Flood Corridor Protection Via Riparian Restoration in an Agricultural Landscape

Project Location: The project is proposed on four separate properties (+/- 80 acres) along the Lower Mokelumne River (between Camanche Dam and the confluence with the Cosumnes River) in northern San Joaquin County.

Sponsoring Agency: The San Joaquin County Resource Conservation District 1222 Monaco Court #23 Stockton, California 95207

Project Manager: John Brodie, Mokelumne River Watershed Coordinator 209 -946-6456 ext. 125 or rvranglr@hotmail.com

Grant Request Amount: $1,604,880.20

_____ February 13, 2003

John B. Meek, Jr.
President, San Joaquin County Resource Conservation District
Board of Directors

Project Objectives:

This project seeks to abate erosion, damage and other effects of flooding in the Lower Mokelumne River Watershed through the creation and/or enhancement of riparian areas in an agricultural landscape. By restoring and increasing the riparian corridor, and at one property conducting a levee set back, this project seeks to advance the following FPCP goals:

- ✓ Provide for transitory storage of floodwaters.
- ✓ Reduce flood damage to levees.
- ✓ Reduce stream bank erosion and/or scour.
- ✓ Reduce the severity of flooding when it occurs on these and neighboring properties.
- ✓ Increase available habitat and provide habitat connectivity and habitat corridors for wildlife.
- ✓ Increase breeding and nesting habitat for neotropical migrant songbirds including species of special concern.
- ✓ Reduce the incidence of non-native invasive species.
- ✓ Allow the project sites and neighboring properties to continue to be used for production agriculture.
- ✓ Enhance the use of environmentally friendly agricultural practices in the watershed.
- ✓ Helps preserve agricultural land in the watershed.
- ✓ Contribute to groundwater recharge.
- ✓ Help filter and trap sediment and other non-point source pollution before it enters the river.
- ✓ The project will compliment other restoration projects taking place within the watershed (projects funded by CALFED, NFWF, CVPIA, and/or Mokelumne River Partnership)
- ✓ Supports a community-driven effort to enhance the natural values of the watershed while protecting private property rights.

These goals will be achieved while allowing the land to remain in private hands, thus relieving the state of the burden of purchasing property or easements. Through this riparian restoration project, the potential value of the land for conservation easements is increased, thereby providing more incentive for landowners to consider those tools.

The four properties proposed for restoration are located between river miles 56 and 54 (Vino Farms), 50 and 49 (Hoffman), 47 and 45 (Nakagawa), and 43 and 42 (Calvary Bible Church)[aerial photos and land use/vegetation maps located in appendix A]. Other riparian restoration projects are underway or expected to start in calendar year 2003 between river miles 62 and 60, 54 and 52, 33 and 31, and 26 and 25. The restoration at the Hoffman property also involves the breaching and setback of approximately 2,000 linear feet of levee.

Minimum Qualifications

This proposal meets points A, B, C, and G4 of the minimum qualifications.

Flood Protection Benefits

San Joaquin County and the Mokelumne River Watershed have a long history of flooding. Historically, flooding along the Mokelumne has been caused generally by late fall and winter rainstorms and snowmelt in the spring and early summer, however rain floods can occur any time in the watershed between November and March (Lower Mokelumne River Watershed Stewardship Plan [WSP] 2002).

Flooding along the Mokelumne is characterized by high peak flows of moderate duration and large volumes of runoff, and can be more severe when the ground is saturated from previous rain. The largest recorded flood along the Mokelumne River occurred in 1964. Due to the completion of Camanche Dam in early 1964, damage was limited (WSP, 2002).

Camanche Dam and reservoir was constructed by the East Bay Municipal Utility District with additional financing from the U.S. government for flood control benefits. The storage capacity of Camanche Dam is approximately 430,900 acre feet, with 200,000 acre feet of that total reserved for flood storage. It provides the primary flood control for areas adjacent to the Lower Mokelumne River and has a channel capacity of 5,000 cubic feet per second (cfs) from Camanche Dam downstream to State Highway 99. Some flooding, however, does occur on adjacent farmland when channel flows exceed 3,000 cfs (WSP, 2002). A diversion dam at Woodbridge, operated by the Woodbridge Irrigation District, provides some incidental flood protection to areas downstream of Woodbridge.

Some of the Mokelumne River's major flood events since the construction of Camanche Dam are included in Table 1 on page 4.

The Federal Emergency Management Agency's Flood Insurance Rate Maps for San Joaquin County identify numerous locations along the Lower Mokelumne River which are subject to recurring flood events. These are summarized in the map of 100 and 500 year flood plains in Appendix B.

The only one of the sites in an urban area (Lodi) is the Calvary Church site. The Thompson and Hoffman sites are the closest of the other sites to the Lodi-Woodbridge area, and though none face immediate threat from urbanization, California population estimates for the next fifty years indicate increasing development pressure on these agricultural lands.

The importance of improving flood protection at these locations is the benefits that will be provided to the urbanized areas of the floodplain in the Lodi and Woodbridge communities. Using the map in Appendix B, there is approximately one square mile of 100 year flood potential property in the city of Lodi between State Highway 99 and Woodbridge Dam. Using U.S. Census Bureau's 2000 Summary Geographic Comparison table, that means an estimated 4, 658 people and 1,747 housing units could be affected by a 100 year flood event along the Mokelumne River on that one stretch just in the city of Lodi.

Table 1
Recorded Maximum Monthly Mean Stream Flows for Major Flood Events Along the Lower Mokelumne River Measured below Camanche or Woodbridge Dam[1]

Year	Month	Stream Flows (measured in cubic feet per second)	Measurement Location
1967	May	3,091	Below Camanche Dam
1967	May	2,602	Below Woodbridge Dam
1970	February	2,652	Below Camanche Dam
1970	February	2,698	Below Woodbridge Dam
1982	May	3,889	Below Camanche Dam
1982	May	3,523	Below Woodbridge Dam
1983	April	3,726	Below Camanche Dam
1983	April	3,640	Below Woodbridge Dam
1986	March	5,116	Below Camanche Dam
1986	March	4,712	Below Woodbridge Dam
1995	June	3,847	Below Camanche Dam
1995	June	3,504	Below Woodbridge Dam
1997	January	4,978	Below Camanche Dam
1997	January	4,748	Below Woodbridge Dam

Those figures do not include housing and business development below Woodbridge Dam, nor the lower density housing, farms, and businesses that also occur in the 100 year floodplain in rural areas both upstream and downstream of the Lodi area.

In addition, flooding can threaten the integrity of five bridges that cross the river below Camanche Dam, including State Highway 99.

At present, the lower Mokelumne River is witnessing a continued decline in riparian habitat quality and quantity, and a trend towards degradation of watershed natural resources. Agriculture (predominantly viticulture), grazing, and urban/suburban areas are the primary land uses and stressors on the watershed, and the greatest threats to riparian habitat. Within the Central Valley, once extensive riparian forests, up to 10 miles wide, have been mostly removed or severely degraded due to anthropogenic disturbances such as development, water diversion, channelization of rivers, and the encroachment of agriculture (Roberts et al. 1977). Riparian ecosystems in California account for less than one percent of the total land area (Smith 1977).

This riparian vegetation is an important part of reducing flood damage in a watershed. A well established corridor of trees, shrubs, and grasses reinforces stream banks and helps prevent erosion. If the vegetation is a well-developed woodland, it can slow and temporarily hold stormwater and runoff, thereby decreasing flood potential. By helping to slow flood waters, they can reduce the occurrence of debris clogs and property damage to roads, bridges, and levees. These plants give an ancillary benefit of helping to filter sediments, livestock waste, and other pollutants from the water. Structural flood damage reduction elements this project will provide include a levee stabilization/erosion control. By using native perennial bunch grasses (with root systems four to

[1] WSP, 2002

eight feet in length) in riparian areas and especially on levees and stream banks, erosion, scouring, and bank undercutting can be reduced. Stabilizing levees on private property is crucial along the lower Mokelumne, because community input workshops held in the watershed indicate privately owned levees are in need of regular repairs and subject to failure (WSP 2002).

Through the restoration of riparian vegetation at these sites, the ability of the Mokelumne River to absorb its own flood energy will be enhanced. How this vegetation will affect the hydrologic and hydraulic conditions at the project sites and nearby properties will vary from site to site based on planting plans and techniques used to restore these riparian areas.

Inundation of historic floodplain will be provided with a levee setback at the Hoffman site. Approximately 20 acres of historic floodplain will be made available with the levee setback, providing for storage of up to 100 acre feet of water during flood events. It is anticipated that this will help slow the initial pulse of floodwaters down stream, thereby helping to reduce erosion and sedimentation of the river.

Bank protection work is at the core of this project, though neither riprap nor dredging are part of the design. Restoration and enhancement of riparian forest buffers and elimination of invasive species are the main techniques used to provide stream bank protection. However, we do not rule out the use of other natural stream bank treatments including branch packing, brush mattresses, dormant post plantings, live stakes, live fascines, and/or revetments.

The potential reduction of future flooding on and off this site will come from the natural value of riparian areas in the reduction of erosion damage, reducing the velocity of flood flows, and providing bank and levee stabilization. Emergency evacuation routes will be unaffected by this project.

Wildlife and Agricultural Land Conservation Benefits

If this project is funded, it will expand habitat and provide habitat corridors in the Lower Mokelumne River Watershed. Two of the proposed sites are adjacent to sites where restoration projects have been approved for funding and/or are already underway (Ledbetter and Thompson sites). The planned restoration will also seek to eradicate invasive species, further improving habitat values.

In order to address the increasing urgency to protect, manage and adequately restore riparian areas that support healthy bird populations, California Partners In Flight (CPIF) and the Riparian Habitat Joint Venture (RHJV) created the Riparian Bird Conservation Plan (RBCP). The goal of the RBCP is to promote and guide the conservation and restoration of riparian habitat sufficient to support the long-term viability and recovery of native bird populations and associated species (RHJV 2000). Historically, the lower Mokelumne River provided habitat for all of the riparian focal species highlighted in the RBCP (Grinnell and Miller 1944). Comparing recent surveys with historical breeding distribution information shows that 11 of the focal species still use the lower Mokelumne for breeding, migration and/or over-wintering Reeves et al. 2001).

Riparian ecosystems in California account for less than one percent of the total land area (Smith 1977) and are considered the most important habitat for conservation of neotropical migrant and

resident songbirds (Manley and Davidson 1993). Riparian habitat also provides productive breeding grounds and vital over-wintering and migration stopover areas (Cogswell 1962, Gaines 1977), and corridors for dispersal (Geupel et al. 1997). Loss of riparian areas has resulted in the severe decline of Yellow Warblers, Warbling Vireo and Blue Grosbeak among others, and the local extirpation of species such as the Yellow-billed Cuckoo and Bell's Vireo along the Mokelumne River (Reeves et al. 2001) and throughout the Central Valley (Geupel et al. 1997, Geupel et al. 2001).

The decline of riparian ecosystems is also a significant contributing factor to the decline of anadromous fish populations. During the past 150 years, mining, poorly managed livestock grazing, timber harvesting, agriculture as well as recreational and urban development have eliminated or substantially disturbed salmon habitat (Levin/Schiewe 2001). An otherwise clean and healthy river may not be able to support a viable salmon population without healthy riverbank ecosystems. (Cederholm et al. 2000).

Birds are good indicators of ecosystem health and of riparian habitat quality in particular. This is because bird populations are sensitive to a number of important components including the levels of primary and secondary productivity in the system, the structural and species diversity of vegetation, and the size and connectivity of habitat patches. In addition, bird numbers have been demonstrated to respond quickly and positively to some, but not all, habitat restoration efforts (RHJV 2000, Geupel et al 2001b). Thus, bird population response is a good indicator of the success of riparian habitat management and restoration.

In the conceptual model for this project, riparian restoration will increase the diversity and richness of riparian bird focal species utilizing the Mokelumne River corridor. These include, but are not limited to, Swainson's Hawk, Willow Flycatcher, Warbling Vireo, Bank Swallow, Yellow Warbler, Common Yellowthroat, Wilson's Warbler, Yellow-breasted Chat, Song Sparrow, Black-headed Grosbeak, and Blue Grosbeak. Using baseline data already in hand, areas where restoration has already taken place will be monitored to measure how birds respond to newly restored areas. This data will be compared to data from areas that lack riparian vegetation in order to measure restoration success.

The restoration of riparian habitat along the Mokelumne River will be designed to recreate Valley Foothill Riparian Habitat (Mayer and Laudenslayer 1988) consisting primarily of the vegetation series' Fremont Cottonwood and mixed willow (Sawyer and Keeler-Wolf 1994). To accomplish this, BRI will plant a variety of native trees and shrubs will be planted for canopy structure, and sedges and grasses for ground cover. The planting design will seek to enhance existing native vegetation by planting a mosaic around existing native plants to create diversity in vertical and horizontal structure (Geupel et al. 2001b). This model will be used to recreate habitat for a variety of neotropical and resident songbirds (RHJV 2000) and at the same time restoring habitat functions for the entire aquatic system (Cederholm et al. 2000). The restoration will require a number of sequential tasks: developing a planting plan, site preparation, planting with weed mats and herbivory protectors, maintenance, and monitoring.

Maintenance and monitoring are critical components of restoring riparian habitat. Maintenance is necessary to ensure that the installed plants have the opportunity to become established and to compete with existing vegetation including non-native invasive plant species. Maintenance is also

necessary to ensure that areas where plants did not establish are replanted to ensure overall project success. Monitoring is critical to understand how well plants are establishing and growing and to monitor the development of the riparian community overall. Site specific monitoring is necessary to ensure restoration project success. In addition to site specific monitoring, this project requires the monitoring of avifauna and their required habitat.

Riparian restoration designed for wildlife will also aid efforts in the watershed to restore rearing and/or spawning habitat for Chinook salmon and steelhead (Cederholm et al. 2000). Riparian restoration and enhancement benefits anadromous species by: supplying organic material to the aquatic foodweb; adding woody debris to in-stream habitat; altering the amount of sunlight that reaches the river; reducing sedimentation by stabilizing banks and filtering sediment and other materials from runoff; and by providing absorption of nutrients and other chemicals from runoff (Nuramulani et al. 1997, Simon 1999).

The sites generally lack unique ecological or biological diversity, and also lack vegetative complexity. The proposed restoration seeks to remedy those situations by using native plants and developing a planting plan that specifically seeks vertical complexity for the benefit of neotropical migrant songbirds.

The existing habitat components are located in thin strips of riparian vegetation along the river banks, frequently characterized by invasive species. With the river nearby, water is available year round. There are no superior representative examples of specific species or habitats. There are generally only one or two habitat types at each one of the sites of any significance. Pockets of other habitat types do exist, however, the dominant habitat (see Appendix A for habitat maps) is upland agriculture/cropland.

All non-native invasive plants [including Chinese tree of heaven (*Ailanthus altissima),* Himalayan blackberry *(Rubus discolor),* saltcedar *(Tamarisk ramosissma),* and perennial pepperweed *(Lepidium latifolia)*] will be targeted for removal. Weeds will be cut and stacked in burn piles for burning to occur after the weeds have dried enough to carry fire (during the burn season). If fire is not an option, the stacked vegetation will naturally decompose on site and provide habitat for species that utilize debris piles. Immediately after clearing, Rodeo® will be applied to the freshly cut stems.

For trees and shrubs, each containerized stock planting location will prepared by clearing a three-foot diameter circle. Each planting location will have a hole augered into the ground to prepare the location for installing 40D supercell containerized plants. Planting locations will be marked with colored flags denoting species. Trees to be planted will include valley oak (*Quercus lobata*), Fremenot's cottonwood (*Populus fremontii*), sycamore (*Platanus racemosa*), white alder (*Alnus rhombifolia*), boxelder (*Acer negundo*), and Oregon Ash (*Fraximus latifolia*). Shrub species to be planted will include California grape (*Vitis californica*), California Rose (*Rosa californica*), blue elderberry (*Sambucus mexicana*), buttonbush (*Cephalanthus occidentalis*) and species of willows (*Salix*). All plants will be grown from seed collected within the watershed.

All containerized stock will be planted with the entire root system below ground and the stem straight up. Two fertilizer packs will be added six inches from each plant. Mesh weed mats will be

placed around the stem of each plant, and a mesh browse protector will be installed on each plant with two bamboo stakes for support.

Public use and access near most of these sites is limited since most of the property in the watershed is privately held and in agricultural production. However, the public will be able to reap some of the benefits at three public parks along the river (two above, and one below Woodbridge Dam). These parks allow fishing (within seasons), wildlife viewing, picnicking, camping, photography, etc. Landowners at other restoration sites within the watershed have granted permission for others to enter their properties for the purpose of examining riparian restoration in progress. This is critical to the overall success of goals in the WSP for the Mokelumne River. By providing examples of what riparian restoration looks like and demonstrating its compatibility with production agriculture, more landowners are likely to conduct riparian restoration on privately held land.

After the project is completed, some monitoring of habitat and wildlife use of the sites will continue by biologists at East Bay Municipal Utility District (EBMUD). Biologists working for EBMUD map the watershed and conduct annual wildlife surveys. Monitoring stations including pit traps will continue to be used or will be established at these sites. In addition, future grants may provide for additional neotropical migrant bird and other monitoring.

The watershed in the immediate upstream areas of the project sites is similar to those areas at the project sites and below. Upstream towards Camanche Dam, the landscape becomes hillier and there tends to be more livestock grazing than in other areas of the watershed. The area is relatively undeveloped, however the entire watershed faces development pressure as the state's population increases.

Agricultural Land Conservation Benefits

Most of the land in the Lower Mokelumne River Watershed, and especially most of the land close to the river, is involved in commercial agriculture production. The predominant land use in the LMR is agriculture. Grapes are San Joaquin County's number one commodity with a year 2000 value of $296,888,000.00 (WSP, 2002). Vineyards account for 51% of agricultural land use in the LMR, far outpacing other ag land uses in the LMR. The next closest is dairy/grazing, at 31%. Water for agricultural uses is available through agriculture wells and the Woodbridge Irrigation District.

The Lodi area is North America's leading Winegrape producing region and is made up of all of the Winegrape growers in Crush District #11 (750 growers farming 80,000+ acres of vineyards). However, not all of the winegrape growers in Crush District #11 reside within the watershed. The Lodi-Woodbridge Winegrape Commission provides marketing support and consumer/tourism incentives. The Lodi Wine and Visitors Center is also touted as an attraction by the Lodi Convention and Visitors Bureau.

Some of the ecological challenges of winegrowing in California are negative impacts to surface and groundwater quality by providing several sources of non-point source pollution such as offsite movement of pesticides, nutrients, and sediment from vineyards. Other sources of non-point source pollution resulting from growing wine grapes include disking of vineyard soil and sulfur dusting, which can result in PM 10's that wash out in rain.

Furthermore, the recent appearance in California of the Glassy-winged sharpshooter, *Homalodisca coagulata*, and the recent appearance in Sacramento County of the vine mealybug, *Plannoccus* ficus, not only represent significant pest problems for winegrowers in the watershed, but threaten the industry's goal of low chemical inputs as a result of increased spraying of pesticides to control this pest. Additionally, vineyard development in some areas has raised serious issues of negative impacts in ecosystem functions.

The California wine community is also facing economic challenges in the global wine marketplace where currently there is an excess of wine grapes and wine, and in many cases highly subsidized competition. Winegrowers in the golden state also face many social and human resource challenges such as worker safety issues, adequate numbers of reliable, well-trained workers, and interactions with community members in the agriculture-urban interface.

The Lodi Winegrower's Workbook program was developed to meet the above challenges in the Lodi winegrowing region. The workbook is a self-assessment developed by Lodi winegrowers for Lodi winegrowers that they can use to measure the level of adoption of sustainable farming practices, identify problems on their farms, and develop action plans to address these problems. Several regions and crops in California have core grower groups using sustainable practices, but up until now, there has been no effective method for delivering this knowledge to the average grower to achieve adoption on an industry-wide scale.

The workbook addresses all aspects of the farming of wine grapes, promoting good stewardship of the soil through practices that enhance its quality, efficient water use in farming operations and protection of surface and groundwater quality, conservation and enhancement of wildlife habitat in and around the vineyard and in riparian areas, and promoted the use of sustainable pest management practices.

Lodi Winegrowers Workbook has stimulated the California wine industry to develop a self assessment workbook for the entire winegrowing industry as a part of its Sustainable Winegrowing Practices (SWP) project[2]. The SWP workbook was published in October 2002 and not only contains an assessment for sustainable vineyard practices but also an assessment for sustainable practices inside the winery. The chapters pertaining to sustainable vineyard practices are directly adapted from the Lodi Winegrower's Workbook.

The project sites are not under Williamson Act contracts. The surrounding area is characterized as agricultural, though the city of Lodi (population 56,999 U.S. census 2000) lies in about the middle of the watershed, including housing along the river and in the floodplain. The town of Woodbridge is immediately adjacent to Lodi and also has residential housing along the river and in the floodplain. There are some low density ranchette communities popping up in the watershed, and there are some in proximity to these sites, however agriculture remains the dominant land use in the area.

The land uses of nearby parcels are currently agriculture. This project is compatible with nearby farming operations and may encourage nearby landowners to conduct riparian restoration on their properties. Land use at the project sites is consistent with the local general plan. Though the parcels are developable, at this time other areas of the watershed are under more development pressure and

[2] See www.wineinstitute.org for more information on the SWP

these parcels will likely remain in agricultural production for the long term. Some of the landowners involved are interested in pursuing conservation after riparian restoration has taken place.

Miscellaneous Benefits and Quality of Proposal

Estimate Total Project Cost	$2,042,752.85
Amount of FPCP Grant Funds Requested	$1,604,880.20
Amount of Local Funds Contributed	
Amount of In-kind Contributions	$ 192,500.00
Additional Funding Sources	$ 245,372.65

Number of persons expected to benefit	6,000
Flood Protection Corridor Funds per person benefited	$267.48

Any ground water recharge benefits will be incidental and depend on the occurrence of flooding in restored areas and levee setback areas. The project, through restored native vegetation, especially grasses, will trap and filter sediment.

Scientific and technical expertise will be required in the design of the planting plan and oversight and management of the invasive species removal and planting. Additional expertise is needed to secure needed permits for the work. All these items are provided for in the grant proposal.

Maintenance will be conducted immediately after plant installation is complete. The maintenance regimen will include weed management and replacement planting. Weed management will consist of continuously targeting problem species on site by mowing and Rodeo® application. If weed management is successful as anticipated, costs for management will reduce during the three-year course of this project.

During the late fall of years two and three, replacement plants will be installed to ensure project success. Each fall, 20 percent of initial tree and shrub planting numbers will be installed. For grasses and sedges, 5 percent of initial plantings will be installed. If mortality is low after each growing season, then replacement plantings will be used to enhance the original planting. If plant mortality is high, planting will infill areas of low cover.

Monitoring

Monitoring will be conducted to assess plant health and habitat development. Annual vigor assessments will be used to determine plant health. Habitat development will be measured via a series of methodologies recording cover for each species encountered within plotted areas. Vigor assessments will be used to determine the health of each containerized tree and shrub planted. Plants will be rated on a scale of 0 to 4 with 0 being a dead plant and 4 showing excellent growth during the growing season. All dead plants will be replaced with a new plant of the same species (up to 20% of original planting numbers for trees and shrubs, and 5% for grasses and sedges).

Habitat assessment will include cover/frequency studies using randomly selected 40 meter transects (Elzinga et al. 2000) across the riparian corridor. Starting at five meters and progressing every five meters along each transect, cover will be recorded for the herbaceous layer, shrub layer, and tree canopy (Elzinga et al. 2000)

Ground cover will be measured by running eight 2 meter transects perpendicular to the main transect line. These transects will alternate on each side of the main transect line. A 20cm x 50cm frame will be placed parallel with the 2m transect tape. Total cover will be recorded using Daubenmire cover classes as modified by Bonham (1989) for each species encountered with the frame. The frame will then be shifted to 0.5m, 1m, and 1.5m marks resulting in cover readings of a 2m x 20cm strip. Cover will be recorded for each species at each mark for a total of four cover readings per 2m transect, and 36 cover readings for the main transect. Average cover for each species will be determined by dividing the total cover for each species by 36. Frequency will be determined by totaling the number of times a single species is found in each cover frame and dividing by 36.

Two approaches will be used to monitor shrub canopy. The first uses a densiometer placed on the ground at each 5m interval and canopy cover read from the grid to determine total shrub cover. The second entails recording cover using the same cover classes as used for ground cover for each species of shrub encountered within a 1m radius circle from the 5m interval. Sapling trees will be recorded as shrubs until they have a diameter at breast height (dbh) greater than 10cm.

Two approaches will be used to monitor tree cover. All trees within 10m on either side of the 40m transect will be measured for dbh, and basal area for each species will be calculated (Elzinga et al. 2000). At each 5m interval along each transect a densiometer will be used to record overstory canopy cover for each of the four cardinal directions. Average cover will be calculated by adding the total cover from the four readings and dividing by four.

The above tasks are expected to result in the successful development of Valley Foothill Riparian Habitat along the prescribed sections of the lower Mokelumne River. The maintenance and monitoring tasks will ensure that the native plants planted on the revegetation site will effectively out-compete non-native invasive plants, and over time eliminate these problem species.

This monitoring is built into the proposal, as is administration to make sure the project is on schedule and within budget parameters. In addition, the budget includes staff time for compiling and preparing quarterly reports.

Bird Monitoring

Point count surveys are a standard monitoring technique (Ralph et al. 1993 and 1995) that Point Reyes Bird Observatory (PRBO) has used widely in the Central Valley since 1993 at various locations along the Sacramento, Cosumnes, and San Joaquin rivers. Point count surveys are one of the most efficient and data-rich methods of monitoring landbird populations. The data are used to calculate secondary population parameters, such as abundance, species richness and diversity. Using the point count method, we can detect annual changes in bird populations, differences in species composition between different habitat types, and abundance patterns of species. Vegetation characteristics (measured at each point count station) will be related to changes in bird species composition and abundance across the stations. These data can be used to evaluate the quality of existing habitat and help guide where and how restoration could be implemented to improve habitat conditions for riparian birds.

All point count stations (approximately 100 stations total) will be visited three times during the breeding season (mid-April through June) following standard protocol (Ralph et al. 1995). Surveys

will be conducted by a trained PRBO field biologist, familiar with the identification of local bird species by sight and sound. Surveys will start at sunrise and be completed within four hours to ensure that birds are monitored during the period when they are most active. Each point will be surveyed for five minutes and all bird detections by sight, song and call will be recorded. Observers will also record any sign of breeding activity (e.g., courtship, nest-building, carrying food). General weather conditions such as temperature, wind speed and percentage of cloud cover will also be noted.

Vegetation data will be collected at point count stations that can be used to relate the differences in bird species composition and abundance to differences in vegetation. Vegetation assessment will be conducted using the releve method (Mueller-Dombois and Ellenberg 1974, Ralph et al. 1993). A 50-meter radius plot, centered on the point count location, will be described using general habitat characteristics including aspect, slope, and maximum tree diameter-at-breast height (dbh). Total cover over the plot of trees, shrubs, herbaceous species, litter, water, and ground will be estimated as well as height of each layer. For each vegetation layer (trees, shrubs, herbaceous species), species composition and relative cover will be recorded as a percentage of total cover for that layer.

Standardized mist-netting at two sites is being proposed to provide important demographic information on songbirds within riparian habitat along the Mokelumne River. By examining individuals captured in the nets for signs of active breeding condition (i.e., cloacal protuberance, brood patch) we can supplement information gained from point count and accurately determine if those species are using the riparian habitat along the Mokelumne River to breed. Furthermore, results from mist-netting can be used to determine where local populations are limited (Nur et al 1999). By determining productivity based on the ratio of young birds versus adults captured in the nets we can predict the future viability of local songbird populations (DeSante and Geupel 1987 , Nur et al 1999). Using recaptures of adults over 3 years of data collection we can estimate annual survivorship and determine if events on the wintering grounds are limiting populations (Chase et al 1999, Nur et al. 1999).

Mist-netting and banding will be conducted per guidelines described in Ralph et al (1993). A banding site will be established at an appropriate station with an array of 10 nets to be operated once in a ten-day period, for a total of ten times during the breeding season between 1 May and 10 August. Following standardized protocol, nets will be unfurled 15 minutes after local sunrise, checked every 30 to 45 minutes (more often in hot weather) and operated for five hours.

Birds captured in the nets will be removed and processed on-site with all individuals (except hummingbirds and game birds) receiving a standard aluminum U.S. Geological Survey Biological Resource Division (BRD) band for permanent identification. Age, sex, wing length, breeding condition, weight, skull ossification, flight feather wear, molt, and fat score of each bird will be recorded as described by Pyle et al. (1997) prior to release of the bird. Birds aged as hatched from a nest during the 2001 breeding season will be recorded as hatch-year-birds and adults (individuals hatched during previous breeding seasons) as after-hatch-year birds. Estimates of survivorship can be generated from recapture rates of banded individuals the following year.

All mist-net data will be submitted to both the U.S. Geological Survey Biological Resource Division's Bird Banding Laboratory and the MAPS program of the Institute for Bird Populations (IBP) in Point Reyes Station, CA.

Mist-netting and banding at two sites during fall migration is proposed to provide information on songbirds, including Neotropical migrants, using riparian habitat along the Mokelumne River as a stop-over and dispersal site. Protocol will follow guidelines from the Migration Monitoring Council (Hussell and Ralph 1995) and will be conducted once a week at the same sites established during the breeding season from late August through October. Mist-netting will be conducted according to the protocol described above for the breeding season.

Area search plots, located at the mist-net sites, will be censused during mist-net operation to provide additional information on bird species using the area during migration. Mist nets do not sample larger bird species such as raptors, waterbirds, etc. and conducting area search censuses will document what other species are using the area. Area search protocol will follow guidelines described by Ralph et al. (1993) with three plots, each approximately 3 hectares, encompassing the mist-net site. Each plot will be censused for 20 minutes and all individuals detected; type of detection (i.e., visual, song, call) and flocking behavior will be recorded on standardized data forms.

Nest monitoring is proposed to investigate songbird productivity within the riparian corridor, a direct measure of songbird population health. Productivity estimates provide information on whether a local population of birds is viable based on nesting success. Nest searching plots will be established at 2 sites. Nests will be located and monitored by PRBO biologists following BBIRD protocol, minimizing human induced predation probability and disturbance to the adults and nest site (Martin and Conway 1997, Martin and Geupel 1993). All data will be shared with the USFWS co-op unit at the University of Montana for inclusion in BBIRD, a national monitoring and research program that receives data from over 20,000 nests per year in North America (Martin and Conway 1997). Vegetation measurements of nest substrate will be conducted after completion of nest cycles. Spot mapping will also be conducted by PRBO biologists at the nest-searching plots to determine the number of pairs of focal riparian species holding breeding territories. The same observer will visit each plot a minimum of eight times during the breeding season, mapping all territorial individuals. (see Ralph et al. 1993 for review).

Bird monitoring along the Lower Mokelumne River will be paid for as part of a previously awarded CALFED grant to the San Joaquin County Resource Conservation District.[3] Sites restored under this proposal will be included as monitoring sites by PRBO.

The SJRCD is a special district authorized by the State Legislature and was formed from the combination of the Bear Creek and Tracy RCDs in 1989. The SJRCD has seven board members that live across San Joaquin County, and has successfully administered EPA, NRCS, and CALFED grants for the development and implementation of public outreach and education programs regarding natural resources in San Joaquin County. The district also has experience administering grants from the Department of Conservation for a Watershed Coordinator (ongoing) and from CALFED for fish

[3] 2002 Ecosystem Restoration Program, proposal # 142 Restoration and Monitoring of Riparian Habitat Corridors Along The Lower Mokelumne River.

passage improvement and riparian restoration along Murphy Creek, a tributary of the Mokelumne River.

SJRCD president **John Meek, Jr**. has farmed and managed farm properties all of his adult life. John has managed 10,000 acres of citrus, cotton, and native pasture. John currently farms 7,500 acres of land, including 1,800 acres in the Delta. In 2000, he began his own firm, J Meek Agribusiness Management. John is an accredited member of the American Society of Farm Managers and Rural Appraisers (ASFMRA). Besides serving on the SJCRCD Board, John also serves on the boards of the Greater Stockton Emergency Food Bank, Cascade Mutual Water Company, and is a member of the ASFMRA Farm Manager Committee

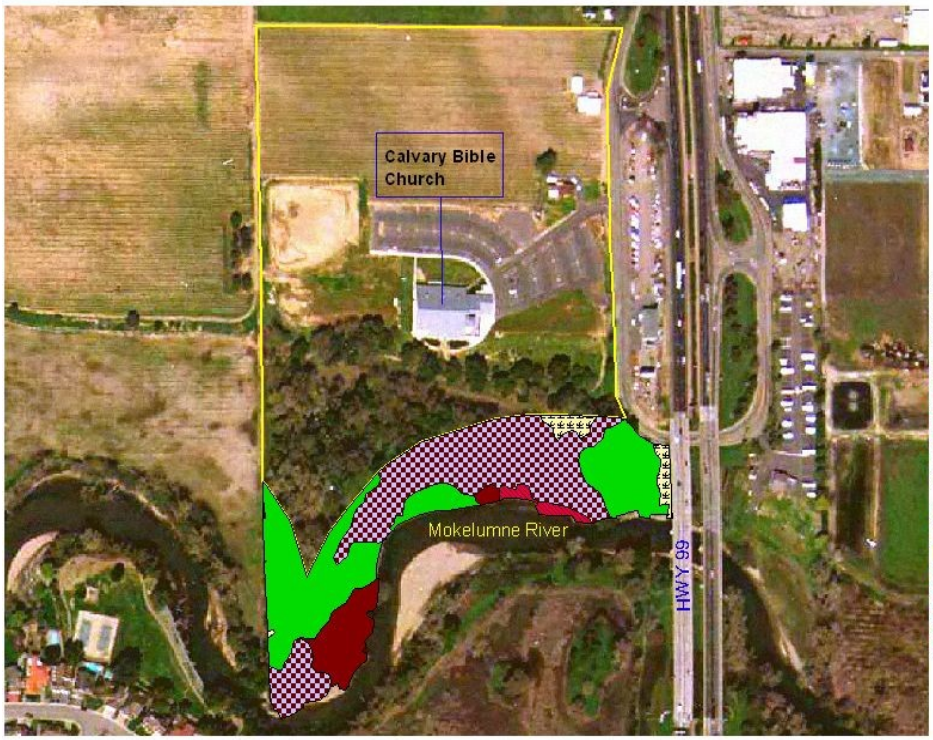
John Brodie has been the only watershed coordinator for the Lower Mokelumne River Watershed. After a career in radio and television, he turned an avocation as a conservation-minded sportsman into a career. He worked for the Ohio Chapter of the Nature Conservancy before his wife accepted a job with the University of the Pacific in Stockton and the family moved to California.

PRBO has been conducting riparian bird monitoring projects throughout the Central Valley in the following watersheds: lower Sacramento River from Red Bluff to Colusa, San Joaquin River, Clear Creek, Cosumnes, and Lassen Foothills area. PRBO also inventoried numerous other watersheds in 1998 and 1999 as part of a Packard Foundation-funded riparian bird initiative. Ongoing programs at PRBO (Palomarin and Southeast Farallon Island Field stations) represent two of the oldest databases on landbird populations in western North America. Results of these studies have contributed significantly to current protocols now used to monitor and assess bird populations throughout the New World. PRBO biologists have been instrumental in the development, standardization and validation of the integrated methods used for terrestrial birds.

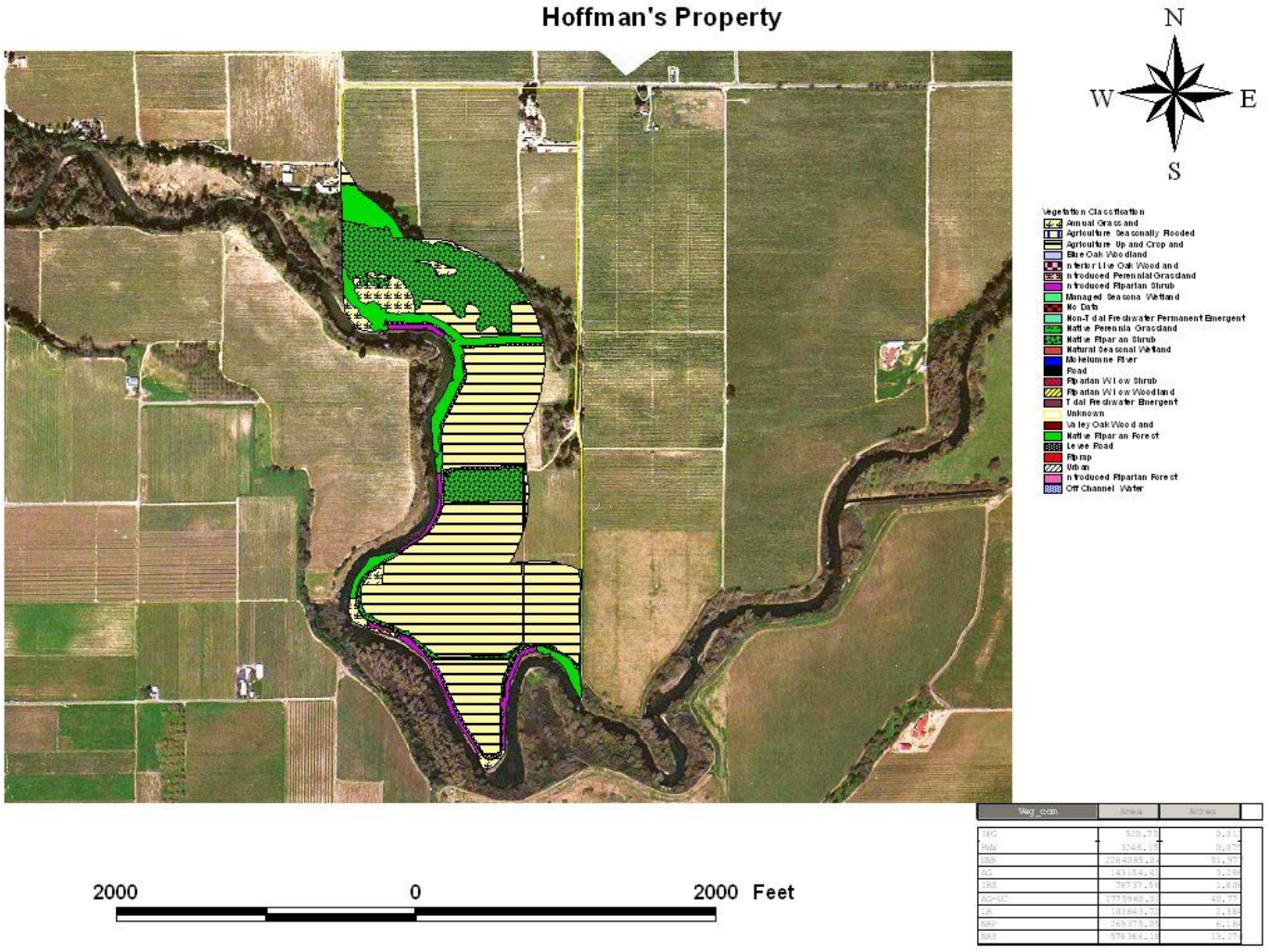
Geoffrey R. Geupel has a degree from Lewis and Clark College (BS Biology 1978) and has been employed as a biologist at PRBO for 21 years. He is currently Director of the Terrestrial Program at PRBO, has over 20 years experience in ornithological monitoring and research and has authored over 30 reviewed publications. Recent publications and presentations have helped define bird-monitoring protocols now used throughout North America. He has taught numerous technical workshops on bird monitoring and currently oversees 40 field biologists annually. Current areas of interest include breeding and population biology, bird response to habitat restoration, and conservation planning. He is currently: Co-Chair of California Partners in Flight, Chair of the Riparian Habitat Joint Venture's Science Committee, Board member of the Central Valley Joint Venture, and member of both the National Cowbird Advisory Council and Important Bird Area (IBA) National Technical Committee.

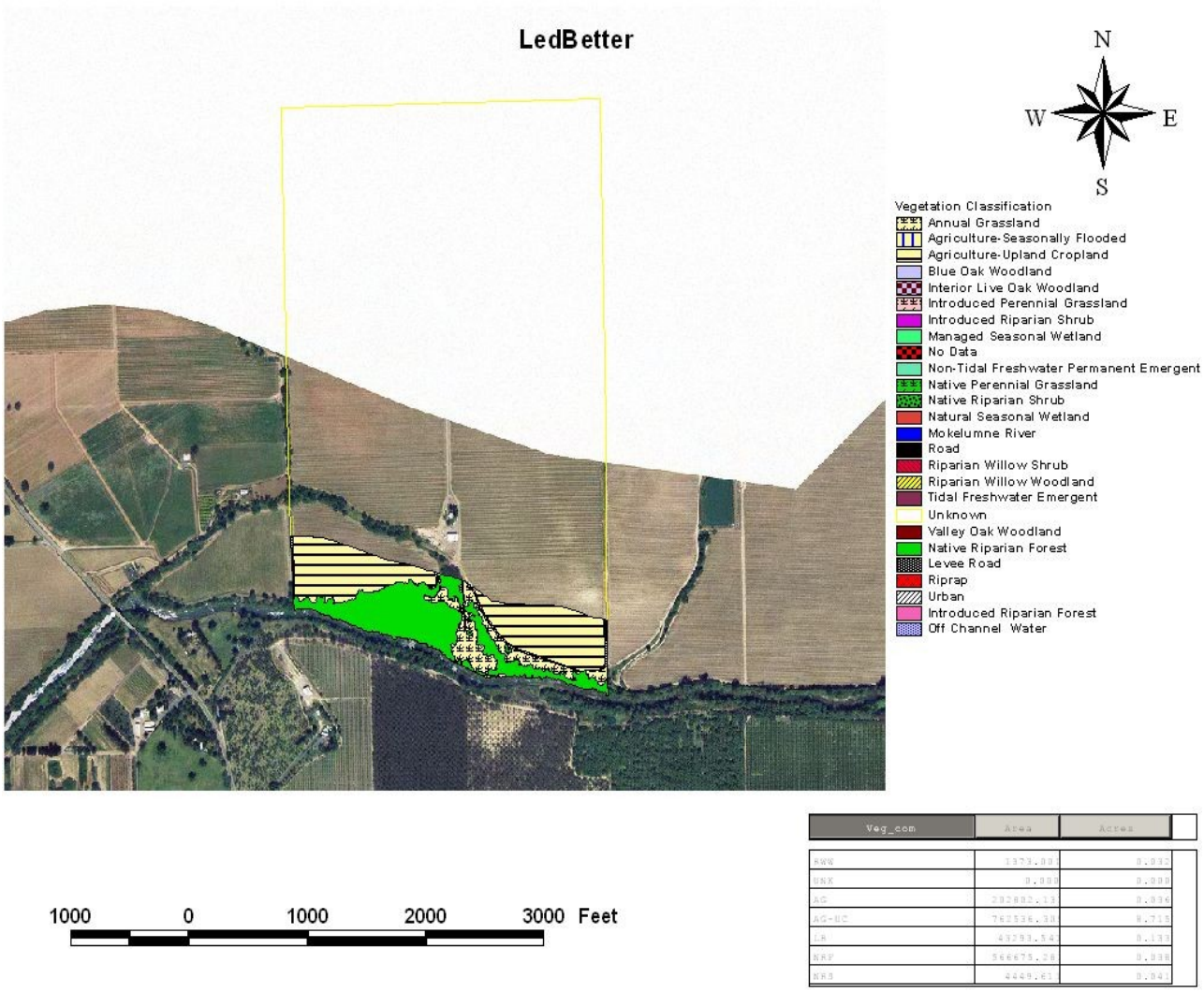
EBMUD will undertake and/or oversee the technical monitoring actions for the project including: logistical coordination for the riparian bird monitoring; monitoring amphibian, reptile, and mammal populations; sampling fish populations; water quality sampling (if citizen monitors are unavailable or are unable to conduct sampling); measuring water flows; and other measures as indicated in the monitoring plan. The SJRCD will work with EBMUD and the community to establish photo points to measure the success of riparian restoration efforts. EBMUD salaries and equipment provide $192,500 cost-sharing. This is from 3 EBMUD biologists ($45,000 each for 3 biologists = $135,000; $50/hour) EBMUD support staff ($50,000; $15/hour) and EBMUD equipment ($7,500).

Appendix A

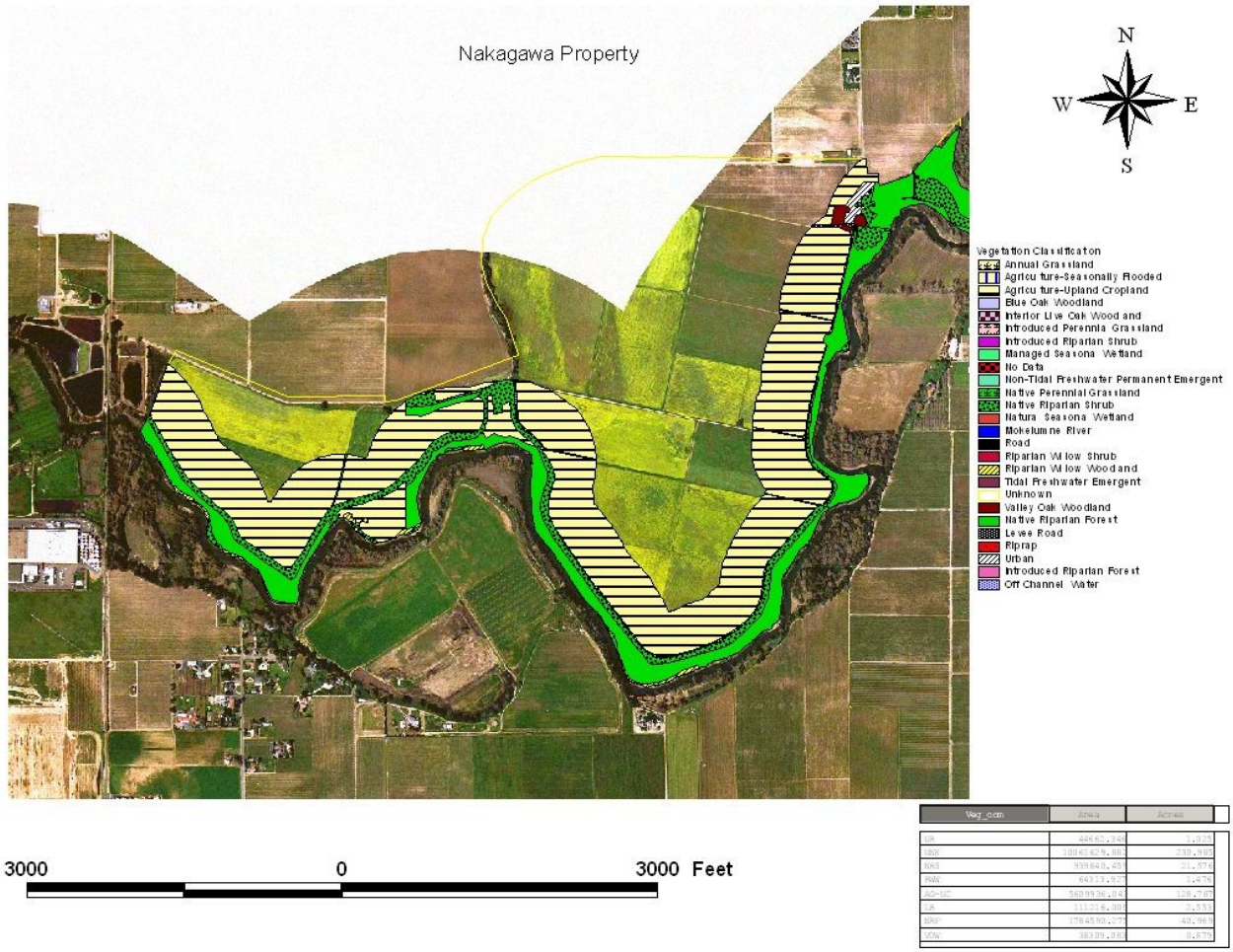


Veg_com	Area	Acres
AG	13906.340	0.319
ILOW	155200.312	3.565
NRF	145534.590	3.341
R	34.049	0.001
RWS	7442.827	0.171
UNK	1253821.039	28.784
VOW	37264.669	0.855


Hoffman's Property
N
W
E
S
Vegetation Classification
Annual Grassland
Agriculture Seasonally Flooded
Agriculture Upland Cropland
Blue Oak Woodland
Interior Live Oak Woodland
Introduced Perennial Grassland
Introduced Riparian Shrub
Managed Seasonal Wetland
No Data
Non-Tidal Freshwater Permanent Emergent
Native Perennial Grassland
Native Riparian Shrub
Natural Seasonal Wetland
Mokelumne River
Road
Riparian Willow Shrub
Riparian Willow Woodland
Tidal Freshwater Emergent
Unknown
Valley Oak Woodland
Native Riparian Forest
Levee Road
Riprap
Urban
Introduced Riparian Forest
Off Channel Water
2000
0
2000 Feet



Veg_com	Area	Acres
RWW	1373.00	0.032
UNK	0.00	0.000
AG	282802.13	6.494
AG-NC	762536.38	17.506
LR	49293.54	1.131
NRF	566675.25	13.009
NRS	4449.62	0.102


Nakagawa Property
N
W
E
S
Vegetation Classification
Annual Grassland
Agriculture-Seasonally Flooded
Agriculture-Upland Cropland
Blue Oak Woodland
Interior Live Oak Woodland
Introduced Perennial Grassland
Introduced Riparian Shrub
Managed Seasonal Wetland
No Data
Non-Tidal Freshwater Permanent Emergent
Native Perennial Grassland
Native Riparian Shrub
Natural Seasonal Wetland
Mokelumne River
Road
Riparian Willow Shrub
Riparian Willow Woodland
Tidal Freshwater Emergent
Unknown
Valley Oak Woodland
Native Riparian Forest
Levee Road
Riprap
Urban
Introduced Riparian Forest
Off Channel Water
3000
0
3000 Feet

Appendix B