for the site to identify the maximum extent of reclaimable agricultural land. Based on the success of the existing agricultural reclamation by Solano Concrete, performance standards were then developed (these are found in the accompanying agricultural reclamation program).

Promoting Integrated Agriculture

In the second phase, the amount of clay and similar soils available were calculated and these volumes compared to groundwater levels to define an area available for "integrated agriculture" and farm operations which integrate both farming practices and habitat. For this project, the production of short-fiber biomass through the planting and harvesting of special strains of willows and poplars was identified as the primary form of integrated agricultural. These trees provide habitat, are harvested on relatively long schedules (three to seven years), do not require prime soils, and, unlike traditional row crops, can be located just above the groundwater table (which requires less backfill soil).

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HABITAT RESTORATION PLAN

an element of the

MINING RECLAMATION PLAN FOR THE MADISON AGGREGATE SITE,

SOLANO CONCRETE, YOLO COUNTY, CALIFORNIA

Zentner and Zentner
Lafayette
Sacramento

Prepared for
Solano Concrete

Project No. 340 SCC

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Land Planning and Restoration

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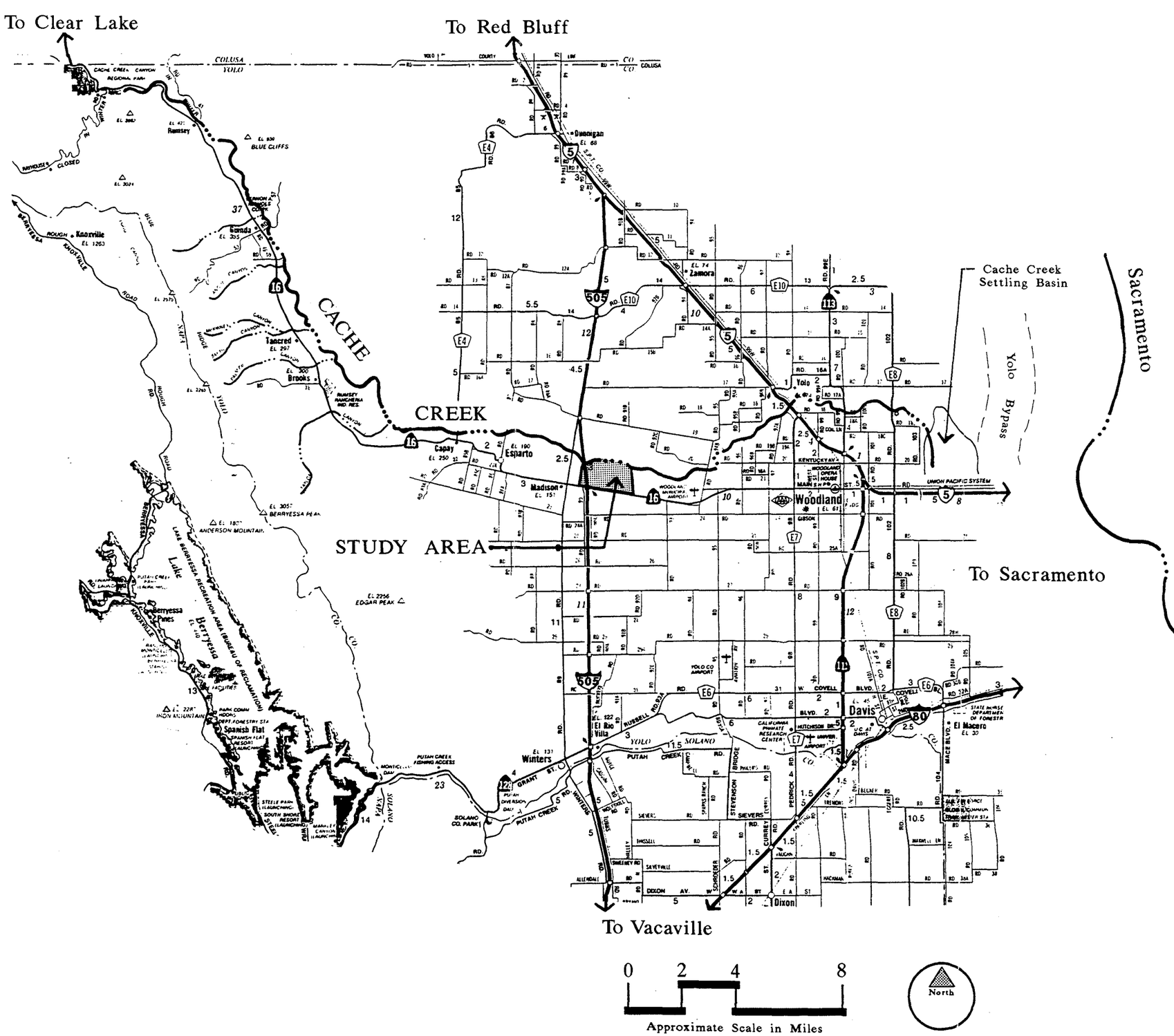

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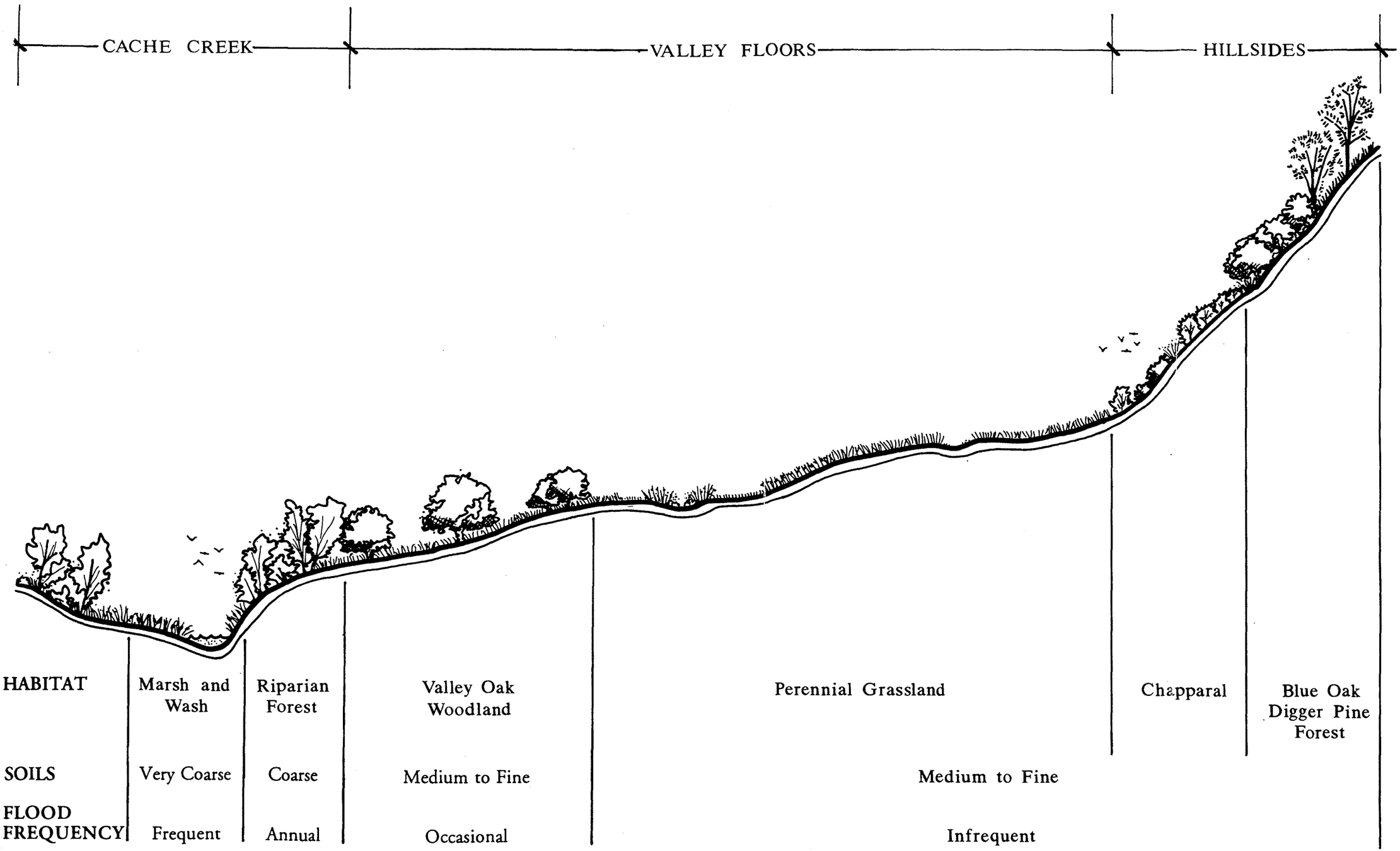
Regional Location Map

FIGURE 1



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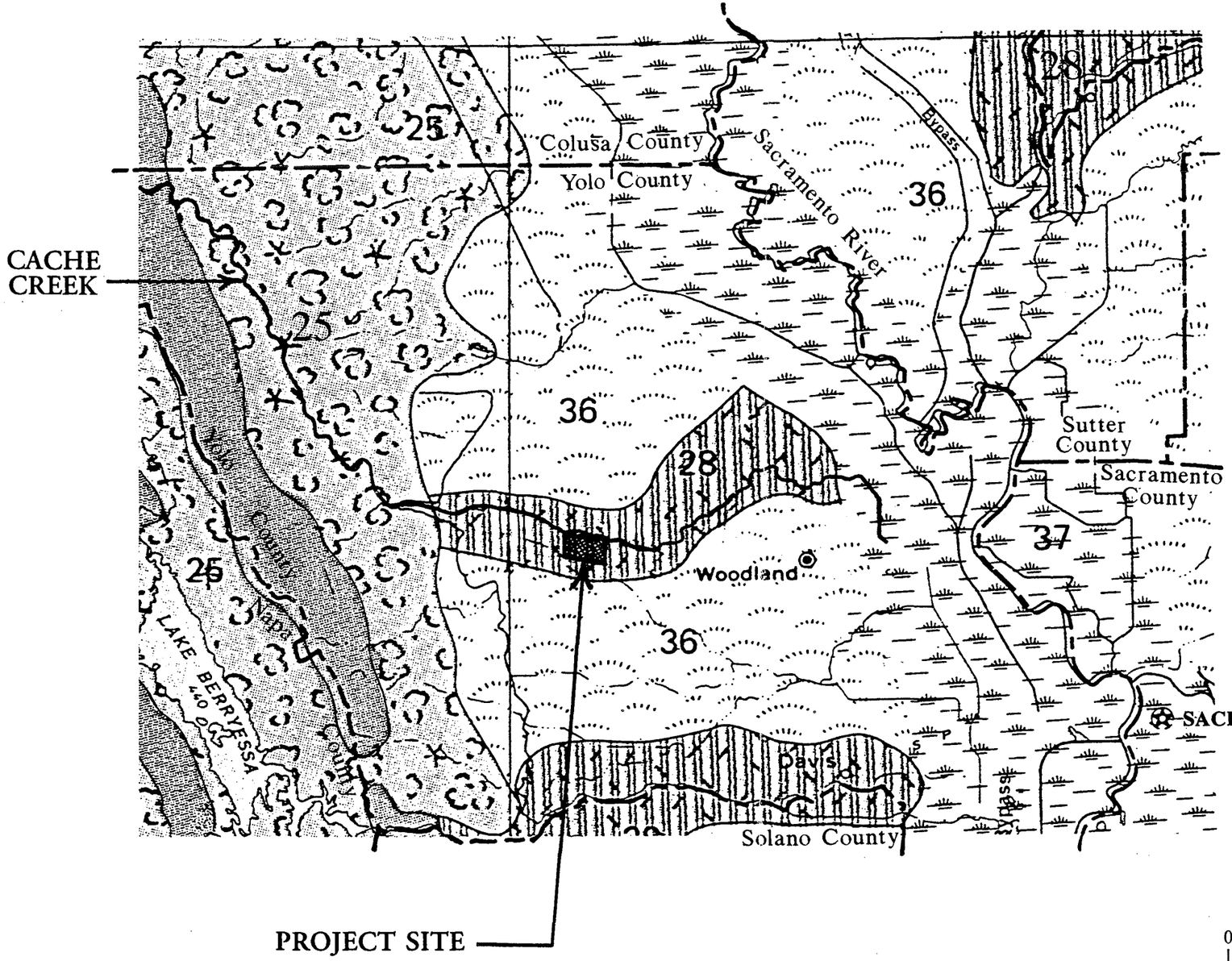
SOURCE: A.W. Kuchler (1977)
Natural Vegetation of Calfornia

Regional Habitat Cross-Section:
Pre-European Conditions

FIGURE 3



LEGEND:

- 25 — Blue Oak-Digger Pine Forest
- 28 — Riparian Forest
- 29 — Chaparral
- 36 — California Prairie
- 37 — Tule Marsh

0 2 4 8

Approximate Scale in Miles

NORTH

Map based on
Natural Vegetation of California,
by A.W. Kuchler, 1977

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Pre-European Regional Habitat Map
FIGURE 2

Creating a Diverse and Integrated System

The third phase compared the soil capability classes and other site constraints to ensure that the location of the reclaimed agricultural lands occur under the most favorable conditions. The remainder lands and the creek corridor were then evaluated for their use as integrated agricultural or as natural habitats. These phases were integral to the design of a reclamation plan that creates an integrated and biologically diverse system. The attendant cross-section illustrates the proposed system.

Restoring Cache Creek

The final phase evaluated Cache Creek and its environs in both its native and existing conditions. Habitats such as open water and marsh, and native species that no longer occur on the site or that are under-represented on the site or in the region, were evaluated for re-establishment on the site. Criteria for re-establishment included compatibility with agricultural uses and functional ability to enhance values such as flood control and groundwater recharge and storage.

This plan focuses on the results of the final phase described above: the evaluation of the site in its existing and native conditions and the formulation of a natural habitats restoration plan for those portions of the site which will not be used for agricultural purposes.

Project Plan

In accordance with the project goals and planning process, most of the unmined portion of the Solano Concrete site will remain in agricultural production. Of the approximately 719 mined acres, the majority will be reclaimed to agricultural purposes. Most of the reclaimed agricultural land will be used for typical crop production. A portion of the reclaimed agricultural land will be used for short-fiber, biomass production. This agricultural use has been sited to act as a buffer and integrating use between the more traditional agricultural lands and the natural habitats.

As of the writing of this plan (October 1995), 33 mined acres on the current Hutson parcel had been reclaimed to farmland. Seven more acres will be reclaimed by Spring of 1996, and another 10-15 acres by Spring of 1997. The balance of the reclamation for the project site will be complete approximately by the end of 2001.

Approximately 290 acres between the restored creek and the agricultural reclamation lands will be restored to natural habitats. The natural habitats will consist of four woodland-pond systems designed to enhance groundwater storage and recharge and wildlife habitat. The upper slopes of these systems will be dominated by valley oak woodlands which will integrate into and buffer the integrated agriculture lands. The mid-terrace lands of the natural habitats will be dominated by a diverse mix of riparian woodland and marsh species, while the lowest portion will be open water habitat. The lack of open water habitat in the region has contributed to the disappearance of a number of species; the few examples of this habitat type in the area are notable for the great diversity and number of wildlife. Consequently, providing open water is an important component of any habitat enhancement plan for this region.

Approximately 57 acres adjacent to the creek, much of which is previously mined land within the ordinance channel of the creek, will be restored to create a diverse creek riparian system and enhance the natural groundwater recharge and flood control capacities of the creek. This plan proposes a conceptual design for this restoration work. Final plans for this element will only be completed after County plans for the entire mining reach are finalized.

This reclamation plan provides for an integrated and diverse system with safeguards to protect each use. Site hydrologic cycles have been planned to ensure agricultural or creek-borne pollutants do not enter the open water habitat. The pond systems will be separated from the main flowline of the creek by heavily wooded berms with crests above the 100-year storm. This keeps any pollutants in the creek from reaching the pond systems. Similarly, tailwater from the undisturbed agricultural operations will drain south, away from the creek, to drain lines along the Highway. Tailwater from the reclaimed agricultural lands will drain to on-site basins, away from the open water habitat. Drain ditches and berms are used to ensure that overflow cannot reach the open water. Finally, Solano Concrete does not use aerial spraying for its reclaimed agriculture near open water.

This policy, in addition to the height (60 to 100 feet) of the willows and poplars in the integrated agriculture land, will help prevent aerial-borne pollutants from reaching the open water.

Ensuring Project Success

This plan includes a five-year, post-construction monitoring, maintenance and performance review process for each phase of reclamation. Hydrology, water quality, plant cover and diversity, and wildlife use will all be analyzed with annual monitoring reports provided to the County. After five years, each phase of the project must meet specific performance standards. The applicant will be responsible for re-designing or re-building unsuccessful portions of the project.

Chapter 1
Introduction

HABITAT RESTORATION PLAN

Madison Aggregate Site

Solano Concrete

A. PURPOSE

The Madison Plant site is located roughly 15 miles west of Woodland along the southern shore of Cache Creek (Figure 1). The purpose of this plan is to guide the reclamation of those mined areas proposed to be restored to natural habitat.

The agriculturally valuable surface soils stock-piled during mining combined with the subsoil remaining after the aggregate is separated out, is sufficient to restore a much of the mined areas to agricultural conditions. Another portion can be reclaimed for integrated agricultural (biomass production) and the remaining area, including Cache Creek, would then be restored to natural habitat. This plan addresses those areas to be restored to natural habitat.

B. HISTORIC CONDITIONS

1. Pre-European Habitat Associations

The hills and mountains of the Coast Ranges in this region are dominated by blue-oak and digger pine associations, reflecting the generally well-drained substrate and dry climate, with chaparral dominating serpentine and other highly mineralized substrates. In pre-European times the Capay Valley and the west edge of the Sacramento Valley would have been predominantly grassland on the drier soils, with valley oak woodland in areas where groundwater consistently occurred at 10 to 20 feet below the surface (Figures 2 and 3).

Narrow swaths of riparian habitats (including active stream courses, adjacent wash floodplains, riparian woodland, patches of marsh, and an envelope of valley oak woodland) would have followed the streams through the surrounding grasslands. And, in the low elevation areas where the streams emptied and annual flood-waters accumulated, the landscape would have been dominated by large marshlands consisting of tules, cattails, and sedges. The streams themselves were subject to high flows during the wet season, and would draw down to a trickle or even dry completely during the summer. Each winter, the rain swollen streams would have moved substantial sediment from the upper watershed to the valleys, causing annual meandering of the stream courses.

Scattered through the grasslands would have been a series of small meandering seasonal water channels, and isolated small basins which would have supported a wide spectrum of localized habitats including seasonally wet meadows, seasonal marsh, perennial marsh, and vernal pools, depending on variations in hydrology and soils. On the upland areas, variations of the "grassland" vegetation would have been determined by vagaries of soils texture, drainage, and chemistry, supporting such 'types' as wildflower fields, mesic grasslands and dry grasslands.

The soils and hydrology of these habitats can be ranged on a gradient from coarse soils with frequent flooding to fine soils with infrequent flooding, which also approximately reflects increasing distance from water courses and increasing depth to groundwater. Typically, a creek bottom or "wash" would contain very coarse soils and be subject to frequent flooding; adjacent lands with riparian woodlands would contain medium textured soils and be subject to at least annual flooding; higher ground dominated by valley oaks would contain medium to fine soils and be subject to occasional flooding; and the highest grounds, dominated by grasslands, would contain medium to fine soils and be subject to infrequent to rare flooding.

2. Twentieth Century Changes

All native habitat types in the region, and throughout most of the western U.S., have been reduced in extent and quality by the expansion in intensive farming and water diversion activities which occurred in the early decades of the

20th century. The diversion or control of the highly variable stream flows allowed intensive farming in many areas which had not been previously considered for any activity aside from grazing. The modifications to flood and normal flows also provided for an increased level of flood protection, allowing greater settlement on historic floodplain lands.

These actions led to the elimination or significant reduction of many riparian woodlands. These areas generally had good soils for intensive farming but were constrained by yearly flooding and, due to the highly seasonal nature of the flows, often had little or no water available for irrigation during the dry summers and falls. Control of the streamflow (to some extent greatly assisted by the public works projects of the 1930's), construction of irrigation canals and ditches, and the high demand for farm products and wood led to the elimination of the extensive valley oak woodlands once associated with the historic waterways of this region.

Associated wildlife has consequently been seriously impacted as well. Large and wide-ranging mammals such as tule elk, pronghorn, grizzly bear, wolf and puma have long since been eliminated from the region. Smaller and more versatile species such as coyote, striped skunk and jack rabbit have persisted on marginal habitat. Less versatile species, such as badgers and Audubon cottontail, have been pushed into smaller and more degraded remnant habitats. Figure 4 shows a cross section of pre-farming habitats on the project site with associated wildlife, emphasizing those species which are now considered by Federal and State agencies to be rare or declining.

C. PROJECT SITE TOPOGRAPHY

Figure 5 shows the project area topography. The relief in the vicinity of the project area is a gently rolling plain which slopes slightly to the east although a few low knolls project above the plain and a few shallow stream channels dissect the plain.

The northern 60% of the site consists of the pre-European Cache Creek floodplain and alluvial fan, its southwestern 20% is the rim of a local basin, and its southeastern 20% is a relatively older terrace related physiographically to the Dunnagin Hills uplift (USDA 1972). The elevation difference between the alluvial fan, basin rim, and older terrace is minor (approximately five feet), but it significantly affected their drainage, soil, and former vegetation. All three are now artificially drained and intensively cultivated, however, and are collectively referred to as a "high terrace" in this report to distinguish them from the existing Cache Creek floodplain, a deep trough with relatively steep sides on the northern edge of the project site.

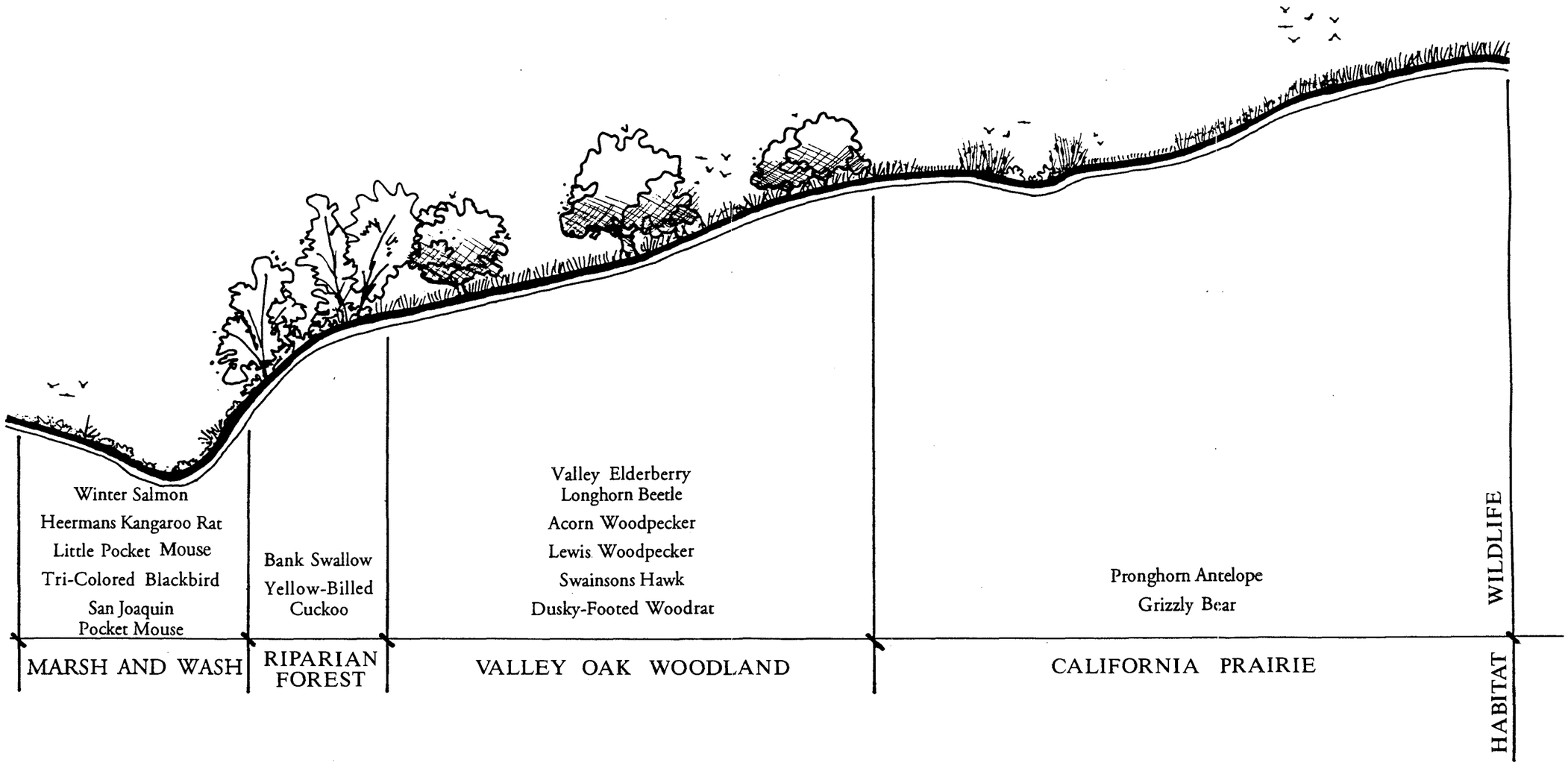
Both the high terrace and the floodplain appear to be level but actually slope slightly upward toward the project area's west end, which is approximately 25 feet higher than the east end. As a result, Cache Creek apparently intercepts a horizontal aquifer just east of the project site as its lowest parts there contain wet ponds. In contrast, the west end of the site is completely dry. An aggregate pit near the center of the site also intercepts the aquifer, as it contains a permanent pond.

Except following major storms, Cache Creek flows only intermittently in the survey area. The Capay Dam diverts most of the surface water north into the West Adams Canal or south into the Winters Canal. The project area's southwest corner is crossed by a channelized remnant of Willow Slough, which drains its basin rim and the associated local basin.

D. PROJECT SITE SOILS

The parent material of all project area soils is Quaternary alluvium (CDMG 1977). Its thickest local unit is sand and gravel, but the high terrace south of Cache Creek is largely covered by varying thicknesses of loamy material that permit it to be farmed.

CACHE CREEK — VALLEY FLOORS



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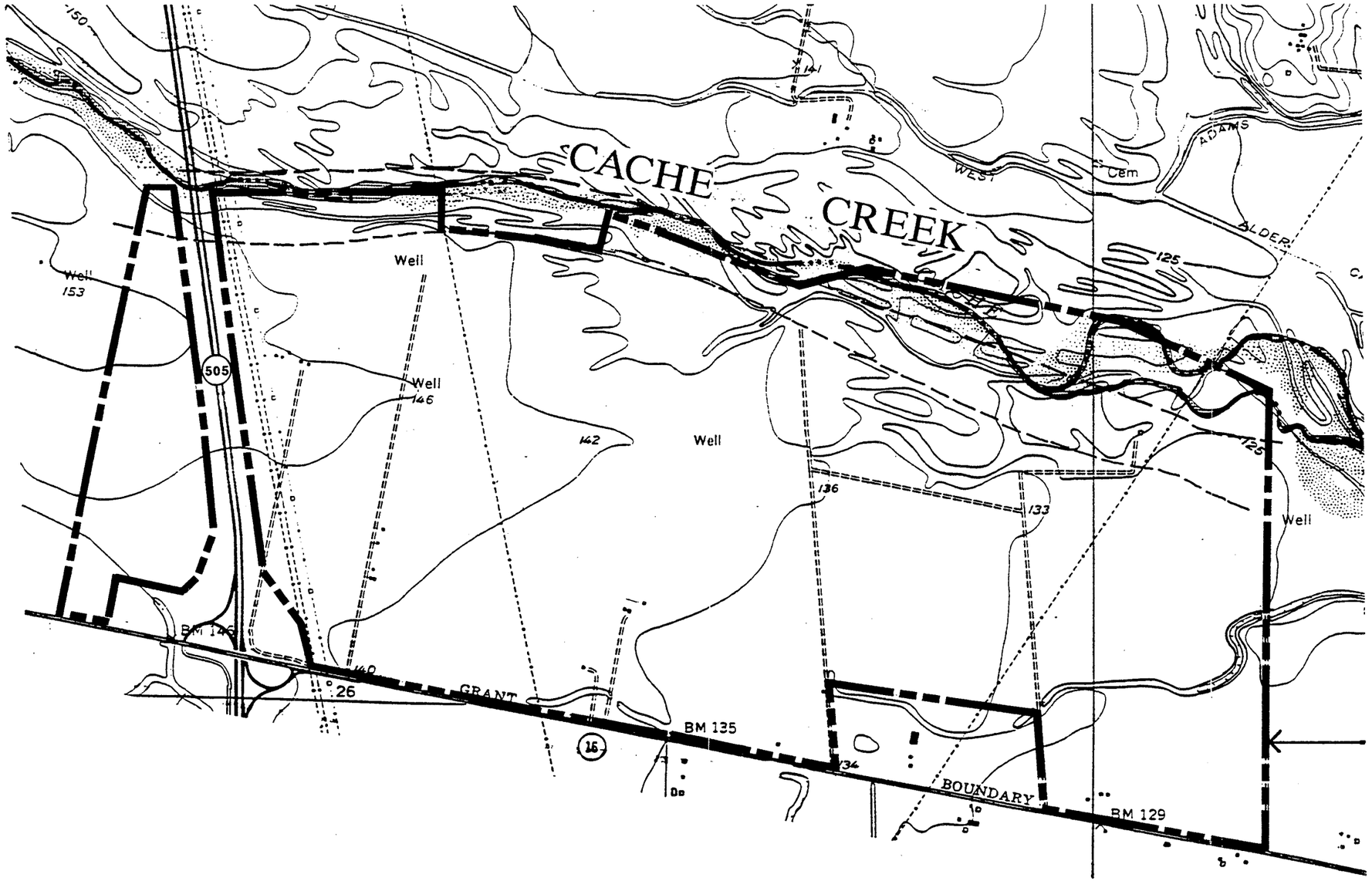
Pre-European Wildlife of the Region
by Habitat Type

FIGURE 4



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Project Area Topography
FIGURE 5

Soils on the site can be roughly arranged on gradients from coarse texture, through moderate texture, to fine texture, which roughly reflects increasing distance from the creek and hence the mode of deposition. Figure 6 provides a highly idealized cross section perpendicular to the line of the creek channel of the project area soils.

The soils of the creek and flood channels have been subject to frequent flooding, with active erosion and deposition. These "soils" tend to be coarse and excessively drained, with the finer sediments washing away downstream and spreading from the creek onto surrounding lands in occasional floods. The soil series of the creek and bank, as roughly mapped by the Soil Survey (SCS, 1972), include Riverwash which is subject to frequent flooding and prolonged stream flows, and Soboba Gravelly Sandy Loam, developed from material recently deposited by the stream. These "soils" are most suited to wash and riparian woodland habitat types.

Immediately adjacent to the creek and the flood channels are flats that were subject to frequent but only brief flooding with active deposition. The soils formed in this band are a highly variable mix of relatively coarse (hence excessively drained) to medium textured loams, mapped by the Soil Survey as Loamy Alluvial Land. Groundwater tended to be relatively shallow in these areas. These soils supported the higher and drier end of the riparian woodland and lower edge of the valley oak woodland habitat. Some of the loamy alluvial land has been subject to farming and some has been mined for aggregate production over the last several decades.

The next series of soils outward from the creek (most of the site) would be overflow lands, where occasional brief flooding deposited a relatively balanced mix of medium- and fine-grained sediment that developed into medium-textured loamy soils. The soil series of this band, as roughly mapped by the Soil Survey, include: Sycamore Silt Loam; Yolo Silt Loam; Brentwood Silty Clay Loam; and San Ysidro Loam. These soil series are not uniform, however, but rather each contains a complex mosaic of various textures ranging from gravelly sandy loams through clays (Ag West Resources, 1995; SCS, 1972), which reflect vagaries in depositional history and pre-farming micro-relief (*e.g.*, old depressions, rises, andswales). These generally loamy soils formerly supported a mix of valley oak

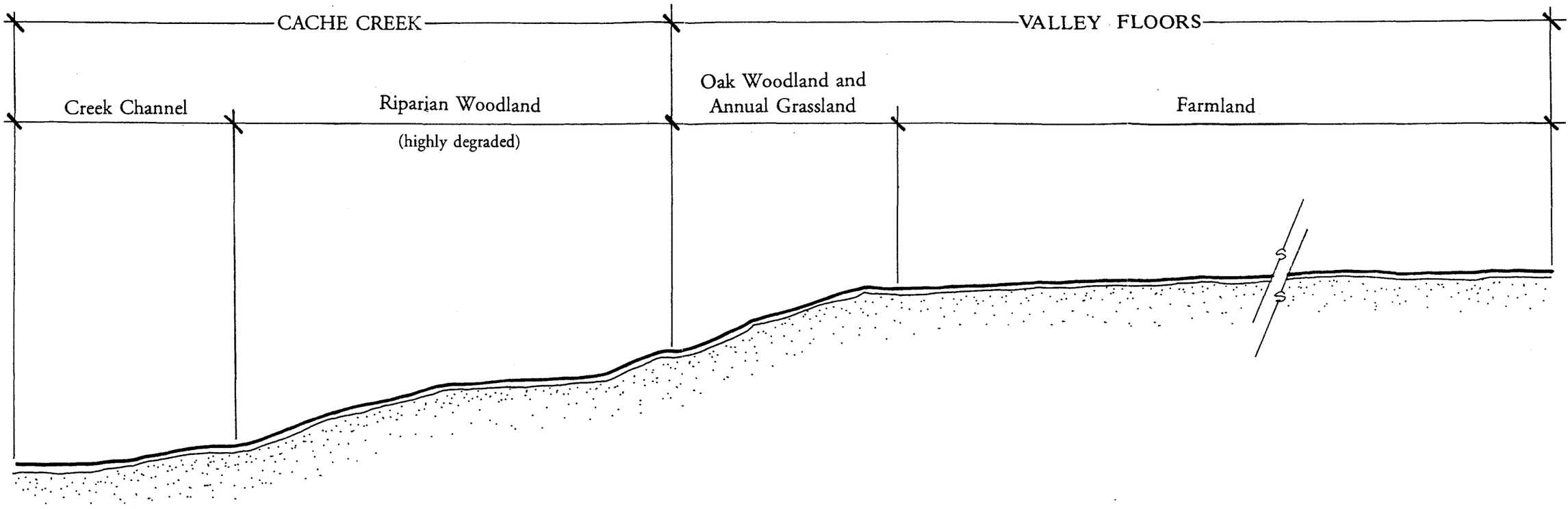
woodland and native prairie. Except for a few tiny slivers of degraded oak woodland and annual grassland along the north edges of the creek, these soils are now devoted almost entirely to agriculture.

Farthest from the creek along the southwestern edge of the site are fine-textured soils located on the edges of small basins. The parent material of these basin-edge soils was primarily clay and silt that settled out of suspension from slack water after infrequent regional flooding. The soil series of this outermost band, as roughly mapped by the Soil Survey (SCS, 1972), include Marvin Silty Clay Loam and Capay Silty Clay. These soils formerly supported mostly native prairie but are now devoted entirely to agriculture.

E. PROJECT SITE HABITATS AND WILDLIFE

1. Introduction

The majority of the project area consists of a high terrace between the Cache Creek floodplain and Highway 16. Almost all of this terrace is now intensively cultivated for field crops. The most predominant crops on the site in 1995 were alfalfa (*Medicago sativa*), wheat (*Triticum aestivum*), and tomato (*Lycopersicon esculentum*). Prior to agricultural development, most of this terrace was vegetated by a dense riparian oak woodland that paralleled Cache Creek and was dominated by valley oak (*Quercus lobata*). The native vegetation in the southeastern part of the project area on the older portion of the high terrace was probably an oak savanna in which valley oaks were scattered at a low density in an herbaceous matrix that included native grasses such as purple needle grass (*Nassella pulchra*) and creeping wild rye (*Leymus triticoides*) as well as numerous native forbs. Trees were probably completely absent in the southwestern part of the project area since its basin rim soils are evidence of poor drainage conditions that favored a variety of obligate and facultative wetland plants including creeping wild rye, saltgrass (*Distichlis spicata*), Mexican rush (*Juncus mexicana*), clustered field sedge (*Carex praegracilis*), cattail (*Typha domingensis*), and bulrush (*Scirpus acutus*).



TEXTURE	Coarse	Coarse	Coarse to Medium	Medium	Fine
PRE-EUROPEAN FLOODING REGIME	Frequent Flooding	Frequent Brief Flooding	Frequent Brief Flooding	Occasional Brief Flooding	Infrequent Flooding
SOIL SERIES	Riverwash	Soboba Gravelly Sandy Loam	Loamy Alluvial Land	Sycamore Silt Loam, Yolo Silt Loam, Brentwood Silty Clay Loam, San Ysidro Loam	Marvin Silty Clay Loam, Capay Silty Clay

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Project Area Soils
FIGURE 6

Eight distinct habitat types now occur in the project area and are shown in Figure 7, including: wash; perennial marsh; seasonal marsh; tamarisk scrub; riparian woodland; woodland; annual grassland; and farmlands. Open water habitat does not naturally occur on the project site but will be discussed below because of its value to wildlife. Results of vegetation surveys are contained in Appendix A.

2. Wash

The wash habitat is characterized by the predominance of bare substrate and by substantial movement of coarse sediment during flood flows. These areas are typically flooded with each storm flow and are wet for substantial portions of the winter and spring. Several areas are included which have been stripped by aggregate mining and which may not be subject to stream flows. These artificially stripped areas support vegetation which is closely comparable to that of the "natural wash", and wildlife use is much the same, hence they are lumped together for discussion. Vegetation is typically very sparse, with small patches of dense shrubbery.

The wash habitat is largely barren, with limited wildlife cover provided by scattered patches of shrubbery, young trees, and herbs. Wildlife usage is somewhat limited, but a few species prefer this habitat type, such as the San Joaquin pocket mouse (*Perognathus inornatus*) and the Audubon cottontail (*Sylvilagus audubonii*).

3. Perennial Marsh

The perennial marsh habitat also is restricted to a few thin strips toward the eastern end of the creek channel (where water backs onto the site from a small downstream dam) and two short stretches of irrigation canal at the southwest and southeast corners of the site. These areas have almost year-round water which serves to support emergent marsh plants.

The wildlife value of the perennial marsh habitat on site is limited due to its very small size, but aquatic insects in this habitat are very productive, and it provides summer water to many animals in the surrounding habitats.

4. Seasonal Marsh

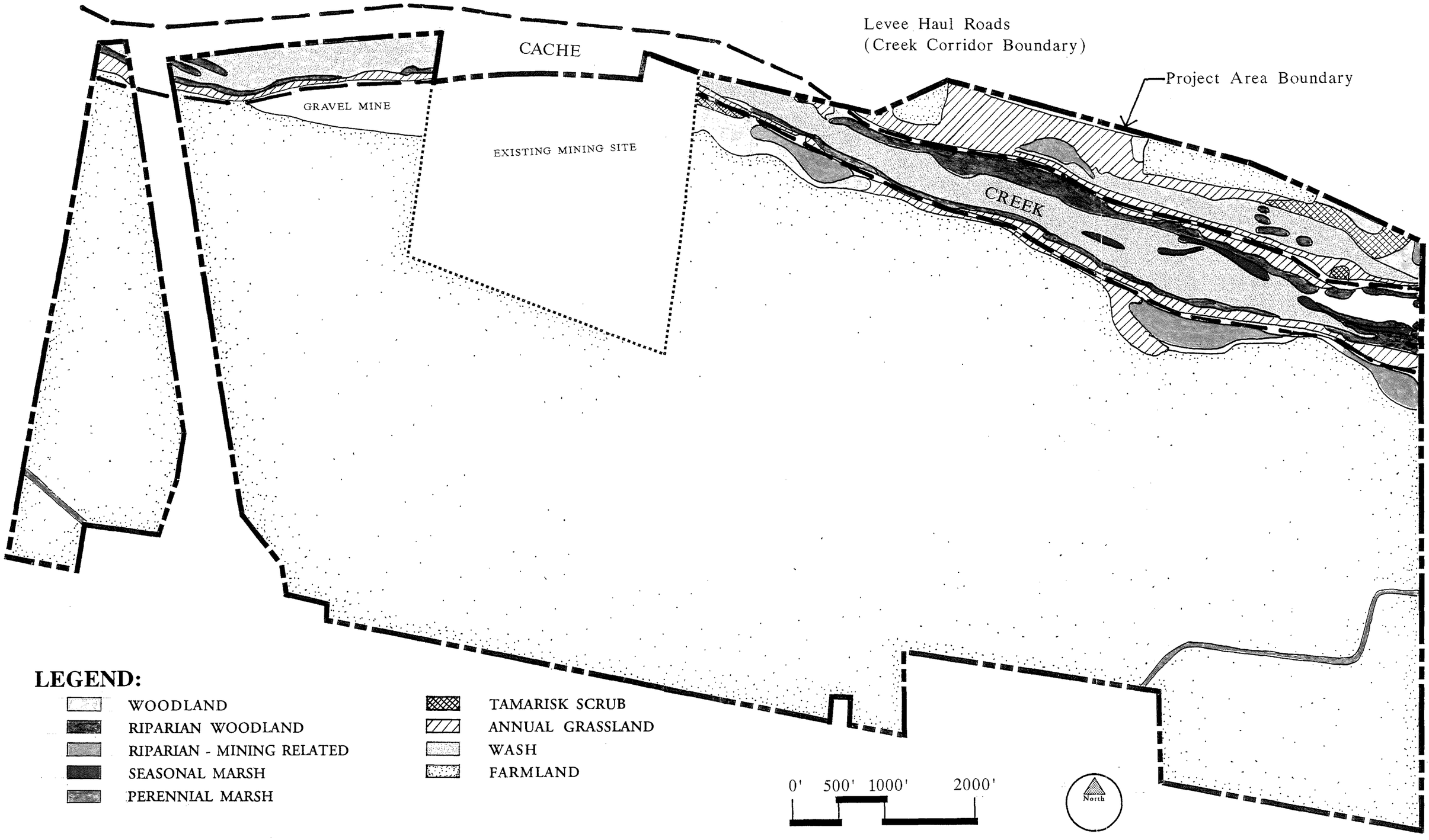
The seasonal marsh habitat is restricted to a few small pockets within the wash habitat that remain inundated into the early summer. These areas are likely ephemeral and will shift and disappear as sediment shifts through the channel and new marshes form. This habitat is of such limited extent on site that it has little wildlife value. Many species of surrounding habitats will use this habitat as a water source during the late spring and early summer before it dries.

5. Tamarisk Scrub

Tamarisk scrub occupies a few scattered patches within the old riverwash creek channel. The substrate in these areas is typically coarse and excessively drained and the density of the understory plant cover ranges from very sparse to moderate. The tamarix itself provides no food, but it does provide shade and cover. Associated plants provide some food for wildlife. This habitat is used for cover by brush rabbits and Audubon cottontail. The bare ground under some of these tamarisk stands is favored by whiptail lizards. Dominance by exotic plants and abundance of barren substrate result in very low overall wildlife value for this habitat type.

6. Riparian Woodland

Riparian habitat generally provides considerable cover, food, roosting and nesting for wildlife, and, therefore, is very important for wildlife. The existing unmined land which supports riparian habitat is the most significant natural habitat remaining on the site due to the abundance of native plant species and the cover provided for wildlife. However, on this site, much of the riparian woodland is primarily a result of the lowering of soil surfaces and subsequent invasion of



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Project Area Habitats

FIGURE 7

riparian species due to mining activities (these areas are shown on Figure 7 as "Riparian Mining Related"). The existing natural riparian woodland habitat consists of thin strips of vegetation dominated by cottonwood and willow trees. The trees are predominantly young to moderate age, with relatively few mature trees. A majority of the live, mature trees are in poor condition, while many dead trees point to the degraded character of the habitat and the prior years of drought. Seedling trees are numerous, especially in the moister parts of the adjacent wash habitat.

Typically the riparian vegetation would be subject to flooding during the winter and spring, with flow continuing into the summer, and with either surface water or shallow groundwater to sustain the trees through the summer and fall. Soils of this habitat would range from coarse to predominantly fine in texture. The relative influence of the controlled release of water from the dam at Clear Lake and diversions to agriculture at the Capay dam by Esparto are not clear, but may have substantially altered the water regime in this reach of the stream. The presence of numerous seedling willows and cottonwoods in the adjacent wash habitat indicates that summer hydrology is adequate to support riparian woodland, and that the lack of riparian woodland in these areas is probably due to drought or agricultural pumping cycles.

The healthiest areas of riparian woodland on site are associated with areas of elevated or prolonged soil moisture. The first is a strip just northeast across the creek from the active gravel pits. The second area has elevated ground water that has been "artificially maintained" by a small dam located just below the site where the Alder Canal enters Cache Creek.

7. Woodland

The woodland habitat occupies a thin fringe of land adjacent to the creek but generally inland from the access road. This area was historically a valley oak woodland association during the formation of the associated soils, as indicated by a high organic content and resulting dark color (SCS, 1972) and was likely to have had seasonally high groundwater.

A scattering of valley oaks still remain, confined to the fringes of the farm fields on Sycamore Loam soils, and some areas of Loamy Alluvial Lands and Riverwash. Many of the valley oaks have been eliminated by farming, with the majority of woodland trees now consisting of black walnut (*Juglans hindsii*) which was introduced to this region as root-stock for orchards of English walnut. The existing tree cover of this habitat type is generally unnaturally sparse. In addition to the tree cover provided by the black walnut and valley oak, the vegetation of the woodland habitat is dominated by exotic annual grasses and scattered weeds.

The woodland habitat can be very important for wildlife. The trees provide roosting, nesting, and cover for a very wide diversity of species. Also, the dominant trees, several associated shrubs, and the annual grass understory all produce considerable food in season. However, as noted in the surveys completed for this analysis, few of the typical species have been observed, probably due to the poor value of the habitat and the disturbance from farming activities.

8. Farmlands and Annual Grassland

The farmlands and annual grassland habitats occupy areas that were primarily California prairie and valley oak woodland prior to European settlement of the region. The existing vegetation in these areas now consists of a wide variety of mostly non-native weeds and grasses along with the planted crops. These areas comprise 85% of the site. The farmlands are plowed and harvested annually. The annual grassland has a sparse to dense cover of annual grasses and a significant number of weeds.

These habitats occur on the following soil series, from Capay Silty Clay and Marvin Silty Clay Loam at the edge of old basins along Highway 16, north through a mix of San Ysidro Loam, Brentwood Silty Clay Loam, Yolo Silt Loam, and Sycamore Silt Loam on the plain just above the creek channel. The Capay and Marvin soils have somewhat poor drainage due to clay content and resulting low permeability, and the Sycamore soil had high seasonal groundwater at 36 to 60 inches, but they are now all well-drained and managed for crop production (SCS, 1972). The Sycamore, Yolo, and Brentwood soils, and some adjacent riverwash areas are believed to have developed under a forest or woodland cover (SCS, 1972).

Plant cover in this area is highly seasonal and the associated plants and invertebrates are generally limited in both abundance and diversity. Only a few native wildlife species are able to coexist with farming, particularly seed gleaning and insectivorous birds, such as mourning doves, Brewer's blackbirds, and a number of sparrows.

The annual grassland is heavily dominated by non-native plants, and as a result, productivity and diversity of native invertebrates is limited, which limits overall value to higher level consumers. A few species, however, are able to make considerable use of this habitat (*e.g.*, grasshoppers, mice, gophers, jack rabbits, and ground squirrels).

9. Open Water

Artificial open water habitat is present on the site in an active sedimentation basin within the existing gravel mined area on the northeasterly portion of the Hutson parcel. This habitat is characterized by year-round standing water and by the general absence of vegetation. This basin is nearly barren due to heavy recent disturbance, but is heavily visited by water fowl and shorebirds. Although not strictly open water, a second area of relatively high avifauna diversity is located in the ponded creek channel and in riparian vegetation located east of the north end of the Snyder East parcel and, therefore, off the project site. This area also has relatively high wildlife use.

10. Delineation of Section 404 Waters on the Project Site

A Section 404 jurisdictional delineation for the project site and Cache Creek was verified by the U.S. Army Corps of Engineers ("Corps") on July 24, 1995, and amended to include the Farnham East parcel on October 12, 1995.

11. Summary

Approximately 85 percent of the project area is currently used as agricultural land, which has relatively low numbers of bird and other species. The creek is dry through most of the site for much of the year, thereby severely limiting wildlife use and much of the remnant riparian vegetation along the channel, which is severely stressed or dead. Significant wildlife use was observed in two areas near the site where near-perennial surface water occurs: the gravel pond at the north end of the Hutson parcel; and the lower creek channel riparian habitat along the northeast end of the Snyder East parcel (see Figure 8 for parcel locations).

F. SPECIAL STATUS SPECIES

Solano Concrete Company properties in Yolo County were surveyed for special status species by Zentner and Zentner in the latter part of 1992. The Farnham West and Farnham East parcels were assessed in July 1994, and September 1995, respectively, for their potential to support special status species. Table Three below lists the survey species which were compiled from state and federal lists of listed and candidate animal and plant species and the Natural Diversity Data Base (CNDDB) of the California Department of Fish and Game (DFG); their protection category; and their occurrence potential and status with regard to restoration. This list of special status species has been updated since its initial preparation in 1993 and reflects current designations.

Occurrence potential and status classifications include the following: L - Likely occurrence on site; R - Not presently occurring on site but presently occurring in the region and a likely target species for restoration; O - Not presently on site or in the region but a likely target species for restoration; N - Not presently on site and not a likely target species for restoration.

SPECIAL STATUS SPECIES

For purposes of this Restoration Plan, special status species are defined as follows:

1. Species listed or proposed for listing as threatened or endangered under the Federal Endangered Species Act (FESA) and as identified in various notices in the Federal Register;
2. Species that are candidates for possible future listing under the FESA;
3. Species listed or candidates for listing under the California Endangered Species Act (CESA); and
4. California Species of Special Concern (CSC) monitored by the California Department of Fish and Game (DFG).

The U.S. Fish and Wildlife Service (FWS) regulates impacts to species listed or proposed for listing as threatened or endangered under the FESA. Candidate species are not afforded the same legal protection as listed or proposed species.

The DFG regulates impacts to listed and candidate species under the CESA. CSC are monitored by the DFG but are not afforded legal protection under the CESA.

TABLE ONE

Wildlife		Category*	Status
Valley Elderberry Longhorn Beetle	*Desmocerus californicus dimorphus*	FT	L
Vernal Pool Fairy Shrimp	*Branchinecta lynchi*	FT	N
Vernal Pool Tadpole Shrimp	*Lepidurus packardi*	FE	N
River Lamprey	*Lampetra ayresi*	CSC	N
Pink Salmon	*Oncorhynchus gorbuscha*	CSC	N
Coho Salmon	*Oncorhynchus kisutch*	SPT	N
Chinook Salmon: Winter & Spring Run	*Oncorhynchus tshawytscha*	FT/SE	N
Sacramento Perch	*Archoplites interruptus*	C2/CSC	N
Hardhead	*Mylopharadon conocephalus*	CSC	N
Sacramento Splittail	*Pogonichthys macrolepidotus*	FPT/CSC	N
California Tiger Salamander	*Ambystoma tigrinum californiense*	C1/CSC	N
California Red-legged Frog	*Rana aurora draytoni*	FPE/CSC	N
Foothill Yellow-legged Frog	*Rana boylii*	C2/CSC	N
Western Spadefoot	*Scaphiopus hammondii*	CSC	N
Northwestern Pond Turtle	*Clemmys marmorata*	C2/CSC	R
California Horned Lizard	*Phrynosoma coronatum frontale*	CSC	R
San Joaquin Whipsnake	*Masticophis flagellum ruddocki*	CSC	N
Giant Garter Snake	*Thamnophis couchi gigas*	FT/ST	N
Double-crested Cormorant (rookery site)	*Phalacrocorax auritus*	CSC	O
Western Least Bittern (rookery site)	*Ixobrychus exilis*	C2/CSC	N
White-faced Ibis (rookery site)	*Plegadis chihi*	C2/ CSC	N
Cooper's Hawk (breeding)	*Accipiter cooperi*	CSC	R
Sharp-shinned Hawk (breeding)	*Accipiter striatus*	CSC	N
Golden Eagle (breeding and wintering)	*Aquila chrysaetos*	CSC	N
Ferruginous Hawk (wintering)	*Buteo regalis*	C2/CSC	R

Wildlife cont'd		Category*	Status
Swainson's Hawk (breeding)	*Buteo swainsoni*	ST	R
Northern Harrier (breeding)	*Circus cyaneus*	CSC	R
Bald Eagle (breeding and wintering)	*Haliaeetus leucocephalus*	FT/SE	R
Osprey (breeding)	*Pandion haliaetus*	CSC	R
American Peregrine Falcon	*Falco peregrinus anatum*	FE/SE	R
Merlin	*Falco columbarius*	CSC	R
Prairie Falcon (breeding)	*Falco mexicanus*	CSC	O
Greater Sandhill Crane (breeding and wintering)	*Grus canadensis tabida*	ST	N
Mountain Plover (wintering)	*Charadrius montanus*	C2/CC	N
Western Snowy Plover (breeding)	*Charadrius alexandrinus nivosus*	C2/CSC	N
Long-biller Curlew (breeding)	*Numenius americanus*	CSC	N
Short-eared Owl (breeding)	*Asio flammeus*	CSC	O
Long-eared owl	*Asio otus*	CSC	R
Burrowing owl (breeding)	*Athene Cunicularia*	CSC	R
Purple Martin (breeding)	*Progne subis*	CSC	N
Bank Swallow (nesting colony)	*Riparia ripari*	ST	L
Tricolored Blackbird (nesting colony)	*Agelaius tricolor*	C2/CSC	R
Yellow Warbler (breeding)	*Dendroica petechia brewstri*	CSC	N
Yellow-breasted Chat (breeding)	*Icteria virens*	CSC	O
San Joaquin Pocket Mouse	*Perognathus inornatus*	FC/CSC	N
Pale Big-eared Batt	*Plecotus townsendii pallescens*	CSC	N
Townsend's Western Big-eared Bat	*Plecotus townsendii*	C2/ CSC	N
Pallid Bat	*Antrazous pallida*	CSC	N

Plants			
San Joaquin Saltbush	*Atriplex joaquiniana*	C2	N
Palmate Birds-beak	*Codylanthus palmatus*	FE/SE	N
Adobe Lily	*Fritillaria pluriflora*	C2	O
Northern California Black Walnut	*Juglans hindsii*	C2	R
Hall's Madia	*Madia hallii*	C2	N

NOTES: *Categories are as follows:

FE	Federally listed as endangered
FT	Federally listed as threatened
FPE	Proposed for federal listing as endangered
FPT	Proposed for federal listing as threatened
C1	Federal candidate for listing: sufficient data on file to support federal listing
C2	Federal candidate for listing: sufficient data currently do not exist to support federal listing
SE	State listed as endangered
ST	State listed as threatened
SPT	State proposed as threatened
CSC	State Fish and Game species of special concern

The Yolo Audubon Society (YAS) observed bank swallow nesting in the sheer face of the active mining portion of the Hutson parcel in 1991, 1992, and 1993 and Zentner and Zentner surveys identified blue elderberry shrubs growing along the northern edge of the project site on the banks of Cache Creek. The blue elderberry is the prefered habitat for the valley elderberry longhorn beetle (VELB). Although no VELB's were observed, shrubs with evidence of VELB exit holes were found on-site. Appendix B contains a table describing the shrubs and identifying their location as depicted on the attached 24x36 vegetation map. No other special status species were observed on the project site.

A number of species are presently known in the region and might occur on the project site with the restoration of appropriate habitat. These species include the bank swallow, Swainson's hawk, burrowing owl, and tricolored blackbird. Several other species are not now known in the region but could be re-introduced under appropriate conditions such as the prairie falcon and adobe lily.

G. SUMMARY

The existing site conditions represent a significant change from the pre-European conditions. The terrace lands, which comprise most of the site south of Cache Creek, have been leveled and the once widespread prairie and valley oak woodlands almost eliminated. The creek has been deepened and the banks built up and steepened to reduce off-creek flooding. The riparian woodlands, marsh, and open water habitats once common in the creek have been significantly altered or eliminated.

These changes are reflected in the large number of rare species known from or now extinct in the region. Surveys completed for this report show, however, that restoration of a more diverse habitat, especially one which includes open water and marshes, can promote significant habitat improvements that are compatible with existing soil and hydrology. The existing pond in the current Solano aggregate pit and the marsh in the creek to the east of the site have much higher bird use and species diversity than most of the other on-site habitats. This small area of habitat and its wildlife use point to the significant opportunities for restoration activities on this site and elsewhere in the region.

Chapter 2
Cache Creek

A. INTRODUCTION

The Cache Creek watershed occupies an area of 1,150 square miles. About 572 square miles of this basin drain into Clear Lake. Below Clear Lake, Cache Creek descends through a canyon to a narrow alluvial valley that broadens near Capay. Downstream from Capay, the gradient continues to decline, from Capay to Yolo, with an intervening section which steepens slightly where the stream crosses bedrock outcrops.

Much of the sediment carried by Cache Creek is deposited within the 14.5-mile-long "mining reach" between Capay and Yolo. This reach is the location of braiding and channel shifting and has also been the site of gravel extraction since at least the 1930's (Environ, 1980). Construction of a diversion dam near Capay and subsequent irrigation diversions in 1912 caused the streambed to be seasonally dry and promoted farming of the adjacent terrace lands.

Although deepening of the creek channel occurred during the period of sand and gravel extraction, net widening of the stream channel is not apparent. Woodward-Clyde Consultants (1976) compared the areas of active erosion and deposition on aerial photographs from 1939 and 1972 and documented a decrease of 73 acres in the area of active streambed, indicating a net narrowing of the channel. Dames & Moore (1991) noted the same trends for the period between 1962 and 1988 and concluded that, over the past few decades, the creek has become straighter (with less in-channel meanders) and more uniform, *i.e.*, the sides and bottom of the channel have fewer surface irregularities.

These changes are likely the result of mining confined to a specific trapezoidal shape by the 1979 Interim Ordinance. A channel shape of this sort reduces off-creek flooding in the reconfigured portion but tends to increase downstream flood velocities, reduce sediment deposition, and increase erosion (Williams and Swanson, 1988).

B. CACHE CREEK REACHES

Cache Creek can be divided into four reaches of approximately equal length. They are:

1. The Coast Range Reach

The Coast Range reach of Cache Creek originates in the northern Coast Range at the outlet of Clear Lake. The creek first flows across a Quaternary volcanic flow that forms a natural dam at the southeastern edge of the lake and then, respectively, crosses Paleocene, Cretaceous, and Plio-Pleistocene sedimentary rocks (CDMG 1977) amid low hills. East of Wilson Valley, a small floored depression in these hills, the creek cuts a series of deep gorges through vertical ridges formed by upturned sandstone sediments of the Cretaceous Great Valley Formation. Little Blue Ridge, Cache Creek Ridge, Cortina Ridge, and Blue Ridge are some of the named features adjacent to Cache Creek in this area. Bear Creek, a significant tributary which enters Cache Creek in the eastern part of this reach, is partially saline as a result of salts derived from the marine Great Valley Formation it drains. This contributes high boron and chloride levels to Cache Creek which are observable downstream.

2. The Capay Valley Reach

Cache Creek leaves the ridgelands in northwestern Yolo County and then flows southeastward through the Capay Valley, a Quaternary alluvium-floored satellite of the Sacramento Valley. The two valleys are separated by the Capay Hills. The coalesced alluvial fans of tributary creeks draining Blue Ridge to the west restrict Cache Creek to the eastern side of Capay Valley. Cache Creek exits Capay Valley and enters the Sacramento Valley by a gorge cut through the Capay Hills at a contact between the Upper Cretaceous sediments of the main hills and the Plio-Pleistocene sediments of Sugarloaf, their southern satellite (CDMG 1977). This gorge is evidence that Cache Creek is older than the uplift which created the Capay Hills.

3. The Hungry Hollow Reach

East of the Capay Hills, Cache Creek crosses Hungry Hollow, a broad depression floored by Quaternary alluvium it has deposited. The hollow is separated from the main part of the Sacramento Valley by the Dunnagin Hills uplift. The creek's alluvial fan, relatively narrow in this reach, is little more than a wide pair of natural levees sloping downward to the north and south into local basins (USDA 1972). Quaternary alluvial gravel deposits under a veneer of loam permit both gravel mining and farming in this reach, which includes the survey area. Cache Creek usually has significant perennial flow in both the Coast Range and Capay Valley reaches even during drought years, but Capay Dam, at the head of the Hungry Hollow reach, diverts almost all of it for irrigation. Consequently the remainder of the creek is dry except immediately following significant rains.

4. The Woodland Reach

Cache Creek's alluvial fan broadens significantly after it passes through the Dunnagin Hills, a low Sacramento Valley tectonic uplift where Plio-Pleistocene sediments are exposed, but otherwise it is geologically similar to the Hungry Hollow Reach. The creek flows just north of the city of Woodland in this reach as it passes more farms and gravel mines. A few miles east of Woodland, Cache Creek ends at a settling basin adjacent to the Yolo Bypass, a large basin which parallels the Sacramento River to its east.

C. REGIONAL VEGETATION PATTERNS

The vegetation of Cache Creek's Coast Range Reach area and the Capay Hills is oak woodland and savannah dominated by blue (*Quercus douglasii*) and interior live (*Q. wislizenii*) oaks where slopes are relatively gentle. On steeper slopes and those with ultramafic substrates woodland dominance shifts to gray pine (*Pinus sabiniana*) and chaparral dominated by chamise (*Adenostoma fasciculatum*) and buck brush (*Ceanothus cuneatus*) becomes frequent. Cache Creek is lined by

riparian gallery forests dominated by valley oaks, Fremont cottonwoods (*Populus fremontii*), and several species of willows (*Salix* spp.). Capay Valley and the alluvial fans of the Hungry Hollow and Woodland reaches were originally vegetated by Valley Oak woodlands and forests. The basins north and south of Cache Creek in the Hungry Hollow Reach are now intensively farmed but probably once contained significant freshwater marsh and native grassland vegetation. Native grassland, now replaced by exotic annual grassland, also formerly vegetated the Dunnagin Hills.

Vegetation sampling completed by Zentner and Zentner along the length of the creek points to a riparian system with a high degree of variability. The contrast, for example, between the riparian forest vegetation found along upper Cache Creek and its North Fork tributary, and the halophytic vegetation dominated by *Distichlis* and *Tamarix* along its semi-saline Bear Creek tributary is dramatic. Riparian forest continues to be robust in the Capay Valley Reach but *Tamarix* is an important component there and at all points below the Bear Creek confluence. The contrast between adjacent portions of the upper part of the Hungry Hollow Reach is also particularly striking. The former is a riparian forest habitat with some open water and the latter a desert-like dry wash resulting from water diversion, historic mining, rapid precipitation infiltration through porous cobbles, and a deep water table. The project area is similar in that the eastern portion exhibits considerable riparian forest development and much open water because it has shallow groundwater while the western portion is desert-like. Groundwater remains relatively shallow and riparian forest consequently is robust at all downstream sample points.

Zentner and Zentner also reviewed and updated habitat maps of the Cache Creek system originally prepared by Jones & Stokes for Yolo County. Table Two shows the results.

TABLE TWO

Existing Habitats of the Cache Creek System

Type	Acres	Percentage
Riparian Woodland	1,517	45
Wash	1,157	32
Seasonal Wetland	444	11
Artificial Wetland	398	10
Open Water	40	1
Marsh	37	1
TOTAL	3,595	

The system is heavily dominated by riparian woodlands, primarily valley oak-dominated woodlands in the Coast Range and Capay Valley reaches, and a desert-like wash in the lower reaches. Within the mining reach, most of the woodland is found in mined basins near or adjacent to the creek, although many stands still occur in the creek at the toe of the levees. Seasonal wetlands are primarily portions of the wash which receive enough inundation or soil saturation to support a limited number of wetland species. Artificial wetlands include constructed ponds and a few marshes, primarily the result of farming or mining activities. Of note is the extremely limited extent of open water and marsh habitat.

D. HISTORIC VALUES OF THE CACHE CREEK SYSTEM

1. Introduction

Much of the value of riparian systems is derived from the flow of water through a gently-sloped and vegetated channel. The combination of water, gentle slopes, and vegetation can remove pollutants from the water, increase nutrient production, flood storage and groundwater recharge, reduce storm erosion, create waterfowl and shorebird habitat, and provide passive and active recreation. The following discussion focuses on these values, as they have been described in the scientific literature, and their applicability to the historic conditions of the mining reach of Cache Creek from Capay to Yolo.

2. Methods

The Federal Highway Administration has prepared a qualitative method for evaluating riparian values based on the functions described for wetlands in the Federal Clean Water Act (CWA). The "Adamus" method, as it is termed, relies on the evaluation of a large number of factors for each wetland or wetland type.

The number of factors or "predictors" examined increases the accuracy of the results which can be used to compare the opportunity and effectiveness of different wetlands for specific values. The results are qualitative in that they are expressed as ratings of high, moderate, or low for each value or function of a particular wetland or wetland system. Because of the applicability of the Adamus technique to riparian systems and its qualitative base, an Adamus analysis was completed on the "historic" riparian system of the mining reach of Cache Creek based upon a review of historic records.

3. Results

a. Groundwater Recharge

Groundwater recharge is the movement of surface water or precipitation through a wetland and into the groundwater system. Early studies found that a substantial portion of the output of shallow vegetated wetlands becomes groundwater, thereby replenishing underground aquifers pumped for agricultural or domestic use. The Adamus method rates riparian wetlands as of high value for groundwater recharge when sufficient vegetation is available to slow flows and the soil is relatively permeable. Cache Creek has an extremely permeable substrate which promotes groundwater recharge. The historic Cache Creek included a variety of terraces, oxbows and pockets that would not only impede floodwater but that would serve to retain some portion of the yearly floods to provide for a longer recharge period.

b. Flood Reduction

Riparian systems can reduce downstream flood peaks by delaying the passage of storm flows and by storing flood waters and releasing them more gradually than adjacent uplands. Adamus found that riparian systems in some areas may reduce downstream flood peaks by as much as 60 to 70 percent. One measure of the value of riparian systems for flood protection is found in reports from flood losses in Pennsylvania. There, of the two bridges left intact (of hundreds washed out) after severe floods, both were immediately downstream of preserved riparian wetlands. Similarly, the Corps is purchasing development rights to 2800 acres of flood-prone, riparian wetlands in the eastern portion of Merced County to ensure flood retention continues to occur in these areas. In historic conditions, Cache Creek included vegetated channels, oxbows, and similar features which slowed flood waters. Of course, while these features provided significant downstream benefits, they also contributed to off-channel flooding in the heavily vegetated reaches.

c. Shoreline Anchoring

Riparian systems can protect waterway edges through the holding power of the vegetation's fibrous root systems. Riparian systems are typically exposed to extreme events and most riparian plants, therefore, can act as erosion control agents. The natural banks of Cache Creek were relatively gently sloped or terraced (reflecting flood events) and heavily vegetated with woody riparian species. These riparian woodlands typically had very dense cover which reflects root extent and, therefore, soil holding power.

d. Sediment Trapping

Riparian systems have the ability to remove sediment and other suspended solids from agricultural and urban runoff. Reduced sediment loads improve downstream water quality and reduce future flood hazards downstream by reducing in-stream sediment deposits which build up bed elevations. Several communities are now requiring the construction of riparian marshes adjacent to urban areas to trap sediments and improve water quality. Cache Creek has historically produced significant amounts of sediment. Sediment deposition in the channel and the ability of the channel to trap sediment before it moves downstream and increases bed elevations (and flood heights) is a product of channel contours and flood velocities. Lower velocities and a highly contoured channel with many basins, as occurred in historic condition, provides for extensive sediment deposition opportunities in upstream areas.

e. Nutrient Transformation

Riparian systems improve water quality by storing nutrients within wetland plants or sediments or by converting nitrogen nutrients to gas. Numerous analyses have found that riparian systems can remove nitrogen, phosphorus, and other nutrient compounds from wastewater flowing through the system where the system includes an extensive system of perennial and seasonal marshes. One report estimated that waste treatment functions of a marsh can be valued at about $14,000 per acre per year if comparing the treatment capability of wetlands to conventional

systems. Marshes are now being constructed throughout the U.S. to act as wastewater treatment centers. Four cases in California have been well-documented. The Arcata (Humboldt County) marshes reduce Biological Oxygen Demand (BOD) by 40 to 50 percent, suspended solids by 80 to 90 percent, and fecal and total coliform by 80 to 90 percent. The Mountain View marsh (Richmond, Contra Costa County) removes as much as 68 percent of the ammonia entering the system and almost all of the nitrate. At Fairfield (Solano County), the evaluators reported an average phosphorus reduction of 25 percent and an average nitrate and ammonia reduction of 50 to 70 percent. A San Diego project, projected to treat 100 million gallons per day (mgd) of wastewater, is reporting similar results. In historic conditions, the riparian woodlands and their associated marshes suspended flows and reduced nitrogen outputs through trapping and plant use or through conversion to gas.

f. Food Chain Support

Through their conversion of nutrients into plants and plant detritus, riparian systems convert pollutants into food for small invertebrates which, in their turn, are preyed upon by larger organisms such as sportfish or waterfowl. Numerous reports have noted the connection between the "outwelling" of nutrients from marshes and commercially important fisheries and that loss of riparian systems leads to game fish population declines. The Adamus method would rate the historic mining reach of Cache Creek as of high value for this function due to the diversity of riparian habitat types, the extent of woodlands, and the high level of retention-detention. Additionally, the creek was then connected to the Sacramento River and the Bay/Delta estuary, where the benefits of food chain support were important.

g. Fisheries Habitat

Riparian systems provide habitat both for adult fish, for feeding and propagation, and for juveniles, primarily for predator avoidance. Several analyses have found that a substantial portion of the commercially important fish of the U.S. utilize riparian systems for some portion of their life cycle. The Cache Creek riparian wetlands would have been of high value for this function as they once supported extensive runs of salmon and steelhead and other fish.

h. Wildlife Habitat

Riparian woodlands are important habitats for migratory ducks, shorebirds, game birds such as quail and pheasant, deer, and many other species. The historic riparian system was of high value for wildlife habitat. Portions of the existing mining reach (the Moore Dam sanctuary especially) are of high value now for a variety of wildlife even under current conditions, reflecting the significant opportunities for restoration throughout the other portions of the creek.

4. Summary

Cache Creek in the mining reach historically provided significant values for groundwater recharge, erosion control, water quality improvement and wildlife habitat. Table Three below summarizes these findings.

TABLE THREE

Cache Creek Values Summary: The Historic Mining Reach

Parameter	Historic Conditions
Groundwater Recharge	High
Flood Reduction	Moderate to High
Shoreline Anchoring	High
Sediment Trapping	High
Nutrient Transformation	High
Food Chain Support	High
Fisheries Habitat	High
Wildlife Habitat	High

E. RIPARIAN LOSSES OVER THE HISTORIC PERIOD

Katibah (1984) estimates that the Sacramento Valley held 921,600 acres of riparian forest prior to European settlement. Roberts et al. (1977) estimated that, in 1848, the Sacramento Valley contained 800,000 acres of riparian forest, based on their identification of soils which were known to contain riparian forests. Warner and Hendrix (1985) estimate that the Central Valley (the Sacramento and the San Joaquin Valleys) contained between 1.6 and 2.0 million acres of riparian forest and woodland.

Katibah et al. (1984) estimate that in 1983, 102,000 acres of riparian forest remained (about 11% of the pre-European total) in the Sacramento Valley with about 49,000 acres (48%) in a disturbed or degraded condition. Perhaps of greater concern is their conclusion that the condition of the other 52% of the remaining habitat is probably suffering severe impacts.

F. EXISTING VALUES OF THE CACHE CREEK SYSTEM AT THE PROJECT SITE

The following discussion of values of the creek system at the project site focuses on riparian values as they have been described above for the Adamus technique. These results are relatively general but they provide a good comparison of the system's historic condition with today's reality.

1. Groundwater Recharge

Cache Creek has an extremely permeable substrate which promotes groundwater recharge. However, bank and stream bottom vegetation is almost non-existent and the shape of the channel (a trapezoid in most cases) promotes the prompt downstream movement of water rather than the retention of floodwater in pockets and oxbows as would occur in an idealized system that then results in groundwater recharge.

2. Flood Reduction

The Adamus method would rate the existing mining reach of the creek as of moderate value for downstream flood protection due to the near-absence of significant stands of woodland vegetation and the relatively flat and uncontoured bottom. In essence, Cache Creek today is acting like an unvegetated, trapezoidal flood channel which protects the immediately adjacent lands but tends to increase velocities and downstream flood peaks, thereby promoting downstream flooding.

3. Shoreline Anchoring

The Adamus method rates the existing Cache Creek riparian system in the mining reach as of low value for shoreline protection due to the near-absence of woody riparian vegetation and the steepness of the channel banks. This value is reflected in the large amounts of sediment which slough off from the banks during almost any flood event and the erosion which is occurring on the banks at many locations.

4. Sediment Trapping

Cache Creek has historically produced significant amounts of sediment. However, with the construction of Clear Lake and Indian Valley Reservoir the amount of sediment in the channel may be as or more reflective of existing cultural practices than of historic soil and geomorphologic conditions. Based upon Zentner and Zentner surveys of the creek, the combination of watershed grazing and over-steepened channel banks provides for significant sediment movement into the channel from adjacent lands. A flat-bottomed channel, such as occurs in the project area, and high velocities, which also occur commonly in the mining reach, provide for poor deposition opportunities, except for the heaviest materials. Consequently, coarser aggregate is being actively deposited in the mining reach but deposition of finer material (primarily silts) in the downstream settling basin is becoming significant.

5. Nutrient Transformation

The creek in the mining reach is of low value for this function. The extent of marshes is extremely limited and retention time within the channel for flood flows is low (see discussions above on sediment deposition and flood protection).

6. Food Chain Support

The Adamus method would rate the existing mining reach of Cache Creek as of low value for this function due to the low diversity of riparian habitat types, the limited extent of woodlands, and the low retention-detention times.

7. Fisheries Habitat

The Adamus method would rate the existing system as of low value due to the absence of perennial water, the channel conditions, and the lack of any connection to the Sacramento River.

8. Wildlife Habitat

The existing system is of moderate to low value for wildlife due primarily to the low diversity of the habitats.

9. Summary

Table Four compares the existing condition of the creek at the project site with the probable historic condition as described above.

TABLE FOUR

Cache Creek Values Summary: Mining Reach

VALUES

Parameter	Existing Conditions	Historic Conditions
Groundwater Recharge	Low to Moderate	High
Flood Reduction	Low to Moderate	Moderate to High
Shoreline Anchoring	Low	High
Sediment Trapping	Low to Moderate	High
Nutrient Transformation	Low	High
Food Chain Support	Low	High
Fisheries Habitat	Low	High
Wildlife Habitat	Moderate	High

The Cache Creek riparian system in the mining reach now has low to moderate values resulting from the deep, trapezoidal shape, the absence of topographic variation and natural channel forms, and the low habitat diversity. Existing conditions, *i.e.*, the deep trapezoidal contours, do provide for the reduction of flood hazards and for the deposition of the heaviest sediment within the mining reach. However, these same conditions increase flooding downstream, promote the movement of fine sediment into the settling basin (where it reduces basin capacity and further exacerbates flood heights), encourage bank erosion and significantly limit the habitat value. The creek system does have significant restoration potential, though, as reflected in the historic values.

G. REGULATION OF RIPARIAN RESOURCES

Regulation of riparian woodland loss in California occurs at many different levels. On the coast and in the immediate environs of San Francisco Bay, the California Coastal Commission and the San Francisco Bay Conservation and Development Commission (BCDC), respectively, wield substantial power over land use decisions and have strict regulations for the protection of riparian wetlands. Throughout California, the Corps regulates the discharge of dredged or fill material into "waters of the U.S." under Section 404 of the CWA, including wetland fill and fill within stream channels tributary to navigable waters. The DFG regulates streambed alterations throughout the State under California Fish and Game Code Section 1600 *et seq*. The California Environmental Quality Act (CEQA) provides important oversight of the environmental effects of most private and public development actions, including impacts on biological resources. Finally, all mitigation must be implemented in accordance with the Yolo County Cache Creek Resource Management Plan (CCRMP).

H. SUMMARY

The existing values of the creek, especially in the project area, are significantly less than the pre-European conditions. Widespread alteration of native habitat has left significant opportunities for restoration of riparian values and habitat. Scattered portions of remnant natural habitat and restored habitat areas provide good indicators for guiding restoration.

The variation in specific values (flood control or erosion control for example) between the existing and pre-European conditions also provides an important blueprint for restoration of the creek. Reconfiguring the existing trapezoidal channel to a multi-terrace channel should greatly improve creek values.

Chapter 3
Habitat Restoration Plan

A. HABITAT RESTORATION GOALS

The goals for the restoration plan include the following:

1. Restore high quality natural habitat dominated by appropriate native plants to those areas not reclaimed for agricultural uses.

2. As consistent with County plans, as outlined in the CCRMP, restore the creek channel to a configuration which will increase the natural values of the creek.

3. Provide an appropriate monitoring and maintenance program, including financing, that will ensure that restoration is successful.

B. PLAN DESCRIPTION

1. Introduction

Agricultural lands will be reclaimed to agricultural use to the maximum extent practicable, given the volume of salvageable agricultural soils and the depth to groundwater. Due to the shortage of substrate for raising mined areas adequately above groundwater, a combination of row crop land and biomass tree farming is proposed for agricultural reclamation. The biomass areas will also serve as buffer for the wetlands and associated habitat.

The attached map and Figure 8 shows the proposed habitat restoration plan. The proportions of row crop, buffer, and natural habitat lands are approximate and are derived from volume analyses based on test bores throughout the site. As indicated on the restoration plan, the area of habitat restoration is divided among three areas: the wetlands and associated habitat; the margins of the lands reclaimed

for agriculture ("hedgerows"); and the creek zone. These are discussed separately below; planting strategies and other common topics are discussed in the following section.

2. Wetlands and Associated Habitats

a. Background

Many unreclaimed aggregate mines have relatively low habitat values. Dry pits, especially, due to the high permeability of the substrate tend to be dominated by exotic, drought-tolerant weeds and significant expanses of barren land. Wet pits tend to have higher habitat values. Euliss (1984) found that migrating waterfowl consistently preferred large expanses of open water in the winter at the Kern Refuge, apparently because of the high visibility of potential predators afforded. Wet pits are also important for many resident species, though, if only because of the presence of perennial water in a Mediterranean climate. This demand is evidenced by the high wildlife use in those portions of the Cache Creek channel with perennial water. As noted in the habitat descriptions in the preceding section of this plan, even though these areas have been significantly disturbed and are almost continuously disturbed by skimming, bird use (and, presumably, other wildlife use) in these areas is relatively high. Similarly, our surveys documented the relatively high wildlife use found in the existing mining pond on the Madison site, even though this area is being actively mined.

The active wildlife use area in this unreclaimed wet pond is typically limited to the open water and the water's edge; up slope only a few feet, the sparse vegetation is often dominated by the same drought-tolerant weeds as noted above. The near absence of organic matter and cover on these slopes and their steepness greatly reduces habitat value.

These conditions can persist for several decades. Zentner and Zentner found essentially no difference in plant community composition in wet gravel pits in Fresno County that ranged from 50 to 20 years old. In more natural systems, the low-terrace riparian trees that establish quickly at the water's edge in aggregate pits (willows and cottonwoods) would gradually be joined by species such as valley oaks as finer materials (*e.g.*, silt and clay) accumulate in the soil.

Work on other aggregate pits has found a number of important strategies for increasing wildlife use (Harrison 1970; Street 1982; Toburen 1974; Stoeker 1982; Milne 1974; Watmough 1983;, including:

1. the provision of a diversity of habitat types and plant communities, including islands, peninsulas, and gently sloping shelves on the shoreline;

2. long, irregular shorelines which increase nesting pair territories and edge;

3. Shallow terraces just below the waterline that are periodically exposed which, in turn, tend to host large number of invertebrates and plants;

4. dense, tall plant cover at the shoreline;

5. Deciduous trees adjacent to the shore to provide shade and leaf litter (important in providing organic matter and invertebrate colonization sites).

6. the provision of secure roosting sites, including constructed floating islands;

In a useful study on gravel ponds along the San Joaquin River in Fresno County, Ballinger (1990) found that bird densities in wet pits were highest on gently sloped vegetated shores, that beaver-induced mortality of shoreline trees had a possibly significant and deleterious affect on pond productivity (due presumably to the reduction in near-shore woodland species), that predators such as coyotes, crows, and raptors probably had significant effects on waterfowl young due to the absence of islands, and that changing water levels and flooding and exposure of near-shore habitats can provide important bird feeding areas.

b. Proposed Habitat Description

Figures 9 through 14 show conceptual cross-sections through the wetlands and associated habitats with associated depth to average high and low groundwater levels.

As shown by these figures, the wetlands and associated uplands will be contoured to provide a variety of features, including varying slopes, peninsulas, and shallow shelves near the water's edge. These will support a variety of plant communities including a mix of oak woodland, riparian woodland, marsh, and open water habitats. The shoreline has been intentionally designed to create a series of coves and similar protected areas with a high degree of "wiggle". This also increases the extent of "edge" or ecotone habitat. Ecotones tend to be important habitat both as intermediary zones (*e.g.*, birds flying from woodlands to forage in the grasslands at the woodlands edge) and as habitat in their own right (*e.g.*, elderberries, home of the listed valley elderberry longhorn beetle, do best on the edges of valley oak woodlands).

The shoreline is further extended by the addition of shallow terraces in the zone between high and low water levels. Periodic exposure increase invertebrate densities due to the oxidation and exposure of the high organic levels in these communities. In turn, this provides a significant amount of food for wildlife. The shoreline will also provide a suitable substrate for the growth of a variety of marsh and woodland communities, including perennial to seasonal marsh and wet meadow, and low-terrace riparian species (such as willows and cottonwoods) that provide high levels of organic matter for the ponds and significant cover. These species would tend to volunteer naturally in these zones but can be enhanced by plantings and maintenance.

Islands are an important component of any open water system. Many wildlife species use islands as nesting and foraging/roosting habitat due to the low occurrence of predators and the high visibility over adjacent waters. However, providing islands is problematic in aggregate mining sites due to either the significant amount of sand and gravel that must be left or the amount of waste materials that must be dumped back to create islands. Over the past several decades, researchers have experimented and refined floating, artificial islands anchored just offshore as a way to both provide this important habitat element

while avoiding the significant costs. These will be used in this project and will be located just off-shore from several of the peninsulas that protrude into the open water area. The islands will be approximately 20'x 20' and covered with gravel and sand to reduce vegetation growth.

The mix and type of habitats proposed are based on surveys of existing high value habitat and soils as described in the previous section of this plan and analyses described elsewhere in the reclamation program. Restoration of these habitats will include establishment of numerous native plant species that were previously eliminated from the site by farming and past heavy grazing by livestock.

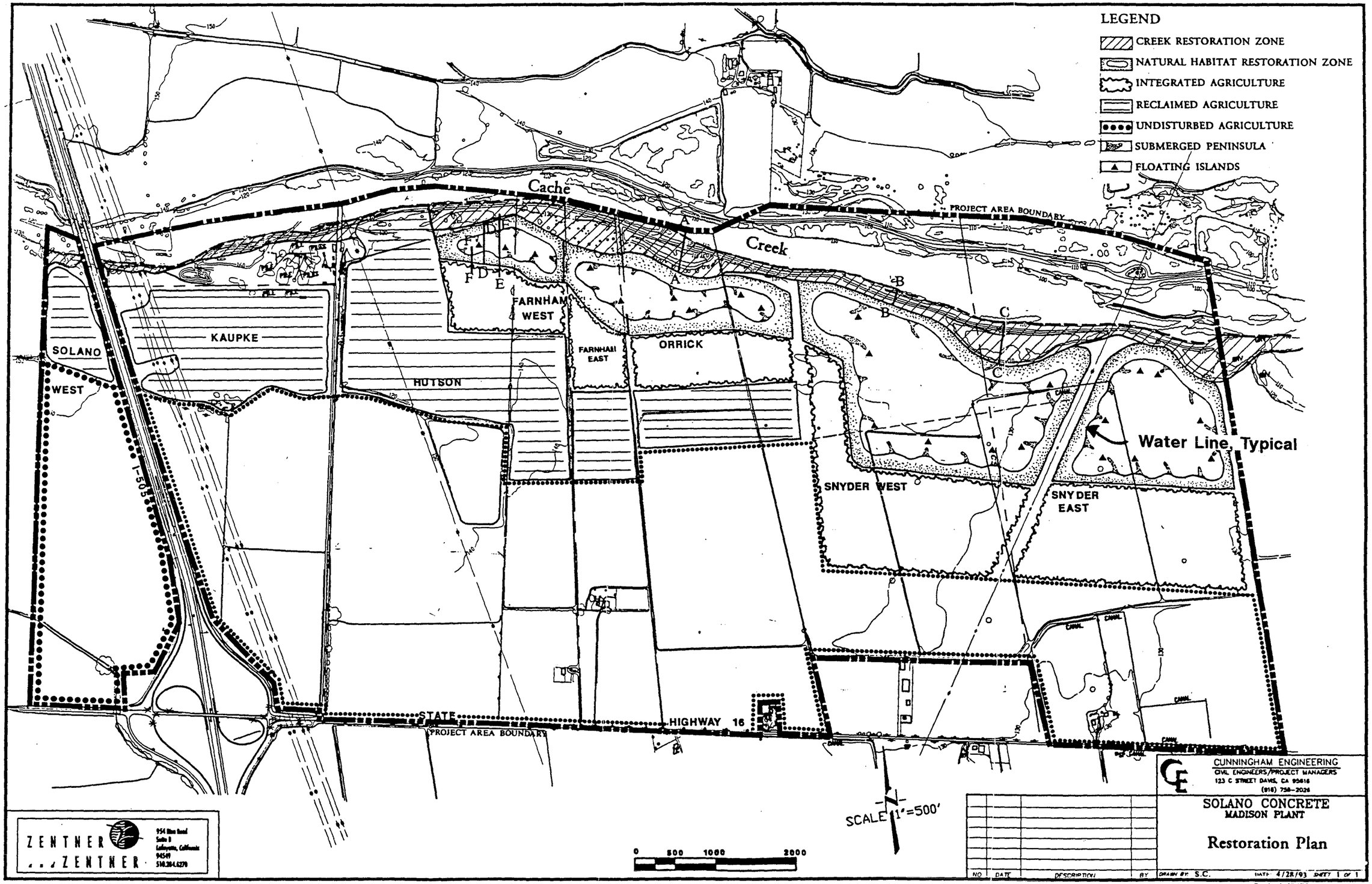
3. Hedgerow Restoration

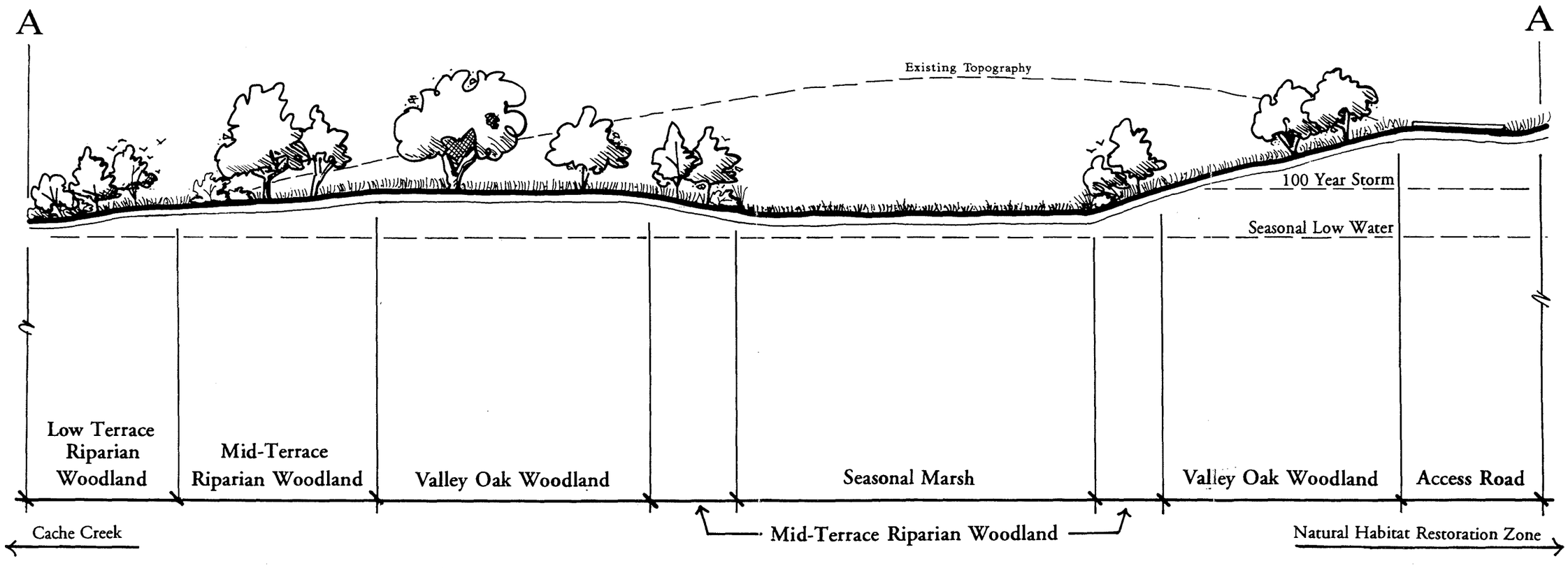
Hedgerows are traditional and important components of any diverse agricultural system. In this project, hedgerow areas will be provided on the edges of the reclaimed agricultural lands. Figures 15 and 16 show a typical planting plan for one hedgerow; this pattern would be duplicated throughout the reclaimed agricultural area.

The 3:1 slopes will be planted with a diverse mix of oak woodland and native grassland species. Valley oaks will be dominant in this area at a density of approximately 30 per acre. These hedgerows will also eventually provide roosting habitat for the Swainson's Hawk (SH). While the project site is probably used for foraging by the SH, it is not near nest sites and the proximity of other alfalfa fields to these nest sites makes high intensity use by SH of the project site unlikely except on rare occasions.

4. Creek Restoration

Creek restoration as described in this plan affects primarily the southern bank of the creek and its implementation is contingent upon its consistency with the CCRMP. No actions are proposed in the creek bed by the plan; these will be the subject of the larger mining reach plan being developed by the County. Additionally, mature cottonwoods and other low-terrace riparian woodland species now found at the toe of the existing levee will be preserved. Above this zone, the


LEGEND
CREEK RESTORATION ZONE
NATURAL HABITAT RESTORATION ZONE
INTEGRATED AGRICULTURE
RECLAIMED AGRICULTURE
UNDISTURBED AGRICULTURE
SUBMERGED PENINSULA
FLOATING ISLANDS
Cache
Creek
PROJECT AREA BOUNDARY
FARNHAM WEST
FARNHAM EAST
KAUPKE
HUTSON
ORRICK
SOLANO WEST
SNYDER WEST
SNYDER EAST
Water Line, Typical
I-505
STATE HIGHWAY 16
PROJECT AREA BOUNDARY
SCALE 1"=500'
0 500 1000 2000
ZENTNER ZENTNER
954 Blue Road Suite B Lafayette, California 94549 510.284.6270
CUNNINGHAM ENGINEERING
CIVIL ENGINEERS/PROJECT MANAGERS
123 C STREET DAVIS, CA 95616
(916) 756-2026
SOLANO CONCRETE
MADISON PLANT
Restoration Plan
NO DATE DESCRIPTION BY
DRAWN BY: S.C. DATE: 4/28/93 SHEET 1 OF 1
Revised: 10/95



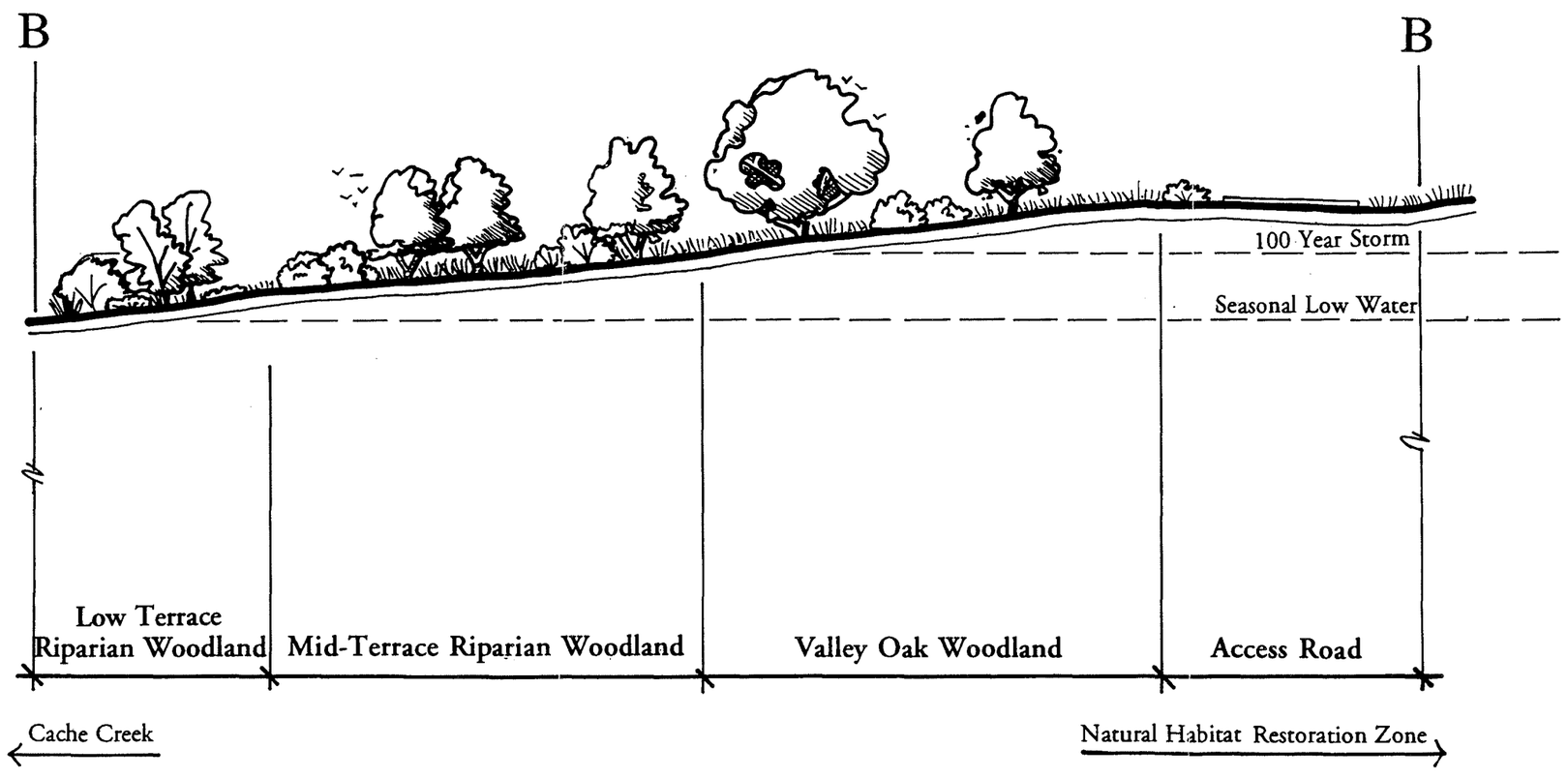
SCALE: 1"=30'-0"

ZENTNER ZENTNER

CREEK BANK RESTORATION

Cross-Section After Reclamation:
Section A-A

FIGURE 9



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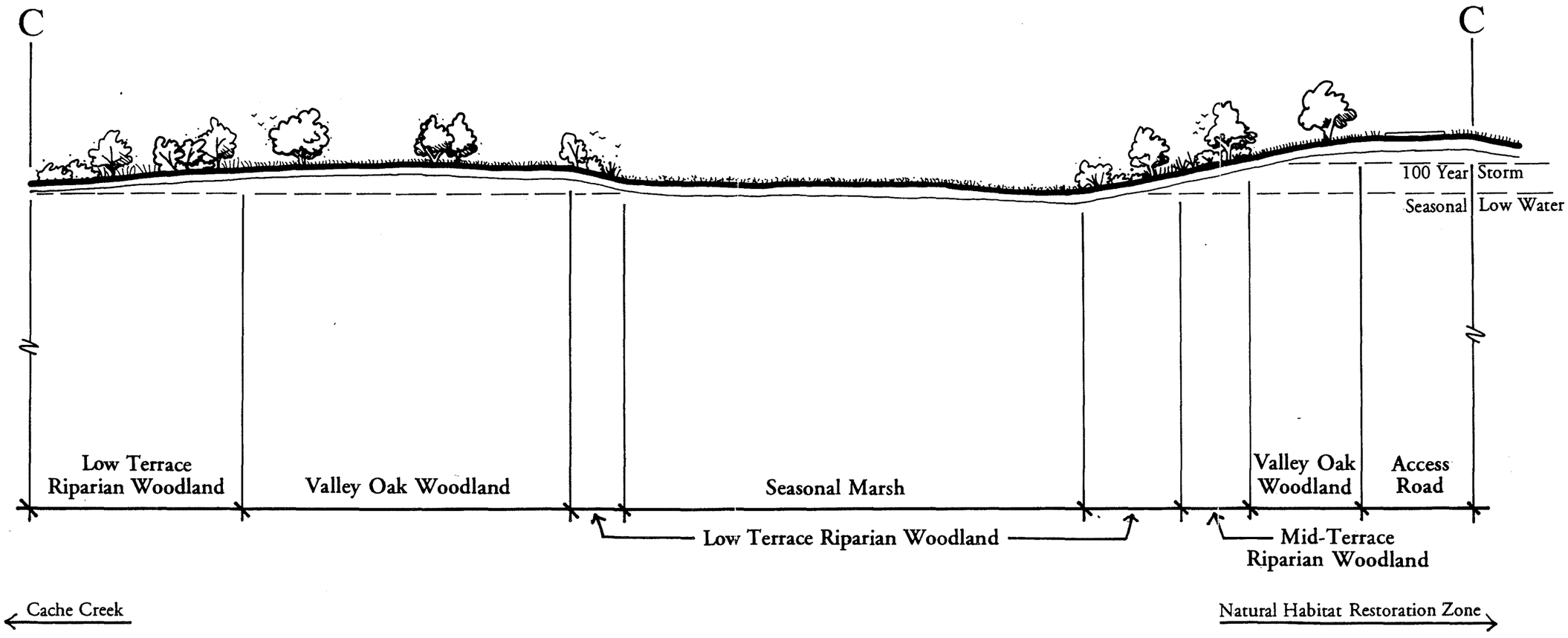
ZENTNER
ZENTNER

CREEK BANK RESTORATION

Cross-Section After Reclamation:
Section B-B

FIGURE 10



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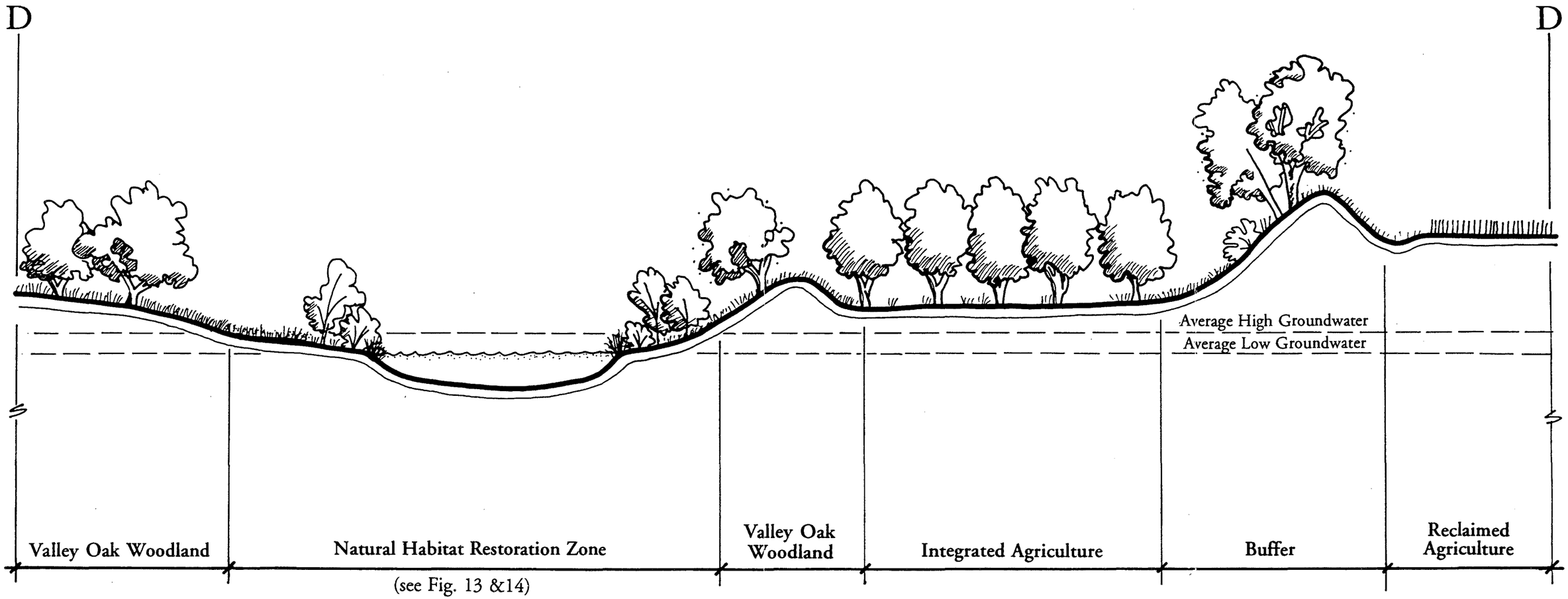
ZENTNER ZENTNER

CREEK BANK RESTORATION

Cross-Section After Reclamation:
Section C-C

FIGURE 11



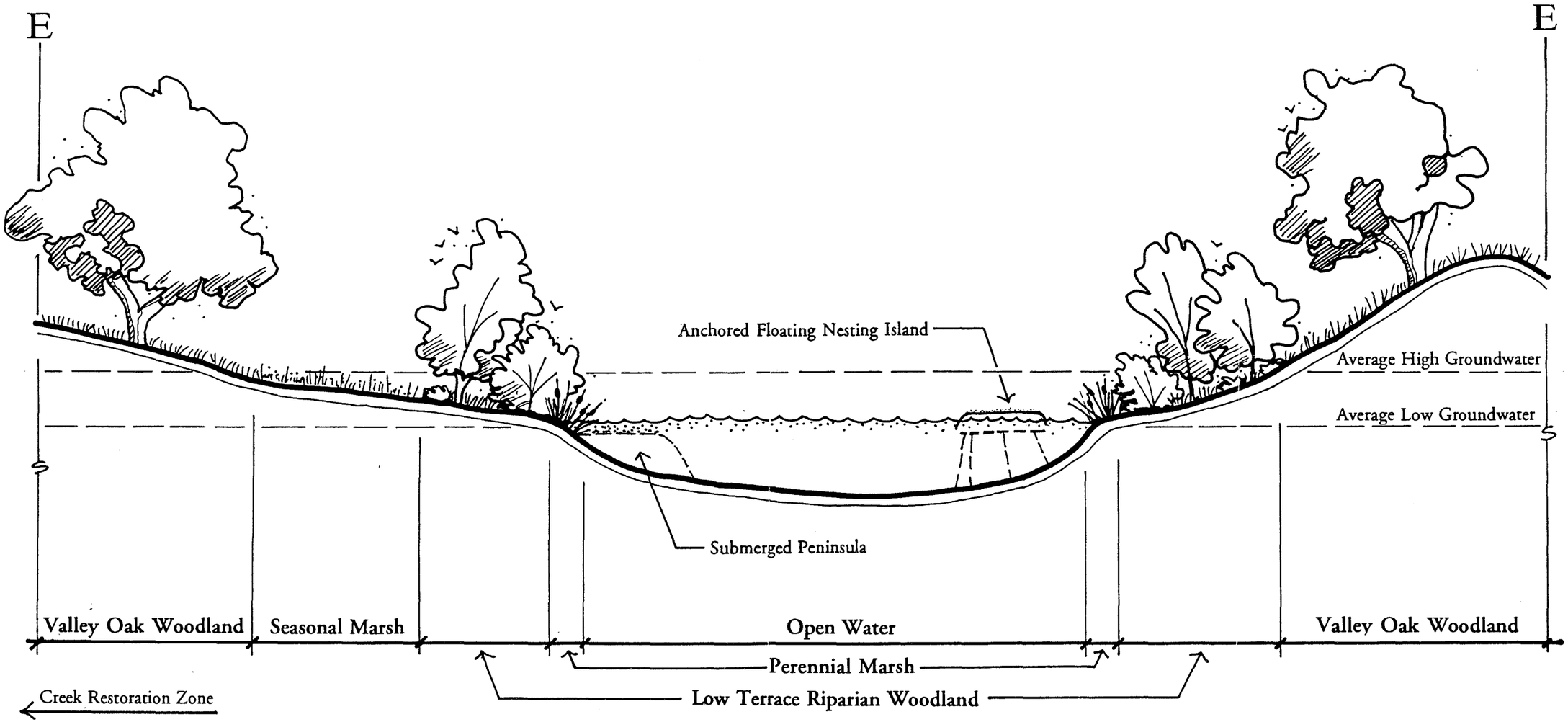
NOT TO SCALE

ZENTNER ZENTNER

WETLAND & ASSOCIATED UPLANDS RESTORATION

Cross-Section After Reclamation:
Section D-D

FIGURE 12



NOT TO SCALE

ZENTNER ZENTNER

WETLAND & ASSOCIATED UPLANDS RESTORATION

Natural Habitat Restoration Zone
Section E-E

FIGURE 13

F

F

Average High Groundwater

Average Low Groundwater

Open Water

Low Terrace Riparian Woodland

Valley Oak Woodland

Integrated Agriculture

Perennial Marsh

NOT TO SCALE

ZENTNER ZENTNER

WETLAND & ASSOCIATED UPLANDS RESTORATION

Natural Habitat Restoration Zone:
Section F-F

FIGURE 14

Creek

Cache

Property Boundary

Detail - Section

~ Restored Farmland ~

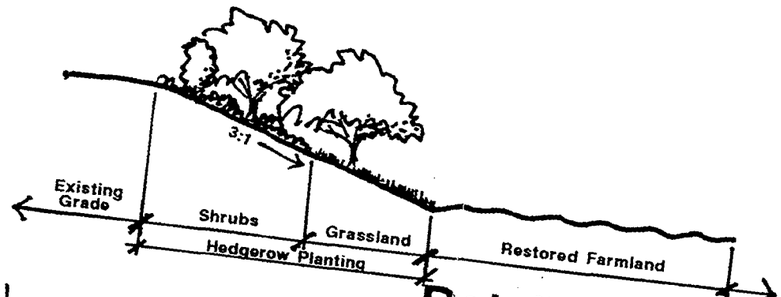
Powerline

Existing

Hedgerow planting area

Property Boundary

Property Boundary

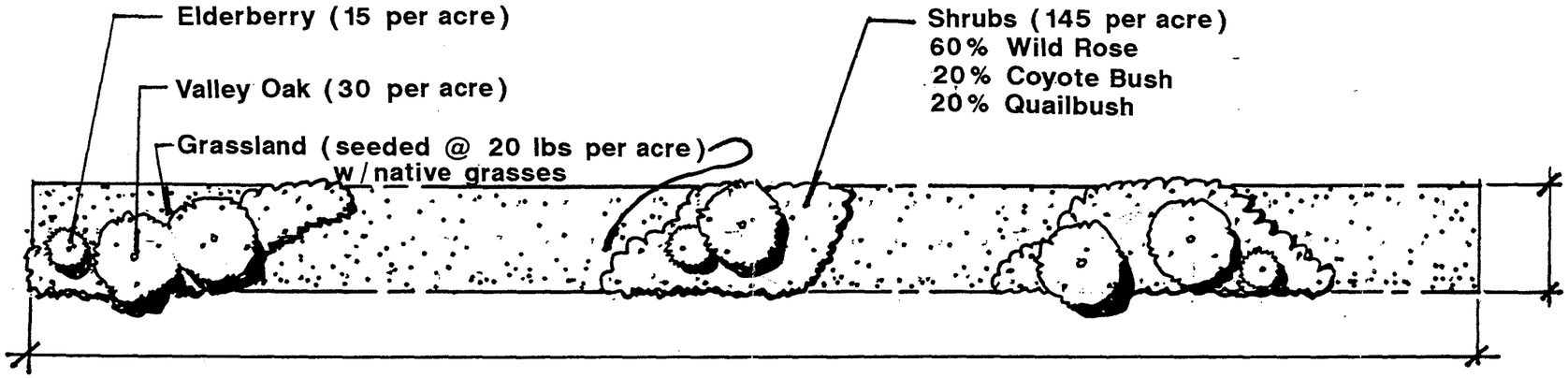


Detail - Section

1"=20'-0"

1"=200'-0"

ZENTNER and ZENTNER



PLAN
1'=50'-0"

ELEVATION
1"=50'-0"

ZENTNER and ZENTNER

Typical Hedgerow Planting
FIGURE 16

plan will increase the diversity of the existing bank by recontouring to create a series of terraces and gentle grades between terraces to mimic the bank of natural stream system (see Figures 9 through 11 for cross-sections). Final elevations of these terraces will be based on the results of flood analyses completed by Cunningham Engineering (1995).

The terraces and slopes will be planted with native species. This will increase flood capacity and desynchronization (slowing flood flows to reduce peak discharges downstream), increase groundwater recharge (by slowing flows and allowing increased percolation), and increase natural habitat and wildlife values (by replacing a weedy and relatively steep levee slope with a gentler slope dominated by natives) by replicating features of the natural topography as described in the previous chapter.

YAS observed bank swallow nesting in the sheer face of the active mining portion of the Hutson parcel in 1991, 1992, and 1993. YAS apparently has observed them in the same site in 1995 (see comment letter No. 13 to the Solano Concrete Company, Inc. Short-Term, Off-Channel Mining Permit Application DEIR [Final EIR, SCH # 94113035, July 1995]), although this has not been confirmed. This is one of the few sites in this region with bank swallow habitat, and it is interesting, although not necessarily surprising, that they would nest in an artificially constructed habitat.

The swallows have obviously become acclimatized to the noise and other effects of mining (acclimatization to periodic and frequent machine noises is a common feature in many birds). The creek restoration program provides an opportunity for the creation of new bank swallow habitat through the creation of over-steepened banks adjacent to the creek (a safe distance from the 100-year flowline), the bank swallow's preferred habitat.

5. Interstate 505 Screening

Screening of the mining operation completed on the Kaupke parcel shall be achieved using plantings of both valley oaks and cottonwoods. These two species are both native to this site. The valley oaks are relatively slow growing, but once mature, provide effective screening due to their significant size and longevity.

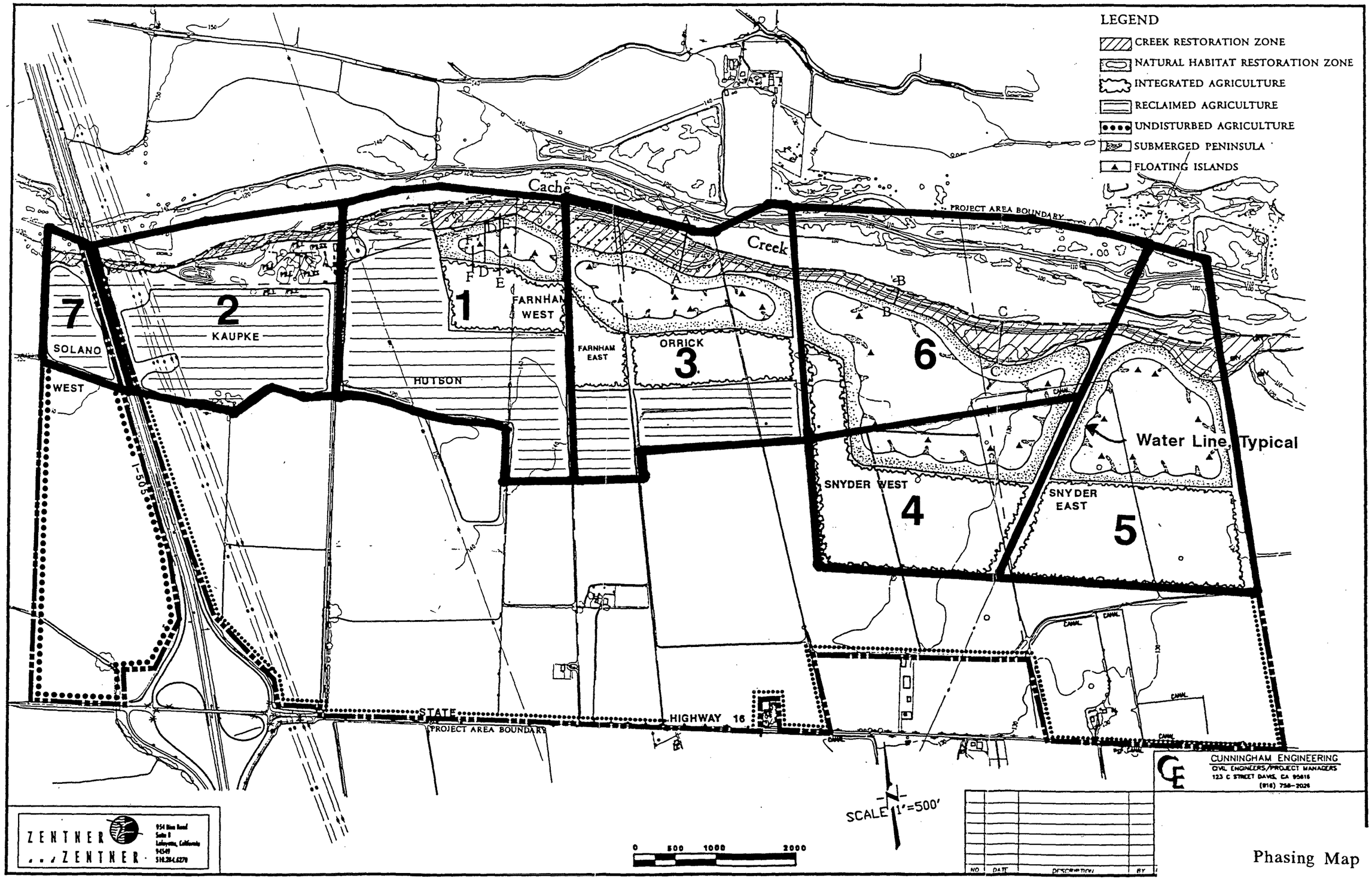
Cottonwoods are relatively fast growing (up to 10 feet per year) but comparatively short-lived. These species thus provide an effective screening combination. The trees will be planted in two rows fronting Interstate 505 with 20 to 40 feet between trees and a similar distance between rows. The species will be staggered so that a single line of one species is not presented. Water will be supplied through a drip irrigation system connected to a local pump. Weed control will be required for the first three years and will consist of heavy mulching (minimum of 3 inches to a diameter of 4 feet around the base of the trees), a pre-emergent spray in the fall after planting and the next fall, and spot spraying of a post-emergent where necessary.

6. Phasing

Natural habitat restoration will occur in the same phases as the mining. However, restoration of the creek portion of any mined parcel will occur concurrent with mining of that parcel while mined land reclamation will occur immediately following the cessation of mining on that parcel. Accordingly, for any of the parcels covered by this plan, the phasing sequence will consist of: (1) restoration of that portion of the creek; (2) mining the parcel; and (3) reclamation of that parcel. Reclamation and mitigation will be implemented in the following phasing sequence as depicted on Figure 17:

Phase I	***Farnham West***
Phase II	***Kaupke***
Phase III	***Orrick, Snyder West, Farnham East***
Phase IV	***Snyder West***
Phase V	***Snyder East***
Phase VI	***Snyder West***
Phase VII	***Solano West***

This phasing program assumes that either the CCRMP or the creek restoration program proposed in this plan will be approved; should neither plan be approved by the time of mining or an alternative developed by the County (such as payment of an in-lieu fee to promote creek restoration), then this creek restoration would not occur.



Phasing Map

FIGURE 17

7. Ownership and Financing

Solano Concrete already has title to or options on all of the land within the proposed mining and reclamation program. Solano Concrete shall be responsible for all construction, monitoring and maintenance of the reclamation project. Solano Concrete shall monitor all habitat construction, maintenance, and monitoring work within the reclamation area until that work is determined to be successfully completed by the County. Solano Concrete shall remain responsible for the success of the restoration efforts unless the County or its designee, at its option, assumes this responsibility.

C. RESTORED HABITAT DESCRIPTIONS

1. Open Water and Marsh Habitats

The open water and marsh habitats are discussed together because they generally occur as a unit, with marsh typically occurring as a fringe at the edge of the open water habitat.

a. Goals

The primary goals of this effort are the creation of a diverse open water and marsh system, and the assurance that this system will be self-maintaining to the maximum extent practicable.

b. Habitat Construction

Habitat diversity will be a product of providing a mix of open water and marsh, with adjacent riparian woodland and oak woodland. Presently, the site and the region have a very limited amount of marsh and open water. Additionally, the naturally-occurring surrounding habitat, which can be very important to many species for roosting, nesting, and cover, is currently preempted by farming or is

otherwise considerably degraded. Restoration of each of these systems will satisfy the habitat diversity goals.

Open water will occur where the groundwater zone intercepts the excavated pit. This depth is indicated on the cross-sections included in this plan and the analyses provided int he reclamation program. Marsh will be constructed on slopes and terraces within the zone of fluctuating water levels, *i.e.*, between the annual high and low water levels. Perennial marsh, dominated by tall-statured species such as cattails, will occur in areas with 6 to 12 months of inundation to a depth of 3 feet. Seasonal marsh is dominated by short-statured forbs such as Baltic rush (*Juncus balticus*) will occur in areas with 2 to 6 months of inundation and soil saturation within the root zone for some period before and after inundation. Wet meadows are dominated by grasses with some forbs on soils with limited inundation but lengthy periods (2 to 8 months) of soil saturation. These plant communities are adapted to fluctuating water conditions and can survive inundation for several months.

One of the more difficult tasks in wetland creation is ensuring that the wetland is self-maintaining. The Sacramento-Yolo Mosquito Abatement District has developed guidelines for use in wetland restoration projects. These were used to develop a series of guidelines for this project as detailed below.

1. The banks of areas that retain water after June 1 (the beginning of the optimal mosquito breeding period) will be steep enough to prevent isolated pooling as the water level recedes and to allow wave action and access by predators. Shoreline configuration will not isolate small channels or shallow ponding areas from the main body of water but will instead provide for continuous access by predators, particularly mosquito fish.

2. Dense stands of aquatic vegetation will be limited in shallow areas to lower harborage and enhance wave action. Perennial marsh species, like cattails and bulrushes, in moderate stands generally do not promote mosquito productivity and will function as substrate for predators of mosquitos.

3. Road access will be provided to all wet areas. Access will be allowed for continual larval and adult mosquito surveillance and the continual monitoring of water quality and vegetation density.

c. Marsh Planting

Experience has demonstrated that planting the mature marsh species in their proposed establishment zone is cost-effective and provides for rapid establishment of a diverse marsh flora. Planting of marsh species is implemented by salvaging plugs of native marsh plants like *Scirpus acutus*, *S. californicus*, and *S. olneyi* from marshes in the vicinity. Transplanting of marsh root masses (the preferred planting strategy) can be extremely successful where the root masses are kept inundated from the time of transplanting and transplanting occurs almost immediately (within hours) after salvaging. Efforts will additionally be made to plant rare marsh species that occur in this region such as *Sagittarian sanfordii* and possibly *Hibiscus californicus*. Their seed will be collected locally and propagated prior to planting at the project site.

Species to be planted in the marsh habitat are shown in Table Five from approximately wettest (perennial marshes) to driest (wet meadows). Approximately 100 plants per acre will be installed, averaging on 20' centers.

TABLE FIVE

Marsh Planting List

Species	Common Name	# Per Acre
Scirpus acutus	Common tule	30
Typha domingensis	Cattails	15
Scirpus americanus	Three-square	10
Hibiscus californica	California hibiscus	5
Eleocharis palustris	Creeping spikerush	20
Carex rostrata	Beaked sedge	5
Equisetum hyemale	Scouring Rush	5
Anemopsis californica	Yerba Mansa	5
Cephalanthus occidentalis	Buttonbush	5

d. Probable Wildlife Use

The marsh and open water areas are important wildlife habitats, and are also very important as water-sources. The small size of the existing areas and the barrenness of adjacent areas, however, severely restricts wildlife usage. The creation of additional marsh and open water areas and the restoration of adjacent upland habitats will substantially expand the wildlife value of these areas.

Some species which will be promoted by expansion of these habitat types by the restoration of adjacent upland habitats include: raccoon, American bittern, great blue heron, great egret, snowy egret, green-backed heron, black-crowned night heron, American coot, swallow species, valley garter snake, aquatic garter snake, Pacific tree-frog, bullfrog, California toad, pied-billed grebe, double-crested cormorant, ruddy duck, belted kingfisher, and many others. Especially important is the provision of habitat for the tricolored blackbird, a protected species.

2. Riparian and Oak Woodland Habitats

a. Habitat Construction

Woodland on the Madison Aggregate site will consist of riparian woodland on the low ground adjacent to the marsh and open-water habitats of the site and valley oak woodland on the high ground surrounding the areas of the riparian habitat. Given the soils and depth to open water, approximately the lower third of the slope above the water level will typically be riparian woodland while the upper two-thirds will be valley oak woodland.

Based on soils (SCS, 1972) most of the project area was historically oak woodland with stringers of riparian woodland along the major stream channels. Associated native grasslands were probably dominated by creeping wild rye with some purple needle grass on higher and drier sites. The riparian woodland occurred on the relatively coarse soils with high year-round groundwater along the creek channels, while the oaks occurred (and still occur) on the drier and relatively coarse loams of the relatively broad natural levees that flanked the major creek channels of the area. Grasses dominated the finer grained soils farther from the creeks. To reestablish riparian woodland will require generally coarse slopes, while oak woodland will require moderate- to fine-textured loams. Cobbly loam, gravelly loam or other loamy textures are acceptable as a subsoil for both woodland types but clays are not suitable. If any significant clay areas are encountered, the plantings will be modified toward open woodland or grassland as appropriate.

Species to be planted in the riparian woodland area (roughly arranged from drier to wetter conditions) are found in Table Six.

TABLE SIX

Riparian Woodland Planting List

Species	Common Name	Approximate #/acre
Quercus lobata	Valley oak	82
Rosa californica	Wild rose	36
Leymus triticoides	Creeping wildrye	400
Sambucus mexicana	Blue elderberry	12
Rubus ursinus	Native blackberry	19
Baccharis viminea	Mule fat	6
Vitis californica	Wild grape	16
Acer negundo	Box elder	18
Cornus stolonifera	Dogwood	16
Populus fremontii	Fremont cottonwood	26
Salix goodingii	Black willow	23
Salix laevigata	Red willow	23
Salix lasiandra	Arroyo willow	23

Average densities will be over 300 trees and shrubs per acre. The trees and shrubs will be planted in clusters. The woodland will appear relatively dense with occasional grassland openings.

The higher ground surrounding the riparian woodlands will be planted in valley oak woodland. Species to be planted in the oak woodland areas are shown in Table Seven.

TABLE SEVEN

Oak Woodland Planting List

Species	Common Name	Approximate #/acre
Pinus sabiniana	Gray pine	3
Quercus wizlensii	Interior live oak	6
Quercus lobata	Valley oak	43
Aesculus californica	California buckeye	5
Sambucus mexicana	Blue elderberry	10
Rubus ursinus	California blackberry	8
Baccharis pilularis	Coyote bush	10
Rosa californica	Wild rose	15
Nassella pulchra	Purple needlegrass	300
Leymus triticoides	Creeping wildrye	100

Average densities will be 100 trees and shrubs per acre. However, these trees and shrubs will be planted in clusters of six to seven trees or shrubs. The clusters will typically consist of a single species, although mixed groupings, *e.g.*, valley oak-blue elderberry also would occur. Gray pine will only be planted as individuals at the higher points on the site. Clusters of trees and shrubs will be planted 25 to 50 feet apart with native grasslands in between the clusters. The trees to be planted in the lower elevations of this community are adapted to fluctuating water conditions and can survive inundation for several months.

b. Probable Wildlife Use

The riparian and oak woodland habitats are important wildlife habitat types. The small size of the existing areas and their degraded nature significantly limits wildlife usage. The creation of additional riparian and oak woodland areas and the reintroduction of numerous native plant species to both preserved on created areas will substantially improve the wildlife value of these areas.

The list of species which will be promoted by expansion of the riparian and oak woodland habitats is very long, and includes: dusky-footed woodrat; mule deer; great horned owl; screech owl; Lewis woodpecker; ruby-crowned kinglet; western bluebird; blue-gray gnatcatcher; solitary vireo; California king snake; California night snake; white-tailed kite; Cooper hawk; Swainson's thrush; hermit thrush; blue-gray gnatcatcher; cedar waxwing; Hutton's vireo; orange-crowned warbler; common yellow-throat; black-headed grosbeak; rufous-sided towhee; dark-eyed junco; Pacific rubber boa; coachwhip; sharp-tailed snake; ring-necked snake; California toad; Pacific tree-frog; and many others. Especially important targets for restoration include the bank swallow, Swainson's hawk, and burrowing owl, all special status species.

Chapter 4
Monitoring and Management

A. INTRODUCTION

Monitoring is divided into two phases. The first phase involves monitoring of the construction project to ensure its compliance with the approved mitigation program and relevant permits. The second monitoring phase will be a study of changes to the habitats after construction to show whether or not the existing and created vegetation is developing as intended. Each phase of mining will require its own monitoring program as detailed in this plan.

This section of the mitigation program provides the general requirements for the monitoring program, specific monitoring parameters, performance standards for determining post-construction success, and a discussion of proposed remedial actions that may be warranted if the performance standards are not met.

B. CONSTRUCTION MONITORING

Construction of all or any portion of this project will be completed by Solano Concrete. Solano Concrete shall require a performance bond from any contractor performing the construction work. Additionally, all construction in the project area that affects either preserved or created habitats shall be monitored by a qualified ecologist with proven experience in the areas of habitat development and restoration, hereafter termed the "Ecological Monitor" (EM). The EM shall be under contract directly to Solano Concrete.

During the construction phase, it is the responsibility of the EM to ensure that the project is built in accordance with the approved mitigation program, relevant permits, and any other documents approved as a part of this project. The EM shall inspect all aspects of habitat construction that relate to implementation of the mitigation program and shall keep a daily construction log of all relevant construction activities. The EM shall immediately notify Solano Concrete whenever construction deviates from the approved permits and mitigation program.

When necessary, the EM shall notify Solano Concrete of any changes required in the relevant project permits due to adverse site or other conditions encountered during construction. Within six months of completion of each phase of the restoration project, the EM shall sign a copy of the construction log and as-builts, certify that the project was built in accordance with the relevant permits, send a copy of the signed as-builts to the relevant permitting agencies and request, in writing, inspection of the project. If the permitting agencies do not respond within 30 days, project construction shall be deemed complete and constructed in accordance with the relevant permits.

C. POST-CONSTRUCTION MONITORING

1. General Requirements

a. Post-construction monitoring of created natural habitats shall occur for five years after reclamation of each unit of mined habitat. Monitoring and construction may be phased such that segments of the project area are monitored at different times.

b. The results of the monitoring program, including photographs taken along permanent transect lines, shall be submitted in an annual report to the relevant County, State and Federal agencies by August 15 of each year.

c. All post-construction monitoring shall be completed at the direction of the EM whose responsibility is to ensure that the project is monitored and maintained in accordance with the relevant permits.

d. To ensure long-term maintenance practices continue that support the purposes of the mitigation program, a maintenance manual shall be developed during the fifth year of the post-construction monitoring and circulated to the relevant permitting agencies for comments. The manual shall then be finalized and submitted to the county or its designee with the final monitoring report. The manual shall detail maintenance procedures such as erosion control, debris removal, exotic plant eradication, irrigation guidelines, species cultural requirements, and replanting.

2. Monitoring Parameters

a. Introduction

Elements of the monitoring program discussed in this section include: woodland (tree and shrub) mortality, vigor, height, and natural regeneration; herb strata (perennial marsh) cover and species richness; and water surface elevations.

b. Woodland Monitoring

Mortality rates, vigor, and height of all planted trees and shrubs will be evaluated by field surveys during both the early spring and late summer (the period of early emergence of new growth and that of greatest stress on the planted vegetation, respectively). Each planted tree or shrub will be assigned to one of three height classes: Class 1 plants will be trees 24 inches or less in height, shrubs 12 inches or less in height, and vines 12 inches or less in diameter; Class 2 plants will be trees from 24 to 60 inches in height, shrubs from 12 to 36 inches in height, and vines from 12 to 36 inches in diameter; Class 3 plants will be trees greater than 60 inches in height, shrubs greater than 36 inches in height, and vines greater than 36 inches in diameter. At the same time, the EM will assign each plant to a category of healthy, unhealthy, or dead. Photographs of each type of plant for a representative sample will be included in the monitoring reports. Woodland monitoring shall also include an inventory of all native trees and shrubs that germinate on-site without artificial propagation and reach a height of 36 inches or more. The height, number, and species of these plants shall be reported in the monitoring reports.

c. *Marsh and Open Water Monitoring*

Permanent plots marked by rebar or other, permanent markers in marshes will be used to assess plant cover, species richness, and the relative cover of wetland species. Sampling will use releves in accordance with the procedure described by Mueller-Dumbois and Ellenberg or similar procedure. At least 15 permanent plots, each 10ft x 10ft, will be used to monitor these elements for each reclaimed mining parcel. Plot locations shall be divided equally among those placed on the edges of the proposed habitat and those placed within the interior of the proposed habitat. Within those two areas, locations shall be randomly selected. Sampling will occur once annually during the late spring.

These plots shall also be monitored each month of the wet season for water surface elevation and inundation period for the first two years of the monitoring period. Water surface elevation monitoring shall consist of a permanent marker (the rebar marker noted above may be used) that can be used to define water depth. Additionally, water quality monitoring for common elements of agricultural tailwater in the region shall be completed each year in the open water areas.

d. *Wildlife*

Bird use will be the only wildlife monitoring completed for this project. Bird surveys shall be completed as set forth below each year during the five-year monitoring period for each reclaimed parcel. These surveys shall each include at least quarterly, three-hour surveys for each reclaimed unit. Surveys shall include a walk-through around half the perimeter of the wetland area within each reclaimed unit. All bird species shall be noted on survey forms along with the numbers of birds, their location, and their activities.

3. Schedule

Table Eight summarizes the monitored elements, the frequency of monitoring by element, the time of year for monitoring, and the years during the monitoring period in which the element is monitored.

TABLE EIGHT

Monitoring Program Summary

Element	Frequency	Season	Years
Woodland Vigor, Height & Mortality	Biannually	Spring & Fall	Each Year
Marsh Hydrology	Bimonthly	Winter & Spring	First 2 Years
Pond Water Quality	Annually	Summer	Each Year
Marsh Cover & Species Richness	Annually	Spring	Each Year
Bird Use	Quarterly	All Year	Each Year

D. PERFORMANCE STANDARDS

Restoration of each reclaimed unit shall be evaluated against the following performance standards at the end of the fifth year of monitoring as depicted in Table Nine.

TABLE NINE

Mitigation Performance Standards

Habitat	Element	Standard
Woodlands		
	Plant vigor	Class 3 and healthy
	Species diversity	Number of species and proportions as in planting plan
	Mortality	80% survival of all planted trees and shrubs
Marsh		
	Hydrology	Hydroperiod and depth sufficient to establish target habitat type
	Plant cover	80% for marsh
	Species richness	6 species from the sample list provided on page 61.

For the woodlands, the performance standards require that all trees be healthy and at least 60 inches or taller (Class 3), the same species be represented in the final mix in similar proportions as are currently proposed, and a mortality rate for all plants of no more than 20% is achieved. Woodland cover is expected to increase relatively quickly due to reasonable proximity of groundwater, and suitable soils.

For the marshes, the hydroperiod and depth of water are extremely important to successful construction. This program provides that the hydroperiod and depth must be appropriate to the establishment of the specific wetland type. Plant cover of the marshes must be at least 80%, with at least six species present (the number of species typically found now in a 10ft x 10ft sample of the wetlands). These species shall be representative of the habitat type to be created. Table Ten below provides a sample for the marsh habitat.

TABLE TEN

Sample Perennial Marsh Plants

Alisma plantago-aquatica	Water plantain
Azolla filiculoides	Mosquito fern
Cyperus eragrostis	Tall flat-sedge
Jussiaea repens var. peploides	Creeping seedbox
Ludwigia peploides	Floating seedbox
Mentha pulegium	Penny-royal
Rorippa sinuata	Spreading yellow cress
Scirpus acutus	Tule
Typha domingensis	Southern cattail
Typha latifolia	Broad-leaf cattail

After completion of the construction program for each reclaimed parcel, the elements noted above will be monitored for a period of five years with monitoring occurring annually from years one through five. At the end of the fifth year of monitoring for each reclaimed unit, a final evaluation will be completed and provided to the County for review. The monitoring or the relevant component of the monitoring shall be extended, if all or a portion of the habitat reclamation is judged to be unsuccessful, until the unsuccessful portion of the project meets the above performance standards.

E. REMEDIAL ACTIONS

The applicant has the responsibility to create a successful reclamation program and will manage the reclamation areas in an iterative manner, i.e., where the monitoring program shows an area is tending toward an unsuccessful conclusion, the applicant shall take action to correct that trend. These actions would include site modification and/or replanting. For example, a portion of the plantings may fail due to inappropriate elevations (too high or too low). The mortality or lack of vigor in the plants would make this problem and the logical solution evident within the first few years of the monitoring.

Generally, the marsh creation components of the program are relatively immune to post-construction problems if the water surface elevations and hydro periods established after construction are appropriate. However, woodland plantings will require active maintenance during the monitoring period and are subject to the common problems of many landscape construction projects.

Major corrective actions will be taken only after consultation with the relevant county, state, or federal agency, as appropriate, and generally will occur after an annual progress report, including recommendations needed to ensure the project meets the performance standards, has been submitted. Where the agencies do not comment within 30 days on the recommendations within the report, the report shall be deemed acceptable and the applicant shall proceed to implement these recommendations. At the end of the fifth year, the monitoring report will summarize the previous reports and evaluate the success of the project against the performance standards. If a major adjustment to the program, *i.e.*, regrading or similar action, has occurred in the recent past, the applicant can request that the final evaluation for all or a specific portion of the project be suspended for a specified period of time.

Where the mitigation program or a portion of the mitigation program fails to meet the performance standard, it will be the applicant's responsibility to correct the unsuccessful portions of the project. Corrective measures will include techniques that have been shown to be successful at this site or other similar areas and could include significant regrading or replanting. These unsuccessful portions of the project will then be monitored until they are shown to meet the same performance standards.

Chapter 5
Preliminary Habitat Construction Specifications

A. CONSTRUCTION NOTES

All specifications throughout this document are preliminary in nature and are not to be used for bidding purposes.

Before actual construction begins, specifications as to detailed quantities, rates, ratios, and/or cultural practices will be required to construct this plan.

The order of operations set forth in these specifications is believed to be the most efficient method of constructing this project; however, changes or adaptations to the order of operations may be necessary to allow for weather conditions or other factors.

It is imperative that the created and existing habitat sites (the "habitat areas") not be disturbed by non-habitat construction, such as emplacement of bridges or other structures. This includes using habitat areas as right-of-ways to transport equipment; this does not include use of existing or planned access roads.

Communication and coordination between those responsible for mining and habitat construction operations is essential. Items such as access to sites, turning on or off utilities, stockpiling materials on project sites, or any situation that might affect each other's operations need to be resolved in advance.

The designated EM will ensure that the habitat area is constructed in accordance with the approved mitigation plan. The EM will be responsible for certifying that the project has been built in accordance with the approved mitigation program and permits and will monitor all operations occurring in the habitat areas. The name and phone number of the EM will be given to the owner's project manager for distribution.

The EM will attend any pre-job conferences or meetings during construction that are pertinent to the habitat areas.

B. ORDER OF OPERATIONS

Coordination and timeliness of scheduling with mining and related reclamation efforts are essential.

1. Marking Boundaries

The EM will be responsible for having the boundaries of the habitat area located and marked, as well as designating any indigenous material that is to be saved or salvaged. All habitat and salvage areas will be marked so they will be easily identified in the field and will be maintained throughout the construction phase where applicable.

2. Grading

Grading operations must follow local regulations with regard to start and stop times and dust control as required. All grading will be done to meet the requirements of the approved mitigation plan. The EM will monitor grading construction and grade checking.

Any plant material that must be salvaged prior to grading will be done at the direction of the EM. Any excess soil that needs to be transported off site will be coordinated with the owner's project manager.

3. Irrigating

All new plants and cuttings, with the exception of willows, cottonwoods and similar low-terrace species, will be irrigated using a drip irrigation system. Before passing through the polyethylene tubing, all water will be filtered and the pressure reduced. Poly lines may be installed above grade. Six-inch staples or jute hooks will be used to secure poly tubing in place. Staples will be placed every ten feet and one foot on both sides of the planting. All lines must be thoroughly flushed before inserting emitters. Lines will be flushed using flushing end caps. Each planting receives its own emitter. It is very important that each emitter is

placed directly over the rootball as the densities of the rootball and indigenous soil are quite different. Pressure testing upon completing the main line and valves will be required. Lateral lines will be left on for a period of at least two hours to visually inspect all leaks. Upon completing the irrigation system, the EM will make a final walk through and verify the system is operating correctly.

4. Planting

All plant material used for this site will be collected from material within the same region. Considerations as to the proximity of the gene pools and planted species vary greatly from one plant species to another, and the EM shall give direction in this area.

Plants for this site will need to have been collected, propagated, and grown for at least one growing season prior to planting. Plant material will be free from disease, insects, weeds, and not rootbound.

All plant material will be identified correctly as to genus and species. All plant species and quantities will correspond to the planting plan. No substitutions will be allowed without prior permission from the EM. The EM will inspect all plants before planting occurs.

Planting should occur sometime between late fall and early spring (see Operation Schedule). All planting holes should be completely settled so plants will not sink below grade. Holes shall be dug in the soil just big enough to accept the rootball. Osmocote 18-6-12 fertilizer will be dibbled in the hole at the specified rate noted in the planting plan. The plant shall be planted so that the crown is level with grade. The rootball will be covered with 1/4" of soil to prevent a wicking effect from drying out the rootball. A plant emitter shall be placed directly on top of rootball and the plant watered thoroughly. Plants shall all be checked for settling and stress. After the planting has been approved and certified by the EM, shredded bark or similar mulch will be placed to a depth of two inches adjacent to the plant, making sure not to cover the crown of the plant.

Pole cuttings will be used on certain riparian species. Poles will be 3/4" to 2" in diameter and three feet in length. All cuttings will be taken from young wood and be free of disease. Two feet of cutting will be pounded into the ground and soil tamped around the cutting. Six to 12 inches will be left above grade and the top cut off at a 45 degree angle. Cuttings must be kept moist and planted the same day as they were cut. The EM will monitor the pole cutting operation and give direction as to locations and identification of plant material.

The location of all salvaged material, such as marsh plants that must be transplanted, will be identified by the EM. The method of planting will also be identified by the EM due to the variable site conditions.

5. Seeding

The optimal time for all seeding operations is in the fall. Seed can be planted any time between fall and spring; however, the earlier the seed is planted, the higher the percentage of seed emergence that becomes permanently established. The key will be to get the root zone as deep as possible before summer conditions arrive. The deeper the roots of the seeded material are before summer conditions arrive, the better opportunities these roots will have to follow the subsurface moisture level downward through the soil.

All seed used on this site will be certified as to germination percentage. Seed will be weed-free and disease-free and follow specifications in the planting plan. No substitutions will be made without advance permission from the EM. All rates and ratios will follow specifications in the planting plan and the EM will inspect all seed, soil preparation, calibration ratios, and phases of seeding operations. Soil preparation and seeding techniques will be adopted for each site and outlined in each site's planting plan.

6. As-Builts

The EM shall be responsible for preparing grading, planting and irrigation as-builts when the project is completed. The planting as-builts will include the location, genus species, and container size of each planted plant. The EM shall

certify that the project has been built in accordance with the mitigation plan and transmit the as-builts and certification to the appropriate agencies.

Chapter 6
Preliminary Maintenance Guidelines

A. INTRODUCTION

All specifications in this maintenance section are general in nature and are not to be used for bidding purposes. This maintenance section will treat all the habitat areas of this project as one area.

B. MAINTENANCE TASK DESCRIPTIONS

1. Weed Abatement

The most significant task in any recently disturbed area will be the control of exotic weeds. The most invasive of these is yellow star thistle (*Centaurea solstitialis*). It is extremely important that exotic weed species are kept under control from the beginning of the maintenance period in an attempt to reduce the seed bank in the soils on site. The EM will be notified in advance before any weed abatement begins. All parties involved in weed abatement tasks will be aware of the mitigation specifications and location of sensitive areas on-site. When mowing with tractor implements, a flail-type mower will be used and a fire extinguisher will be on the tractor at all times.

2. Basin Control

Planting hole weed control is very important, especially during the first two years of maintenance. Weeds in and around plant holes will compete for sunlight, water, and nutrients with the plants. Areas adjacent to the plants will be kept weed free in a four foot diameter circle centered around each plant. Planted trees and shrubs that are closer than six feet will have a weed free strip between them. No use of weed-eating machinery will occur in or around the crown area of the plant so as to prevent girdling.

3. Native Grass Management

The EM will direct the timing of weed abatement as dictated by site conditions and weather. Native grass areas will need to be mowed periodically to promote root growth. Exotic annual grasses in native grass areas will need to be mowed as seed heads are being formed but before seed maturation.

Note: It may be necessary during the first two years of the maintenance period to use integrated pest management techniques and incorporate broadleaf herbicide applications. This may be necessary if invasive exotic weeds become dominant after mowing operations. Herbicide applications will be kept to a minimum and all spraying will be done by a California licensed qualified applicator. All herbicides used will follow the written recommendation of a California licensed pest advisor. This written recommendation will be kept on file by the EM. No spraying will occur within ten feet of any wetland area.

4. Plant Care

Most plants should require little cultural care, except for irrigation and weed control in the basins. Plants should be fertilized once in the spring of the second and third year of maintenance. Fertilizer will be dibbled into the basin in accordance with specific guidelines contained in the maintenance program.

Trees may need to be staked. This decision will be made by the EM. Two eight-foot, pressure-treated stakes, two inches in diameter, will be placed two feet in the ground, one foot on either side of the tree where so directed. One-inch tree-tie tape will be placed in a figure-eight pattern between the tree and stake one foot below the top of the stake.

5. Irrigation

The irrigation system on this site is critical, not only for the target plants, but also regarding irrigation malfunctions, which could allow over watering of nontarget vegetation. A check of the irrigation system should be done during each watering. All irrigation scheduling decisions will be made by the EM.

6. Maintenance

All drip lines and filters shall be flushed as needed. Emitters must be checked regularly for malfunctions, the position of emitter over rootball, and vandalism. Flushing end caps must be checked regularly. Backflow devices and main line systems shall be drained completely at the end of the irrigation season to prevent rupturing due to freezing during the winter season.

7. Scheduling

Irrigation for plantings is a temporary tool to help establish the created habitat. Water will be decreased every year and ideally will not be needed by the fourth year. Watering the plants should not be used to create lush plants, which will become dependant on regular watering. Deep watering, spaced at the longest time possible before plants show signs of stress, will be used. This watering will encourage plant roots to travel downward into water zones in the soil.

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Appendix A
Vegetation Survey Results

Riparian vegetation along Cache Creek (CC) and its Bear Creek and North Fork tributaries was numerically sampled at 14 points in 1992:

1. CC at Hwy 29 near its Clear Lake Outlet in Lake County.
2. North Fork CC at Hwy 20 in Lake County.
3. Bear Creek at Hwy 20 in Colusa County.
4. CC Canyon at Hwy 16 bridge in Yolo County.
5. CC at Road 41 in Capay Valley, Yolo County.
6. CC at Road 57 in Capay Valley, Yolo County.
7. CC at Road 82B near Capay Dam, Yolo County.
8. CC at Road 85, Hungry Hollow, Yolo County.
9. CC at Road 87, Hungry Hollow, Yolo County.
10. CC at Hwy 505, Hungry Hollow, Yolo County.
11. CC at Road 94B, Woodland Reach, Yolo County.
12. CC at Interstate 5, Woodland Reach, Yolo County.
13. CC at Hwy 113, Woodland Reach, Yolo County.
14. CC at Road 102, Woodland Reach, Yolo County.

Sampling utilized the Braun-Blanquet Cover Abundance Scale in which the following numerical values are given to the indicated percent coverages:

Numerical value	Percent coverage
5	>75%
4	50-75%
3	25-50%
2	5-25%
1	1-5%
+	<1%

Results are given in the table below. Numbers across the top correspond to the sample points given above. Species by family and non-vegetation types are listed along the left side of the table.

	SAMPLE POINTS													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Non-vegetation														
Open water	5	2	3	4	4	3	3	2			3			
Gravel and cobbles		2	1			2	4	4	5	5	3	4	2	4
Anacardiaceae														
Toxicodendron diversilobum												2		
Aristolochiaceae														
Aristolochia californica					+									
Asteraceae														
Ambrosia psilostachya				1	1									
Artemisia douglasiana					1					+			2	
Aster exilis						1								
Baccharis viminea				+	+			1	1	1	2			+
Centaurea solstitialis										1				
Conyza canadensis										1				
Gnaphalium chilense							1							
Lactuca serriola														1
Solidago occidentalis	+	1												
Xanthium strumarium	+	+					1	1		+				3
Betulaceae														
Alnus rhombifolia	1	1												
Boraginaceae														
Heliotropium curassavicum									+	+				
H. europaeum										+				
Brassicaceae														
Brassica geniculatum								1	+	+				1
Lepidium latifolium			1						+	+				
Chenopodiaceae														
Atriplex patula hastata										+				
Cyperaceae														
Scirpus acutus	1						+							
S. olneyi			1											
Fabaceae														
Melilotus alba				2	1	+		2		+	2		2	2
Fagaceae														
Quercus lobata	1	+			2	1	+					1	2	
Juglandaceae														
Juglans hindsii					1	+	+	+		+	+		1	+
Loasaceae														
Mentzelia laevicaulisy								+		+				
Poaceae														
Agropyron elongatum			1											
Arundo donax						+	1	+		1	1	1		
Cortaderia atacamensis				1	1	1	1	+			+			
Crypsis schoenoides							1							
Cynodon dactylon				1						+				1
Distichlis spicata			3											
Leptochloa fascicularis							2			+	1			
Paspalum distichum				2	1	1								
Phragmites australis	1													
Poa annua							1							
Rosaceae														
Rosa californica	1	1			1							2	1	
Rubus procerus	1	+										2		
Rubus ursinus	+													
Rubiaceae														
Cephalanthus occidentalis				+										
Salicaceae														

	SAMPLE POINTS													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Populus fremontii	1	1		+	2	1	+	2	+	+	1	3	4	2
Salix gooddingii	1							+		1	1	1	1	2
S. hindsiana	1	1		2	2	1		1	+	1	2			2
S. laevigata	1	2		2	1	1	+	+	+	+	1		2	
S. lasiolepis	+													+
Sambucaceae														
Sambucus mexicana						+						+	1	+
Solanaceae														
Nicotiana glauca								+						1
Tamaricaceae														
Tamarix parviflora			2	2	2	3	2	3	1	2	2	2	3	3
Typhaceae														
Typha domingensis				2	2	1	+	2			+			
T. latifolia		2												
Vitaceae														
Vitis californica				+	1						+	+	1	

Appendix B
Blue Elderberry Survey Results

BLUE ELDERBERRY OCCURRENCES

The table below provides the following information for each blue elderberry individual or clone in the survey area:

1. Map location number.
2. Height in feet.
3. Number of stems equal to or greater than one inch in diameter.
4. Presence (+) or absence (-) of valley elderberry longhorn beetle (VELB) exit holes.

Location Number	Height	Number of Stems	VELB Exit Holes	Location Number	Height	Number of Stems	VELB Exit Holes
1	8	50	-	43	5	2	-
2	12	70	-	44	7	5	-
3	15	90	-	45	20	120	+
4	12	70	+	46	8	40	-
5	6	2	-	47	12	60	-
6	5	3	-	48	15	90	-
7	8	40	+	49	10	40	-
8	15	200	-	50	5	3	-
9	20	120	-	51	7	12	-
10	20	90	+	52	18	50	-
11	20	90	+	53	6	8	-
12	20	110	+	54	8	30	+
13	10	60	+	55	4	1	-
14	4	2	-	56	10	50	-
15	3	40	-	57	12	40	-
16	5	12	+	58	18	70	+
17	4	1	-	59	20	40	-
18	8	60	+	60	5	4	-
19	8	40	-	61	15	90	+
20	5	3	-	62	6	10	-
21	7	4	-	63	5	3	-
22	8	20	-	64	6	6	-
23	10	40	-	65	20	200	-
24	8	10	-	66	3	0	-
25	8	40	-	67	10	7	-
26	10	40	-	68	12	20	-
27	8	90	-	69	NA*	NA	NA
28	18	90	-	70	18	40	-
29	7	40	-	71	15	20	-
30	3	2	-	72	10	7	-
31	7	40	-	73	5	3	-
32	10	60	-	74	12	6	-
33	12	70	-	75	NA	NA	NA
34	12	70	-	76	6	6	+
35	8	40	-	77	7	20	-
36	7	50	-	78	10	20	-
37	7	30	-	79	10	10	-
38	8	50	-	80	10	15	-
39	12	70	-	81	4	4	-
40	8	12	-	82	6	6	-
41	6	7	-	83	15	120	-
42	10	70	-	84	15	70	+

Location Number	Height	Number of Stems	VELB Exit Holes
85	4	9	-
86	4	30	-
87	10	11	+
88	8	70	+
89	30	80	-
90	12	90	-
91	10	70	+
92	12	90	+
93	2	0	-
94	18	90	+
95	15	200	+
96	10	70	+
97	12	90	-
98	15	70	NA
99	20	90	+
100	15	200	+
101	15	70	+
102	20	80	-
103	12	60	+
104	4	4	-
105	8	20	-
106	20	140	-
107	20	100	+
108	12	60	-
109	15	90	-
110	8	20	-
111	8	6	-
112	8	7	-
113	6	4	-
114	6	3	-
115	5	2	-
116	8	5	-
117	6	1	-
118	12	10	-
119	8	4	-
120	10	6	-
121	8	25	-
122	12	40	-
123	18	110	+
124	15	90	-
125	8	10	-
126	10	90	-
127	15	90	+
128	10	60	-
129	10	90	-
130	8	20	-
131	18	120	-
132	15	200	-
133	12	60	-
134	15	80	-
135	15	150	+
136	15	60	-
137	10	15	-
138	8	5	-
139	18	100	-
140	1(cut)	70	+
141	1(cut)	50	+
142	22	30	-
143	16	2	-
144	15	34	-
145	20	10	-
146	10	6	-
147	10	8	-
148	10	40	-
149	20	9	-
150	12	4	-
151	12	4	-
152	12	3	-

* NA=Data not available

NOTE*

Elderberry reference numbers are found in the Zentner and Zentner mitigation plan, dated October 1995.

LEGEND

Symbol	Vegetation Type	Acreage
P	Perennial Marsh	1.40 ac
S	Seasonal Marsh	4.00 ac
Wd	Woodland	8.00 ac
RF	Riparian Forest	36.15 ac
RM	Riparian Mining-Related	16.00 ac
W	Wash	103.47 ac
G	Grassland	62.97 ac
TS	Tamarisk Scrub	7.31 ac
F	Farmland	

PROJECT BOUNDARY

HWY 505

Highway 16

Road

Bluff

Location Map

To Red Bluff

Cache Creek

Woodland

To Sacramento

Esparto

Winters

Davis

To Vacaville

North

APPROXIMATE SCALE: 1"=500'

Cache Creek
Vegetation Map

LEGEND

- CREEK RESTORATION ZONE
- NATURAL HABITAT RESTORATION ZONE
- INTEGRATED AGRICULTURE
- RECLAIMED AGRICULTURE
- UNDISTURBED AGRICULTURE
- SUBMERGED PENINSULA
- FLOATING ISLANDS

Cache Creek

PROJECT AREA BOUNDARY

SOLANO WEST

KAUPKE

HUTSON

FARNHAM WEST

FARNHAM EAST

ORRICK

SNYDER WEST

SNYDER EAST

I-505

STATE HIGHWAY 16

PROJECT AREA BOUNDARY

PILE PILES

CANAL

GNV

SP

Water Line, Typical

SCALE 1"=500'

0 500 1000 2000

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SOLANO CONCRETE
MADISON PLANT

Restoration Plan

NO. DATE DESCRIPTION BY

DRAWN BY: S.C. DATE: 4/28/93 SHEET 1 OF 1

Revised: 10/95