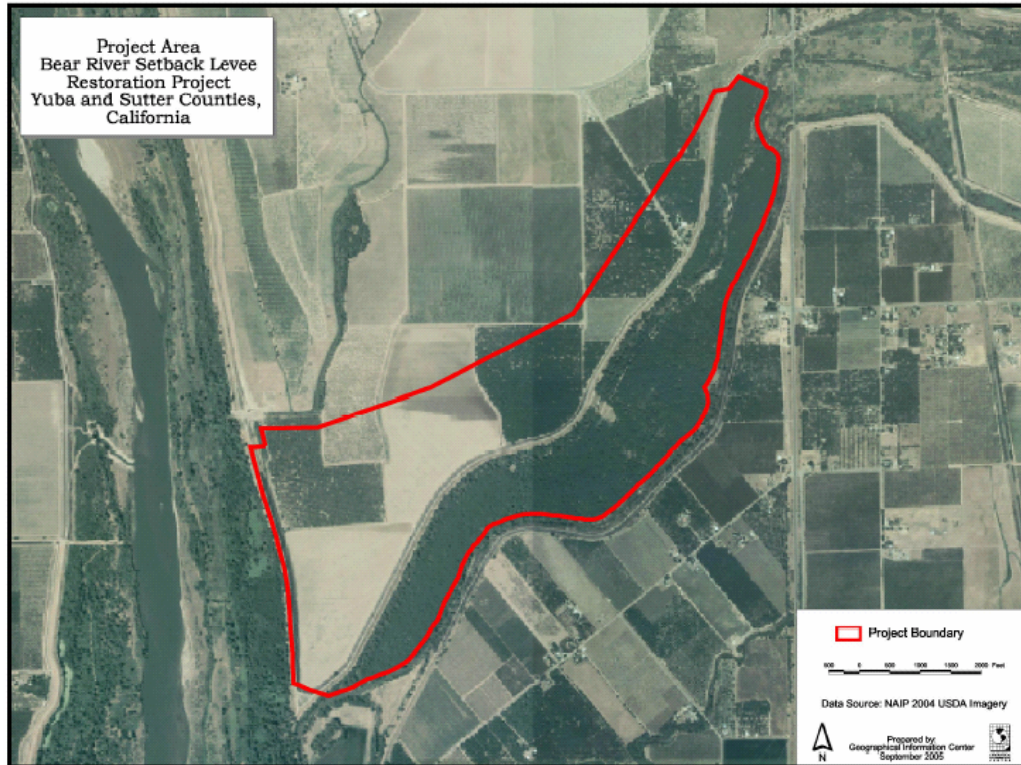


ISSUED FOR APPROVAL

Riparian Restoration Plan for the Bear River Setback Levee Project

Bear River Miles 2-4 R, Feather River Mile 12 L
Yuba and Sutter Counties, California

December 15, 2005



Prepared for:



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About the cover:

Aerial photograph of the Bear River Setback Levee Restoration Project boundary.

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RIPARIAN RESTORATION PLAN FOR THE BEAR RIVER SETBACK LEVEE PROJECT, BEAR RIVER MILES 0-3.2 AND FEATHER RIVER MILE 12 L, YUBA AND SUTTER COUNTIES, CALIFORNIA

EXECUTIVE SUMMARY

The Three Rivers Levee Improvement Authority (TRLIA) is a joint powers authority with the mission of advancing the flood safety of southwestern Yuba County, California. TRLIA's member agencies include Reclamation District (RD) 784 and the County of Yuba. The southwestern portion of Yuba County is subject to seasonal flood threats from many rivers and creeks, including the Yuba River, Feather River, Bear River, Western Pacific Interceptor Canal (WPIC), and tributary drainages. Because of this flood risk, many local rivers have been confined by constructed levees. Most of the current levee systems in Yuba County were built during the 1920s using construction practices of that era.

TRLIA is modifying the levee system in southwestern Yuba County to address identified deficiencies in the system and to reduce river stages by increasing Bear River floodway capacity. Increasing the Bear River floodway capacity will be achieved through a levee setback on the lower Bear River. The levee setback also provides significant opportunities to enhance the ecological values of the project area through restoration of native habitats in the levee setback area, complemented by native habitat restoration in the adjacent existing floodway area.

The levee setback project site consists of 395 acres in the levee setback area, including the footprint of the setback levee, and 300 acres in the existing floodway. More than half of the project site between the existing levee and the setback levee alignment contains orchards, with the remainder occupied by row crop fields and developed areas. The agricultural and developed uses will be discontinued and the orchards removed from this area. The walnut orchard will also be removed from the floodway portion of the project site.

With the cessation of agricultural practices, frequent flood events, and nearby seed sources, native plant recruitment will occur on the project site. However, assessment of soil and anticipated hydrologic conditions indicates that without active restoration, the project site is likely to become dominated by non-native weedy species. Weed communities generally do not provide good-quality habitat for most wildlife.

The riparian restoration described in this plan will use native species of trees, shrubs, grasses, and herbaceous understory to provide high-quality wildlife habitat and minimize weed establishment. Soil analyses and water table depth indicate that the levee setback area, like the existing floodplain, is well suited to supporting a dense stand of riparian vegetation. Hydrology appears to be the major factor regulating

vegetative growth on this site. The post-project flooding regime on the site will provide the necessary hydrologic conditions to support riparian vegetation.

Several opportunities to provide habitat for sensitive species are available in the Bear River setback levee project area and orchard within the existing Bear River floodplain. Shaded riverine aquatic (SRA) habitat and valley oak riparian forest components of the restoration design will enhance habitat for fish species, including Central Valley salmon species and steelhead. Riparian forest and adjacent grassland will provide nesting and foraging habitat for Swainson's hawk. Elderberry shrub clusters that may provide habitat for the valley elderberry longhorn beetle (VELB) will be provided in the restoration area. Dense clusters of a variety of shrub species are included to support a diversity of migratory songbirds. In addition, several mitigation requirements for effects of TRLIA's ongoing levee improvements are embedded in the restoration plant design. These include several categories of waters of the United States as well as VELB mitigation.

The objectives of the Restoration Plan are to:

- enhance and restore fish, wildlife, and riparian habitat in the project area;
- maximize a variety of riparian plant communities and other floodplain habitat types;
- meet hydraulic roughness value objectives in the expanded floodway;
- enhance connectivity between adjacent riparian habitats and river channels;
- minimize long-term operations and maintenance costs;
- provide mitigation for terrestrial resource impacts of TRLIA's levee improvement activities to the extent possible; and
- provide protection for a known archaeological site within the levee setback area.

The Restoration Plan encompasses 521 acres of native habitat types—including high acreages of cottonwood/willow association, valley oak riparian forest, riparian scrub, and grassland/savanna—within the levee setback area, on remnant levee segments, and in the floodway. It also includes enhancing shaded riverine aquatic (SRA) habitat within 68 acres along the secondary Bear River channel. (The remainder of the project site will consist of the 56-acre setback levee footprint and right-of-way and a 50-acre area being developed by Wildlands, which will include Swainson's hawk mitigation.)

The plant design included in the plan is intended to:

- communicate project layout to the restoration contractor, regulatory agencies, and project stakeholders;
- decrease cost while maintaining integrity of the plant design;
- match plant placement to site conditions, management objectives, and wildlife habitat requirements;
- estimate plant material so that appropriate numbers can be cultivated;
- provide a framework to document and analyze plant survivorship; and
- provide a framework for adaptive management decisions regarding replanting, if necessary.

Planting preparation would begin in spring 2006. Most planting would take place in fall and winter 2006–07, followed by planting of grasses and herbaceous understory in riparian areas in 2007–08. The plan includes monitoring, comparison with performance goals, and adaptive management as necessary.

I. INTRODUCTION

A. Project Overview

The Three Rivers Levee Improvement Authority (TRLIA) is a joint powers authority with the mission of advancing the flood safety of southwestern Yuba County, California. TRLIA's member agencies include Reclamation District (RD) 784 and the County of Yuba. The southwestern portion of Yuba County is subject to seasonal flood threats from many rivers and creeks, including the Yuba River, Feather River, Bear River, Western Pacific Interceptor Canal (WPIC), and tributary drainages. Because of this flood risk, many local rivers have been confined by constructed levees. Most of the current levee systems in Yuba County were built during the 1920s using construction practices of that era.

TRLIA is modifying the levee system in southwestern Yuba County to address identified deficiencies in the system and to reduce river stages by increasing Bear River floodway capacity. Increasing the Bear River floodway capacity will be achieved through a levee setback on the lower Bear River. The setback levee also provides significant opportunities to enhance the ecological values of the project area through restoration of native habitats in the setback area, complemented by native habitat restoration in the adjacent existing floodway area.

River Partners, a 501(c)(3) non-profit corporation based in Chico, was contracted by Bookman-Edmonston, a division of GEI Consultants (B-E/GEI) to design the environmental enhancement work that is an integral component of TRLIA's Bear River Setback Levee Project.

The setback levee will entail setting back the Bear River right bank levee from the mouth of the Bear River to RM 3.2. The length of the setback levee is approximately 2 miles. Portions of the existing Bear and Feather River levees will be degraded to allow water to flow into the levee setback area during high river stages. Two segments of the right bank Bear River levee, totaling approximately 7,800 lineal feet, will be degraded to the toe elevation. Approximately 1,500 lineal feet of the lowest segment of Feather River left bank levee and a 200-foot-long notch will be removed to the toe elevation to facilitate hydraulic and ecological connectivity with the Feather River floodplain. Remaining portions of the existing levees that are no longer required for flood control will remain intact for habitat enhancement and will not be maintained for flood control purposes.

The project will reconnect and restore approximately 339 acres of floodplain (setback area) and will restore or enhance approximately 300 acres of land in the current floodplain near the confluence of the Feather and Bear Rivers that is particularly suitable for riparian restoration and mitigation. A breakdown of the project acreage is shown in Table 1. Restoration of the floodway expansion area will create and improve fish and wildlife habitat that have previously been reduced or damaged along the lower Feather and Bear Rivers. Restoration of the levee setback area and the existing Bear River floodplain between Bear RM 2.0 and 3.5, which is currently occupied by a walnut

orchard, will include low-density planting between Bear RM 2.7 and RM 3.5 to optimize floodway capacity, as described later in this report.

Table 1. Bear River Setback Levee Project Land Areas.

Project Land Areas	
Acres	
Setback Area	
New levee footprint (including toe ROW)	56
Setback area between existing and new levee	281
Existing Bear and Feather River levee footprint	58
Existing Bear River floodway	300
Total	695
Restoration/Mitigation, Levee and Channel Areas	
Acres	
Riparian Restoration Subtotal	496
Mitigation	
Corps 404 Mitigation	38
VELB Mitigation	10
Swainson's Hawk Mitigation	39
Mitigation Subtotal	87
Enhancement Subtotal	56¹
Setback Levee Footprint Subtotal	56
Total	695

¹ Includes native grass, channel, and existing riparian areas to be enhanced

This Restoration Plan assumes the following structural conditions within the project boundary:

- segments of the Bear River levee (approximately 62%) will be removed;
- sections of the Feather River levee (approximately 38%) will be degraded;
- a swale will be constructed to convey floodwaters back to the Bear River channel;
- no permanent borrow pits will be excavated in the setback area; and
- the Bear River channel alignment will not be modified.

B. Purpose of the Restoration Plan

Floodplains and associated riparian vegetation support natural biotic communities that are becoming increasingly scarce in the Central Valley. Environmental enhancement of the Bear River setback levee project area and adjacent Bear River floodway will partially restore these communities to their former range. The Restoration Plan identifies project goals, objectives, management hypotheses, implementation procedures, and potential implementation challenges for the restoration of riparian habitats on the project site.

The Restoration Plan summarizes current and historical site conditions, such as land-use, soils, topography, hydrology, vegetation, and wildlife, that have been used to guide the formation of a conceptual site model, and provides an outline of the physical and biological factors that influence site ecology. The conceptual site model, in turn, is the basis for a plant design that is specific to the soils, topography, and anticipated hydrology of the setback levee area and adjacent floodway. Additionally, the restoration design encompasses several mitigation requirements of TRLIA's levee improvement projects. Implementation and management recommendations, as well as a timeline for project milestones, are discussed. To the extent possible, the restoration concept has been designed to reduce operation and maintenance (O & M) costs associated with long-term management of the project site and allow for a return to the natural physical and biological processes within the project area.

C. Restoration Goals and Objectives

Several goals and objectives have been identified for the Bear River Setback Levee Project (TRLIA, 2004a). These goals also delineate the parameters for the environmental enhancement work. Additional objectives specifically guide the actions devoted to habitat restoration. Table 2 summarizes the environmental enhancement process or study goals that guided the development of the Restoration Plan. The special considerations define some of the issues that will guide implementation.

The primary goal of the environmental enhancement work is to identify a feasible restoration project to:

- enhance and restore fish, wildlife, and riparian habitat in the project area;
- maximize a variety of riparian plant communities and other floodplain habitat types;
- meet hydraulic roughness value objectives in the expanded floodway;
- enhance connectivity between adjacent riparian habitats and river channels;
- minimize long-term O & M costs;
- provide mitigation for terrestrial resource impacts of the TRLIA flood control projects to the extent possible; and
- provide protection for a known archaeological site within the levee setback area.

Table 2. Process goals, objectives, and special considerations for riparian restoration.

Overall Process Goals
<ul style="list-style-type: none">▪ Collaborate with local entities and stakeholders to identify and address restoration issues and concerns.▪ Produce a restoration plan for the Bear River setback levee area to identify, evaluate, and detail site-specific project implementation activities.▪ Evaluate restoration options with hydraulic modeling and assessment.
Purpose of Riparian Restoration Plan
<ul style="list-style-type: none">▪ Identify project goals, objectives, management hypotheses, and potential implementation challenges for the riparian restoration of the setback levee area,▪ Summarize the site history, soils, topography, hydrology, vegetation, and wildlife,▪ Outline current understanding of the physical and biological factors that influence site ecology (a conceptual site model),▪ Describe the plant design for the setback levee area and the rationale for its selection,▪ Set forth procedures for implementation of the riparian restoration, and▪ Provide a timeline for project milestones.
Summary of Special Considerations
<p>Any future management activities on the site should:</p> <ul style="list-style-type: none">▪ Protect archeological resources,▪ Develop measures to reduce potential for colonization of invasive, non-native plants,▪ Support measures to prevent potential for fish stranding, and▪ Use local seed sources.

II. SITE DESCRIPTION

A. Location

The Bear River Setback Levee Project is located 13 miles south of Marysville in Yuba County (Figure 1). The project area lies on the east bank of the Feather River at RM 12, downstream of Star Bend. The proposed environmental enhancement work (restoration and mitigation) will take place within the levee setback area and the Bear River floodway (Figure 2). The site is bordered on the west by the 698-acre Lake of the Woods Management Unit of the Feather River State Wildlife Area, owned by the State of California and managed by California Department of Fish and Game (DFG). To the northeast of the proposed setback levee area and just east of State Route 70 is the 5,000-acre Plumas Lake Specific Plan area. The Plumas Lake Specific Plan, adopted in 1993, includes a variety of land use designations that would allow the construction of approximately 12,000 dwelling units and 610 acres of commercial and industrial land uses.

B. Land-use History

The Bear River setback levee project area contains two known prehistoric archaeological sites, with several others located nearby. At the time of Euro-American contact, the native peoples living in the Sacramento Valley identified themselves as Nisenan or Southern Maidu, a group of Penutian-language speakers who had moved into the area about 1,000 years before (Moratto, 1984). The Valley Nisenan settled in villages on elevated landforms adjacent to major rivers, with populations ranging from about 100 to 1,200 inhabitants. Villages that were occupied in or near the project area during the ethnographic contact period were known as "Holloh" and "Lelikian" (Wilson and Towne, 1978).

The southwest section of the Bear River setback levee project area is part of the land grant of New Helvetia, deeded to John Sutter by the Mexican government in 1840s. Shortly after land acquisition, Sutter built Hock Farm and managed the area for free-range cattle.

Hydraulic gold mining began in the Bear River Basin in 1853. The geomorphology and hydrology of the project site was drastically altered by the influx of hydraulic mining sediments to the lower Bear River.

The project area has been primarily used for agriculture, especially following the construction of the levees along the Feather and Bear Rivers in the early 1900s. Although the project area has been subject to major flood events that have resulted in crop damages, agriculture has remained the primary land use. Orchards (primarily walnut and some prune) have historically occupied the majority of the project area with some acreage just north of the Bear River levee devoted to row crops.

The existing Feather River and Bear River levees are part of the Sacramento River Flood Control Project (SRFCP). These levees were constructed by the US Army Corps of Engineers (USACE) in easements obtained by the state of California through the Sacramento-San Joaquin Drainage District. The levees are maintained by Reclamation District (RD) 784 under the supervision of the Reclamation Board.

Figure 1. Location and Vicinity Map for Bear River setback levee project area, Yuba and Sutter Counties, California.

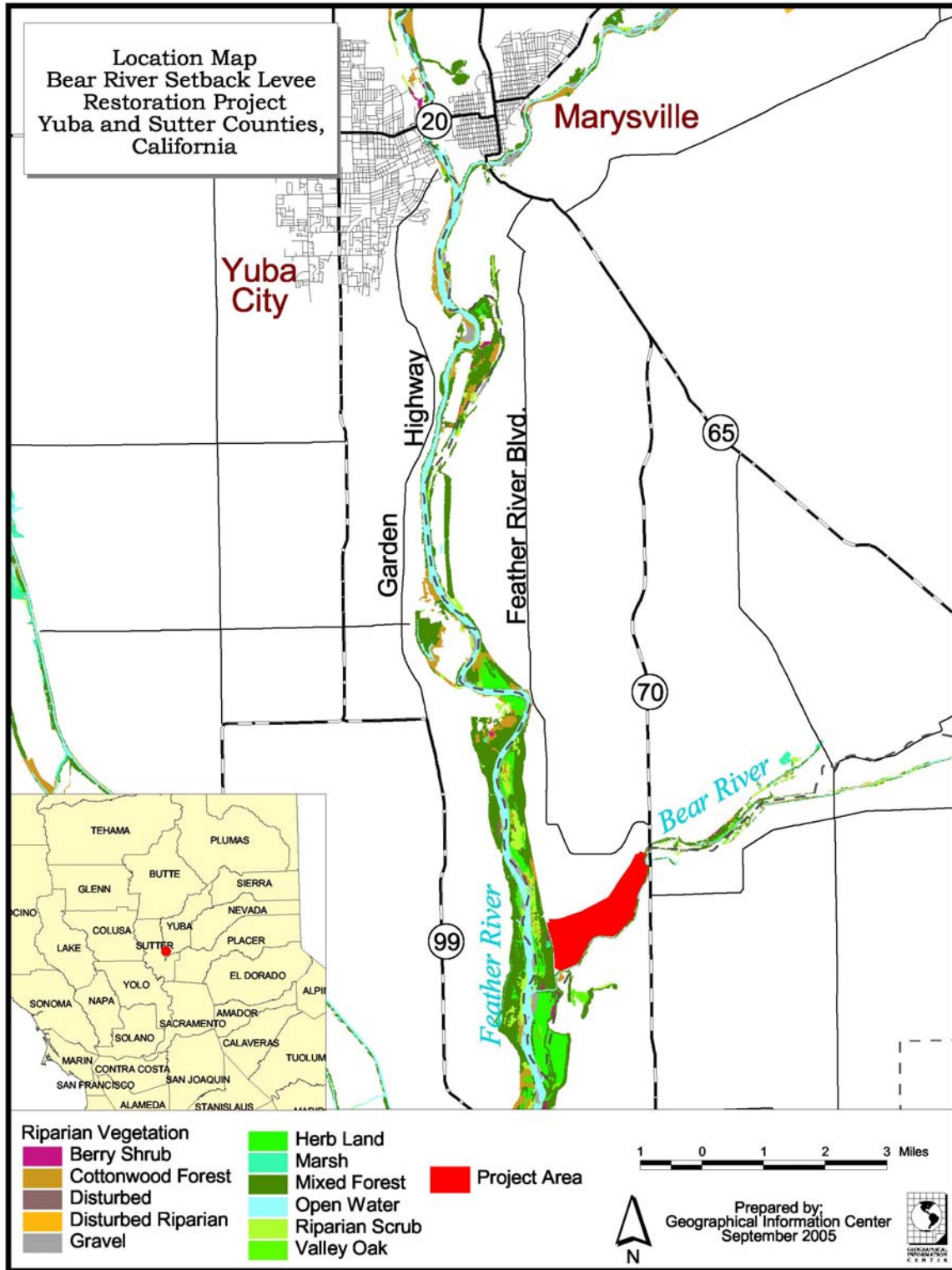
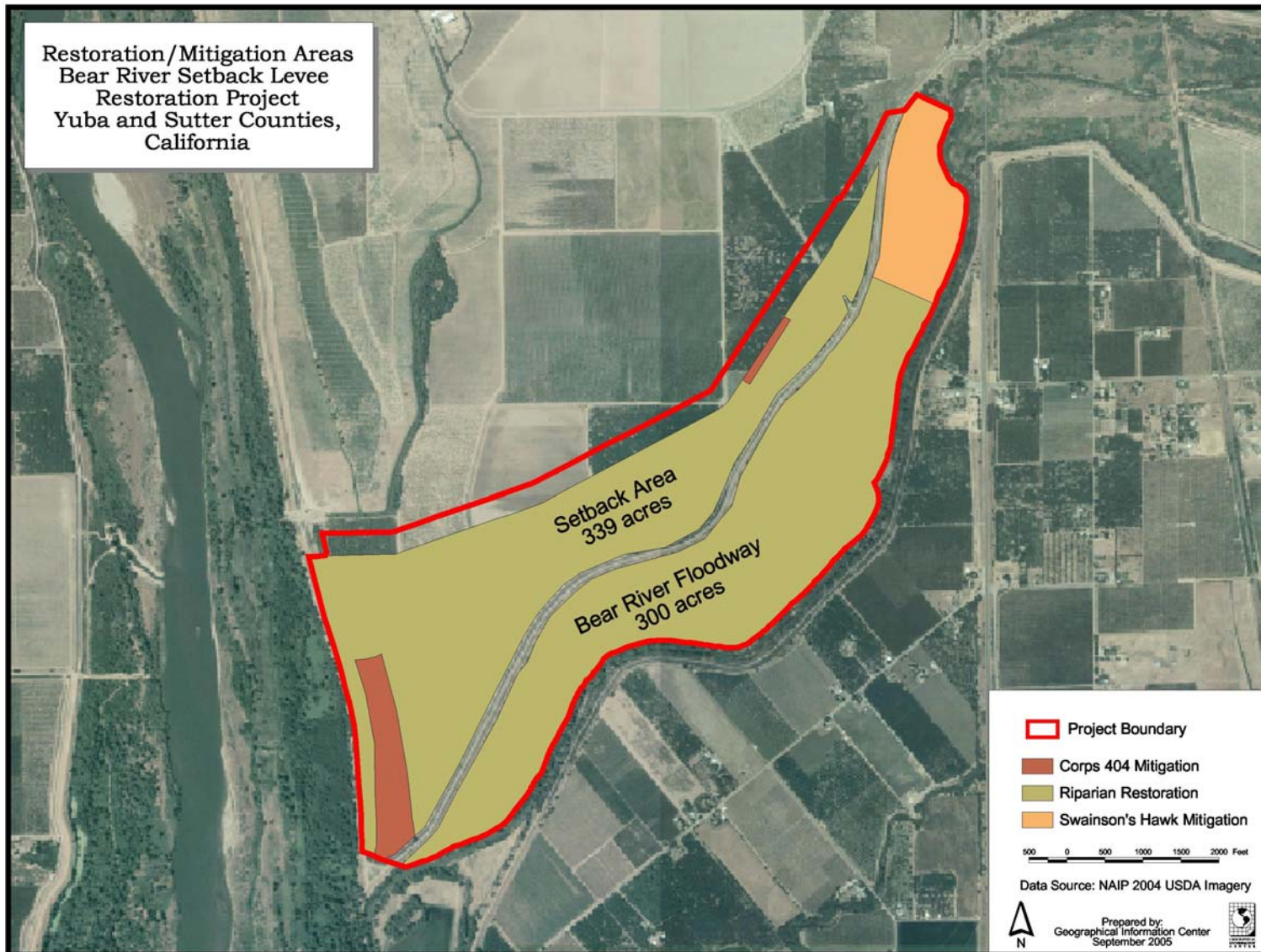


Figure 2. Proposed environmental enhancement work (restoration and mitigation) within the Bear River Setback Levee Project, Yuba and Sutter Counties, California.



C. Agricultural Infrastructure

There are seven agricultural wells and pumps located within the project area. One of the wells will be lost due to the construction of the setback levee. The remaining infrastructures will be kept and utilized to irrigate sub-areas of the restoration project. Specific well and pump information may be found in Appendix I.

D. Soils

Three soil types have been identified within the project area (Figure 3):

- Columbia Fine Sandy Loam,
- Shanghai Silt Loam, and
- Kilaga Clay Loam.

The Feather and Bear Rivers are bordered by Columbia Fine Sandy Loam. This soil type is formed from alluvium derived from mixed sources and is typically subject to frequent flooding. Most of the proposed setback levee area and adjacent orchard is made up of Shanghai Silt Loam, a very deep somewhat poorly drained soil, characteristic of floodplains. Only a small section of the proposed project area was found to contain Kilaga Clay Loam. This soil is limited by slow permeability and contains a deep hardpan. Table 3 describes characteristics of the three soil series located throughout the project site. A full description of each soil series is available in Appendix II.

Figure 3. Soils Map for the Bear River Setback Levee Project Area, Yuba and Sutter Counties, California.

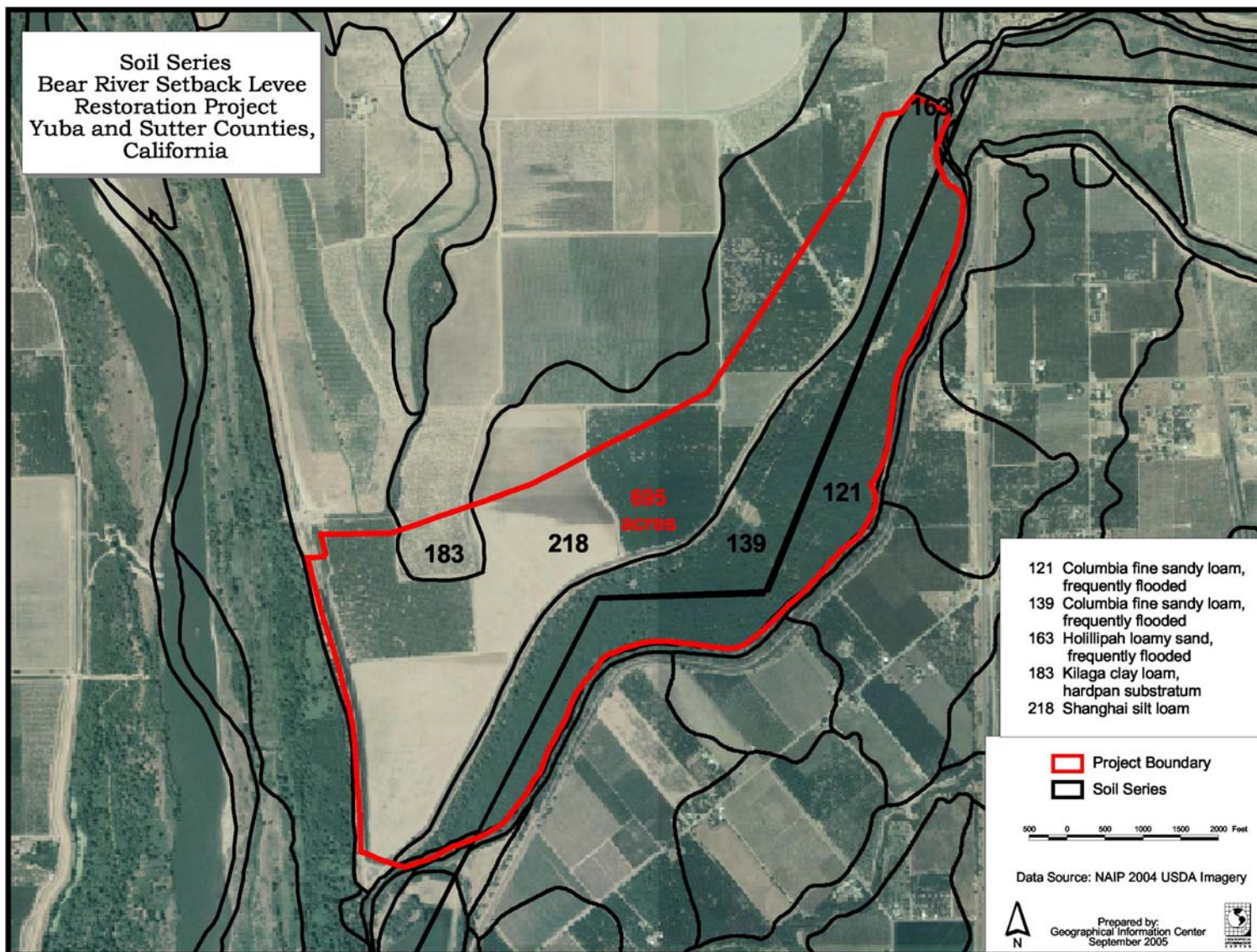


Table 3. Summary of soil series found within the Bear River setback levee project area.

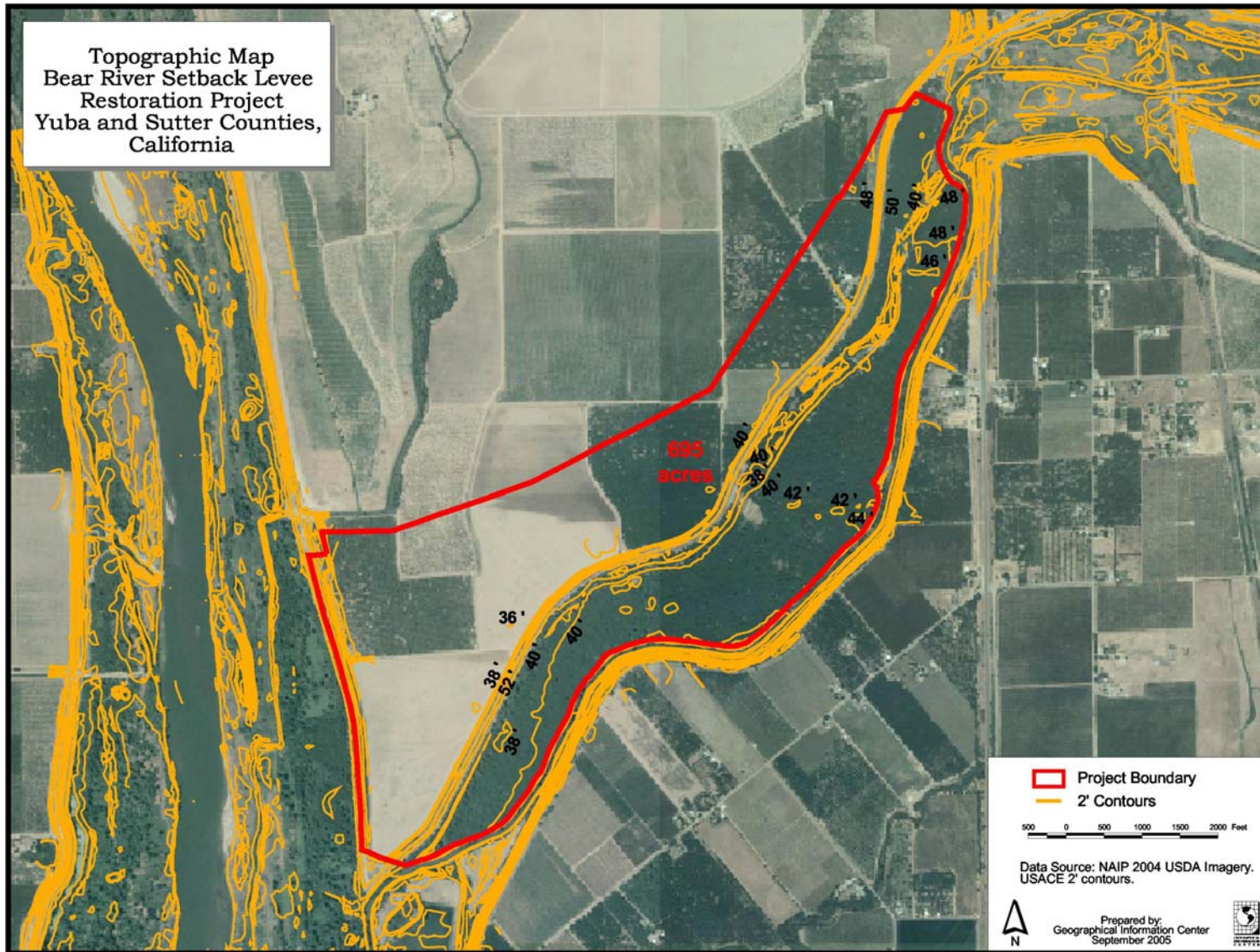
Soil Property	Columbia fine sandy loam, frequently flooded	Shanghai silt loam	Kilaga clay loam
Mapping Unit	Sutter County 121 & Yuba County 139	218	183
Percent slope	0-1%	0-1%	0-1%
Texture	sandy loam	silt loam	clay loam
Depth of soil	very deep	very deep	deep to a hardpan
Drainage	moderately well	moderately poor	well
Permeability	rapid	moderately rapid	slow
Available water holding capacity	low	moderate	high
Plant growth limitations	Potential flooding in December to April.	Potential flooding in December to April	Hardpan present. Potential flooding in December to April.

Several soil cores were drilled throughout the project area by Taber Consultants in February of 2004 to determine the exact soil characteristics throughout the setback levee area and within the existing levees. At the time of soil core excavation, the existing walnut orchard was not included in the project boundary. Therefore, no soil cores were sampled in this area. The majority of the setback levee area (from soil surface to approximately 10 feet depth) contains soils dominated by clay and silt, and the existing Bear River levee is made up almost entirely of clay (TRLIA, 2005b). Soils identified below the levee fill material were consistent with those found within the setback levee area. Some quartz deposits were identified within the project area, which lend evidence to the presence of historical hydraulic gold mining in the watershed.

E. Topography

Land leveling for agriculture has disrupted the natural topography of the project site. According to topographic mapping conducted for the setback levee design, elevations throughout the setback levee area range from approximately 30 feet (northwest corner of the floodway near the Feather River levee) to 40 feet (northeast corner of the floodway at the east most location of the new Bear River levee alignment) above sea level. Existing Bear River levee elevations range from 58 to 61 feet above sea level (TRLIA, 2005b). Figure 4 illustrates variations in topography throughout the site.

Figure 4. Topographic Features of the Bear River Setback Levee Project Area, Yuba and Sutter Counties, California.



It is evident from specific topographic and hydraulic characteristics of the setback levee area, the anticipated flooding regime (depth, duration, and extent of flooding), and drainage patterns, that there may be potential for fish stranding within the levee setback area. Once portions of the existing Bear River levee are degraded, floodwaters will flow out of the contemporary floodplain, which is approximately 4 feet above the current floodplain, and concentrate near the intersection of the Feather River Levee and the Bear River Setback Levee, the lowest elevation of the setback area. To address the fish stranding potential, a swale will be constructed to pass receding flood water back into the Bear River.

Currently, the construction of the setback levee is scheduled to be conducted simultaneously with the degradation of existing levees and swale excavation per design (Appendix III). Suitable material from levee degradation and swale construction will serve as borrow for the new setback levee. In addition to supplying borrow material, sections of the Feather River levee will be degraded to the toe elevation to improve connectivity between the expanded floodplain and the Lake of the Woods area.

Surplus material from levee degradation and swale excavation will be placed along the new setback levee (approximately 5,500 feet). An approximately 300-foot-wide berm that will not exceed 25% of the setback levee height (maximum height roughly 5 to 7 feet) will be constructed along much of the interior of the new setback levee. In addition, extra fill will be used to raise the elevation approximately 2 feet in the northeast corner of the site to bring it to grade with the current floodplain within the existing levees. Fill will also be placed in the northwest corner near the intersection of the existing Feather River Levee and the future Bear River Setback Levee, which will help prevent fish stranding and facilitate drainage through the proposed swale.

F. Hydrology

1. Historical information

Hydraulic gold mining in the Bear River watershed was responsible for the deposition of large volumes of sediment (up to 5 meters in some areas) along the lower Bear River (James, 1989). Large flood flows, such as the flood of 1862, were the primary means of sediment transport to lower reaches of the Bear River during the era of hydraulic mining. Initial mining efforts harvested gold from the soil surface which was composed of finer soil particles. Technological developments in the 1870s facilitated the mining of coarse cemented gravels that caused even greater disturbance to natural geomorphic and hydraulic processes along the Bear River (James, 1989). After the cessation of hydraulic mining in the mid to late 1880s, the lower Bear River channel was strewn with mining sediments that form weaker armor than those of pre-mining periods (James, 1989). Years of channel aggradation led to periods of rapid erosion and channel incision.

The Bear River watershed is one of California's more regulated systems. Flows are largely controlled by releases from Camp Far West Reservoir and the South Sutter Irrigation District Diversion Dam. Flows in the lower Bear River range between 0 and 40 cubic feet per second (cfs) from June to December. Flows along this reach are estimated to average between 2,500 and 5,200 cfs during winter months (National

Marine Fisheries Service, 2001). Despite flow regulation, several floods have been recorded on the Bear River since the mid 1800s. Recent floods (particularly that of 1997) led the USACE to revise estimates of the 100- and 200-year flood events and increase the levee elevations required to decrease the likelihood of these potentially catastrophic events. The new 200-year floodplain near the confluence of the lower Feather and Bear Rivers encompasses the Plumas Lake Specific Plan area.

During flood events, high-velocity flows enter the floodway orchard from the east. These flows have been observed to exit the Bear River main channel at approximately RM 3 and flow directly toward the existing north levee. Previous water velocities have been so forceful that passage over the existing walnut orchard has left gullies the size of pickup trucks (Bob DeValentine, personal communication). The water flows into the Bear River side channel directly south of the north levee (Bob DeValentine, personal communication).

2. Hydraulic Analysis

MBK engineers performed a hydraulic analysis for the project site to determine the vegetation roughness values allowed in the setback levee and orchard area in order to maintain objective water level elevations at the Western Pacific Interceptor Canal (WPIC) (MBK Engineers, 2005). Channel roughness values (also known as Manning's n values) refer to the degree of flow resistance caused by vegetation on the floodplain during flood events. The hydraulic analysis was completed using two hydraulic models: USACE HEC-RAS Lower Feather Floodplain Mapping Study model and the MBK Engineers 2-D model of the Feather-Bear River. The models were calibrated to the 1997 flood, the event that caused the redesignation of the 100- and 200-year floodplain. The modeling showed the following results, as illustrated in Figure 5:

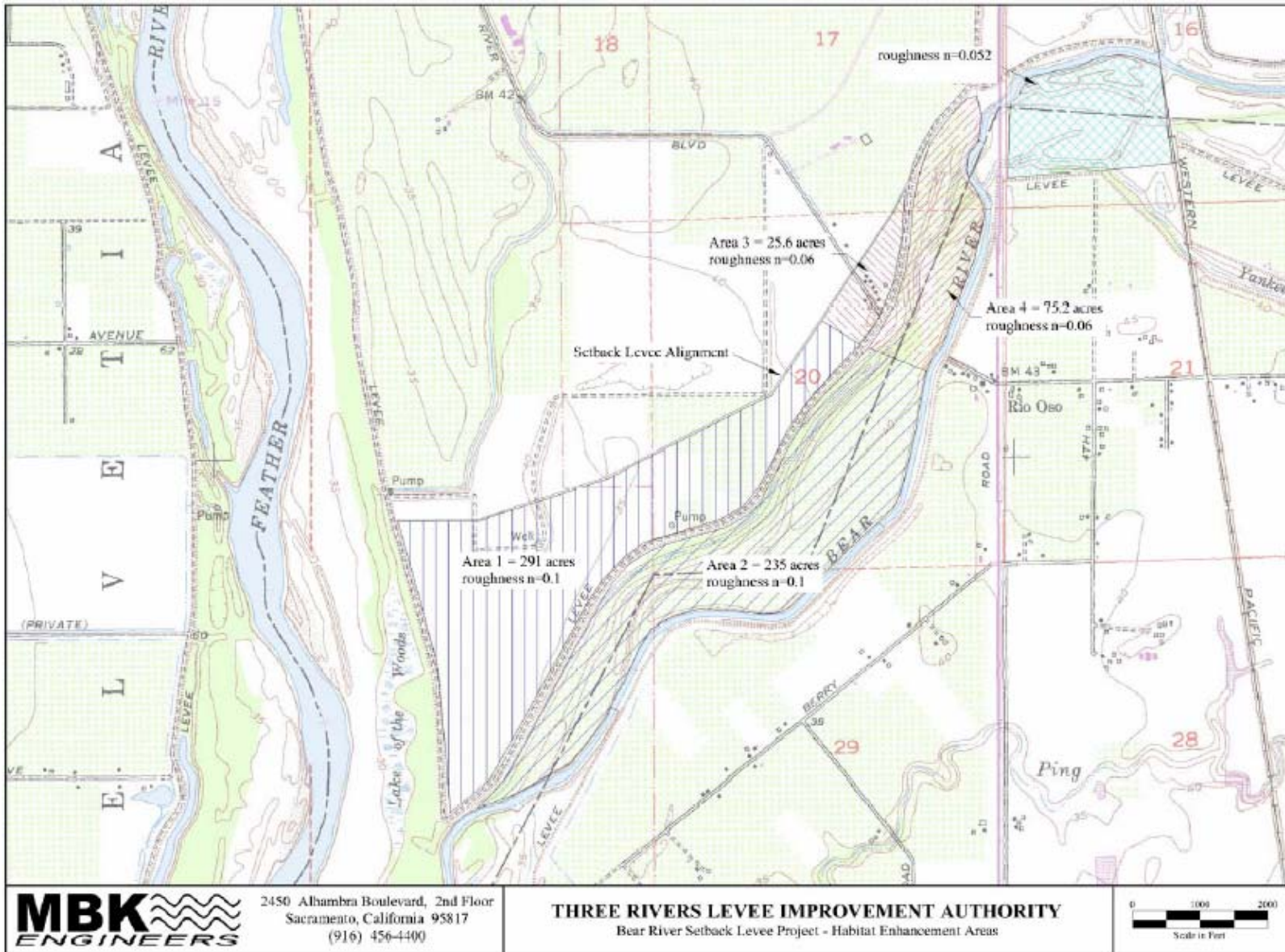
The project features that were modeled consisted of the following.

- Approximately 500 acres of the restoration project area can be planted to a Manning's roughness value of 0.1.
- Approximately 100 acres of the project area must be maintained to an average roughness value no greater than 0.06. The upper 100 acres lies on the narrowest part of the floodplain and has a significant effect on the water surface elevation of the Western Pacific Interceptor Canal (WPIC).

According to MBK Engineers (2005), a value of 0.1 represents a non-maintained vegetation area of dense trees with branches above the flood stage and little understory (riparian forest). Conversely, a value of 0.06 represents a maintained vegetation association with light to medium brush and a light stand of trees (grassland-savanna) (MBK Engineers, 2005).

Restoration design considerations for the project area are based on the hydraulic analysis. The plant design is consistent with the roughness values recommended by MBK Engineers. Future maintenance of the vegetation associations in the upper part of the project site will be necessary to ensure that the lower roughness value is maintained in perpetuity.

Figure 5. Results of hydraulic modeling showing target roughness values for potential restoration areas.



G. Geomorphology

To understand the prospective geomorphological impacts of restoration, Phillip Williams & Associates (PWA) collected historical information regarding site-specific influences on the geomorphology of the lower Bear River and developed two models to evaluate potential project-related changes to hydrology and sediment transport.

1. Historical Information

A combination of hydraulic gold mining and levee and dike building modified the natural landscape throughout the Feather and Bear River watersheds. Prior to these activities, geological investigations reveal that the Bear River in the project area had a somewhat resistant cohesive clay bed composed of the Riverbank formation. The channel is believed to have had an anastomosing form, with two or more branches (PWA 2005). The rapid aggradation of hydraulic mining debris, which consisted of coarse materials such as gravel and sand, covered the more resistant Riverbank formation.

Levees and dikes were constructed by farmers in an attempt to control the river and its floodwaters. Discharges of the late 1870s floods were probably not especially large, but aggradation had raised the channel bed to heights that aggravated flooding and triggered a series of channel avulsions beginning in 1870 until the channel was finally stabilized by levees and dikes in 1881 (Lardner and Brock 1924). Because of the levee systems, mining debris was deposited within the much narrower floodplain. As a result the inner contemporary floodplain channel is now approximately 4 feet higher than the outer historical floodplain (PWA 2005).

After the cessation of hydraulic mining, sediment production discontinued and channel incision commenced. A series of high flows in the mid-1950s penetrated into the clay layer of the riverbank formation and slowed erosion rates. The Bear River at the project site has incised approximately 20 feet through the erodible hydraulic debris and in the more resistant Riverbank formation (PWA 2005).

2. Geomorphic Studies

PWA performed hydraulic and sediment transport modeling to evaluate project impacts within the setback area. RMA2, a 2-D hydrodynamic model, calculated depth-averaged flow velocity, flow direction, flow depth, and energy gradient for elements that represented the channel and floodplain. The output of the RMA2 modeling was used to assess differences in velocity and flow path for various scenarios. In addition, the output was used to carry out a 2-D sediment transport model, SED2D, to assess deposition, erosion and transport patterns for bed-load sediments. Both models were run using the 100- and 200-year flood events.

Storm events influence the site in different ways. Feather-centered storms create higher flows on the Feather River than the Bear River, creating a backwater effect and more depositional conditions in the lower Bear River. Bear-centered storms create a steeper hydraulic gradient and more erosive conditions. Floods in which both the Bear and Feather Rivers flood simultaneously create the greatest flood hazard. Because the project area responds differently to storms that are focused on the Feather and Bear Rivers, PWA simulated several scenarios to evaluate project impacts. Results

demonstrated that velocity decreased in the levee setback area and along the south Bear River levee. These results also showed that the potential for erosion along the south levee and channel incision in the Bear River will be minimal.

The sediment transport assessment illustrated a trend away from erosion and toward deposition in the project area, with much of the deposition occurring cumulatively during small but frequent events (5- to 10-year floods).

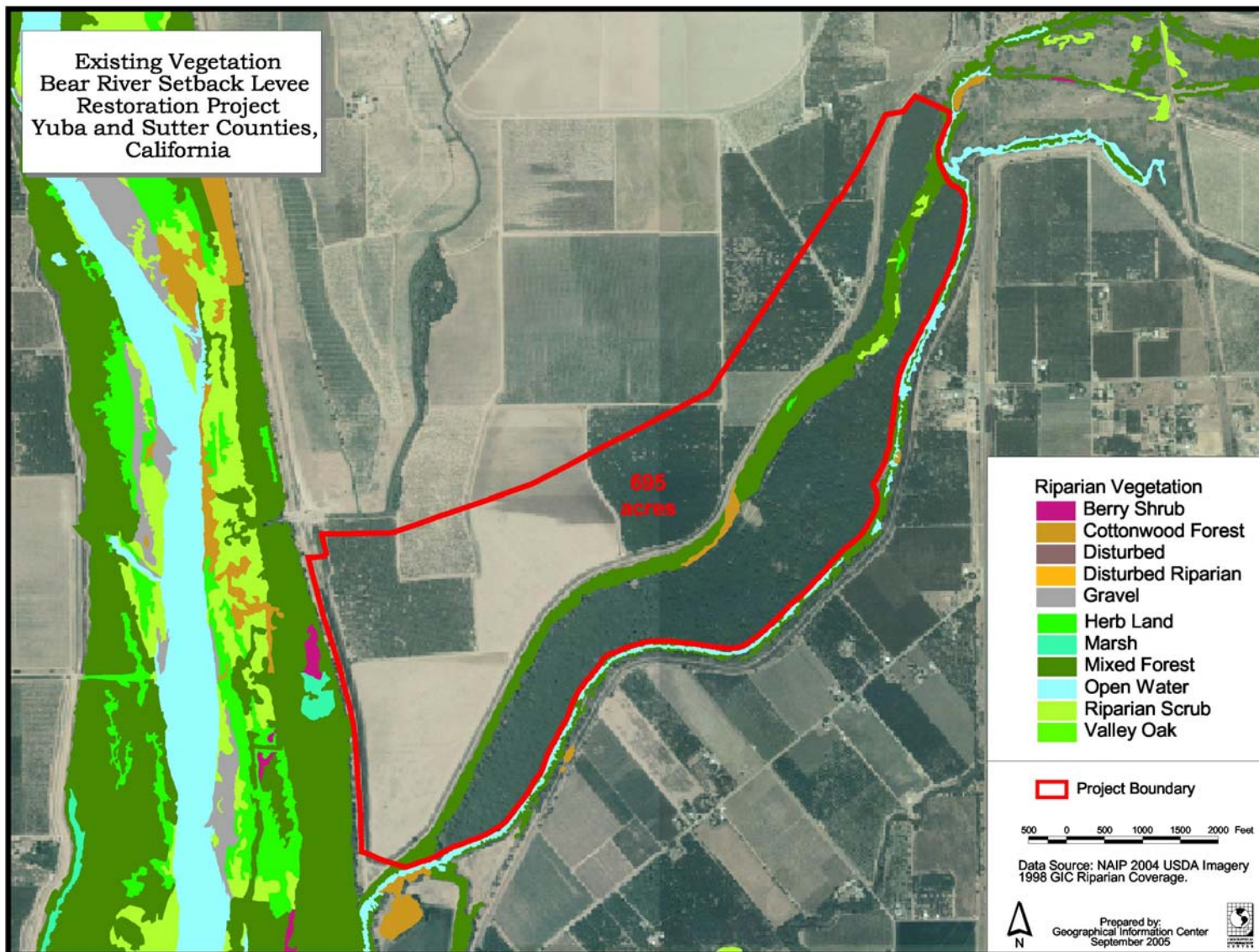
H. Vegetation

The California Native Plant Society (CNPS) online Inventory of Rare and Endangered Plants of California (California Native Plant Society 2004) was used to identify plant species of special concern that could potentially exist within the project area. Of the species identified, only two are known to occur in habitat types consistent with those found within the project boundaries: Wright's trichocoronis (*Trichocoronis wrightii* var. *wrightii*) and rose mallow (*Hibiscus lasiocarpus*) (TRLIA, 2004b). Both species are CNPS List 2 species which are classified as rare, threatened, or endangered in California. Wright's trichocoronis and rose mallow are known to inhabit freshwater marshes, ditches, canals, and associated riparian areas. Focused surveys have found no evidence of either species on the project site.

Due to extensive farming within and around the project area, very little remnant native vegetation remains (Figure 6). Relatively intact native plant associations can be found directly south and west of the site. The Lake of the Woods area, located to the west, is covered by a dense mixed riparian forest, previously described by Holland (1986). The upper canopy is dominated by such riparian tree species as Fremont cottonwood (*Populus fremontii*), valley oak (*Quercus lobata*), boxelder (*Acer negundo*), white alder (*Alnus rhombifolia*), sycamore (*Platanus racemosa*), Goodding's willow (*Salix gooddingii*), and red willow (*S. laevigata*). The lower canopy consists of shrub layer containing buttonbush (*Cephalanthus occidentalis*), California rose (*Rosa californica*), blue elderberry (*Sambucus mexicanus*), and shrubby willows. These shrubs provide a trellis for lianas of California grape (*Vitis californica*) and virgin's bower (*Clematis ligusticifolia*). The herbaceous understory is composed of various native grasses, sedges, and rushes (TRLIA, 2004b).

The edges of the Bear River main channel and its associated northern side channel support a more drought-tolerant valley oak forest. This association is characterized by a valley oak-dominated upper canopy, with Oregon ash (*Fraxinus latifolia*), sycamore, and young valley oak controlling the lower canopy. Shrub species such as blue elderberry, California rose, coyote brush (*Baccharis pilularis*), and California blackberry (*Rubus ursinus*) are present in varying densities throughout the area. Vines of California pipevine (*Aristolochia californica*), virgin's bower, and California grape are found climbing on nearby vegetation. The understory includes a variety of grasses, sedges, and forbs such as creeping wild-rye (*Leymus triticoides*), Santa Barbara sedge (*Carex barbarae*), and mugwort (*Artemisia douglasiana*) (TRLIA, 2004b). To provide flood conveyance, several corridors have been cleared of vegetation by the Department of Water Resources within the Lake of the Woods area and along the Bear River.

Figure 6. Native Vegetation Present within and around the Bear River Setback levee Project Area, Yuba and Sutter Counties, California.



I. Wildlife

The Lower Feather River complex attracts a diverse assortment of wildlife that thrives in riparian vegetation both seasonally and year-round. Resident breeding birds include a number of hawks, owls, and passerines. Migratory song birds known to frequent this habitat in spring include blue grosbeak, yellow warbler, song sparrow, willow flycatcher, and tricolored blackbird. Waterfowl are found to winter along this corridor in large numbers annually. Focal bird species, such as Swainson's hawk and yellow-billed cuckoo, utilize the area in late spring for breeding and rearing young (Josselyn et al. 1988). Heron and egret rookeries can be seen atop some of the largest stands of trees throughout the spring. Threatened reptile and amphibian species potentially present in the vicinity of the project area include giant garter snake, western pond turtle, California horned lizard, and Foothill yellow-legged frog. Historically the Lower Feather River complex harbored vast herds of tule elk (*Cervus nannodes*), antelope (*Antilocapra Americana*), and black-tailed deer (*Odocoileus hemionus*). The extinct California grizzly bear (*Ursus horribilis*) was also a resident at one time (DFG, 1963). Today, mule deer, ringtail, river otter, and Western gray squirrel are among the more common resident mammal inhabitants. The project site and surrounding area contain several blue elderberry shrubs, the obligate host of the federally threatened valley elderberry longhorn beetle (VELB). A list of potential species known to occur within and around the project area is available in Appendix IV.

1. Fisheries

The Feather and Bear Rivers support a diverse assortment of native resident and migratory fish species with a wide range of habitat requirements (Table 4). Disturbance to natural river processes (i.e. instream flow inhibition, high water temperatures, migration barriers, unscreened diversions, and poor water quality) has had adverse affects on the reproduction and survival of several of these species. The most significantly altered along the Feather and Bear Rivers are the Central Valley spring-run Chinook salmon (federally and state listed as Threatened) and Central Valley steelhead (federally listed as Threatened). These rivers also support Central Valley fall-run Chinook salmon, green sturgeon, hardhead, and California roach.

Approximately 15 miles of available habitat for anadromous fish species exists in the lower Bear River between the South Sutter Irrigation District Diversion Dam and the Feather River confluence. As a direct result of long periods with reduced stream flow, no self-sustaining populations of migratory species, such as Chinook salmon and steelhead, are found along this reach. During wet years, however, Chinook salmon and steelhead have been observed migrating up and spawning in the lower Bear River (National Marine Fisheries Service, 2001).

The Bear River Setback Levee Project will increase the amount of floodplain potentially exposed to inundating flows by approximately 339 acres. The restoration project will convert this and an additional 232 acres of floodplain (existing walnut orchard) to native habitats, mainly riparian forest. Floodplain restoration will allow for higher quality floodplain habitat (better water quality, food inputs, and shelter) for juvenile salmonids and other native species such as Sacramento splittail and steelhead. Organic material produced by native deciduous species restored within the floodplain provides an

increased nutrient load for the aquatic environment. This influx of nutrients provides for a greater invertebrate population, thereby creating an abundant food source for fish. Large stands of native riparian trees create a valuable source of shaded riverine aquatic (SRA) habitat, which functions to cool water temperatures to levels adequate for salmon spawning. Large trees also contribute a future source of large woody debris, important for young fish refugia.

Table 4. Habitat Requirements for native fish species present in the lower Feather and Bear Rivers.

Common Name	Scientific Name	Resident (R) or Migratory (M)	Migration Period	Time Spent in Freshwater	Important Habitat Features
Central Valley fall-run Chinook salmon	<i>Oncorhynchus tshawytscha</i>	M	June-December	1-7 months	Gravel substrate, shaded riverine aquatic (SRA) habitat, large woody debris (LWD), water temperatures 13-18 degrees C.
Central Valley spring-run Chinook salmon	<i>Oncorhynchus tshawytscha</i>	M	March-September	3-15 months	Gravel substrate, SRA, LWD, water temperatures 13-18 degrees C.
Central Valley steelhead trout	<i>Oncorhynchus mykiss</i>	M	September-March	1-3 years	Gravel substrate, SRA, LWD, water temperatures 10-15 degrees C
Rainbow trout	<i>Oncorhynchus mykiss</i>	R	None	Entire life	Fast-flowing, cool (15-18 degrees C), clear, waters, SRA
Sacramento splittail	<i>Pogonichthys macrolepidonus</i>	R	None	Entire life	Shallow slow-moving water (5 -24 degrees C), emergent vegetation on floodplains
Green sturgeon	<i>Acipenser medirostris</i>	M	Late February to early July	2 years	Large cobble substrate and deep (> 3m) fast water (8-14 degrees C) for spawning
White sturgeon	<i>Acipenser transmontanus</i>	M	February to early June	A few months	Deep holes (3-23m) with swift currents or deep gravel riffles for spawning, water temperatures 8-19 degrees C
Hardhead	<i>Myulopharodon conocephalus</i>	R	None	Entire life	Clear, well oxygenated, deep pools with slow currents and warm water (24-28 degrees C), gravel riffles or pool heads for spawning, affected by non-native fish
Speckled dace	<i>Rhinichthys osculus</i>	R	None	Entire life	Clear, well-oxygenated water (0-30 degrees C), abundant cover, shallow riffle habitat
California roach	<i>Hesperoleucus symmetricus</i>	R	None	Entire life	Low flow, warm temperatures (30-35 degrees C), and edge mats of vegetation, affected by non-native fish
Pacific lamprey	<i>Lampetra tridentata</i>	M	Early March to late June	5-7 years	LWD, rocky riffles (35-60 cm) for spawning, water temperatures 12-18 degrees C
Sacramento sucker	<i>Catostomus occidentalis</i>	R	None	Entire life	Wide range of habitats, emergent vegetation, warm water temperatures (20-25 degrees C)
Sacramento pikeminnow	<i>Ptychocheilus grandis</i>	R	None	Entire life	Deep pools, SRA, water temperatures 18-28 degrees C
Tule perch	<i>Hysterocarpus traski</i>	R	None	Entire life	Cool (< 22 degrees C), well-oxygenated water, emergent aquatic plants, deep pools, SRA, LWD
Riffle sculpin	<i>Cottus gulosus</i>	R	None	Entire life	Fast-flowing rock riffles, SRA, water temperatures 10-16 degrees C

Source: Inland Fishes of California (Moyle, 2002).

III. CONCEPTUAL SITE MODEL

This conceptual site model:

- presents an understanding of the physical and biological factors that influence site ecology,
- describes management alternatives,
- outlines the restoration strategy,
- identifies ecological benefits and targeted wildlife species, and
- describes the plant design.

The principles described in this section serve as a guide for project implementation.

A. Physical and Biological Factors That Influence Site Ecology

1. Past Environmental Conditions

Hydraulic mining has greatly altered the Bear River floodplain. Decades of aggradation and erosion have created a deeply incised Bear River channel. Additional hydrologic alterations in the project area are the result of the upstream Camp Far West Reservoir Dam and the South Sutter Irrigation District Diversion Dam. The WPIC has also altered the hydrology of the lower Bear River. The WPIC was constructed as part of the Sacramento River Flood Control Project in 1941 for the purpose of intercepting water approaching RD 784 and traps backwater flows from the Bear River.

Agriculture became the dominant land-use on the project site in the late 1800s with the Feather and Bear River levees constructed shortly thereafter. Natural vegetative conditions that existed prior to this period are difficult to define without aerial photographs or personal observations. Native American inhabitation within the area suggests that the site contained a bountiful food source built upon a subsistence of valley oak acorns. Other sources of food for native tribes consisted of California grape berries, wild onion, wild sweet potato, deer, elk, black bears, rabbits, and other small game (Wilson and Towne, 1978). Grasses, herbs, and rushes provided both food and material for basketry and clothing.

2. Likely Successional Patterns without Restoration

The setback of the Bear River northern levee combined with discontinued agricultural management will expose the project area to natural biological and physical processes that have been suppressed for over a century. The project area contains nutrient rich soils that will support a dense vegetative community. The presence of minimal native seed sources within the project boundary and the reduced competitive ability of native riparian species makes the site prone to rapid colonization by non-native species such as Johnson grass (*Sorghum halepense*) and starthistle (*Centaurea solstitialis*) once the existing orchards are removed. These aggressive species are difficult to eradicate and become dense in relatively short periods (< 5 years). Non-native woody domination of the site could potentially increase hydraulic roughness within the area and increase O & M costs.

3. Comparison to Nearby Vegetation (Reference Sites)

Nearby reference sites provide the most accurate record of site conditions prior to agricultural conversion. The Lake of the Woods Wildlife Management Area, just west of

the project area, supports a dense stand of riparian trees and shrubs. Vegetation in this area is characteristic of associations found in alluvial soils with a shallow water table (< 9 feet). A dense valley oak forest resides directly south of the setback levee area and along the north fringe of the Bear River. This association is built on alluvial soils composed primarily of clay. The Bear River channel is deeply incised and consequently the nearby vegetation is exposed to a deeper water table (> 10 feet).

4. Site Successional Model

In general, physical factors control the framework within which the biological community functions (Pringle *et al.* 1988). However, with increasing distance and greater elevation from the main channel (especially with an altered flow regime), the magnitude, frequency, and duration of floods diminish (Gregory *et al.* 1991) and biological factors become more important in influencing the community (Johnson *et al.* 1995). Biological factors include:

- competition (sunlight and moisture) from non-native species (Adams *et al.* 1992; Danielson and Halvorson 1991; Efsseff *et al.* 2000),
- rodent predation of seeds and girdling of young trees (Griffin 1980; Knudsen 1987), and
- browse pressure from herbivores (insects, rabbits, and deer) (Griffin 1971).

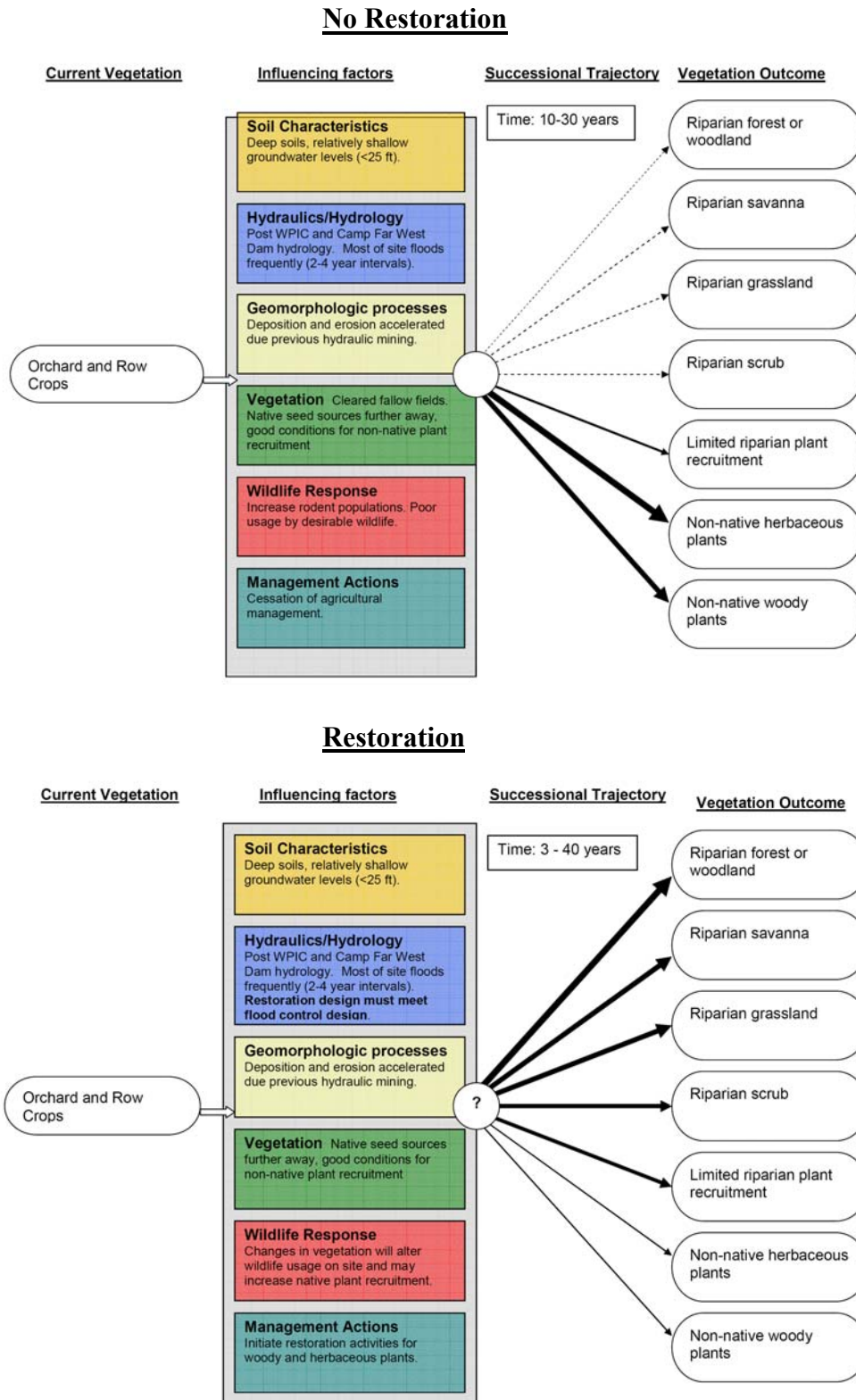
The combination of these factors is also important (Griffin 1971, 1976; Knudsen 1987; McCreary 1990). For example, weeds provide ideal habitat for rodents (Chouinard *et al.* 1999), which, in turn, can girdle young trees or consume seeds and acorns.

Management options that address these factors tilt the successional trajectory toward desirable native riparian species. For example, restoration practices reduce plant competition from non-native species and limit the negative effects caused by predation and herbivory.

The site assessment indicates that without restoration, the Bear River setback levee area and adjacent orchard is likely to become dominated by non-native plants and continue to provide poor habitat value. With the cessation of agricultural practices, native plant recruitment will occur due to frequent flood events and nearby seed sources but at a rate that is too slow to provide good-quality short-term wildlife habitat.

A graphical depiction of the conceptual site model is provided in Figure 7. This figure compares the ultimate ecological outcome of no restoration versus restoration. The figure shows the current vegetation state on the left, the influencing factors, the time period assumed, and the likelihood of certain vegetation outcomes on the right. Factors provided in the table are simplified and include a description of the most important variables that influence the successional trajectory. Thicker arrows suggest a higher probability of vegetation following that successional pattern.

Figure 7. Diagram of the Conceptual Site Model for the restoration of the Bear River Setback Levee Project Area.



B. Identification of Ecological Benefits and Targeted Wildlife Species

Riparian areas harbor the most diverse assemblage of wildlife species of all habitat types in California. Restoration of the Bear River setback levee project site will have a number of ecological and biological benefits in both the short and long term. Complete restoration will:

- enlarge and connect habitat (diminish fragmentation) along the lower Feather and Bear Rivers,
- reduce the potential for invasion of non-native plant species, and
- improve the habitat for a variety of wildlife species that are dependent on riparian habitat.

1. Sensitive Species

The design approach focuses on the habitat requirements of multiple sensitive species known to utilize riparian communities, including Swainson's hawk, Sacramento splittail, Central Valley spring-run Chinook salmon, Central Valley fall-run Chinook salmon, Central Valley steelhead, and VELB. These species and their specific habitat needs are listed in Table 5 and are discussed in greater detail below. Habitat requirements are compiled in the California Wildlife Habitat Relationship System, CWHR 8.0 (California Department of Fish and Game 2002) and Inland Fishes of California (Moyle, 2002).

2. Habitat Requirements for Sensitive Species

a) Swainson's Hawk

The current distribution and nesting habitat of the Swainson's hawk is not confined to riparian areas but is directly affiliated with such habitat. Over 90% of these birds are found to nest in cottonwoods and valley oaks that provide excellent cover near tree-tops, the prime look-out location for foraging (Josselyn et al., 1988). Preferred nesting trees are typically within 300 feet of a major valley stream, creek, or slough. Grasslands with abundant populations of small mammals are the preferred foraging habitat for Swainson's hawk. In the Central Valley, these hawks generally nest in riparian areas that are adjacent to grassland and pastures. The habitat requirements for Swainson's hawk, dense native riparian cover adjacent to grassland, are consistent with goals of this restoration plan.

b) Central Valley Salmon

(1) Spring-run Chinook

Spring-run Chinook salmon enter freshwater rivers as immature fish in spring and early summer. They hold in deep pools in upstream reaches for several months and spawn in areas with adequate gravel composition in early fall. Juvenile salmon require low water temperatures (13-18 degrees C) and refugia from predation (Moyle, 2002). Such conditions are typically made available by the presence of SRA habitat and LWD. Much of the former spring-run Chinook habitat has been eliminated by dams. The lower Feather and Bear Rivers are among some of the few remaining spawning areas for spring-run Chinook salmon. Enhancing floodplain and SRA habitat that can benefit spring-run Chinook salmon is consistent with the goals of this plan.

(2) Fall-run Chinook

Fall-run Chinook salmon begin migration to natal freshwater streams in late summer and early fall. These fish migrate as mature adult fish and spawn in gravel redds within a few days or weeks after arrival at spawning grounds. While the duration of juvenile freshwater inhabitation is significantly shorter (only 1-7 months) than that of spring-run Chinook (3 to 15 months), the habitat requirements are very similar (Moyle, 2002). The fall-run Chinook are the most abundant of the Central Valley Chinook salmon, yet their habitat range is also dwindling due to migration barriers. Enhancing floodplain and SRA habitat that can benefit fall-run Chinook salmon is consistent with the goals of this plan.

c) Steelhead

Dams have also separated Central Valley steelhead from much of its former range. One of the documented remaining populations is found in the lower Yuba River, a major tributary to the Feather River. Central Valley steelhead is a cold water species that requires adequate gravel composition for spawning. Central Valley steelhead spend about half their lives in freshwater streams, which may account for the dramatic effect river regulation and habitat loss have had on this fish species. Enhancing floodplain and SRA habitat that can benefit steelhead is consistent with the goals of this plan.

d) Valley Elderberry Longhorn Beetle

VELB rely on blue elderberry shrubs for the completion of their lifecycle. The females lay eggs directly on the stem of the blue elderberry. Once hatched, the larvae bore into the pith of the tree and move down toward the base. Larvae reside in the stems of blue elderberry shrubs for one to two years before emerging as adults in early spring (mid-March to early June) to feed on the host plant's stem, leaves, and flowers. The presence of blue elderberry within and around the project area indicates the potential for VELB inhabitation. VELB habitat is provided in this plan.

3. Targeted Avian Species

Riparian ecosystems harbor the most diverse bird communities in the arid and semi-arid portions of the western United States (Knopf et al. 1988, Dobkin 1994, Saab et al. 1995), and may also provide the most important avian habitat in California (Manley and Davidson 1993). Therefore, a restored site will provide vital habitat and conditions for neo-tropical migratory birds, western yellow billed cuckoos, and other riparian dependent avian species (Figure 8).

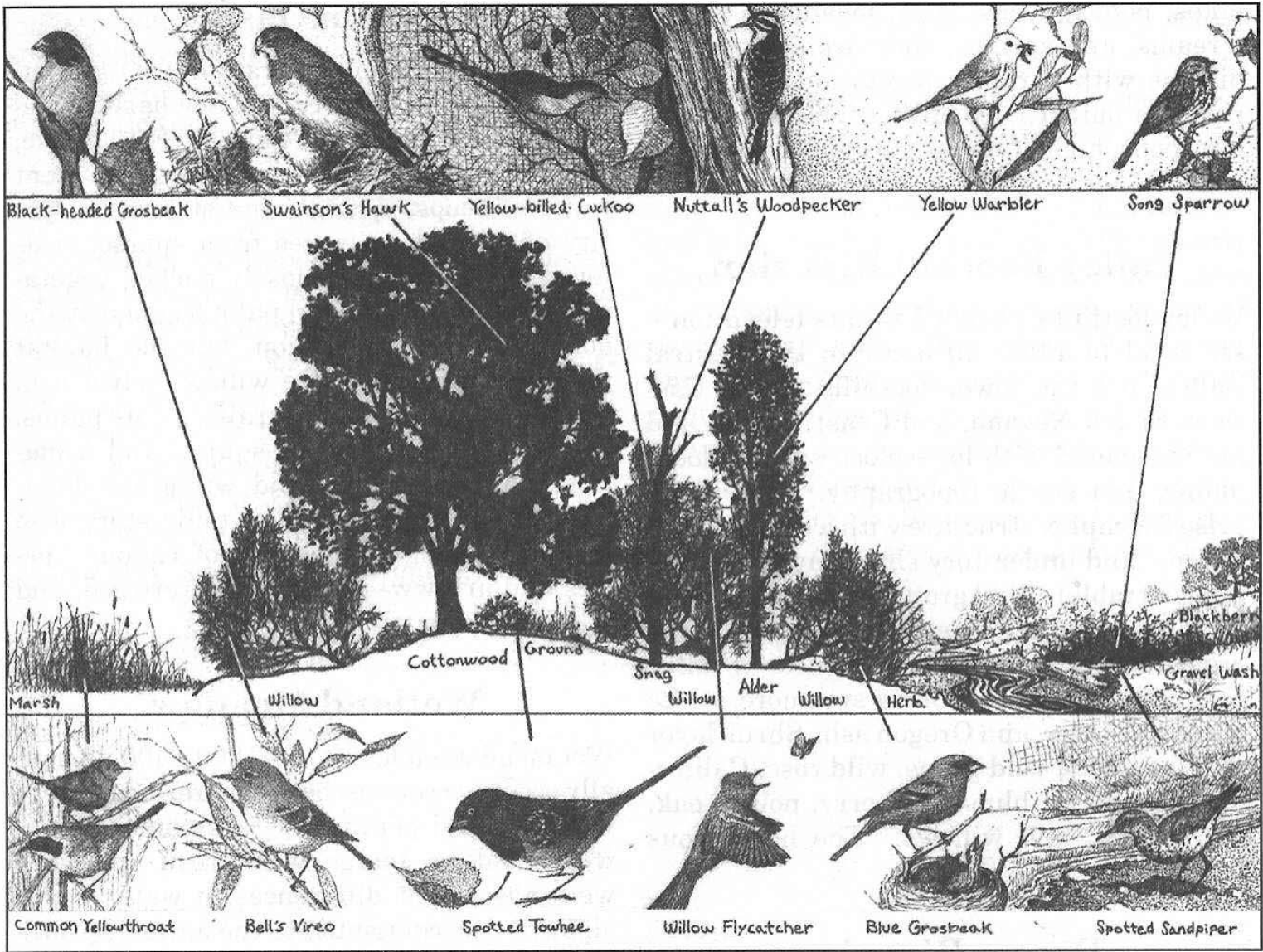
The benefits to terrestrial species are realized relatively quickly. Increases in species richness and numbers of neo-tropical migratory birds may be seen within three years of restoration (Geupel et al., 1997; RHJV, 2000).

Table 5. Matrix of Targeted Species Habitat Needs, Bear River Setback Levee Project Area.

Species	Habitats	Habitat Elements							Notable Habitat Features	
		Substrate	Tree layer	Riparian Inclusions	Herbaceous layer	Shrub layer	Hardwood	Invertebrates		Terrestrial insects
Swainson's hawk (<i>Buteo swainsoni</i>)	Valley foothill riparian forest Valley oak woodland Herbaceous		S	S		S				Nests in open riparian habitat, open grasslands with scattered large trees or groves.
Sacramento splittail (<i>Pogonichthys macrolepidotus</i>)	Slough Floodplain				E	E		E		Found in slower moving sections of large rivers and in sloughs. Requires flooded vegetation such as terrestrial shrubs and herbs for spawning and rearing.
Central Valley fall-run Chinook salmon (<i>Oncorhynchus tshawytscha</i>)	Main stem of large rivers Open ocean Estuary	E						E		Requires suitable conditions in the main stem of large rivers (gravel composition, water depth, and velocity) for spawning. Young fish survival is dependant on food source abundance (aquatic invertebrates and detritus) and available refugia. Emigrate to saltwater within 3 months to 2 years after emergence. Peak migration to freshwater occurs in September and October and spawning takes place in October and November.
Central Valley spring-run Chinook salmon (<i>Oncorhynchus tshawytscha</i>)	Main stem of large rivers Open ocean Estuary	E						E		Same as Fall-run Chinook except this species enters the river as immature fish in May and June and spawn after reaching maturity, typically in mid-September.
Central Valley steelhead (<i>Oncorhynchus mykiss</i>)	Main stem of large rivers Open ocean Estuary	E						E		Spend the first 1-3 years of life in freshwater streams then emigrates to salt or brackish waters for adult life stage. Spawns in main stem of large river systems in gravel substrate.
Valley elderberry longhorn beetle (<i>Desmocerus californicus dimorphus</i>)	Valley foothill riparian forest Valley oak woodland					E				Host plant is Mexican elderberry (<i>Sambucus mexicana</i>)

Notes: E = essential habitat element, S = secondary habitat element, Valley Oak Woodland = Valley Oak Series.
Sources: California Wildlife Habitat Relations Database (CWHR 2002) and Inland Fishes of California (Moyle, 2002).

Figure 8. Habitat Value of Native Riparian Plants (RHJV 2000)



C. Restoration Strategy

The following strategies were used to develop restoration guidelines:

- **Employ active restoration techniques to establish riparian vegetation.** The site's location near extensive existing riparian vegetation and repeated exposure to flooding makes the Bear River setback levee area a good candidate for active restoration. Active restoration employs modern farming techniques to efficiently and rapidly establish riparian vegetation in predetermined patterns required by focal wildlife species. General tasks include site preparation, native plant species propagation and planting, weed control, and supplemental irrigation.
- **Develop a plant design based on management objectives and current site conditions.** The design, though not based strictly on a "historical" or "climax" vegetation target, is intended to provide high-quality habitat for targeted wildlife, including neo-tropical migratory birds and anadromous fish species (CWHR 2002).
- **Use new information to adjust management strategies (adaptive management).** Restoration implementers should regularly evaluate project progress and respond quickly to new information. Management strategies may require adjustment to enhance project success.

D. Restoration Potential

Based on soil analyses and water table depth, the Bear River setback levee project area is extremely suitable to support a dense stand of riparian vegetation. Hydrology appears to be the major factor regulating vegetative growth on this site.

E. Mitigation

Several opportunities are available within the Bear River setback levee project area and adjacent floodway to provide mitigation for impacts on certain habitat types resulting from TRLIA's levee improvement projects on the Bear River and WPIC (collectively referred to as the Feather-Bear-WPIC Levee Improvements Project for permitting purposes). Table 6 lists the mitigation requirements that will be accommodated on the project site for impacts of the first stage of these projects (levee improvements on the upper Bear River and WPIC, and construction of the setback levee foundation and tie-ins). Anticipated impacts of the second stage, consisting of the completion of the setback levee, degradation of existing levee segments, and restoration are minor and will also be mitigated within the levee setback area (Table 7). The Restoration Plan includes mitigation for the following land-cover types:

- emergent wetland,
- willow scrub,
- riparian scrub,
- riparian woodland,
- other waters of the United States, and
- valley oak riparian forest, and
- valley oak forest.

In addition, the plan includes a 10-acre VELB mitigation site in the levee setback area, and Wildlands will develop 39 acres of grassland/savanna within a 50-acre section of

the upper floodway portion of the project site to provide mitigation for TRLIA project effects on Swainson's hawk foraging habitat.

Table 6. Summary of TRLIA Mitigation Requirements Included On Site for Impacts of Stage 1 of the Feather-Bear-WPIC Levee Improvements Project.

Affected Habitat (Location)	Impact Type	Acres Affected	Comp. Ratio	Comp. Acres	Acreage Subtotal	Proposed Location and Comments
U.S. Army Corps of Engineers Clean Water Act Section 404 Mitigation						
Willow scrub (WPIC borrow ditch)	P	3.00	2:1	6.00	6.46	Levee setback area
	T	0.23	2:1	0.46		
Riparian scrub (Clark Slough detention basins)	P	0.32	2:1	0.64	0.64	
	T	0.00	2:1	0.00		
Riparian woodland (Clark Slough detention basins)	P	0.00	2:1	0.00	0.02	
	T	0.01	2:1	0.02		
Emergent wetland (WPIC borrow ditch)	P	0.18	2:1	0.36	0.38	
	T	0.01	2:1	0.02		
Other waters: waterways/drainages (WPIC, Algodon Canal, Clark Slough)	P	5.09	1:1	5.09	28.73	
	T	11.82	2:1	23.64		
Other waters: valley oak forest (Algodon Canal)	P	0.16	2:1	0.32	1.20	
	T	0.44	2:1	0.88		
SUBTOTAL				42.85	42.85	
U.S. Fish and Wildlife Service Endangered Species Act Mitigation						
Valley elderberry longhorn beetle (upper Bear, WPIC, setback levee tie-in at Feather River levee)	P			Approx. 10	Approx. 10	Levee setback area
California Department of Fish and Game California Endangered Species Act Mitigation						
Swainson's hawk (levee slopes and footprint)	P	39.04	1:1	39.04	39.04	Upper floodway orchard area
Key: Comp. = Compensation P = Permanent T = Temporary Source: Jones & Stokes 2005.						

Table 7. Summary of Anticipated TRLIA Mitigation Requirements Included On Site for Impacts of Stage 2 of the Feather-Bear-WPIC Levee Improvements Project.

Affected Habitat (Location)	Impact Type	Acres Affected	Comp. Ratio	Comp. Acres	Acreage Subtotal	Proposed Location and Comments
U.S. Army Corps of Engineers Clean Water Act Section 404 Mitigation						
Valley oak forest	P	0.65	2:1	1.3	1.3	Levee setback area
U.S. Fish and Wildlife Service Endangered Species Act Mitigation						
Valley elderberry longhorn beetle	P				0.16	Levee setback area
<p>Notes: 1. This table is preliminary only. Permits, conditions, and ratios have not been finalized with USACE or U.S. Fish and Wildlife Service (USFWS). Compensation acreage shown for Section 404 mitigation is for reference purposes only. Because the project will create a substantial amount of USACE-jurisdictional habitat, specific mitigation is not required.</p> <p>Key: Comp. = Compensation P = Permanent</p>						

F. Planting Design

1. Purpose of Planting Design

The plant design is an important component of the adaptive management framework and provides a testable hypothesis of site understanding. The plant design is intended to:

- communicate project layout to the restoration contractor, regulatory agencies, and project stakeholders;
- decrease cost while maintaining integrity of the plant design;
- match plant placement to site conditions, management objectives, and wildlife habitat requirements;
- estimate plant material so that appropriate numbers can be cultivated; and
- provide a framework to document and analyze plant survivorship, and make adaptive management decisions regarding replanting, if necessary.

2. Procedure

The plant design will be translated to the field through the use of a labeling system that identifies a woody plant for each planting location. This system allows for the rapid implementation of the site-specific design and monitors survival patterns across a field. The procedure consists of the following steps:

- Review site assessment information.
- List design considerations (based on the physical setting, wildlife objectives, or management issues).
- Match vegetation to site conditions and project goals:
 - identify appropriate vegetation associations,
 - express plant arrangement for particular vegetation associations (a “tile”),
 - provide a rationale for selection, and
 - assign vegetation associations to project areas.
- Estimate plant numbers and develop a plant design map.
- Enter data into a database, print labels, and modify database based on new information.

The computer database system provides the link between the design and field implementation. Each planting location receives a computer-generated vinyl label that lists its row and plant number, location, and species name and number code. This system connects the vegetation series to specific field conditions (e.g., flood-tolerant species in wet areas) or management objectives (e.g., dense vegetation to serve as a wildlife screen). The labels are installed on stakes in the field prior to planting, which communicates the plan to the planting crew. All plants are number coded and workers can match plants with the proper label.

Any deviations will be recorded and updated in the database. Plant deviations from the original design (e.g., planting an elderberry shrub at a valley oak location) can be recorded during the first census. The advantage of this system is that a site-specific

design can be implemented with unskilled labor and up to 25 acres a day can be planted. The database is also an important adaptive management tool that allows for monitoring patterns in a plant species' survival rate or growth patterns across a field.

3. Notable Site Conditions and Design Characteristics

Physical and biological features influence long-term survivorship and the selection of vegetation. When considering design, site condition is one important factor, but wildlife requirements and management practices are also critical elements. Based on the available information, the most influential factors on the design are:

- wildlife objectives and the strategy to produce immediate habitat benefits,
- hydraulic considerations,
- mitigation needs,
- site access, and
- management practices

Specific design considerations are presented in Table 8.

4. Match Vegetation to Site Conditions and Project Goals

Initial meetings among project affiliates brought attention to the hydraulic considerations and mitigation requirements that have guided the development of the plant design. The plant design represents a culmination of these important factors and current site conditions. Plant composition and orientation within the design is based on MBK Engineers' hydraulic analysis recommendations for appropriate vegetation roughness values for the project area. Based on the historical and current site information, the project area will support:

- Fremont cottonwood and mixed willow association,
- valley oak association,
- seasonal/emergent wetland mitigation,
- mitigation for other waters of the United States,
- high-density shrub clusters, including approximately 10 acres devoted to mitigation for VELB,
- grassland savanna, including 39 acres that will serve as Swainson's hawk mitigation developed by Wildlands, and
- SRA habitat enhancement.

Table 8. Design considerations for the Bear River setback levee project area.

Objective	Example of Project Design Considerations (Hypothesis)
Project Objectives	
Provide immediate (< 3 years) habitat benefits and high probability of long-term survivorship	The Bear River setback levee project area is likely to sustain oak woodland, savanna, and grassland in the long term (>25-80 years). In the short term, relatively transient species (cottonwood and willows) will provide several generations of targeted bird species with nesting and foraging habitat. Plant both forests to maximize high-quality habitat as the slow-growing, but shade-tolerant oaks mature.
Maintain general flood flow conveyance patterns	Orient rows parallel to general flow direction and do not direct flows toward levees or other sensitive structures (see next section). The upland east area of the project site will be planted to low tree density in order to maintain low roughness values and low water levels at the WPIC.
Minimize fire danger to site	Maintain a mowed 30-foot buffer during the restoration. Because annual grasses are the most common fire hazard, plant species that will help shade out annual grasses along the perimeter of the site. Plant the road area to perennial grasses.
Wildlife Objectives	
Minimize disruption to wildlife	Use vegetation as a screen by planting trees in curved rows and planting perimeter areas with grass and herbaceous plants such as mugwort and gumplant in the second year.
Minimize sources of weeds, provide habitat along project edges	Plant native plants to displace weeds in areas outside the main plantable area. Use spreading plants such as blackberry and rose to out-compete the weeds that currently grow along these areas.
Maintain high plant species and vegetative structural diversity	Point Reyes Bird Observatory (PRBO) data suggests that bird diversity is highest in areas with 5-7 shrub species over a 50-square-meter area. Consistent with this observation, vary density across the site to allow light gaps and create structural differences (grouping trees together will create pockets of shade and light gaps), create vegetation patches (grouping small shrubs together will mimic larger plants and may attract desirable wildlife species faster than if they were grown apart), and include herbaceous plantings between plant rows.
Plant levee remnants to native riparian vegetation	Feather and Bear River levee fragments will be planted with native riparian vegetation to provide cover for wildlife.
Provide cover and nesting sites for Swainson's hawk.	Tall riparian trees will provide nesting and perching areas. Plant adjacent perennial grassland to provide consistent access to prey and good availability of prey.
Provide VELB habitat while minimizing potential impacts to neighbors	Plant elderberry across the site. Buffers will exclude elderberry from areas that are subject to future maintenance (i.e., along the new setback levee).
Enhance habitat for anadromous fish species (spring-run Chinook, fall-run Chinook, steelhead).	Plant fast- and slow-growing riparian tree species adjacent to the side channel to increase the amount of SRA habitat in the project area in both the short and long-term. These trees will also contribute to water quality, provide detritus for invertebrate populations, and provide a source of LWD for juvenile salmonid refugia.

Figure 9 shows the locations of the proposed vegetation associations. To translate the vegetation associations to the field, the entire restoration area is to be made up of smaller planting units (a 5-row by 10-plant area), referred to as “tiles.” The project area can be divided into a grid overlaying the site, with each square on the grid representing a tile (Appendix V). Vegetation is assigned for each area of the grid, based on site conditions, mitigation requirements, or wildlife needs. The CNPS vegetation classification system (Sawyer and Keeler-Wolf 1995) was used to communicate the vegetation composition for each area.

The tiles describe plant composition (what plants are included in an area) and arrangement (how the plants are located relative to each other). Arrangements allow development of habitat features (for example, grouping trees to create dense groves for western yellow-billed cuckoos, or grouping small shrubs together to mimic a large shrub, for cover-dependent wildlife). Conventional ecological theory holds that high plant species diversity and structural diversity translates to high wildlife diversity. Thus, alternative vegetation associations will be embedded into the design.

a) Fremont Cottonwood and Mixed Willow Association

The high water table (<9 feet) on the west portion of the project site makes this area particularly suitable for a plant association dominated by such phreatophytes as Fremont cottonwood and willow. Plant species found within this association are similar to those found in the Lake of the Woods Wildlife Management Area.

b) Valley Oak Association

The majority of the project area will be planted with a valley oak-dominated association. This plant association will mimic that found along the Bear River in areas containing a water table deeper than 10 feet. A deeper water table will make this area suitable to grow drought-tolerant species such as elderberry and coyote brush.

c) Shrub Clusters and VELB Mitigation Planting

The valley oak association will contain a series of densely planted shrub clusters. According to the PRBO Conservation Science, planting dense clusters of approximately five to seven different shrub species greatly enhances bird diversity (PRBO 2004). Approximately 10 acres of this shrub planting may be devoted to an association dominated by blue elderberry that will provide mitigation habitat for VELB.

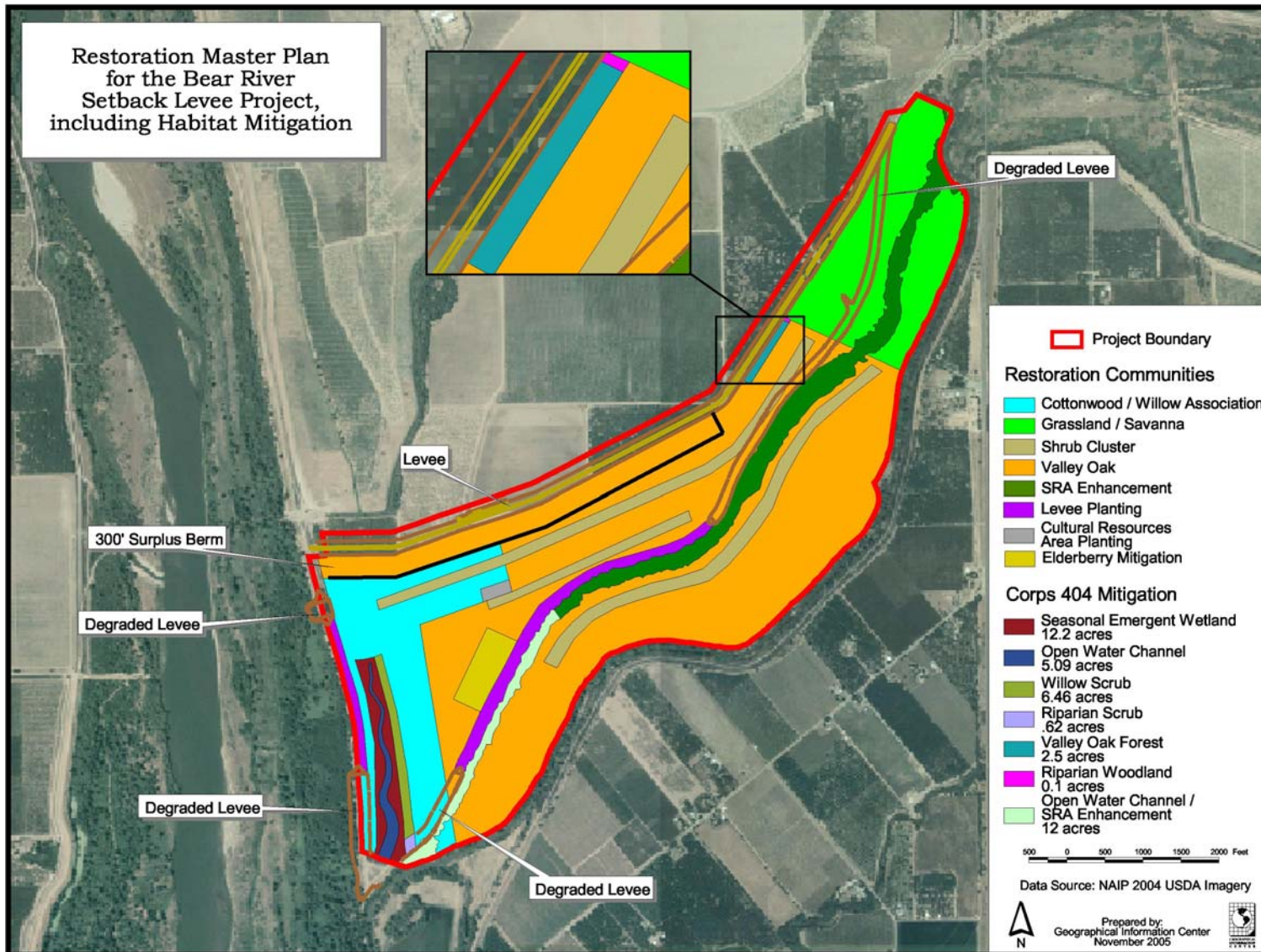
d) Grassland/savanna

The upland area on the east section of the project boundary will be planted to a native grassland/savanna habitat. This location will be planted with a mix of native grasses. The native grass area must remain at a low woody density in perpetuity.

e) SRA Enhancement

A strip of remnant riparian vegetation exists along a side channel of the Bear River that meanders throughout the middle of the project site. While much of this area is composed of native riparian plants (cottonwood, valley oak, and willow), the understory is dominated by large brambles of non-native Himalayan blackberry. Enhancement of the fringe of this intermittent channel will include the removal of Himalayan blackberry

Figure 9. Proposed Plant Community Map for the Bear River Setback Levee Project Area, Yuba and Sutter Counties, California.



individuals followed by a dense understory planting of riparian natives known to provide optimal SRA habitat (willows, white alder, and cottonwood). No plantings will occur within the secondary Bear River channel.

f) Levee Remnant Planting

Segments of the Bear River and Feather River levees will be degraded. Retained levee sections will be planted with drought-tolerant species such as valley oak, coyote brush, and elderberry.

g) Cultural Resources Area

Subsurface testing has revealed the presence of Native American archaeological remains in two portions of the project area. One area will require special vegetative cover to protect it from disturbance. To protect this area, densely spaced California blackberry, California rose and poison oak will be planted.

5. Mitigation

The restoration includes features that will mitigate some of the impacts of the levee setback construction and TRLIA's levee improvements on the WPIC and upper Bear River (collectively referred to as the Feather-Bear-WPIC Levee Improvements Project for permitting purposes), as described previously. These are shown in Tables 6 and 7 and described below.

a) Seasonal/Emergent Wetland

Seasonal and emergent wetland mitigation will be created within the floodplain swale along the western boundary of the levee setback area. Soil excavation and contouring will lower surface elevations to facilitate seasonal inundation and natural recruitment of rushes and cattails. The plant design includes buttonbush, black willow, Oregon ash, and bulrush.

b) Other Waters of the United States: Waterways, Drainages

Approximately 5.09 acres of the setback area swale will provide mitigation for other waters of the United States. The thalweg of the swale at the outlet to the Bear River is at an elevation that will be inundated by the Ecological Threshold Flow (ETF) probably every year (less than the 2-year event). The thalweg (22 feet) of the swale rises gradually upstream to meet the existing floodplain elevation at about 30-31 feet. The low-flow channel will be approximately 2 feet deep. Therefore, the "floodplain" of the swale near the outlet to the Bear River is expected to be inundated at a flow between the 1.1 and 2-year event. An additional 12 acres of mitigation for other waters of the United States will be provided within the SRA enhancement that is to occur near the secondary Bear River channel. Plantings that are adjacent to the Bear River side channel will be planted with both fast- and slow-growing tree species that could serve as SRA habitat in the short and long-term. These trees will also provide a future source of LWD.

c) Willow Scrub and Riparian Scrub

The willow scrub and riparian scrub land cover types will be mitigated with the Fremont cottonwood/mixed willow association, located in the western half of the setback levee area adjacent to the setback area swale. This association is dominated by hydrophilic species such as Fremont cottonwood and sandbar willow.

d) Riparian Woodland

Riparian woodland will be mitigated with the valley oak association. Although dominated by valley oak, other species are present, including elderberry, Fremont cottonwood, Oregon ash, and willows. An understory of California blackberry and California wild rose will be planted amidst the trees and shrubs.

The majority of the remaining acreage of the Bear River setback levee area will be planted with an association dominated by valley oak.

e) Grassland habitat and Swainson 's hawk

Wildlands, Inc. will be implementing Swainson's hawk foraging habitat on the eastern 50 acres of the existing walnut orchard in the floodway (Appendix VI), of which 39 acres will serve as California Endangered Species Act (CESA) mitigation and 11 acres of enhancement. An additional 33 acres of grassland/savanna habitat will be created on the north side of the existing Bear River levee by the restoration contractor to meet the low roughness requirement. This area will provide additional foraging habitat for Swainson's hawk, outside the mitigation requirement, and will complement the larger riparian restoration project. The close proximity of the project boundary to the Bear and Feather Rivers make this project particularly well suited for Swainson's hawk habitat. The project will provide substantial nesting territory for Swainson's hawk by planting associations dominated by cottonwood and valley oak.

f) VELB mitigation

The restoration project will incorporate approximately 10 acres of mitigation habitat for VELB. This area will include a plant association dominated by blue elderberry and will contain large shrubs of blue elderberry that have been transported from construction impact areas and transplanted in accordance with guidelines previously established by the U.S. Fish and Wildlife Service (USFWS) (Appendix VII) (one additional transplant will occur in spring 2006). The purpose of transplanting is to transfer healthy, mature, blue elderberry individuals to the mitigation area to facilitate the recolonization of VELB to the project site. In addition, the area will be planted with elderberry seedlings and associates (other woody species) in accordance with USFWS guidance. All elderberry shrubs will be planted a sufficient distance from project levees to ensure that elderberries will not be disturbed by, or interfere with, levee maintenance activities.

IV. PROJECT IMPLEMENTATION

A. Regulatory Compliance

1. Environmental Compliance

California Environmental Quality Act (CEQA) compliance has been completed for this project, and National Environmental Policy Act (NEPA) compliance has been completed as part of the USACE Section 404 permitting processes. Coordination is underway with DFG, USFWS, the National Marine Fisheries Service (NMFS), USACE, and the Regional Water Quality Control Board for the necessary permits and authorizations.

2. Herbicide Application Permits

Herbicides will be used on the project as approved by DFG, and according to county and state permitting and reporting requirements. Roundup® (glyphosate) and 2,4-D are likely to be the most commonly used herbicides on the project. Rodeo® (glyphosate, for areas adjacent to water bodies) and Garlon® (triclopyr, for woody species control) may also be used.

B. Pre-Project Surveys and Monitoring of Project Implementation

1. Cultural Resources

Subsurface testing has revealed the presence of Native American archaeological remains in two portions of the project area. Coordination with the Most Likely Descendent (MLD) is ongoing to ensure the protection of the sites.

If archaeological materials such as historic building or structure remains, and artifact deposits or scatters, or prehistoric artifacts such as stone tool flaking debitage, mortars, pestles, shell, or bone are encountered during project implementation, all ground-disturbing activity must cease within a 100-foot radius of the find. A qualified cultural resource specialist must be contacted to identify the materials, determine their possible significance, and formulate appropriate mitigation measures. Appropriate mitigation may include no action, avoidance of the resource, and potential data recovery.

In the event that human remains are uncovered during project implementation, all ground-disturbing activities within the vicinity of the find must cease and the Yuba County Coroner must be contacted immediately. If the Coroner determines the remains to be of Native American origin, the Coroner must contact the Native American Heritage Commission (NAHC) within 24 hours. The NAHC will contact the MLD of the remains and the MLD, in cooperation with the property owner and TRLIA, will determine the ultimate disposition of the remains.

2. Species of Concern

a) Rare Plants

A qualified botanist has conducted surveys for special-status plant species with potential to occur on the site. No special-status plants were found.

b) Swainson's Hawk and Other Raptors

Because project activity could occur during the breeding season of Swainson's hawk and other raptors (February 15 to September 15), a qualified biologist will conduct

preconstruction surveys to identify active nests in the non-orchard trees in the setback levee area, in accordance with DFG guidelines. Restoration activities will be scheduled to prevent disturbance of nesting raptors as necessary.

c) Valley Elderberry Longhorn Beetle

All elderberry shrubs within 100 feet of potential project activities will be protected from disturbance or transplanted if necessary, in accordance with USFWS guidance.

d) Giant Garter Snake

Qualified biologists will conduct surveys immediately preceding any work in potential giant garter snake habitat (e.g., unnamed ditch in the project area and areas within 200 feet of aquatic habitat). All protective measures specified by USFWS and DFG will be implemented to minimize the potential for take.

C. Site Preparation

1. Orchard Removal

The existing walnut orchard in the floodway will be removed prior to onset of restoration activities. Approximately 200 additional acres of existing orchard will need to be removed on the north side of the Bear River prior to the construction of the Bear River setback levee and riparian restoration. The ecological benefits provided by the current walnut orchards are expected to be surpassed by the rapid wildlife responses observed after the first year of restoration.

2. Existing Riparian Habitat

Enhancement of the remnant riparian area along the Bear River side channel, which follows the existing Bear River northern levee alignment, will require repeated efforts to permanently eradicate Himalayan blackberry. Removing Himalayan blackberry will consist of mowing and spraying. With small infestations, weed eaters may be used to reduce blackberry thickets. With larger areas, a flail mower or masticator will be used to cut or shred blackberry canes. Following the mechanical treatment, herbicide will be applied to eradicate remaining blackberry canes. If canes are young and actively growing, Roundup® (glyphosate) will be applied. Woody stems will be treated with Garlon® (triclopyr). There will be no landscape manipulation (i.e., grading) to prepare the area for planting. Extra caution will be exercised to ensure that native species, especially blue elderberry, are not damaged. Typical restoration implementation practices required to enhance growth of native species, such as weed control and irrigation, will be more challenging to execute due to the sparse nature of this planting.

3. Swale Construction

Prior to riparian restoration implementation, swale construction and levee degradation must occur. The swale, which is designed to eliminate fish entrapment, will be constructed along approximately 2,800 feet of the lower Feather River Levee.

4. Levee Degradation

Sections (62%) of the existing north Bear River Levee will be degraded to elevations ranging from 40-44 feet. The gravel road on the remaining Bear River levee will be removed and levee crown rounded. Segments (38%) of the existing Feather River levee will also be removed. A 200-foot-long notch will be cut in the Feather River levee

near the setback levee tie-in, and all or parts of the southern 1,500 feet of the Feather River levee will be degraded to the toe elevation to facilitate hydraulic and ecological connectivity between the setback area and the Lake of the Woods Unit. The degraded and remaining portions of the Bear and Feather River levees will be planted with native riparian species. Additional details on the floodplain swale and removal of existing levee segments may be found in Appendix III.

5. Surplus Material Berm

A waterside setback levee berm will be constructed west of Station 60 (approximately Bear RM 2.7) to dispose of excess materials. The current plan is for a maximum 300-foot-wide berm, of which 50 feet would serve as the RD 784 maintenance road. The berm height will not exceed 25% of the setback levee height (maximum height ranging from about 5 to 7 feet high). The surplus material berm will be planted with native upland species.

6. Restoration Area

Once appropriate ground surveys are completed, the entire project area will be disked and floated to smooth the surface for irrigation and tractor operations (mowing and spraying). Existing native plants will be protected with fencing to minimize potential damage from machine operation. Prior to these activities, operations will be initiated to begin eradication of non-native species.

D. Field Layout and Plant Spacing

Field layout and plant spacing is based on the efficient operation of the irrigation system, use of mechanized maintenance equipment, desire to rapidly provide good habitat, and recognition of hydraulic and hydrological conditions. The restoration area is divided into sub-areas (Figure 9):

- upland grassland area of which 39 acres of Swainson's hawk mitigation will be completed by Wildlands Inc.,
- main field with full restoration planting containing 212 plants per acre,
- shrub clusters with double-density planting,
- swale with USACE Section 404 mitigation,
- SRA enhancement with blackberry control and sparse woody native planting, and
- levee remnants with a drought-tolerant woody and native grass planting.

Details of the field layout and implementation activities are summarized in Table 9. Figure 10 provides a graphical depiction of the vegetation types, including strips of densely vegetated, low-statured shrub clusters. Over time, plant mortality, recruitment, and flood events will alter this original layout.

E. Irrigation

Prior to project implementation, a more detailed irrigation design will be developed. Based on knowledge of the site and preliminary design, the following are expected to be the requirements for the system:

- The plant spacing throughout most of the restoration and mitigation areas will be 20-foot-wide rows with a 10-foot distance down the planting rows, and rows planted in an approximate east-west direction. Shrub clusters will be planted with 20-foot-wide rows with a 5-foot distance down the rows. Levee remnants will be planted with 10-foot-wide rows with a 5-foot distance down the rows.

- The Cultural Resources Area will be planted with 10-foot wide rows with 2-foot distance down the rows. During ground preparation of this area (stump grinding and light disking), a qualified cultural resource monitor will be on-site to ensure that the ground disturbing activities do not adversely affect buried resources.
- Planting rows will curve and run parallel to flood flows. The irrigation system will utilize existing wells as water sources.
- Native plants within the setback area will be flood irrigated. A drip irrigation system will be used on levee remnants and in the existing Bear River floodway.
- The drip-line emitters will be spaced, with three emitters per plant 12 inches apart. The design flow will be 0.6 gallons per hour per emitter (1.8 gallons per plant per hour).

Within selected areas, soil-moisture sensors will be placed 1) near the Bear and Feather Rivers, 2) in the middle of the setback levee area, 3) in the middle of the grassland, 4) in the middle of the removed orchard, and 5) on top of the levee remnants. Sensors will be installed at depths of 12 and 36 inches.

In conjunction with these measurements, plant stress observations before and after irrigation periods will be necessary to critically judge the timeliness and effectiveness of irrigation. Measurements provide the most direct assessment of soil moisture. Table 10 provides the irrigation goals of the project.

Table 9. Summary of field and irrigation layout for the Bear River setback levee project area.

Factor	Main Field	Grassland/Savanna	Shrub Clusters	Levee Remnants/Surplus Material Berm
Approx. area (acres)	491	33	54	22
Location (see Figure 9)	Main body of unit, including a strip of remnant riparian vegetation exists along a side channel of the Bear River that meanders throughout the middle of the project site.	Upland area on the east section of the project boundary that must maintain low roughness values.	Long bands of shrubs interspersed through the central project area.	Areas identified in the Levee Plan (Appendix III) for levee retention and disposition of excess material (Surplus berm).
Planned vegetation type (see Appendix V)	Fremont cottonwood/mixed willow association, valley oak association, seasonal/emergent wetland, swale (open water channel) SRA enhancement. Drought tolerant, upland species on surplus material berm.	Perennial native grasses.	Densely clustered shrubs within the valley oak association.	Drought tolerant, upland species.
Irrigation type	Flood and drip	None	Drip	Drip
Water source and delivery	Use existing irrigation systems in the setback area and DeValentine property.	Not applicable.	Use existing irrigation systems in the setback area and DeValentine property.	Use existing irrigation system in the setback area.
Ground preparation	Disk	Disk	Disk	Asphalt and gravel to be removed and levee crown rounded.
Planting berms	Not required.	Not required.	Not required.	Not required.
Row Orientation	Rows will parallel the setback levee and oriented east to west.	Not applicable.	Rows will parallel Bear River bank and oriented east to west.	Rows will follow the orientation of the remaining Feather and Bear River Levee.
Plant spacing	Variable. Row spacing: 10-20 feet In-row spacing: 2-10 ft.	Not applicable.	Row spacing: 20 feet. In-row spacing: 5 feet.	Variable. Row spacing: 10-20 feet. In-row spacing: 5-10 ft.
Density (plants/acre) ¹	212-965	Not applicable.	386	212-531
Decommissioning	Remove any above ground irrigation features (pump connections, flush outs, etc). Remove and recycle drip system hoses. Destroy wells that will not be used for restoration per county well destruction standards.			

Figure 10. Cross-section through Bear River Plant Design.

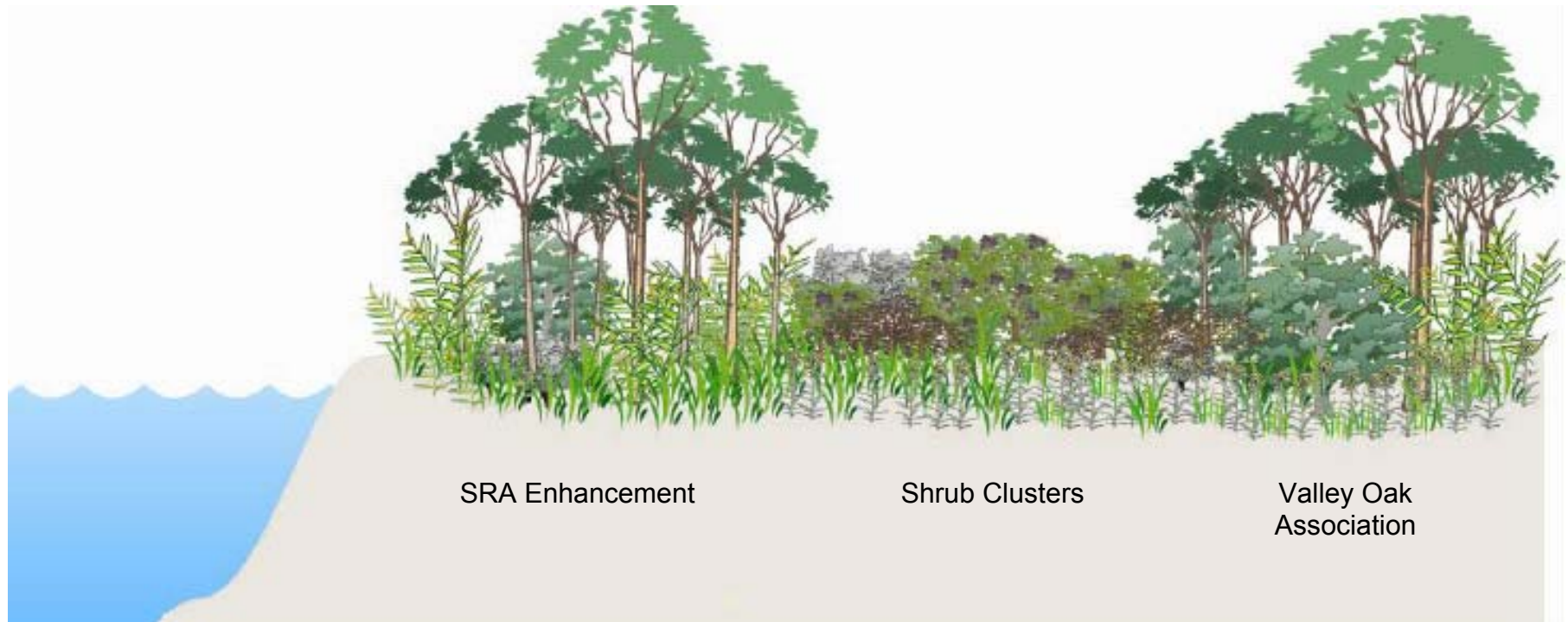


Table 10. Irrigation goals for the Bear River setback levee project area.

Year	Goal	Frequency
1	Keep the shallow roots (1-2 feet) of young plants moist to ensure optimum growth and survival.	Utilize soil moisture probes to monitor and maintain moisture throughout the soil column.
2	Encourage deep rooting and enhance field access to facilitate weed control.	Deliver less frequent but longer irrigations.
3	Encourage deep rooting and enhance field access to facilitate weed control.	Continue with long irrigations and extend the period between irrigations.

F. Plant Material Collection and Propagation

To preserve any ecotype differences, plant material will be collected from vegetation as near as possible to the project site. Table 11 summarizes the types of plant propagation material to be used for woody species. Field cuttings of cottonwood and willows will be collected in January or February when the trees are dormant. A lead time of 12 to 18 months is required from time of seed collection to transplant maturity for plants grown in containers at a nursery. Seeds for the herbaceous understory will be bought at local nurseries or collected from sources near the project site.

Table 11. Standard planting materials and times for woody species

Species	Nursery Grown		Direct Planting		Standard Planting Time (primary method)
	Seeds	Cuttings	Seeds	Cuttings	
Arroyo willow	2	2		1	Feb-Mar
Black willow	2	2		1	Feb-Mar
Box elder	1				Oct-Apr
Buttonbush	1	2			Oct-Apr
California blackberry	1			2	Oct-Apr
Coyote bush	1	1		2	Oct-Apr
Dutchman's pipevine	1	2			Oct-Apr
Elderberry	1				Oct-Apr
Fremont cottonwood	2	2		1	Feb-Mar
Oregon ash	1				Oct-Apr
Red willow	2	2		1	Feb-Mar
Sandbar willow	2	2		1	Feb-Mar
Western sycamore	2	1			Oct-Apr
Wild rose	1	2		2	Oct-Apr
Valley oak	2		1		Nov-Dec
White alder	1	2			Oct-Apr

1 – primary method, 2 – secondary method.

G. Plant Installation

Once site preparation is complete and the irrigation systems are in place, plant installation can begin. The planting of woody species begins with the staking and labeling of each plant location. The location of woody species is expressed by the planting tiles (Appendix V).

1. Planting Woody Species

Approximately 138,000 woody plants will be planted within the restoration project area. Table 12 presents a preliminary estimate, and future reports by the contractor (as built) and/or the monitoring entity will provide the actual numbers planted. Additional details for the planting of woody species include the following:

- **Initial planting:** Initial planting will occur in the fall (oaks and nursery stock) and will continue through winter and spring (direct cuttings). By spring, the initial planting should be complete.
- **Replanting:** A replant of any missing or dead plants will occur before a survivorship census is completed for year 1. The plant design approach (over-planting) will minimize future replanting efforts in years 2 and 3.

Acorns will be planted directly into the field during the fall. Cottonwood and willow cuttings will be planted in February and March. Nursery material will be planted in the spring or fall when weather conditions are cool and moist (Table 11).

Table 12. Summary of proposed plant species for restoration of the Bear River setback levee area.

Common name	Scientific name	Species composition (%)	Density (plant/acre)	Total Number
Box elder	<i>Acer negundo</i> L.	4	9	5,000
Bulrush	<i>Scirpus acutus</i> or <i>Scirpus californicus</i>	1	2	881
Buttonbush	<i>Cephalanthus occidentalis</i>	3	6	3,606
California blackberry	<i>Rubus ursinus</i>	10	22	12,623
Clematis	<i>Clematis ligusticifolia</i>	3	8	4,514
Coyote bush	<i>Baccharis pilularis</i> .	9	21	11,708
Dutchman's pipevine	<i>Aristolochia californica</i>	3	7	4,246
Elderberry	<i>Sambucus mexicana</i>	15	34	19,217
Fremont cottonwood	<i>Populus fremontii</i> ssp. fremontii	5	12	6,972
Grass plugs	various species	2	4	2,465
Oregon ash	<i>Fraxinus latifolia</i>	4	9	5,091
Poison oak	<i>Toxicodendron diversilobium</i>	1	2	1,298
Valley oak	<i>Quercus lobata</i>	14	31	17,954
Western sycamore	<i>Platanus racemosa</i>	5	11	6,146
White alder	<i>Alnus rhombifolia</i>	1	3	1,649
Wild rose	<i>Rosa californica</i>	12	28	15,933
Wild Grape	<i>Vitis californica</i>	1	3	1,488
Arroyo willow	<i>Salix lasiolepis</i>	2	5	2,739
Gooding's black willow	<i>Salix goodingii</i>	2	5	2,903
Red willow	<i>Salix laevigata</i>	0	1	332
Sandbar (narrow-leaf) willow	<i>Salix exigua</i>	4	10	5,423
TOTAL		100.0	233	132,188

2. Native Grasses

The planting of native grass minimizes the invasion of non-native species, enhances wildlife habitat, limits erosion, and provides less hazardous fire conditions. Soil conditions indicate that native grass will do well on the project site. The east upland area of the site (33 acres) will be planted with primarily native grasses (Table 13) to ensure that appropriate roughness values are maintained. The grassland will also provide foraging habitat for Swainson's hawk. Native grasses will also be drilled within the swale to preclude the invasion of non-native and establishment of woody species from establishing within the swale, native grasses will be drilled. Planting creeping

wildrye between plant rows and around the project perimeter will reduce long-term management costs devoted to control non-native species.

Seed will be purchased from stock collected from the same ecoregion as the restoration project. In the upland grassland, the seeding rate will be approximately 13 pounds per acre, and seed will be planted with a no-till drill. Five pounds per acre of creeping wildrye will be applied to the row centers of the valley oak association and project perimeter. Native grass seeding will be applied in November or December before the first rains.

Table 13. Summary of potential native grass species to be seeded for restoration of the Bear River setback levee project area.

Common name	Scientific name	Rate (lb/acre)	Est. Total lbs
Upland Grassland (33 acres)			
Blue wildrye	<i>Elymus glaucus</i>	3	99
Creeping wildrye	<i>Leymus triticoides</i>	4	132
Meadow barley	<i>Hordeum brachyantherum</i>	2	66
Purple needlegrass	<i>Nasella pulchra</i>	4	132
Total		13	429
Swale (12 acres)			
Blue wildrye	<i>Elymus glaucus</i>	3	36
Creeping wildrye	<i>Leymus triticoides</i>	4	48
Meadow barley	<i>Hordeum brachyantherum</i>	2	24
Purple needlegrass	<i>Nasella pulchra</i>	4	48
Total		13	156
Row Centers (240 acres)			
Creeping wildrye	<i>Leymus triticoides</i>	5	1200
Total		5	1200

In addition to native grass seeding, plugs of native grass and sedge will be planted. Plugs are an especially important method for cultivating plants that do not reproduce well by seed (e.g. Santa Barbara sedge and deer grass). Santa Barbara sedge requires irrigation and shade for successful establishment. This species will likely flourish in the floodplain swale and within the understory of the dense riparian forest planting near the Bear River. Deer grass is a more drought-tolerant species that will be planted in the upland grassland area to increase species richness. Table 14 shows the recommendations for plug planting within the project boundary.

Table 14. Summary of potential native grass and sedge species to be plug-planted for restoration of the Bear River setback levee project area.

Common name	Scientific name	plugs/acre	Area and # of Acres	Est. Total plugs
Deer grass	<i>Muhlenbergia rigens</i>	2500	Upland grassland, 33 Acres	82,500
Santa Barbara sedge	<i>Carex barbarae</i>	2500	Row Centers, 50 Acres	125,000
Santa Barbara sedge	<i>Carex barbarae</i>	11,000	Low flow channel of swale, 2.3 Acres	25,300
Total				232,800

3. Herbaceous Plants

Incorporation of herbaceous plants will provide important wildlife habitat, produce seed sources, and inhibit the establishment of invasive, exotic species. Mugwort and great valley gumplant are especially important components of riparian communities and appear to be good competitors against invasive non-native species. These native herbaceous plants (Table 15) will be seeded between plant rows of the Fremont cottonwood/mixed willow association using a no-till drill. Appropriate seeding time is typically between the months of December and February. Seeds will be collected or purchased from the same ecoregion as the restoration project.

Table 15. Summary of recommended understory herbaceous plant species for the Bear River setback levee project area.

Common Name	Scientific Name	Rate (lbs/acre)	Total lbs.
Mugwort	<i>Artemisia douglasiana</i>	0.5	14
Great valley gumplant	<i>Grindelia camporum camporum</i>	0.5	14.5
Total		1.0	18.5

Planting efforts will focus on the woody plants in the first year with the native herbaceous plants and grass planted in year 2. Table 16 provides a timeline for implementation of native woody, grass, and herbaceous species planting.

Table 16. Calendar of planting implementation for the Bear River Setback levee area.

Date	Trigger	Action
Spring Year 1	Weed germination, soil moisture for field activities.	Maintain complete weed control and prepare a seed bed through mowing, spraying, and disking when weeds are young.
Fall Year 1	Planting of woody species.	
Fall Year 2 (typically November)	After about an inch of rain, when the winter weeds "flush" (germinate).	Spray weeds (Roundup) to give the natives a good start. Directly seed native grass using a no till drill. Mix the seed prior to planting (no observed difference between mixed and separate seeding). Apply 30 pounds/acre of 16-20-0 fertilizer (no observed difference, but fertilizer may benefit new seedlings under extremely cold weather).
Early Spring Year 3	Assessment of weeds in previous year, appearance of broadleaf plants.	Control broadleaf plants (2,4-D) if woody plants are dormant and weather conditions comply.
Spring Year 3 to end of project	Weeds taller than 8", or if weeds threaten to shade natives.	The objective is to increase vegetative growth (and not necessarily seed production) of the native grass. Well-timed mowing will reduce the competition with non-native weeds, and may encourage vegetative growth (such as tillering) of the native grass.

H. Plant Maintenance

1. Plant protectors

Plant protectors (one-quart milk cartons) will be installed with a few inches of wood shavings applied as mulch to hold soil moisture and minimize weed growth. Caution

must be taken to not bury the top leaves of small-statured nursery stock. These protectors shield the plant from desiccation, herbivory, and drift from herbicide applications.

2. Weed Control

Weed control is necessary for the successful establishment of native plants and habitat improvement. The weeds of greatest concern at the site are Himalayan blackberry (*Rubus discolor*), Johnson grass, and starthistle.

During the growing season, weeds along the planting rows will primarily be controlled by the timely spraying of Roundup® or a generic herbicide brand with glyphosate as the active ingredient. Rows will also be mowed with side mower and weed eater as needed. The aisles between the planted rows (centers) will be mowed or disked to minimize weed growth and propagation. Spraying and mowing should be implemented every 3-6 weeks during the growing season for at least the first 2 years.

In areas to be planted with herbaceous species, a strict spraying and mowing regimen will be conducted for an entire season before planting. Once the herbaceous species are planted, weed control methods will be limited to mowing and possibly wicking with Roundup®. If broadleaf weed pressure becomes significant in an area planted with native grasses, a broadleaf-specific herbicide (2,4-D) may be used.

Recommendations on spray rates and substances will be obtained from a pest control advisor.

I. Herbivore Control

A number of measures can help control or minimize the effects of herbivores on young plants (Table 17). Cultural practices such as mowing or spraying can discourage most of these herbivores and overplanting may provide more material than they can eat.

The proposed restoration area will be monitored regularly to assess damage caused by herbivores. Significant problems tend to arise with regard to acorn predation by rodents, suggesting that the first year of planting is especially important because the bare ground conditions are likely to discourage rodents on the site.

Based on field observations, the areas of highest deer browse are estimated to be immediately adjacent to the existing vegetation. The large open areas of the site are expected to receive little browse pressure. Control measures may be necessary only in discrete areas.

Table 17. Summary of herbivore control methods.

Herbivore	Type of Damage	Comment on measure(s) or plant response
Deer	Browsing sapling.	Spray chemical repellent ("Hot sauce") Install plastic screens, netting, or chicken wire. Temporary deer fencing (New Zealand style) might be appropriate at this site.
	Use trees to rub velvet off antlers.	Saplings can resprout.
Beaver	Cut down woody species to build dams	Dismantle dams or, if damage becomes severe, herbivore removal. Woody species can stump sprout.
	1) Eat bark and cambium at the base of sapling, usually girdling the entire stem. 2) Dig-up recently planted acorns and eat them.	Saplings resprout, unless vole populations and pressure is high. Voles live only in dense herbaceous (weed) cover and never stop moving when in the open to avoid predators. Removing dense weed cover reduces populations.
Pocket Gophers (<i>Thomomys bottae</i>)	Eat root systems (probably killing more saplings than any other vertebrate pest).	Control of weed cover allows predators to hunt gophers; however, gophers can persist in an open, weed-free field. Frequent disking, weed mulch control, or flooding reduce populations. A variety of birds will prey on gophers if given the opportunity, so raptor perches may reduce plant predation by gophers.
Ground Squirrels (<i>Otospermophilus beecheyi</i>)	Dig up and shred plants and protectors. Eat the bark of willow and cottonwood saplings and limbs.	Anticoagulant baits effectively controls populations. Flooding or disking can reduce populations.
Rabbits and Hares	Browse early spring growth.	Most seedlings resprout.

J. Access

Access for the restoration project will be limited to the previously determined project right-of-way.

K. Monitoring and Reporting

1. Restoration Planting

In order to successfully implement the restoration project, monthly activity reports will be prepared throughout each year of the project. An annual quantitative survey will be conducted between June and August.

During the restoration project, monitoring results will be recorded in the following ways:

- monthly field reports,
- end-of-season monitoring,
- annual photo points,
- annual end of season reports, and
- final report.

These methods are described briefly below.

2. Mitigation Planting

Mitigation areas will require annual monitoring in addition to efforts directed toward the restoration planting. Monitoring efforts are outlined in a habitat mitigation and monitoring plan and should follow specific guidelines described for the particular species or habitat.

L. Performance Goals

1. Restoration Planting

Given the presence of good soils and potential exposure to frequent flooding, the project area should sustain rapid growth of restored riparian species throughout the life of the project implementation (approximately 3 years). An “over-planting” approach is used to rapidly establish native riparian species. Over-planting the project site will decrease O & M costs by eliminating the need for any additional replanting efforts. The ultimate ecological objective for over-planting is that in time the area will thin out and create a complex of open canopy, dense forest, and dead snags, all of which provide benefits to wildlife.

It is anticipated that at the end of the 3-year establishment period, 70% survivorship of woody species will be attained. Over time, mortality based on differences of soil textures and water table depths will create areas of complex, open canopy, dense forest, and dead snags, all of which create habitat for wildlife.

2. Mitigation Planting

Following project construction and mitigation implementation, a 10-year monitoring program will be conducted in the Section 404 mitigation areas to determine the mitigation sites’ progress toward meeting the established success criteria. The monitoring will include both quantitative surveys to check survival and percent cover, and qualitative surveys for overall condition and success of mitigation efforts. The performance criteria that will be used to determine mitigation area success are shown in Table 18. Additionally, continued success of the mitigation wetlands, without human intervention must be demonstrated for three consecutive years, once the success criteria has been met.

Table 18. Performance criteria to measure mitigation success.

Year	Survival of Trees and Shrubs (%)	Total Cover (%)
1	85	5
2	75	10
3	65	15
4	55	20
5	50	25
6	50	25
7	50	25
8	50	25
9	50	25
10	50	25

In addition to these quantitative assessments, qualitative assessments will include general plant health, excessive weed competition, appropriate hydrological conditions, signs of herbivory, use by wildlife, and vandalism.

M. Monthly Field Reports

The restoration contractor will complete monthly reports documenting field activities and observations for three years. These reports generally note planting and maintenance activities, irrigation schedules, weed pressure, plant growth, soil moisture, vandalism, and rodent damage. Soil moisture data (qualitative and/or quantitative) will also be collected during the growing season.

N. End-of-Season Monitoring

At the end of the first growing season, the restoration contractor will conduct a complete census of all woody species planted. The data are best analyzed using a database to calculate survivorship, and to determine any changes to or omissions from the original planting design. During years two and three, woody species plantings will be sampled to determine survivorship, growth, and coverage. If the budget allows, sampling of native grass and herbaceous understory plantings will also be conducted.

O. Photopoints

In additions to quantitative surveys, the restoration contractor will take pre- and post-planting photographs to provide qualitative information on vegetation changes at the restoration site. The photographs will be taken annually at established photo points late in the growing season.

P. Wildlife Use

Very few wildlife studies have been conducted in the specific project region. The adjacent Lake of the Woods Wildlife Management Area, however, was established in 1969 for the sole purpose of wildlife habitat conservation. Aside from the acquisition of lands for habitat conservation, the only known population assessments in this area are devoted to yellow-billed cuckoo.

The restoration contractor should work closely with other entities (DFG, USFWS, and PRBO) to monitor wildlife usage of the project area. Any wildlife observations encountered during regular management or monitoring activities will be recorded for future reporting.

Q. Reporting

1. End-of-Season Reports

The end-of-season report will document the monitoring data, review the site activities, provide a budget analysis, and recommend future management actions. End-of-season reports will be produced following the end-of-season meeting to help the restoration contractor prioritize the project's needs and share project progress with TRLIA.

2. Final Report

The final report will summarize the project, including information developed in the end-of-season reports. It will analyze activities in terms of the restoration plan and provide long-term management suggestions.

R. Safety Issues

The health and safety of all employees are an integral part of restoration work. Prior to any work in the project area, all personnel will be briefed on safety issues associated with the site.

S. Standard Field Procedures

All restoration personnel will be required abide by the following safety procedures.

- Prior to any work on the unit, staff will be briefed on safety issues associated with the site. Employees will have a safety binder that will entail safety procedures and emergency information. All employees will be responsible for complying with safe work practices.
- In case an employee incurs any injuries or illnesses while on the job, they are instructed to call 911 or the nearest health care provider, Rideout Memorial Hospital, 726 4th St. Marysville, CA 95901. Employees should also contact their place of employment to report the situation.
- Employees will comply with the requirements of the Drug-Free Workplace Act of 1990 (Government code Section 8350 et seq.).

T. Impacts and Concerns

Communication with adjoining landowners is critical to the successful implementation of a restoration project. TRLIA should discuss restoration goals and objectives with project neighbors before implementation begins. Neighbor surveys can provide invaluable input about site history and past management practices and address any concerns or suggestions from surrounding landowners. Neighboring landowners should remain an integral part of the restoration process throughout the life of the project.

U. Flood and Fire Contingencies

The restoration contractor will be required to remove all farm equipment from the site during the flood season (November 1 to April 15). In the event of a flood during the restoration establishment period, flood debris will be cleared from the site following the flood season by the restoration contractor.

Throughout the implementation of the project, periodic mowing between rows and clusters, and along the perimeter of project areas, will need to be conducted to reduce potential fire hazards. Fire breaks greater than 30 feet will be included around the project boundary.

V. Implementation Timeline

Figure 11 shows the timeline for the restoration project with respect to the major tasks.

Figure 11. Implementation Timeline for the Bear River Setback Levee Restoration Project.-

Task	2005		2006				2007				2008				2009			
	Sum	Fal	Win	Spr	Sum	Fal	Win	Spr	Sum	Fal	Win	Spr	Sum	Fal	Win	Spr	Sum	Fal
1. Collect and Propagate Plants	█	█	█	█														
2. Prepare Areas for Restoration and Mitigation		█		█	█	█												
3. Plant Native Grasses in Swainson's Hawk Mitigation Area						█												
4. Establish Layout for Restoration				█	█	█												
5. Install Irrigation System					█	█												
6. Plant Riparian Vegetation						█	█		█	█								
7. Maintain Riparian Plantings						█	█	█	█	█	█	█	█	█	█	█	█	█
8. Plant Native Grasses in Upland Grasslands Area and Bear River Floodway						█	█											
9. Plant Native Grasses and Herbaceous Understory in Setback Area									█	█								
10. Monitor and Report Results						█	█	█	█	█	█	█	█	█	█	█	█	█
11. Destroy wells and remove irrigation system																		█

V. BUDGET

A. Capital Cost

The estimated capital budget for the restoration of the Bear River setback levee project is based on the following assumptions:

1. Most of the existing wells will be used for irrigation and the remaining well will be destroyed as part of levee construction.
2. All of the available wells are supplied by PG&E.
3. The restoration contractor will destroy the wells used to irrigate the project upon completion of the project in accordance with California regulations.
4. The planting will be watered with drip irrigation due to the soil types.
5. Irrigation facilities will need to be installed and removed on a seasonal basis due to floodwaters.
6. The project will need to be performed at prevailing wage with all prevailing wage workday restrictions (5 days @ 8hrs/ day).
7. The restoration contractor will not be responsible for the removal of any of the buildings or utilities on the proposed properties; therefore, costs are not included in this budget.
8. The duration of the implementation phase of the project will be 3 years.
9. There are no hazardous materials issues on any of the properties.
10. The existing levees will be degraded in 2006, simultaneously with setback levee construction, and restoration planting will begin in fall 2006.

Table 19 shows the estimated cost for restoration implementation by year. The table also includes an estimated cost for Swainson's hawk mitigation to be conducted by Wildlands, Inc. A 20% contingency is added to cover possible changes in scope, coordination with levee construction and other factors.

Table 19. Estimated cost for the restoration and mitigation of the Bear River setback levee project area.

	Fall 2005	2006	2007	2008	2009	Total Labor and Expenses
MITIGATION ITEM						
USACE CWA 404 (Swale Area)						
Task 1 Site Preparation		3,000				\$ 3,000
Task 2 Planting		45,900	5,100			\$ 51,000
Task 3 Irrigation System Installation		38,000				\$ 38,000
Task 4 Maintenance (Irrigation and Weed Control)		2,500	10,000	8,000	4,500	\$ 25,000
Task 5 Monitoring and Reporting Years 1-3		1,000	6,000	6,000	6,000	\$ 19,000
Task 6 Additional Monitoring and Reporting Years 4, 6, 8, 10					31,000	\$ 31,000
Task 7 Fencing for 3 identified 404 mitigation areas					33,000	\$ 33,000
Task 8 Management		7,600	5,700	3,800	1,900	\$ 19,000
Total USACE CWA 404 (Swale Area)	\$ -	\$ 98,000	\$ 26,800	\$ 17,800	\$ 76,400	\$ 219,000
Valley Elderberry Longhorn Beetle (VELB)						
Transplant Elderberry Bushes	18,000					\$ 18,000
Field Maintenance (Irrigation and Weed Control)		4,000	2,500	2,000	1,500	\$ 10,000
Monitoring and Reporting Years 1-3		1,000	3,000	3,000	3,000	\$ 10,000
Additional Monitoring and Reporting Years 4-10					16,000	\$ 16,000
Fencing for VELB mitigation area					9,000	\$ 9,000
Total VELB	\$ 18,000	\$ 5,000	\$ 5,500	\$ 5,000	\$ 29,500	\$ 63,000
Total Mitigation Capital Cost	\$ 18,000	\$ 103,000	\$ 32,300	\$ 22,800	\$ 105,900	\$ 282,000
RESTORATION & ENHANCEMENT						
Task 1 Seed Collection	6,000					\$ 6,000
Task 2 Plant Material	66,000	171,600	26,400			\$ 264,000
Task 3 Remove 193 Acres of Walnuts (De Valentine)		292,000				\$ 292,000
Task 4 Remove 200 Acres of Orchards in Setback Area		320,000				\$ 320,000
Task 5 Grade and Prepare 51 Acres of Existing (Removed) Levee Footprint		42,000				\$ 42,000
Task 6 Field Preparation 501 Acres		149,000				\$ 149,000
Task 7 Install and Retrofit Irrigation System on 552 Acres		542,000				\$ 542,000
Task 8 Plant Trees, Shrubs, and Herbaceous Understory on 552 Acres		492,000	14,000			\$ 506,000
Task 9 Field Maintenance (Irrigation and Weed Control) on 552 Acres		29,000	705,000	493,500	211,500	\$ 1,439,000
Task 10 Management		108,800	81,600	54,400	27,200	\$ 272,000
Task 11 Monitoring		4,000	28,000	28,000	28,000	\$ 88,000
Total Restoration & Enhancement	\$ 72,000	\$ 2,150,400	\$ 855,000	\$ 575,900	\$ 266,700	\$ 3,920,000
Subtotal Mitigation, Restoration & Enhancement	\$ 90,000	\$ 2,253,400	\$ 887,300	\$ 598,700	\$ 372,600	\$ 4,202,000
20% Contingency	\$ 18,000	\$ 450,680	\$ 177,460	\$ 119,740	\$ 74,520	\$ 840,400
Total Mitigation, Restoration & Enhancement	\$ 108,000	\$ 2,704,080	\$ 1,064,760	\$ 718,440	\$ 447,120	\$ 5,042,400
Swainson's Hawk Mitigation	\$ 500,000					\$ 500,000
Total Mitigation, Restoration & Enhancement, and Swainson's Hawk Mitigation	\$ 608,000	\$ 2,704,080	\$ 1,064,760	\$ 718,440	\$ 447,120	\$ 5,542,400

B. Operation and Maintenance Costs

Extensive operation and maintenance (O & M) activities result in increased financial and ecological costs. Intense management activities within the floodway are not only more expensive but could potentially cause considerable damage to habitat functions and values. Whenever possible, unnecessary activities should be avoided to help preserve the natural physical and biological processes within the project area.

The upland grassland on the east section of the project site represents a hydraulically sensitive location on the floodplain. The planting in this area (low woody density) is intended to ensure that adequate water elevations are maintained within the WPIC. Keeping this area free of woody species, however, will be a challenge. Undesired woody species presence within this grassland will require immediate removal, which will increase O & M costs. While the upland area will be planted with native species, the site will inevitably harbor unwanted woody species unless a more native dominant ground cover is present (e.g., rose and blackberry). Exposure to periodic flooding will facilitate the transport and deposition of sediments and debris within the grassland area. This deposited material could hinder native grass growth, leading to woody species invasion. All large, woody materials carried into the grassland by flood flows will need to be removed following the flood. Specific O & M details will be presented in a separate report.

VI. CONCLUSIONS

This plan outlines the implementation of riparian restoration of the setback levee area and walnut orchard in the existing Bear River floodplain. Restoration provides an opportunity to provide habitat for critical species and demonstrate the use of techniques that will accelerate natural processes on the site. Approximately 138,000 woody riparian plants will be planted across the site along with native grass and herbaceous understory plants. In the long term, the majority of the site is likely to support a mixed riparian forest and valley oak woodland reflecting the soil patterns and water table elevations across the site. The Restoration Plan provides a blueprint for implementation and serves as an important tool to guide the project.

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Appendix I. Existing agricultural infrastructure information for the Bear River setback levee project area.

Pump Test Report

Customer & Pump Information

Nameplate HP on motor:	25
Motor RPM	1800
Motor Efficiency	89%
Meter factor (K _s):	not used
Depth of Pump	80 y
Pump Make	B/J
Driver Make	U/S
Discharge Head Type	CAST
Column Diameter (in)	10
Shaft Length (ft)	80
Shaft Diameter (inches)	2.25

Name: DANNA & DANNA
 Test Date: 06/23/05 Meter #: 92476R
 Pump Location: PUMP # 23
MOVING'S 90AC - SOUTH
 GPS: N 38° 57.834
W 121° 32.991

Run Number

		1	2	3
Standing Water Level (ft)		16		
Drawdown (ft)		8		
Pumping Water Level (ft)	1	24		
Discharge Pipe above ground (ft)		1		
Discharge Pressure at Gage (psi)				
Discharge Pressure at Gage (ft)	2	33.5		
Total Lift (ft)	3	27.5		
Column Friction Losses (ft)				
Discharge Head Loss (ft)		1		
Total Dynamic Head (ft)	4	28.5		
Flow Rate (GPM)	Q	110.1		
Water Horsepower	5	5.9		
Number of dial rotations				
Time for dial rotations (secs)				
OR				
KW from meter		18.7		
Input Horsepower	6	25.8		
Thrust Bearing Losses (hp)	7			
Shaft Losses (hp)	8			
Brake Horsepower (hp)	9	22.9		
Impeller Efficiency	10	86%		
Pumping Plant Efficiency	11	52%		
KWH/AF	12	92		

P.G. & E. RATE SCHEDULE: AG-4B

Pump Test Report

Customer & Pump Information

Nameplate HP on motor:	40
Motor RPM	1765
Motor Efficiency	90%
Meter Inlet (K _s):	not used
Depth of Pump	100'
Pump Make	b/j
Driver Make	C/E
Discharge Head Type	CAST
Column Diameter (in)	10"
Shaft Length (ft)	1.00
Shaft Diameter (inches)	2.50

Name: Danna & Danna
 Test Date: 07/22/05 Meter #: 92477R
 Pump Location: Pump #20
 GPS: N 38° 57.308'
W 121° 33.620'
 Run Number

		1	2	3
Sitting Water Level (ft)		31		
Drawdown (ft)		36		
Pumping Water Level (ft)	1	57		
Discharge Pipe above ground (ft)		1		
Discharge Pressure at Casing (psi)				
Discharge Pressure at Crane (ft)	2	10		
Total Lift (ft)	3	80		
Column Friction Losses (ft)				
Discharge Head Loss (ft)		1		
Total Dynamic Head (ft)	4	59		
Flow Rate (GPM)	5	1809		
Water Horsepower		17.0		
Number of dial rotations				
Time for dial rotations (secs)		0		
OR				
KW from meter		50.7		
Input Horsepower	6			
Thrust Bearing Losses (hp)	7	0		
Shaft Losses (hp)	8			
Brake Horsepower (hp)	9			
Impeller Efficiency	10			
Pumping Plant Efficiency	11			
KWH/AF	12			

P.G. & E. RATE SCHEDULE: AG 4B

Pump Test Report

Customer & Pump Information

Nameplate HP on motor:	40
Motor RPM	1800
Motor Efficiency	90% +
Meter factor (K _m):	not used
Depth of Pump	100 ?
Pump Make	B/J
Driver Make	U/S
Discharge Head Type	CAST
Column Diameter (in)	10
Shaft Length (ft)	100
Shaft Diameter (inches)	2.25

Name: DANNA & DANNA
 Test Date: 06/28/05 Meter #: 6936R5
 Pump Location: PUMP # 19
KRAYLEVICH 44
 GPS: N 38° 57.282'
W 121° 34.036'

Run Number

		1	2	3
Standing Water Level (ft)		27		
Drawdown (ft)		29.5		
Pumping Water Level (ft)	1			
Discharge Pipe above ground (ft)				
Discharge Pressure at Gage (psi)				
Discharge Pressure at Gage (ft)	2			
Total Lift (ft)	3			
Column Friction Losses (ft)		57.5		
Discharge Head Loss (ft)				
Total Dynamic Head (ft)	4	58.5		
Flow Rate (GPM)	Q	2214		
Water Horsepower	5	32.7		
Number of dial rotations				
Time for dial rotations (secs)				
OR				
iKW from meter		31.8		
Input Horsepower	6	42.6		
Thrust Bearing Losses (hp)	7			
Shaft Losses (hp)	8			
Brake Horsepower (hp)	9	38		
Impeller Efficiency	10	85%		
Pumping Plant Efficiency	11	77%		
KWH/AF	12	178		

P.G. & E. RATE SCHEDULE: AG 4B

Pump Test Report

Customer & Pump Information

Nameplate HP on motor:	50
Motor RPM	1800
Motor Efficiency	90%
Meter factor (K _m):	not used
Depth of Pump	80 ?
Pump Make	B/J
Driver Make	U/S
Discharge Head Type	CAST
Column Diameter (in)	10
Shaft Length (ft)	80
Shaft Diameter (inches)	2.25

Name: DANNA & DANNA
 Test Date: 06/23/05 Meter #: 6934R1
 Pump Location: PUMP # 23
PEACH ORCHARD
 GPS: N 38° 57.834
W 121° 32.991

Run Number

		1	2	3
Standing Water Level (ft)		14		
Drawdown (ft)		42		
Pumping Water Level (ft)	1			
Discharge Pipe above ground (ft)				
Discharge Pressure at Gage (psi)		1		
Discharge Pressure at Gage (ft)	2			
Total Lift (ft)	3			
Column Friction Losses (ft)				
Discharge Head Loss (ft)		1		
Total Dynamic Head (ft)	4			
Flow Rate (GPM)	Q	1769		
Water Horsepower	5			
Number of dial rotations				
Time for dial rotations (secs)				
OR				
KW from meter		33.4		
Input Horsepower	6			
Thrust Bearing Losses (hp)	7			
Shaft Losses (hp)	8			
Brake Horsepower (hp)	9	20		
Impeller Efficiency	10	56%		
Pumping Plant Efficiency	11	59%		
KWH/AF	12	103		

P.G. & E. RATE SCHEDULE: AG 4A

will be lost to construction

DeValentine Ag Well Information:

7/24/05

Steve DeValentine supplied the following information concerning the Ag wells located in the river bottom parcels. I do not know the specific locations of each of the wells. He said he showed your crew the locations of the wells on the survey conducted on 6/17/05 by River Partners.

Well 1:

25 HP Electric Turbine Pump - Depth, casing type & width not known.

Well 2:

50 HP Electric Turbine Pump - Depth, casing type & width not known.

Well 3:

50 HP Electric Turbine Pump - Depth, casing type & width not known.

This was the only information he supplied during our conversation. If you require further information, let me know what you need and I will pursue it with them at future meetings. Please call me if you have questions.

Appendix II. Soil series descriptions for soils found within the Bear River setback levee project area.

LOCATION COLUMBIA CA
Established Series
Rev. DJL/CAF/MAV/SBS/DWB
06/2003

COLUMBIA SERIES

The Columbia series consists of very deep, moderately well drained soils formed in alluvium from mixed sources. These soils are on flood plains and natural levees and have slopes of 0 to 8 percent. The mean annual precipitation is 12 to 25 inches, (305 to 635 mm) and the mean annual temperature is about 61 degrees F, (16 degrees C).

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, nonacid, thermic Oxyaquic Xerofluvents

TYPICAL PEDON: Columbia fine sandy loam, on a nearly level plowed field. (Colors are for dry soil unless otherwise stated.)

Ap--0 to 11 inches, (0 to 28 cm); pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; few very fine tubular and many very fine interstitial pores; slightly acid (pH 6.4); clear smooth boundary. (7 to 12 inches, (18 to 31 cm) thick)

A--11 to 16 inches, (28 to 41 cm); pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; common very fine tubular pores, slightly acid (pH 6.4); clear wavy boundary. (4 to 8 inches, (10 to 20 cm) thick)

C1--16 to 23 inches, (41 to 58 cm): pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; common fine prominent yellowish brown (10YR 5/6) masses of iron accumulations, strong brown (7.5YR 5/6) moist; slightly acid (pH 6.5); clear wavy boundary. (4 to 8 inches, (10 to 20 cm) thick)

C2--23 to 26 inches, (58 to 66 cm); pale brown (10YR 6/3) sand, dark brown (10YR 3/3) moist; single grained; loose, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; slightly acid (pH 6.5); clear smooth boundary. (0 to 5 inches, (0 to 13 cm) thick)

C3--26 to 31 inches, (66 to 79 cm); very pale brown (10YR 7/3) and reddish yellow (7.5YR 6/6) fine sandy loam; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine tubular pores; common fine prominent yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) masses of iron

accumulations moist; neutral (pH 7.0); clear smooth boundary. (2 to 8 inches, (5 to 20 cm) thick)

C4--31 to 34 inches, (79 to 86 cm); very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; moderate medium prismatic structure; hard, friable, slightly sticky and slightly plastic; very few very fine roots; many very fine and fine tubular pores; many medium distinct reddish yellow (7.5YR 6/6), strong brown (7.5YR 5/6) masses of iron accumulations moist; slightly alkaline (pH 7.5); clear smooth boundary. (0 to 5 inches, (0 to 13 cm) thick)

C5--34 to 38 inches, (86 to 97 cm); very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; very few very fine roots; many fine tubular and common very fine interstitial pores; many medium distinct reddish yellow (7.5YR 6/6), strong brown (7.5YR 5/6) masses of iron accumulation; slightly alkaline (pH 7.7); clear smooth boundary. (2 to 10 inches, (5 to 25 cm) thick)

C6--38 to 41 inches, (97 to 104 cm); pale brown (10YR 6/3) sand, dark brown (10YR 3/3) moist; single grained; loose, nonsticky and nonplastic; common very fine roots; common very fine tubular and many very fine interstitial pores; neutral (pH 7.0); abrupt smooth boundary. (1 to 5 inches, (2.5 to 13 cm) thick)

C7--41 to 55 inches, (104 to 140 cm); pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; few very fine roots; many very fine, medium and coarse tubular pores; many medium distinct reddish yellow (7.5YR 6/6) and strong brown (7.5YR 5/6) masses of iron accumulation moist; moderately alkaline (pH 8.0); clear smooth boundary. (0 to 15 inches, (0 to 38 cm) thick)

Ab--55 to 59 inches, (140 to 150 cm); gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) moist; massive; hard, friable, sticky and slightly plastic; very few very fine roots; many very fine, fine and medium tubular pores; common fine distinct strong brown (7.5YR 5/6), dark brown (7.5YR 3/2) masses of iron accumulation moist; moderately alkaline (pH 8.0).

TYPE LOCATION: Solano County, California; 400 feet south of the south end of the bridge at the north end of Ryer Island. Not sectionalized, T.5 N., R.3 E.

RANGE IN CHARACTERISTICS: The mean annual soil temperature is 60 to 65 degrees F, (16 to 18 degrees C). The soil between depths of 8 and 25 inches, (20 to 64 cm) is moist in some or all parts from late October to late May or June and is dry in all parts the remainder of the year, unless irrigated. The 10 to 40 inches, (25 to 102 cm) particle-size control section is stratified fine sandy loam, very fine sandy loam, silt loam, loam, loamy sand, loamy fine sand, fine sand or sand and averages 10 to 18 percent clay, when mixed, and has greater than 15 percent fine sand or coarser. Up to 35 percent gravel may occur below a depth of 40 inches, (102 cm). Redoximorphic

features occur between 10 and 48 inches, (25 to 122 cm). Content of organic matter decreases irregularly with depth.

The A horizon is 10YR 7/2, 6/4, 6/3, 6/2, 5/4, 5/3 or 5/2 and moist color of 10YR 5/4, 4/4, 4/3 or 4/2. Texture is sandy loam, sand, loamy sand, loamy fine sand, fine sandy loam, loam or silt loam and commonly is stratified. Reaction is slightly acid to slightly alkaline.

The C horizon is 10YR 8/4, 8/1, 7/4, 7/3, 7/2, 7/1, 6/4, 6/3, 6/2 6/1, 5/4 or 5/3 and moist color of 10YR 7/4, 7/3, 7/2, 6/2, 6/4, 5/4, 5/3, 5/2, 4/4, 4/3, 4/2, 4/1, 3/3, or 3/4. Redoximorphic features have hues of 10YR, 7.5YR, 5YR or 2.5YR with chroma of 3, 4 or 6. Texture is stratified sand to silty clay loam. Finer textures occur below 40 inches, (102 cm). Reaction is slightly acid to slightly alkaline but may be moderately alkaline in horizons underlain by an Ab horizon.

The Ab horizon is 10YR 6/1, 5/1, 4/1, 4/2, 3/1 or 2/1; 2.5Y 6/2. Moist colors are 10YR 5/1, 4/1, 3/1, 2/1; N 2/0; 2.5Y 3/2. Texture is mucky clay loam, clay loam, silty clay loam, silty clay or clay. Depth to a buried horizon ranges from 40 to 60 inches, (102 to 152 cm). Some pedons lack a buried horizon and some pedons are calcareous at 40 inches, (102 cm) or more. Reaction is neutral to moderately alkaline.

COMPETING SERIES: There are no other series in this family.

GEOGRAPHIC SETTING: Columbia soils are on flood plains with bar and channel topography in some natural areas or are on natural levees. These soils formed in alluvium from mixed sources. Elevations are 10 below sea level to 155 feet, (47 m) above. The climate is subhumid with hot dry summers and cool moist winters. Mean annual precipitation is 12 to 25 inches, (304 to 635 mm). Mean January temperature is 45 degrees F, (7 degrees C), mean July temperature is 80 degrees F, (27 degrees C). Mean annual temperature varies from 58 to 63 degrees F, (14 to 17 degrees C). Frost-free period is 230 to 340 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Arvin](#), [Clear Lake](#), [Sacramento](#), [Shanghai](#) and [Sycamore](#) soils. Arvin soils are not saturated with water within 60 inches, (152 cm) of the surface and are in similar or slightly higher flood plain positions. Clear Lake and Sacramento soils have clay textures and are in basins. Sycamore soils have less than 15 percent fine or coarser sand and are in similar flood plain positions.

DRAINAGE AND PERMEABILITY: Moderately well drained; negligible to medium runoff; moderately rapid permeability. Clay substratum phase has slow permeability below a depth of 40 inches, (102 cm). Sandy substratum phase has rapid permeability below a depth of 40 inches, (102 cm). Except where drained, these soils are saturated at 20 to 48 inches, (51 to 122 cm) for several months in the period from November to April. In areas not protected by levees or other flood control structures these soils are

subject to occasional to frequent, brief to long periods of flooding in November to May. Rare flooding occurs in partly protected areas.

USE AND VEGETATION: These soils are used for irrigated hay, small grain, and orchard and row crops. Vegetation consists of a fairly dense cover of oaks, cottonwoods, willows, vines, shrubs and grasses near stream channels, but more open away from the channels.

DISTRIBUTION AND EXTENT: These soils occur in the central valley of California. The soils are moderately extensive in MLRA-16, 17.

MLRA OFFICE RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Reconnaissance Survey of Southwest Washington 1911.

REMARKS: The series was redefined in the Chico area of Butte County, California 1925. The type location was moved to Madera County, California 1/1959. The type location was moved to Solano County, California 1970.

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from the surface to a depth of 16 inches, (41 cm) (Ap, A)

Oxyaquic subgroup - the zone from 20 to 48 inches, (51 to 122 cm) is saturated for several months.

CEC/Clay ratio estimated from similar soils with laboratory data in the W. Stanislaus Soil Survey Area and University Laboratory data.

Edit log: Runoff terminology adjusted 4/96 to adjective criteria of the Soil Survey Manual (10/93). 5/2003 Proposed edits for use in Butte County (again); Range in Characteristics: expand allowed gravel from 5 to 35 percent below a depth of 40 inches. A horizon: add textures sand, loamy sand, loamy fine sand, and add: commonly is stratified. C horizon: add colors moist 10YR 6/2 and 3/4. Geographic setting: expand elevation from 150 to 155 feet. In remarks added history of type location moves.

ADDITIONAL DATA: NO: 50-CAL-20-39-1-1 to 3 University of California, Madera County, Tehama County, and UC Berkley, 58-52-48.

National Cooperative Soil Survey
U.S.A.

LOCATION SHANGHAI CA
Established Series
Rev. ENV/DJL/TDC/CEJ/ET
03/2003

SHANGHAI SERIES

The Shanghai series consists of very deep, somewhat poorly drained soils that formed in alluvium from mixed sources. Shanghai soils are on flood plains and have slopes of 0 to 2 percent. The annual temperature is about 62 degrees F. and the annual precipitation is about 18 inches.

TAXONOMIC CLASS: Fine-silty, mixed, superactive, nonacid, thermic Aquic Xerofluvents

TYPICAL PEDON: Shanghai silt loam - on a nearly level slope of less than 1 percent in an irrigated prune orchard at 30 feet elevation. (Colors are for dry soil unless otherwise stated. When described on April 9, 1979, the soil was moist throughout.)

Ap--0 to 11 inches; very pale brown (10YR 7/4) silt loam, brown (10YR 4/3) moist; common medium distinct yellowish brown (10YR 5/6) mottles, yellowish brown (10YR 5/8) moist; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common very fine roots; common very fine tubular pores; neutral (pH 7.0); clear smooth boundary. (7 to 14 inches thick)

A--11 to 21 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) moist; common large distinct strong brown (7.5YR 5/6) mottles, dark yellowish brown (10YR 4/6) moist; massive; slightly hard, friable, slightly sticky and plastic; common very fine roots; common very fine tubular pores; neutral (pH 7.0); gradual wavy boundary. (3 to 10 inches thick)

C1--21 to 27 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) moist; many medium prominent yellowish brown (10YR 5/8) and many large prominent strong brown (7.5YR 4/6) mottles, dark yellowish brown (10YR 3/6) and dark reddish brown (2.5YR 3/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; common very fine tubular pores; neutral (pH 7.0); gradual wavy boundary. (6 to 18 inches thick)

C2--27 to 36 inches; pale brown (10YR 6/3) silt loam, dark yellowish brown (10YR 4/4) moist; many medium prominent yellowish brown (10YR 5/8) and many large prominent strong brown (7.5YR 4/6) mottles, dark yellowish brown (10YR 3/6) and dark reddish brown (2.5YR 3/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; very fine tubular pores; neutral (pH 7.0); gradual wavy boundary. (9 to 16 inches thick)

C3--36 to 54 inches; very pale brown (10YR 7/3) silt loam, dark yellowish brown (10YR 4/4) moist; common medium distinct strong brown (7.5YR 5/8) mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; neutral (pH 7.0); gradual wavy boundary. (8 to 18 inches thick)

C4--54 to 62 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 3/3) moist; many medium distinct yellowish red (5YR 5/8) mottles; massive; soft, friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; neutral (pH 7.0).

TYPE LOCATION: Sutter County, California; approximately 1.2 miles north of Yuba City on Live Oak Highway, then east on Rednall Road to levee; 2,000 feet north and 900 feet east of the intersection of Rednall Road and the western levee of the Feather River, approximately 800 feet from river, in the New Helvetia land grant T.15 N., R.3 E. Yuba City Quadrangle.

RANGE IN CHARACTERISTICS: The mean annual soil temperature is 60 degrees to 65 degrees F. The soil temperature is above 47 degrees F. the entire year. The soil between depths of 6 and 18 inches is dry in all parts from June through October and is moist in some or all parts from November through May unless irrigated. The difference between average July and average January soil temperature is 30 degrees to 33 degrees F.

The 10 to 40 inches control section is stratified layers of silt loam to fine sandy loam and silty clay loam, but is dominantly silt loam with less than 15 percent coarser than very fine sand. Clay content ranges from 20 to 35 percent. Content of organic matter decreases irregularly with depth. Reaction is slightly acid to moderately alkaline.

The A horizon has dry color of 10YR 7/4, 7/3, 6/4, 6/3, 5/4; 2.5Y 6/2 or 7/2 and moist color of 10YR 4/4, 4/3; 2.5Y 4/2, 3/2 or 3/3 with mottled colors dry and moist of 10YR 4/6, 5/6, 5/8; 7.5YR 5/6, 7/6 and 5YR 6/8. It is silty clay loam, silt loam or fine sandy loam.

The C horizon has dry colors of 10YR 8/4, 7/4, 6/4, 8/3, 7/3, 6/3; 2.5Y 6/2 or 7/2 and moist color of 10YR 6/6, 6/4, 6/3, 5/6, 5/3, 3/3, 5/4, 4/4; 2.5Y 5/2, 4/2, or 5Y 6/3 with prominent or distinct mottles. Some pedons have a clay layer at 40 to 60 inches.

COMPETING SERIES: There are no other series in this family.

GEOGRAPHIC SETTING: Shanghai soils are on flood plains with slopes of 0 to 2 percent. They formed in alluvium from mixed sources. Elevations are 20 to 150 feet. The climate has hot dry summers and cool moist winters. Mean annual precipitation is 14 to 22 inches. Average January temperature is about 45 degrees F., the average July temperature is about 77 degrees F., and the mean annual temperature is 60 degrees to 64 degrees F. The frost-free season is about 260 to 290 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Columbia](#) and [Holillipah](#) soils. Columbia soils are on similar flood plain positions. Holillipah soils are on similar but slightly higher flood plain positions in areas adjacent to rivers.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; runoff is very slow; permeability is moderate, but may be slow below 40 inches. Unless protected, these soils are subject to flooding. Unless drained, in low lying areas and areas adjacent to levees, a water table is present at a depth of 30 to 60 inches in December through April and below a depth of 48 inches in May to November. In other areas, the water table is at 36 to 60 inches in December through April.

USE AND VEGETATION: This soil is used for irrigated orchards, small grains and row crops.

DISTRIBUTION AND EXTENT: Southeastern part of Sacramento Valley. Soils are moderately extensive.

MLRA OFFICE RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Sutter County, California 1984.

REMARKS: The activity class was added to the classification in February of 2003. Competing series were not checked at that time. - ET

Last revised by the state on 2/91.

National Cooperative Soil Survey
U.S.A.

LOCATION KILAGA CA

KILAGA SERIES

The Kilaga series consists of deep and very deep, well drained soils formed in alluvium from mixed rock sources. These soils are on terraces with slopes of 0 to 9 percent. The mean annual precipitation is about 20 inches and the mean annual temperature is about 62 degrees F.

TAXONOMIC CLASS: Fine, mixed, active, thermic Mollic Haploxerafals

TYPICAL PEDON: Kilaga loam on a less than 1 percent slope in a cultivated field at 130 feet elevation (Colors are for dry soil unless otherwise noted).

Ap--0 to 10 inches; strong brown (7.5YR 5/6) loam, dark reddish brown (5YR 3/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; common very fine and fine vertical roots; many very fine tubular and interstitial pores; slightly acid (pH 6.5); abrupt smooth boundary. (5 to 10 inches thick)

A--10 to 19 inches; strong brown (7.5YR 5/6) heavy loam, reddish brown (5YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine tubular and interstitial pores; few thin clay films lining pores and bridging mineral grains; slightly acid (pH 6.5); clear wavy boundary. (5 to 9 inches thick)

Bt1--19 to 30 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate medium angular blocky structure; very hard, friable, sticky and plastic; few very fine random roots; common very fine and fine tubular and interstitial pores; many moderately thick clay films lining pores and on ped faces; neutral (pH 7.0); gradual wavy boundary. (8 to 15 inches thick)

Bt2--30 to 56 inches; reddish brown (5YR 4/4) clay matrix with reddish brown (2.5YR 4/4) ped faces, dark reddish brown (2.5YR 3/4) moist; moderate coarse prismatic and strong medium and coarse angular blocky structure; very hard, firm, sticky and plastic; few very fine random roots; few very fine tubular pores; continuous thick clay films on ped faces and lining pores; neutral (pH 7.3); gradual wavy boundary. (15 to 26 inches thick)

BCt--56 to 83 inches; reddish brown (5YR 4/4) sandy clay loam matrix with reddish brown (2.5YR 4/4) ped faces, dark reddish brown (5YR 3/4) moist; moderate medium angular blocky structure; very hard, friable, sticky and plastic; very few very fine random roots; common very fine and fine tubular and interstitial pores; many moderately thick clay films in pores and bridging mineral grains; moderately alkaline (pH 7.9).

TYPE LOCATION: Placer County, California; 1.5 miles southwest of Lincoln; 40 feet south and 600 feet east of the northwest corner of section 21, T.12 N., R.6 E. Lincoln Quadrangle

RANGE IN CHARACTERISTICS: Depth to duripan or stratified alluvium is 40 to 80 inches. The mean annual soil temperature is about 59 to 65 degrees F. and usually is not below 47 degrees F. at any time. The soil between depths of 5 to 15 inches is usually dry in all parts from May 15 until October 15, and is moist in some or all parts all the rest of the year.

The A horizon has dry color of 10YR 6/3, 5/3, 4/3, 4/4; 7.5YR 5/6 or 5/4 and moist colors of 10YR 3/4, 3/3, 3/2; 7.5YR 3/4; 5YR 3/4, 4/4. This horizon has more than 1.2 percent organic matter in the upper 4 inches and decreases with depth. Texture is clay loam, loam or sandy loam. Reaction is medium acid to neutral. The lower boundary is gradual with a gradual clay increase between the A and Bt horizon.

The Bt horizon has dry color of 10YR 5/4, 5/3; 7.5YR 5/4, 5/2; 5YR 6/4, 6/3, 5/4, 5/3, 4/4 and moist color of 10YR 4/4, 3/4; 7.5YR 4/4, 4/2; 5YR 3/4, 4/4; 2.5YR 3/4. Textures are heavy clay loam, silty clay loam, silty clay, sandy clay or clay. Clay content ranges from 35 to 50 percent. Structure is blocky or prismatic. Reaction is neutral to moderately alkaline. Manganese stains appear randomly in the Bt horizon.

COMPETING SERIES: These are the [Argonaut](#), [Conosta](#), [Contra Costa](#), [Fancher](#) (T), [Phipps](#) and [Trabuco](#) series. The Argonaut, Conosta and Fancher soils have a paralithic contact at a depth of 20 to 40 inches. Contra Costa soils have a lithic contact at 20 to 40 inches. Phipps soils are on dissected hills and have 5 to 30 percent gravel throughout. Trabuco soils are on foothills and have 5 to 35 percent coarse fragment in the series control section.

GEOGRAPHIC SETTING: Kilaga soils are on nearly level to gently rolling terraces. Slopes range from 0 to 9 percent. Elevations are 50 to 200 feet. They formed in alluvium derived from mixed sources. The climate is subhumid with hot, dry summers and cool, moist winters. Mean annual precipitation is 15 to 25 inches. Average January temperature is 46 degrees F.; average July temperature is 79 degrees F.; mean annual temperature is 62 degrees F. The freeze-free season is 250 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [Cometa](#), [Fiddymnt](#), [Kimball](#), [Snelling](#) and [San Joaquin](#) soils. The Cometa and Kimball soils have abrupt A-B boundaries. The Fiddymnt and San Joaquin soils have duripans within 40 inches of the soil surface. The Snelling soils have fine-loamy argillic horizons. All are in similar positions.

DRAINAGE AND PERMEABILITY: Well drained; slow to medium runoff; slow permeability. Some areas are subject to rare or occasional flooding.

USE AND VEGETATION: Used mostly for production of grain, irrigated pasture, orchard and field crops. Uncultivated areas are covered with annual grass, forbs and scattered oaks.

DISTRIBUTION AND EXTENT: Eastern edge of the Sacramento Valley, California. The soils are moderately extensive.

MLRA OFFICE RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Placer County (Western part), California, June 1974. Source of name from Kilaga Springs.

REMARKS: The activity class was added to the classification in January of 2003. Competing series were not checked at that time. - ET

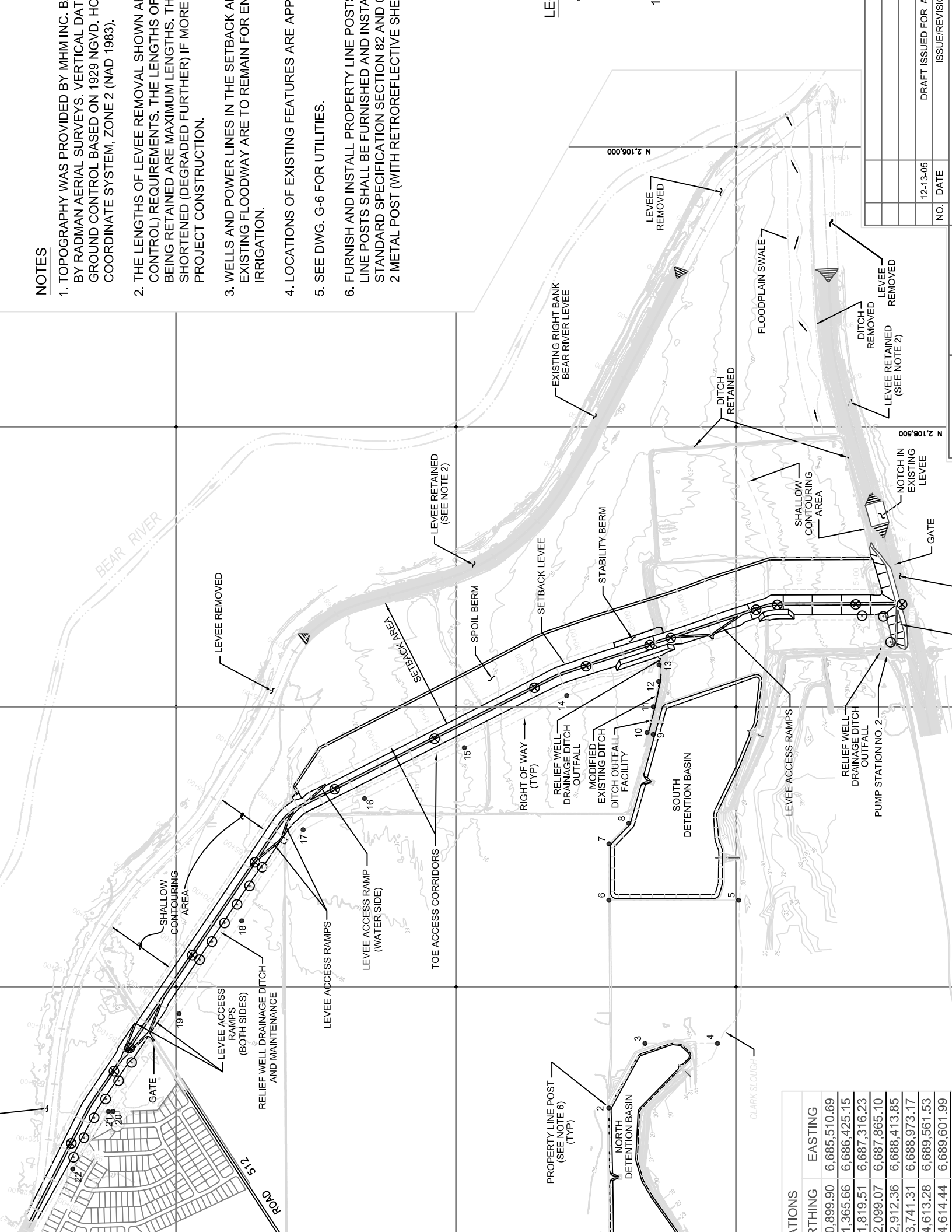
Last revised by the state on 5/88.

National Cooperative Soil Survey
U.S.A.

Appendix III. Topographic Information-Feather River and Bear River Levee Plan

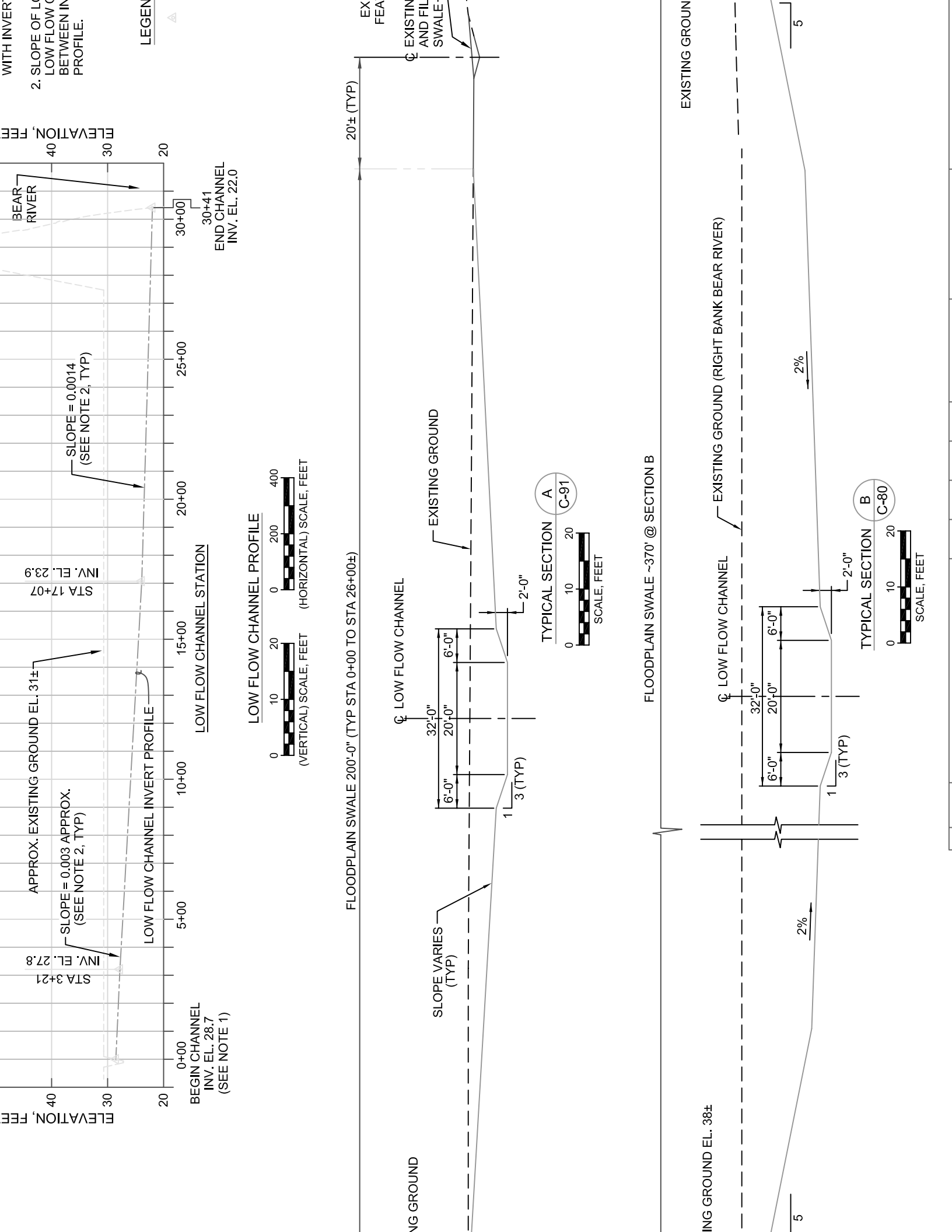
NOTES

1. TOPOGRAPHY WAS PROVIDED BY MHM INC. BY RADMAN AERIAL SURVEYS. VERTICAL DATUM IS NGVD. HORIZONTAL DATUM IS NAD 1983.
2. THE LENGTHS OF LEVEE REMOVAL SHOWN ARE MAXIMUM LENGTHS. THE LENGTHS OF LEVEE RETAINED ARE MAXIMUM LENGTHS. THE LENGTHS OF LEVEE SHORTENED (DEGRADED FURTHER) IF MORE PROJECT CONSTRUCTION.
3. WELLS AND POWER LINES IN THE SETBACK AREA ARE TO REMAIN FOR EXISTING IRRIGATION.
4. LOCATIONS OF EXISTING FEATURES ARE APPROXIMATE.
5. SEE DWG. G-6 FOR UTILITIES.
6. FURNISH AND INSTALL PROPERTY LINE POSTS. LINE POSTS SHALL BE FURNISHED AND INSTALLED AT 20' INTERVALS. STANDARD SPECIFICATION SECTION 82 AND 83 SHALL APPLY. 2 METAL POST (WITH RETROREFLECTIVE SHEETS) SHALL BE INSTALLED AT EACH CORNER.



STATIONS	NORTHING	EASTING
1	0.899.90	6.685.510.69
2	1.365.66	6.686.425.15
3	1.819.51	6.687.316.23
4	2.099.07	6.687.865.10
5	2.912.36	6.688.413.85
6	3.741.31	6.688.973.17
7	4.613.28	6.689.561.53
8	4.614.44	6.689.601.99

NO.	DATE	ISSUE/REVISION
12-13-05		DRAFT ISSUED FOR A

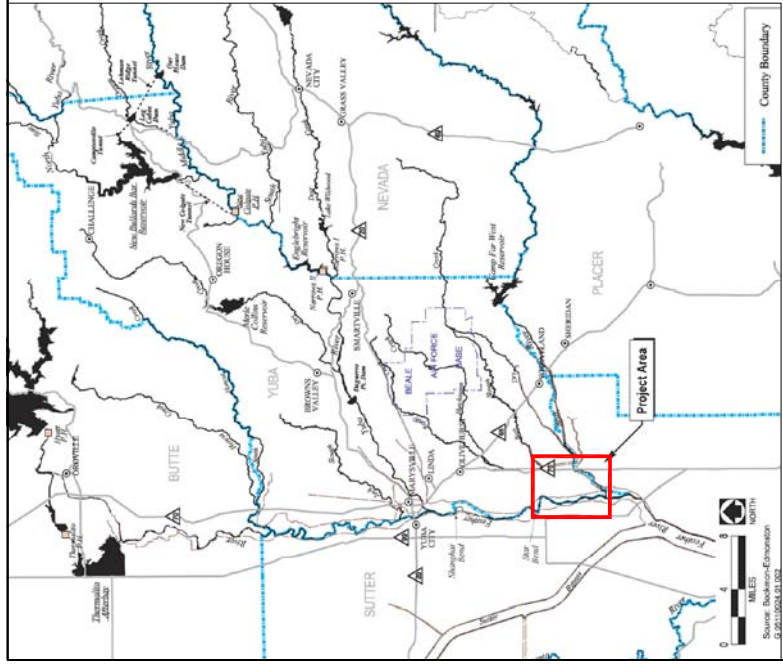


Appendix IV. A list of wildlife species present within and around the Bear River Setback Levee Project area.

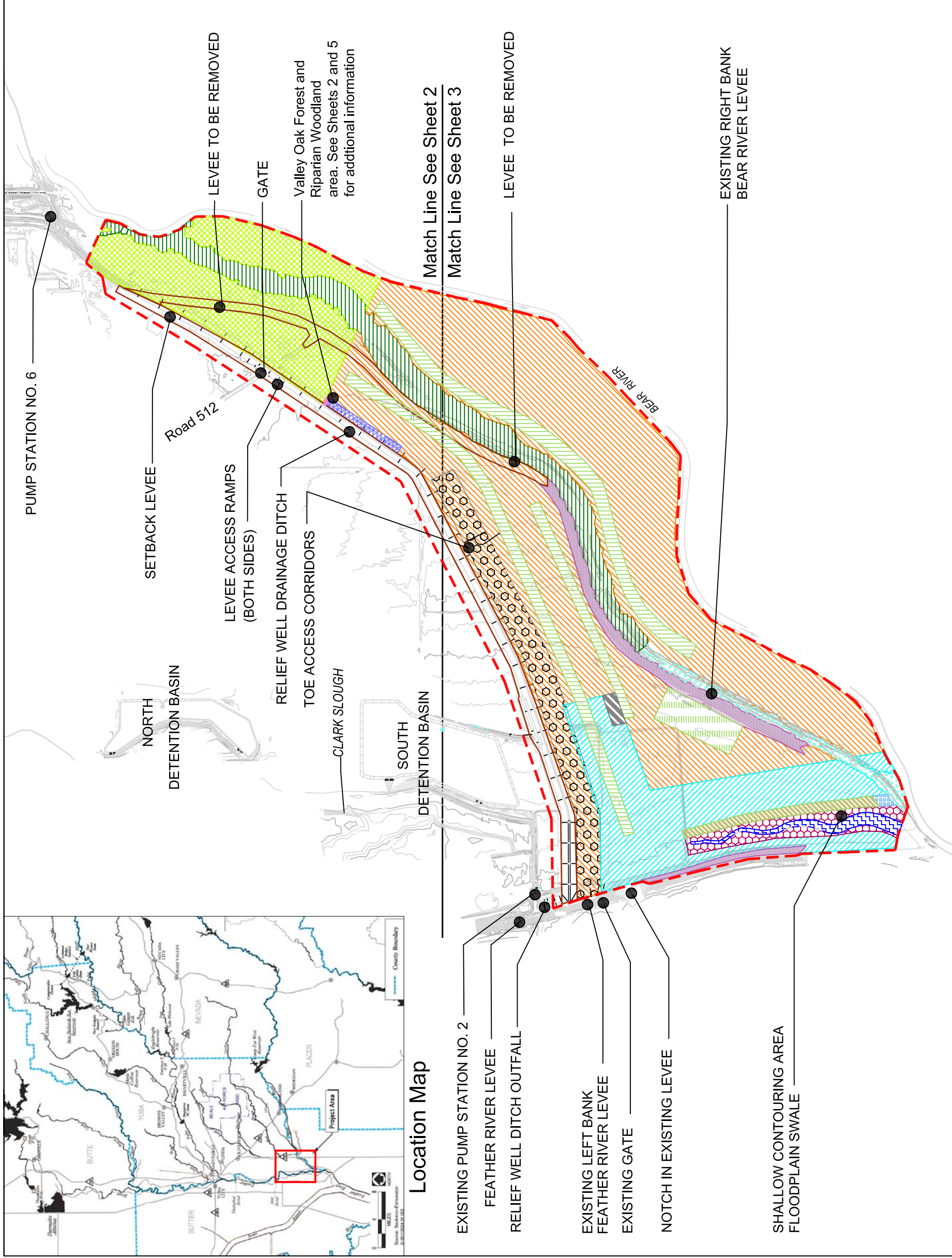
Categories	Common Name	Scientific Name
Raptors	American kestrel	<i>Falco sparverius</i>
	Bald eagle ¹	<i>Haliaeetus leucocephalus</i>
	Cooper's hawk	<i>Accipiter cooperi</i>
	Ferruginous hawk	<i>Buteo regalis</i>
	Golden eagle	<i>Aquila chrysaetos</i>
	Merlin	<i>Falco columbarius</i>
	Northern harrier	<i>Circus cyaneus</i>
	Red-tailed hawk	<i>Buteo jamaicensis</i>
	Red-shouldered hawk	<i>Buteo lineatus</i>
	Sharp-shinned hawk	<i>Accipiter striatus</i>
	Swainson's hawk ¹	<i>Buteo swainsoni</i>
	Turkey Vulture	<i>Cathartes aura</i>
	White-tailed kite	<i>Elanus leucurus</i>
	Screech owl	<i>Otus kennicottii</i>
	Great Horned owl	<i>Bubo virginianus</i>
Resident Song Birds	California quail	<i>Callipepla californica</i>
	Common yellowthroat ¹	<i>Geothlypis trichas</i>
	Horned lark	<i>Eremophila alpestris</i>
	Mourning dove	<i>Zenaidura macroura</i>
	Oak titmouse	<i>Baeolophus inornatus</i>
Migratory Song Birds	Ring-necked pheasant	<i>Phasianus colchicus</i>
	American goldfinch	<i>Carduelis tristis</i>
	American pipit	<i>Anthus rubescens</i>
	American robin	<i>Turdus migratorius</i>
	Black headed grosbeak ¹	<i>Pheucticus melanocephalus</i>
	Blue grosbeak	<i>Guiraca caerulea</i>
	House finch	<i>Carpodacus mexicanus</i>
	Hutton's vireo	<i>Vireo huttoni</i>
	Lazuli bunting	<i>Passerina amoena</i>
	Lark sparrow	<i>Chondestes grammacus</i>
	Marsh wren	<i>Cistothorus palustris</i>
	Northern mockingbird	<i>Mimus polyglottos</i>
	Pacific slope flycatcher	<i>Empidonax difficilis</i>
	Red-winged blackbird	<i>Agelaius phoeniceus</i>
	Song sparrow ¹	<i>Melospiza melodia</i>
	Spotted towhee	<i>Pipilo maculatus</i>
	Swainson's thrush ¹	<i>Catharus ustulatus</i>
	Tri-colored blackbird	<i>Agelaius tricolor</i>
	Western meadowlark	<i>Sturnella neglecta</i>
	Willow flycatcher ¹	<i>Empidonax traillii</i>
Wilson's warbler ¹	<i>Wilsonia pusilla</i>	
Wrentit	<i>Chamaea fasciata</i>	
Yellow warbler	<i>Dendroica petechia</i>	
Yellow-billed cuckoo ¹	<i>Coccyzus americanus occidentalis</i>	
Yellow-breasted chat ¹	<i>Icteria virens</i>	
Passerines	Ash-throated flycatcher	<i>Myriarchus cinerascens</i>
	Tree swallow	<i>Tachycineta bicolor</i>

	Bank swallow	<i>Riparia riparia</i>
	Western kingbird	<i>Tyrannus verticalis</i>
Corvids	Yellow-billed magpie	<i>Pica nuttalli</i>
	Western scrub jay	<i>Aphelocoma californica</i>
Woodpeckers	Acorn woodpecker	<i>Melanerpes formicivorus</i>
	Downy woodpecker	<i>Picoides pubescens</i>
	Lewis' woodpecker	<i>Melanerpes lewis</i>
	Nuttall's woodpecker	<i>Picoides nuttallii</i>
Water Birds	Belted Kingfisher	<i>Ceryle alcyon</i>
Large Wading Birds	Great blue heron	<i>Ardea herodias</i>
	Great egret	<i>Ardea alba</i>
	Green heron	<i>Butorides virescens</i>
	Sandhill crane	<i>Grus canadensis tabida</i>
Waterfowl	Common merganser	<i>Mergus merganser</i>
	Mallard	<i>Anas platyrhynchos</i>
	Wood duck	<i>Aix sponsa</i>
Insects	Valley elderberry longhorn beetle	<i>Desmocerus californicus diamorphus</i>
Reptiles	California horned lizard	<i>Phrynosoma coronatum</i>
	Common kingsnake	<i>Lampropeltis getulus</i>
	Giant garter snake	<i>Thamnophis couchi gigas</i>
	Southern alligator lizard	<i>Elgaria multicarinata</i>
	Western rattlesnake	<i>Crotalus viridis</i>
	Western fence lizard	<i>Sceloporus occidentalis</i>
	Western pond turtle	<i>Clemmys marmorata</i>
	Western skink	<i>Eumeces skiltonianus</i>
Amphibians	American Bullfrog	<i>Rana catesbeiana</i>
	California slender salamander	<i>Batrachoseps attenuatus</i>
	Foothill yellow-legged frog	<i>Rana boylei</i>
	Pacific tree frog	<i>Hyla regilla</i>
	Red-legged frog	<i>Rana aurora draytonii</i>
	Western spadefoot toad	<i>Spea hammondi</i>
Mammals	Bobcat	<i>Lynx rufus</i>
	Beaver	<i>Castor sp.</i>
	Raccoon	<i>Procyon lotor</i>
	black-tailed jackrabbit	<i>Lepus californicus</i>
	Brush rabbit	<i>Sylvilagus bachmani</i>
	California ground squirrel	<i>Spermophilus beecheyi</i>
	California vole	<i>Microtus californicus</i>
	Coyote	<i>Canis latrans</i>
	Mule deer	<i>Odocoileus hemionus</i>
	Ringtail	<i>Bassariscus astutus</i>

Appendix V. Sample vegetation tiles and plant design schematic for the Bear River setback levee project.



Location Map



**Restoration Master Plan
for the Bear River
Setback Levee Project,
including Habitat Mitigation
Plan**

NOTES:

1. See sheet 2 and 3 for planting areas.
2. See sheet 4, 5, and 6 for plant species and quantities.



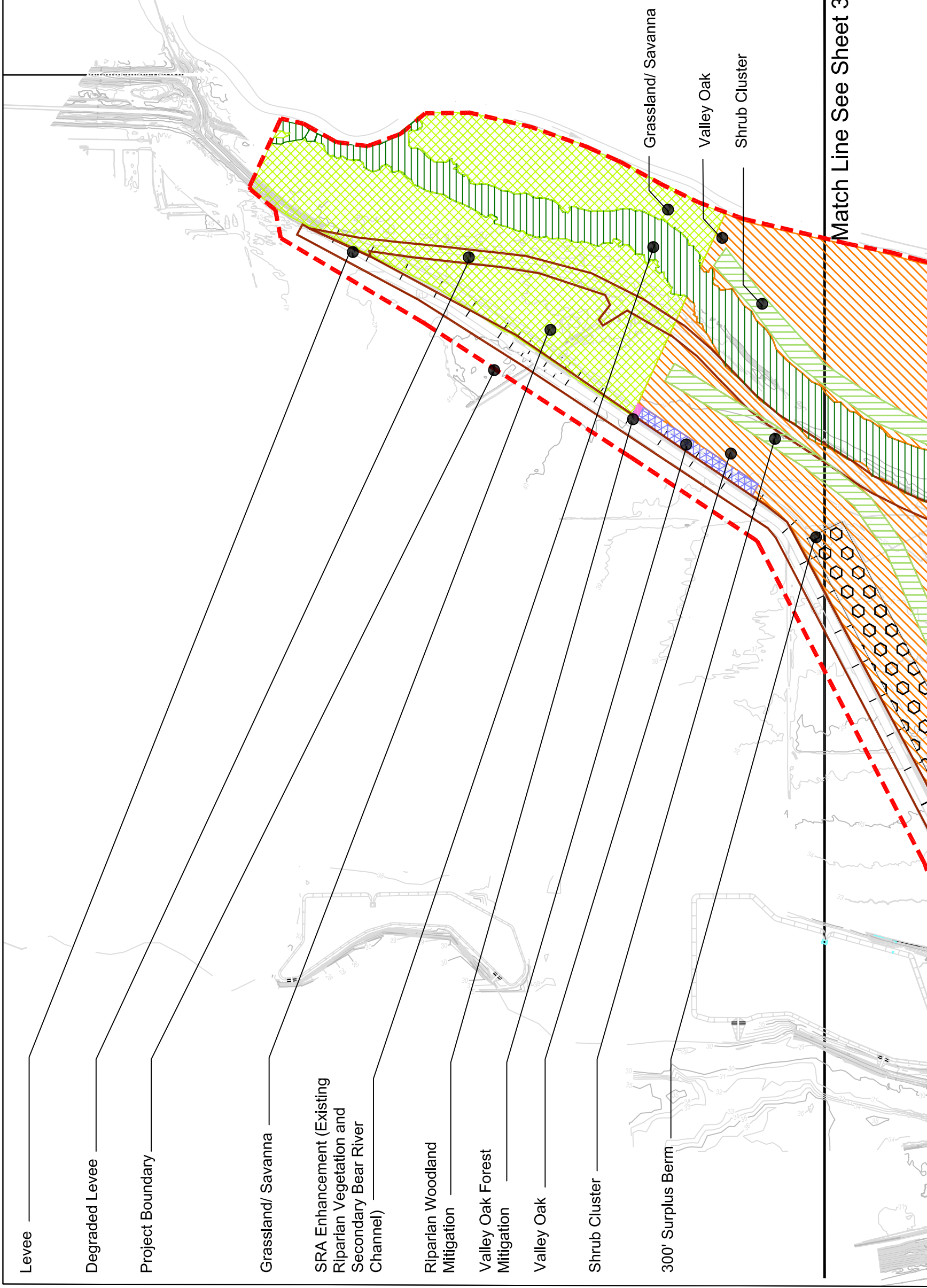
Overall Site Plan
Sheet 1
Sheet 1 of 6

"These plans communicate the planting design program for the restoration area. These plans include sufficient information to allow for general understanding of the required planting construction for this project; however, these plans do include comprehensive details and specifications and, therefore, can not be interpreted as complete documents for use during actual construction."



December 14, 2005

Restoration Master Plan for the Bear River Setback Levee Project, including Habitat Mitigation Plan



NOTE:

1. See sheet 4, 5, and 6 for plant species and quantities.
2. SRA enhancement will consist of removing Himalayan blackberry throughout portions of the existing riparian vegetation and replacing it with cottonwoods, white alder and willows. No restoration plantings will take place in the secondary Bear River channel.



0 800 1600 feet



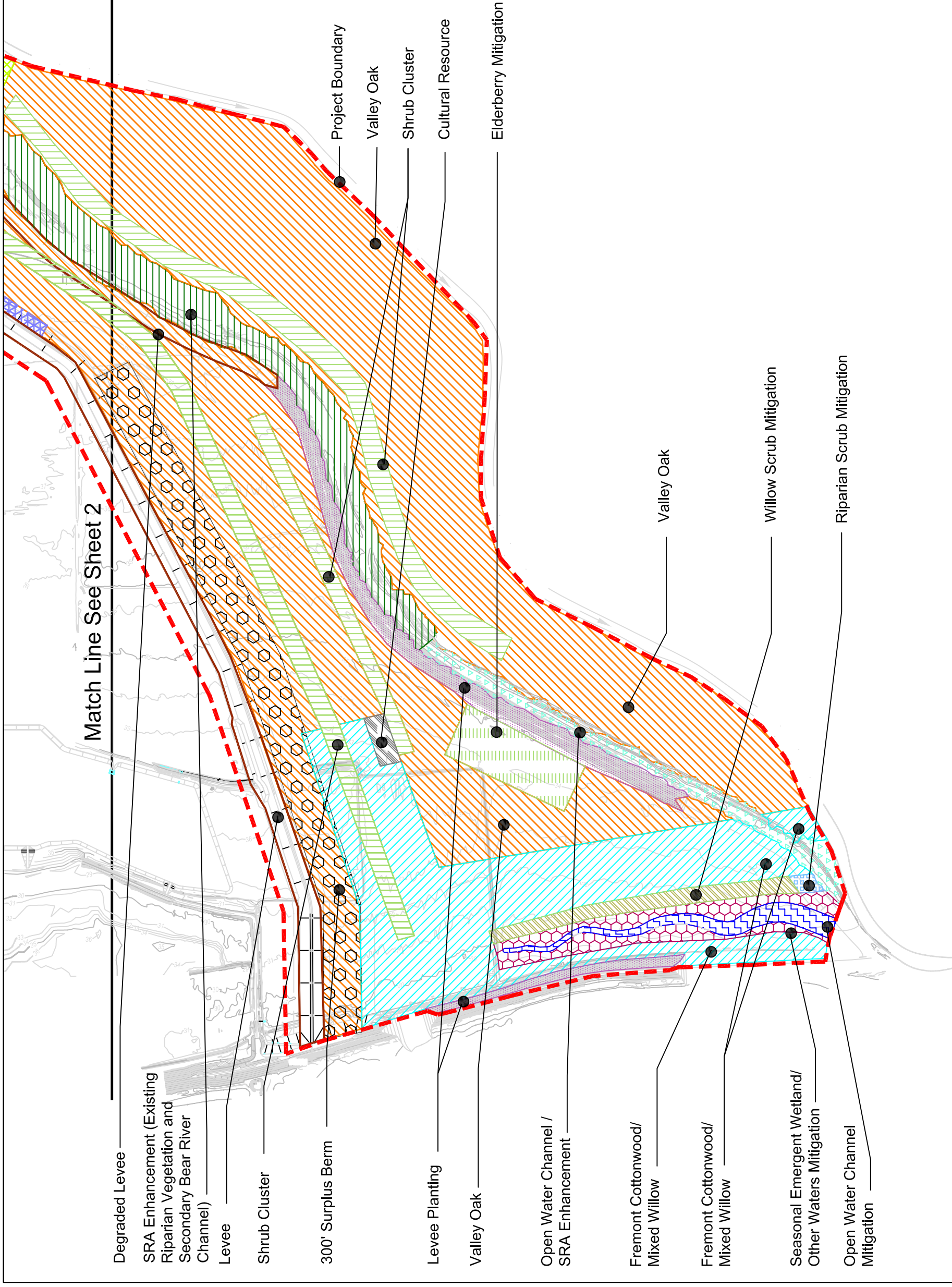
Planting Plan
Sheet 2
Sheet 2 of 6

"These plans communicate the planting design program for the restoration area. These plans include sufficient information to allow for general understanding of the required planting construction for this project; however, these plans do include comprehensive details and specifications and, therefore, can not be interpreted as complete documents for use during actual construction."



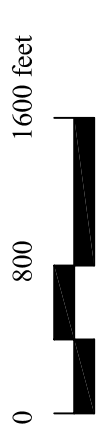
December 14, 2005

Restoration Master Plan for the Bear River Setback Levee Project, including Habitat Mitigation Plan



NOTE:

1. See sheet 4, 5, and 6 for plant species and quantities.
2. SRA enhancement will consist of removing Himalayan blackberry throughout portions of the existing riparian vegetation and replacing it with cottonwoods, white alder and willows. No restoration plantings will take place in the secondary Bear River channel.



Planting Plan
Sheet 3
Sheet 3 of 6

"These plans communicate the planting design program for the restoration area. These plans include sufficient information to allow for general understanding of the required planting construction for this project; however, these plans do include comprehensive details and specifications and, therefore, can not be interpreted as complete documents for use during actual construction."

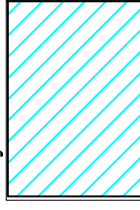


December 14, 2005

Plant Species and Quantities

Restoration Master Plan for the Bear River Setback Levee Project, including Habitat Mitigation Plan

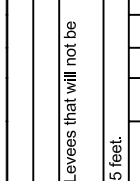
Key



Key



Key



Key



Description

Association: Fremont cottonwood/mixed willow
Estimated Area (acres): 78
Note: Main planting layout
Mugwort and great valley gumpplant will be seeded between rows as per the restoration plan.

Plant	Row					Code	Common name	Tile total	Species comp. (%)	Assoc. total
	1	2	3	4	5					
1	aw	dl	ro	wg	ro	BE	Box elder	5	10%	1658
2	aw	rw	bt	sy	vo	BT	Burtonbush	6	12%	1989
3	wg	wa	bb	bb	be	BB	California blackberry	3	6%	995
4	be	dl	co	ro	co	CL	Clematis	3	6%	995
5	bt	bw	co	bw	ro	CO	Fremont cottonwood	7	14%	2321
6	bw	co	sy	bt	wa	VO	Valley oak	2	4%	663
7	ro	co	wg	be	bb	SY	Western sycamore	3	6%	995
8	vo	be	sw	co	bt	WA	White alder	2	4%	663
9	be	bt	sw	co	aw	WG	Wild grape	3	6%	995
10	bw	sy	cl	sw	bt	RO	Wild rose	5	10%	1658
						AW	Arroyo willow	3	6%	995
							Gooding's black willow	4	8%	1326
						RW	Red willow	1	2%	332
						SW	Sandbar (narrow-leaf) willow	3	6%	995
						All	All	50	100%	16580

Association: Valley oak

Estimated Area (acres): 298
Note: Main planting layout.

Creeping wildrye seed will be drilled between rows as per the restoration plan.

Plant	Row					Code	Common name	Tile total	Species comp. (%)	Assoc. total
	1	2	3	4	5					
1	cb	vo	oa	be	eb	BE	Box elder	2	4%	2533
2	vo	cb	ro	dp	vo	BB	California blackberry	4	8%	5066
3	ro	oa	vo	ro	aw	CL	Clematis	2	4%	2533
4	bb	vo	eb	cb	sw	CB	Coyote bush	5	10%	6333
5	sy	eb	co	cb	eb	DP	Dutchman's pipevine	3	6%	3800
6	bb	vo	dp	oa	cl	EB	Elderberry	8	16%	10132
7	sy	eb	ro	vo	bb	CO	Fremont cottonwood	2	4%	2533
8	eb	ro	vo	co	be	OA	Oregon ash	3	6%	3800
9	vo	vo	sy	eb	cb	VO	Valley oak	10	20%	12665
10	eb	dp	cl	sy	bb	SY	Western sycamore	4	8%	5066
						RO	Wild rose	5	10%	6333
						AW	Arroyo willow	1	2%	1267
							Sandbar (narrow-leaf) willow	1	2%	1267
						All	All	50	100%	63328

Association: Shrub cluster

Estimated Area (acres): 54

Note: Double density area. Row spacing=22 feet, plant spacing=5 feet.

Creeping wildrye seed will be drilled between rows that fall between the Valley oak association.

In areas dominated by Fremont cottonwood/mixed willow association, plant mugwort and great valley gumpplant.

Plant	Row					Code	Common name	Tile total	Species comp. (%)	Assoc. total
	1	2	3	4	5					
1	vo	be	bb	ro	bb	BB	California blackberry	8	16%	3338
2	ro	eb	vo	cb	cb	CB	Coyote bush	7	14%	2921
3	eb	cb	bb	po	bb	EB	Elderberry	15	30%	6259
4	eb	bb	ro	po	vo	PO	Poison oak	2	4%	835
5	cb	ro	eb	bb	ro	VO	Valley oak	5	10%	2086
6	bb	eb	eb	eb	eb	RO	Wild rose	10	20%	4173
7	vo	ro	eb	eb	eb	SW	Sandbar willow	3	6%	1252
8	eb	ro	cb	eb	ro	All	All	50	100%	20864
9	eb	cb	cb	bb	ro					
10	ro	eb	be	vo	be					

Description

Association: Levee remnants
Estimated Area (acres): 19
Note: This applies to areas of the Bear and Feather River Levees that will not be degraded.
Double density area. Row spacing=10 feet, plant spacing=5 feet.

Plant	Row					Code	Common name	Tile total	Species comp. (%)	Assoc. total
	1	2	3	4	5					
1	vo	eb	cb	ro	vo	BB	California blackberry	7	14%	1413
2	vo	bb	ro	cb	eb	CB	Coyote bush	11	22%	2221
3	cb	ro	cb	bb	bb	DP	Dutchman's pipevine	2	4%	404
4	cb	vo	eb	ro	vo	EB	Elderberry	10	20%	2019
5	vo	bb	eb	ro	ro	VO	Valley oak	11	22%	2221
6	ro	eb	bb	ro	eb	RO	Wild rose	9	18%	1817
7	eb	ro	bb	cb	ro	All	All	50	100%	10095
8	eb	cb	vo	bb	vo					
9	cb	vo	eb	bb	eb					
10	cb	dp	dp	cb	ro					

Association: Seasonal emergent wetland mitigation

Estimated Area (acres): 12.2
Note: Main planting layout.

Mugwort and great valley gumpplant will be seeded between rows as per the restoration plan.

Plant	Row					Code	Common name	Tile total	Species comp. (%)	Assoc. total
	1	2	3	4	5					
1	br	br	aw	oa	bw	BE	Box elder	2	4%	104
2	br	br	br	bw	oa	BT	Burtonbush	12	24%	622
3	bt	oa	br	bt	bt	CO	Fremont cottonwood	2	4%	104
4	br	bt	bt	bt	bt	OA	Oregon ash	9	18%	467
5	br	bt	bt	br	bw	AW	Arroyo willow	2	4%	104
6	br	br	be	br	br	BW	Gooding's black willow	5	10%	259
7	oa	be	aw	oa	oa	SW	Sandbar (narrow-leaf) willow	1	2%	52
8	bw	oa	sw	oa	bt	BR	Burflush	17	34%	881
9	bw	oa	co	bt	br	All	All	50	100%	2593
10	br	br	co	br	br					

Association: SRA enhancement

Estimated Area (acres): 56

Note: Main planting layout.
This area also includes 125,000 plugs of Santa Barbara sedge (Carex barbarae).

Plant	Row					Code	Common name	Tile total	Species comp. (%)	Assoc. total
	1	2	3	4	5					
1	co	bw	co	co	oa	BE	Box elder	2	4%	476
2	wg	bw	bt	bw	oa	BT	Burtonbush	3	6%	714
3	wa	g	g	oa	be	BB	California blackberry	4	8%	952
4	wa	g	g	oa	cl	CL	Clematis	4	8%	952
5	wg	ro	bb	aw	cl	CO	Fremont cottonwood	8	16%	1904
6	g	ro	bb	co	be	G	Grass plugs	10	20%	2380
7	g	cl	g	g	ro	OA	Oregon ash	3	6%	714
8	wa	co	g	ro	ro	WA	White alder	4	8%	952
9	bw	co	bt	bt	bb	WG	Wild grape	2	4%	476
10	wa	cl	co	co	bb	RO	Wild rose	4	8%	952
						AW	Arroyo willow	1	2%	238
							Gooding's black willow	5	10%	1190
							Sandbar (narrow-leaf) willow	4	8%	952
						All	All	50	100%	12852

Planting Species and Quantities Sheet 4 Sheet 4 of 6

"These plans communicate the planting design program for the restoration area. These plans include sufficient information to allow for general understanding of the required planting construction for this project; however, these plans do include comprehensive details and specifications and, therefore, can not be interpreted as complete documents for use during actual construction."



December 14, 2005

Restoration Master Plan for the Bear River Setback Levee Project, including Habitat Mitigation Plan

Plant Species and Quantities

Key Description

Common name	Scientific name	Rate (lb/acre)	Est. Total lbs
Association: Grasslands/savanna			
Upland Grassland (83 acres) Note: This planting mix applies to the 33 acres of native grasses in the Setback Area. This area also includes 82,500 plugs of deer grass (<i>Muhlenbergia rigens</i>).			
Upland Grassland (85 acres)			
Blue wildrye	<i>Elymus glaucus</i>	3	99
Creeping wildrye	<i>Leymus triticoides</i>	4	132
Meadow barley	<i>Hordeum brachyantherum</i>	2	66
Purple needlegrass	<i>Nasella pulchra</i>	4	132
		13	429

Common name	Scientific name	Rate (lb/acre)	Est. Total lbs
Association: Willow scrub mitigation			
Estimated Area (acres): 6.46			
Note: Main planting layout.			
Mugwort and great valley gumpplant will be seeded between rows as per the restoration plan.			

Plant	Row	Code	Common name	Tile total	Species comp. (%)	Assoc. total
1	2	ro	Box elder	5	10%	138
1	3	ro	Buttombush	6	12%	166
2	ro	bb	California blackberry	3	6%	83
2	bt	bb	Clematis	3	6%	83
3	ro	co	Fremont cottonwood	7	14%	193
3	bt	co	Valley oak	2	4%	55
4	ro	co	Western sycamore	3	6%	83
4	bt	co	White alder	2	4%	55
5	ro	co	Wild grape	3	6%	83
5	bt	co	Wild rose	5	10%	138
6	ro	co	Arroyo willow	3	6%	83
6	bt	co	Gooding's black willow	4	8%	111
7	ro	co	Red willow	1	2%	28
7	bt	co	Sandbar (narrow-leaf) willow	3	6%	83
8	ro	co	All	50	100%	1382

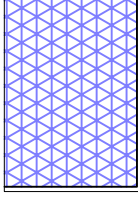
Plant	Row	Code	Common name	Tile total	Species comp. (%)	Assoc. total
1	2	ro	Box elder	5	10%	13
1	3	ro	Buttombush	6	12%	16
2	ro	bb	California blackberry	3	6%	8
2	bt	bb	Clematis	3	6%	8
3	ro	co	Fremont cottonwood	7	14%	18
3	bt	co	Valley oak	2	4%	5
4	ro	co	Western sycamore	3	6%	8
4	bt	co	White alder	2	4%	5
5	ro	co	Wild grape	3	6%	8
5	bt	co	Wild rose	5	10%	13
6	ro	co	Arroyo willow	3	6%	8
6	bt	co	Gooding's black willow	4	8%	11
7	ro	co	Red willow	1	2%	2
7	bt	co	Sandbar (narrow-leaf) willow	3	6%	8
8	ro	co	All	50	100%	131

Plant	Row	Code	Common name	Tile total	Species comp. (%)	Assoc. total
1	2	ro	Box elder	5	10%	13
1	3	ro	Buttombush	6	12%	16
2	ro	bb	California blackberry	3	6%	8
2	bt	bb	Clematis	3	6%	8
3	ro	co	Fremont cottonwood	7	14%	18
3	bt	co	Valley oak	2	4%	5
4	ro	co	Western sycamore	3	6%	8
4	bt	co	White alder	2	4%	5
5	ro	co	Wild grape	3	6%	8
5	bt	co	Wild rose	5	10%	13
6	ro	co	Arroyo willow	3	6%	8
6	bt	co	Gooding's black willow	4	8%	11
7	ro	co	Red willow	1	2%	2
7	bt	co	Sandbar (narrow-leaf) willow	3	6%	8
8	ro	co	All	50	100%	131

Plant	Row	Code	Common name	Tile total	Species comp. (%)	Assoc. total
1	2	ro	Box elder	5	10%	21
1	3	ro	California blackberry	4	8%	43
2	ro	cb	Clematis	2	4%	21
2	dp	ro	Coyote bush	5	10%	53
3	ro	oa	Dutchman's pipevine	3	6%	32
3	eb	cb	Elderberry	8	16%	85
4	ro	oa	Fremont cottonwood	2	4%	21
4	eb	cb	Oregon ash	3	6%	32
5	ro	co	Valley oak	10	20%	106
5	eb	cb	Western sycamore	4	8%	43
6	ro	cl	Wild rose	5	10%	53
6	dp	cl	Arroyo willow	1	2%	11
7	ro	co	Sandbar (narrow-leaf) willow	1	2%	11
8	ro	co	All	50	100%	532

Plant	Row	Code	Common name	Tile total	Species comp. (%)	Assoc. total
1	2	ro	Box elder	5	10%	1
1	cb	ro	California blackberry	4	8%	2
2	ro	cb	Clematis	2	4%	1
2	dp	ro	Coyote bush	5	10%	2
3	ro	oa	Dutchman's pipevine	3	6%	1
3	eb	cb	Elderberry	8	16%	3
4	ro	oa	Fremont cottonwood	2	4%	1
4	eb	cb	Oregon ash	3	6%	1
5	ro	co	Valley oak	10	20%	4
5	eb	cb	Western sycamore	4	8%	2
6	ro	cl	Wild rose	5	10%	2
6	dp	cl	Arroyo willow	1	2%	1
7	ro	co	Sandbar (narrow-leaf) willow	1	2%	1
8	ro	co	All	50	100%	22

Plant	Row	Code	Common name	Tile total	Species comp. (%)	Assoc. total
1	2	ro	Box elder	5	10%	102
1	cb	ro	California blackberry	4	8%	204
2	ro	cb	Clematis	2	4%	204
2	dp	ro	Coyote bush	5	10%	408
3	ro	oa	Dutchman's pipevine	3	6%	153
3	eb	cb	Elderberry	8	16%	204
4	ro	oa	Fremont cottonwood	2	4%	102
4	eb	cb	Oregon ash	3	6%	153
5	ro	co	Valley oak	10	20%	204
5	eb	cb	Western sycamore	4	8%	204
6	ro	cl	Wild rose	5	10%	204
6	dp	cl	Arroyo willow	1	2%	51
7	ro	co	Sandbar (narrow-leaf) willow	1	2%	255
8	ro	co	All	50	100%	2754



Association: Valley oak forest mitigation
Estimated Area (acres): 2.5
Note: Main planting layout.
Creeping wildrye seed will be drilled between rows as per the restoration plan.



Association: Riparian woodland mitigation
Estimated Area (acres): 0.1
Note: Creeping wildrye seed will be drilled between rows as per the restoration plan.



Association: Open water channel/ISRA enhancement mitigation
Estimated Area (acres): 12
Notes: Main planting layout.

"These plans communicate the planting design program for the restoration area. These plans include sufficient information to allow for general understanding of the required planting construction for this project; however, these plans do not include comprehensive details and specifications and, therefore, can not be interpreted as complete documents for use during actual construction."



Plant Species and Quantities

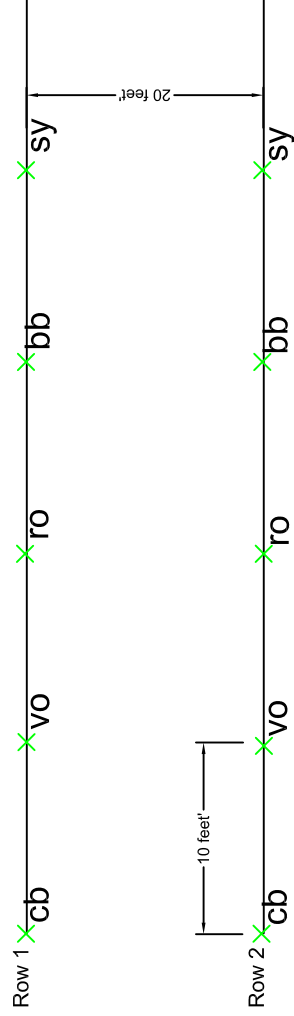
Restoration Master Plan for the Bear River Setback Levee Project, including Habitat Mitigation Plan

Key

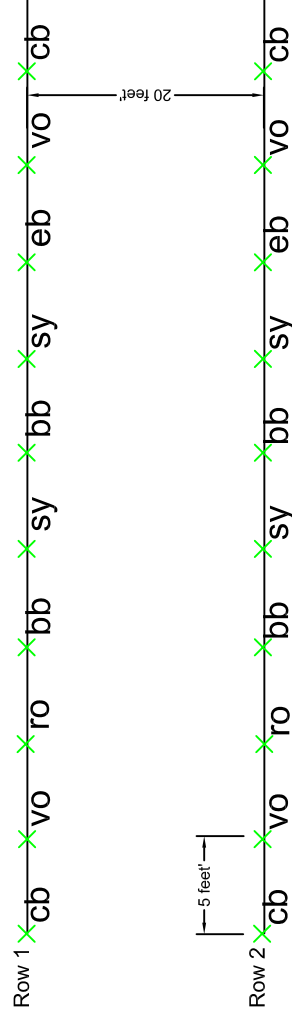
Description		Association: Elderberry mitigation					Association: Cultural resources area				
Plant	Code	Common name	Title	Species comp. (%)	Assoc. total	Plant	Code	Common name	Title	Species comp. (%)	Assoc. total
1	aw	Box elder	BE	5	10%	1	bb	California blackberry	BB	16	32%
2	aw	Buttonbush	BT	6	12%	2	bb	Poison oak	PO	16	32%
3	wg	California blackberry	BB	5	10%	3	ro	Wild rose	RO	18	36%
4	be	Elderberry	EB	14	28%	4	po	All		50	100%
5	bt	Fremont cottonwood	CO	1	2%	5	ro				
6	bw	Valley oak	VO	2	4%	6	bb				
7	ro	Western sycamore	SY	2	4%	7	bb				
8	vo	Oregon ash	OA	2	4%	8	ro				
9	be	Wild rose	RO	6	12%	9	ro				
10	bw	Arroyo willow	AW	3	6%	10	po				
		Gooding's black willow	BW	3	6%						
		Sandbar (narrow-leaf) willow	SW	1	2%						
		All		50	100%						
					2128						
					43						

Planting Details

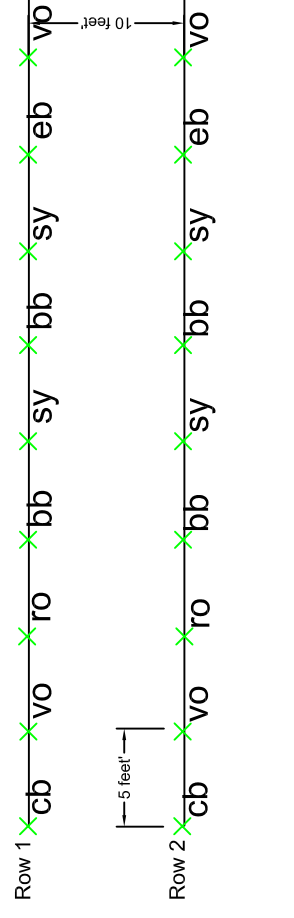
Main Planting Layout:



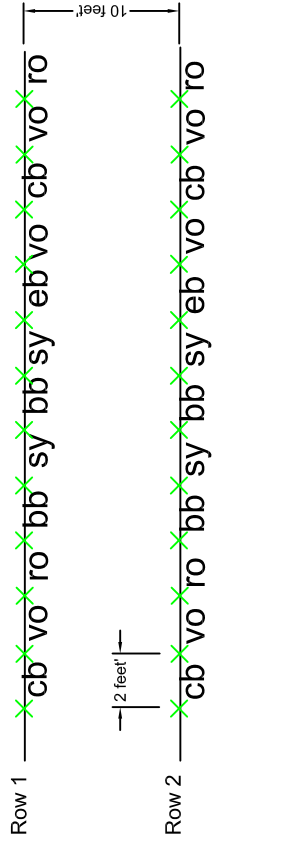
Shrub Cluster Planting Layout:



Levee Planting Layout:



Cultural Resources Planting Layout:



Legend

Cb X vo X ro = Graphically illustrates different plant species; refer to Plant Species and Quantities Sheets 4 to 6.

Notes

- Species will be placed per Association Tiles in rows throughout planting area with the quantities indicated on the plant list; see Sheets 4 to 6.
- Refer to Sheets 2 and 3 for planting location information.

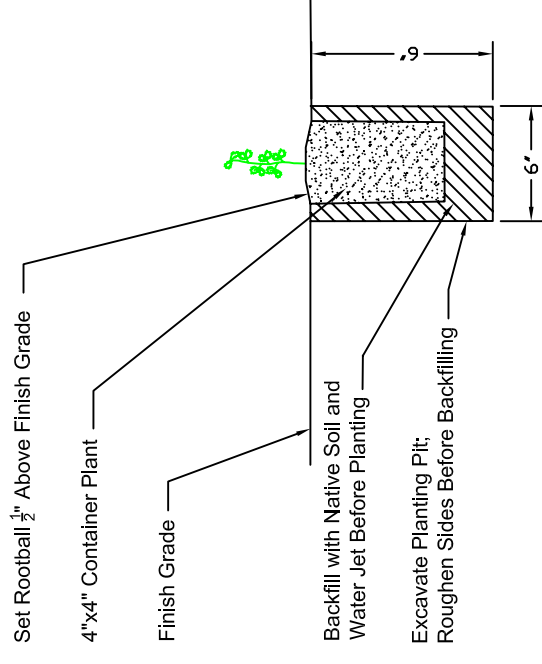
Plant	Code	Common name	Title	Species comp. (%)	Assoc. total
1	bb	California blackberry	BB	16	32%
2	bb	Poison oak	PO	16	32%
3	ro	Wild rose	RO	18	36%
4	po	All		50	100%
5	ro				
6	bb				
7	bb				
8	ro				
9	ro				
10	po				

Association: Open water channel mitigation

Estimated Area (acres): 5.1 The open water channel mitigation lies with the setback area swale. To preclude invasion of non-native and woody species, the low flow channel of the setback area swale will include 25,300 plugs of Santa Barbara sedge (Carex barbarae) planted 2 feet apart. Other areas of the swale will be drilled with native grasses.

Common name	Scientific name	Rate (lb/acre)	Est. Total lbs
Blue wildrye	<i>Elymus glaucus</i>	3	36
Creeping wildrye	<i>Leymus triticoides</i>	4	48
Meadow barley	<i>Hordeum brachyantherum</i>	2	24
Purple needlegrass	<i>Nassella pulchra</i>	4	48
		13	156

Main Planting Layout:



Note

- Refer to Sheets 1 to 6 for additional information.

Typical Plant Layout Detail

Planting Species
and Quantities

Sheet 6

Sheet 6 of 6

Typical Plant Layout Detail

"These plans communicate the planting design program for the restoration area. These plans include sufficient information to allow for general understanding of the required planting construction for this project; however, these plans do include comprehensive details and specifications and, therefore, can not be interpreted as complete documents for use during actual construction."



December 14, 2005

Appendix VI. Implementation Plan for Swainson's Hawk Mitigation (Wildlands, Inc)

Native Grassland Habitat Establishment

Bear River Swainson's Hawk Mitigation Site

The Bear River Swainson's Hawk (*Buteo swainsoni*) Mitigation Site property ("Property" or "Mitigation Site") is approximately 50-acres in size and is located on the Yuba Sutter County Line (**Figure 1 – Location Map**). Historically, the site was riparian floodplain. It is currently vegetated with walnut orchards. Excellent Swainson's hawk nesting and refugia habitat exists immediately adjacent to the mitigation site, encouraging and supporting Swainson's hawk use of the site. The site will be prepared for planting native grassland habitat mix including creeping wild rye (*Leymus triticoides*), blue wild rye (*Elymus glaucus*), slender wheat grass (*E. trachycaulus*), and meadow barley (*Hordeum brachyantherum*) in fall 2006.

Swainson's Hawk Foraging Habitat Requirements

Swainson's hawks forage for small mammals, birds, and insects in grasslands. Native grassland habitat is the historic forage materials utilized by Swainson's hawks before conversion of the Central Valley to agriculture.

Tree Removal

Walnut trees will be removed to allow the establishment of native grassland habitat and to increase flood control capabilities.

Native Grassland Habitat Establishment

Native grassland habitat will be established by the Mitigation Site Operator in fall 2006. Species proposed for planting in the native grassland include creeping wild rye (*Leymus triticoides*), blue wild rye (*Elymus glaucus*), slender wheat grass (*E. trachycaulus*), and meadow barley (*Hordeum brachyantherum*).

Table 1. Proposed native grass species for Bear River Swainson' Hawk Mitigation Site

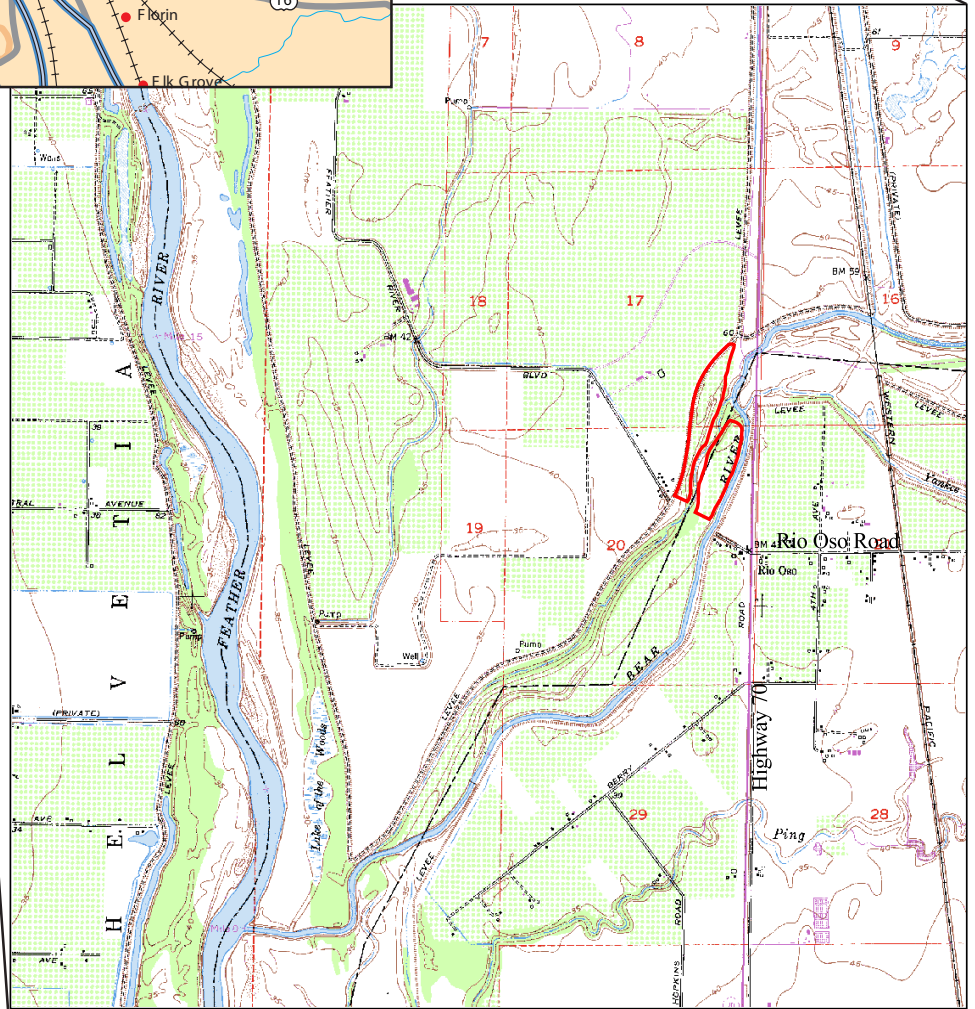
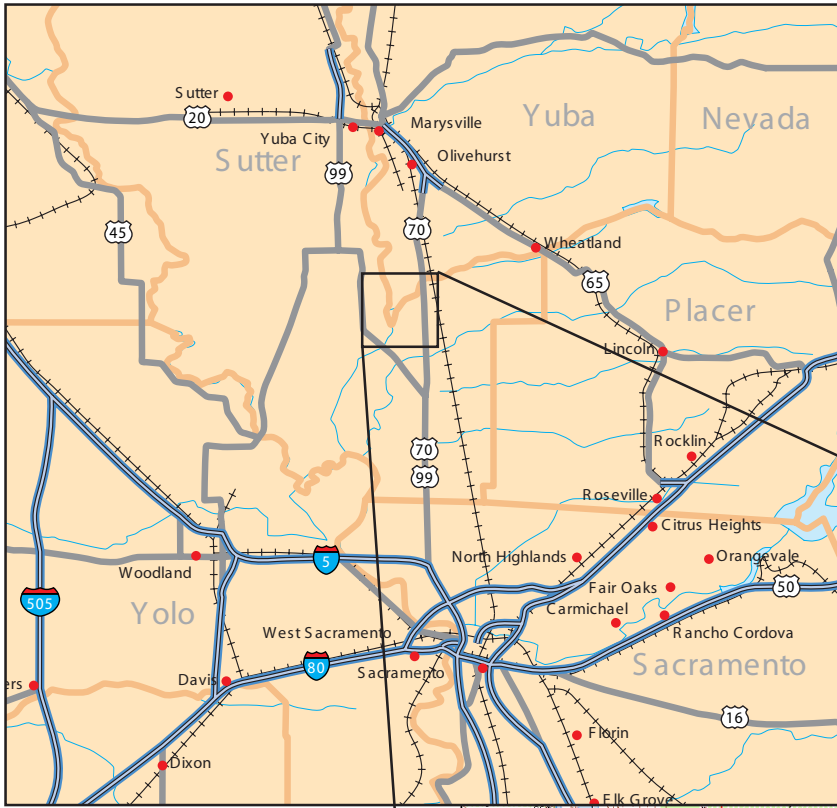
Common Name	Scientific Name	Rate (lbs. pls/acre)	Total est. lbs
Blue Wildrye	<i>Elymus glaucus</i>	4	218
Creeping Wild Rye	<i>Leymus triticoides</i>	4	234
Slender Wheat Grass	<i>Elymus Trachycaulus</i>	3	172
Meadow Barley	<i>Hordeum brachyantherum</i>	4	303
	Total	15	927

After walnut tree removal in early spring 2006, glyphosphate will be applied to begin the eradication of the dominant under story of non-native Bermuda grass (*Cynodon dactylon*). A second application of glyphosphate will be applied in the late spring. Ten days after the second application, the site will be disked. Weeds will be allowed to resprout and a third application of glyphosphate will be applied in mid summer. Ten days after the third application the site will be disked again.

In early fall 2006, the site will be disked and ring rolled and seeded with native grass seed using a tractor and drill seeder. In late winter or early spring of 2007, broadleaf-specific herbicides will be applied to control broadleaf species that would otherwise out-compete native grassland species. If needed, a second application of broadleaf herbicides will be applied in late spring and spot spraying of problem weeds will occur in late summer.

In late spring of 2008, after seed break, the site will be mown to control weed species and stimulate growth of native grasses; if needed, herbicides will be used as well. If needed, a second application of herbicides will be applied in summer 2008. In fall 2008, additional native grass seeds will be planted at approximately one-fourth of the original volume, if necessary, to account for any attrition that may occur during native grassland establishment.

In late spring 2009 and 2010, broadleaf herbicides will be applied as needed to control weeds, and the site will be mowed to discourage weed growth and stimulate growth of native grasses. Non-native weedy and invasive species will be removed by mechanical means (e.g. mowing, hand weeding, weed eaters) or spraying of herbicides for the first five years. After that time the native grassland should be well established and management will concentrate only on the removal of encroaching woody vegetation and the removal of invasive exotic species.



Wildlands, Inc.

Bear River Swainson's Hawk Mitigation Site

Figure 1

Bear River Mitigation Site Vicinity

Endowment Worksheet - Bear River Flood Control Project Swainson's Hawk Preserve

Task	Expenditure Type	Labor/Source	Specification	Unit	Number of units					Cost/item	Total Cost	Recurrence Interval	Annual Cost
					Land Manager ¹ (\$140/hr)	Senior Biologist/Assistant Land Manager ¹ (\$125/hr)	Jr. Biologist/Maintenance Personnel (\$90/hr)	Field Technician (\$20/hr)	Item				
					140	125	90	20					
1) Operations Management													
Replace perimeter fence	capital	contract	Replace perimeter fencing	feet					0	3.00/ft	\$ -	1	\$ -
Replace gate	capital	contract	Replace gate	item					0	500.00	\$ -	40	\$ -
Replace Signs	capital	staff	Replace signs	item					30	6.00	\$ 180	5	\$ 36
Signage	annual	staff	Inspect existing signs and repair or replace as necessary	L. hours					8		\$ 160	1	\$ 160
weed control	annual	staff	weed control	L. hours		3			16		\$ 695	1	\$ 695
herbicides	annual	N/A	weed control equipment/chemicals	item					1	500.00	\$ 500	2	\$ 250
Trash removal	annual	staff	Pick up and remove trash	L. hours					20		\$ 400	1	\$ 400
Tree removal	capital	contract	woody vegetation removal	L. hours					16		\$ 320	2	\$ 160
Mowing	capital	contract	Mowing to increase Swainson's hawk foraging habitat	per acre					50	40.00	\$ 2,000	1	\$ 2,000
Truck	capital	N/A	Truck	item					0.10	35,000.00	\$ 3,500	5	\$ 700
Annual report prep	annual	staff	Prepare annual management report and submit to CDFG	L. hours	2		8				\$ 1,000	1	\$ 1,000
Site/Agency tours	annual	staff	Site tours and agency visits	L. hours		6					\$ 750	5	\$ 150
Sub-total												\$ 5,551	
2) Monitoring													
Swainson's hawk surveys	annual	staff	Quantitative surveys to determine Swainson's hawk nesting/site use	L. hours			24				\$ 2,160	10	\$ 216
Monitoring Report Preparation	annual	staff	Prepare reports detailing use of the site by Swainson's hawk	L. hours		4	24				\$ 2,660	10	\$ 266
Easement monitoring	annual	contract	Monitor compliance with conditions of conservation easement	item						1.00	\$ 500	1	\$ 500
Sub-total												\$ 982	
3) Property Ownership Costs²													
Insurance	annual	N/A		item							N/A	1	
Taxes	annual	N/A		item							N/A	1	
Sub-total												N/A	

¹ Hourly wage shown is salary plus 33% for fringe benefits

² Taxes and Insurance not applicable as the site will be owned by a government entity.

ENDOWMENT COST

Swainson's hawk habitat acreage	50,000
Total credits/values	50,000
Endowment per acre	\$5,803.45
Initial endowment deposit (Total Preserve)	\$290,172.41
Mature Endowment Starting Principle	\$290,172.41
Contingency percent	10%
Net interest rate*	2.5%

*Net Interest Rate is interest less inflation

Rate is guaranteed through investment firm

MAINTENANCE/MANAGEMENT COST

Reoccurrence interval	1	2	5	10	15	20	40
Reoccurent expenses	\$ 4,755	\$ 820	\$ 4,430	\$ 4,820	\$ -	\$ -	\$ -
Contingency (10%)	\$ 476	\$ 82	\$ 443	\$ 482	\$ -	\$ -	\$ -
Total reoccurent expenses	\$ 5,231	\$ 902	\$ 4,873	\$ 5,302	\$ -	\$ -	\$ -
Cumulative expenses**	\$ 5,231	\$ 6,133	\$ 10,104	\$ 16,308	\$ 10,104	\$ 16,308	\$ 16,308

**Cumulative expense is the reoccurent expense carried forward to all years of the same multiple (Year 10 cumulative = Year 1+ Year 5 + Year 10)

***Endowment is verified with 200 years of reoccurring maintenance/management costs. The endowment principle following each 40 year period, which represents the cumulation of all reoccurent interval costs, is always greater than the starting principle; the endowment is non-wasting.

****Maintenance by Wildlands occurs for a period of 5 years, endowment funded management begins year six.

Note: Weed management in the typical year is expected to be addressed by grazing management. However, professional hours are allocated annually to provide for those years when selected additional weed control activities will be conducted, such as hand pulling, string-trimming, and possibly occasional chemical applications. The direct cost budget item is provided for the tools and chemicals needed for these periodic, though not annual, weed management activities.

Appendix VII. Conservation Guidelines for the Valley Elderberry Longhorn Beetle

United States Department of the Interior
Fish and Wildlife Service
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

Conservation Guidelines for the Valley Elderberry Longhorn Beetle

Revised July 9, 1999

The following guidelines have been issued by the U.S. Fish and Wildlife Service (Service) to assist Federal agencies and non-federal project applicants needing incidental take authorization through a section 7 consultation or a section 10(a)(1)(B) permit in developing measures to avoid and minimize adverse effects on the valley elderberry longhorn beetle. The Service will revise these guidelines as needed in the future. The most recently issued version of these guidelines should be used in developing all projects and habitat restoration plans. The survey and monitoring procedures described below are designed to avoid any adverse effects to the valley elderberry longhorn beetle. Thus a recovery permit is not needed to survey for the beetle or its habitat or to monitor conservation areas. If you are interested in a recovery permit for research purposes please call the Service's Regional Office at (503) 231-2063.

Background Information

The valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), was listed as a threatened species on August 8, 1980 (Federal Register 45: 52803-52807). This animal is fully protected under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). The valley elderberry longhorn beetle (beetle) is completely dependent on its host plant, elderberry (*Sambucus* species), which is a common component of the remaining riparian forests and adjacent upland habitats of California's Central Valley. Use of the elderberry by the beetle, a wood borer, is rarely apparent. Frequently, the only exterior evidence of the elderberry's use by the beetle is an exit hole created by the larva just prior to the pupal stage. The life cycle takes one or two years to complete. The animal spends most of its life in the larval stage, living within the stems of an elderberry plant. Adult emergence is from late March through June, about the same time the elderberry produces flowers. The adult stage is short-lived. Further information on the life history, ecology, behavior, and distribution of the beetle can be found in a report by Barr (1991) and the recovery plan for the beetle (USFWS 1984).

Surveys

Proposed project sites within the range of the valley elderberry longhorn beetle should be surveyed for the presence of the beetle and its elderberry host plant by a qualified biologist. The beetle's range extends throughout California's Central Valley and associated foothills from about the 3,000-foot elevation contour on the east and the watershed of the Central Valley on the west (Figure 1). All or portions of 31 counties are included: Alameda, Amador, Butte, Calaveras, Colusa, Contra Costa, El Dorado, Fresno, Glenn, Kern, Kings, Lake, Madera, Mariposa, Merced, Napa, Nevada, Placer, Sacramento, San Benito, San Joaquin, San Luis Obispo, Shasta, Solano, Stanislaus, Sutter, Tehama, Tulare, Tuolumne, Yolo, Yuba.

If elderberry plants with one or more stems measuring 1.0 inch or greater in diameter at ground level occur on or adjacent to the proposed project site, or are otherwise located where they may be directly or indirectly affected by the proposed action, minimization measures which include planting replacement habitat (conservation planting) are required (Table 1).

All elderberry shrubs with one or more stems measuring 1.0 inch or greater in diameter at ground level that occur on or adjacent to a proposed project site must be thoroughly searched

for beetle exit holes (external evidence of beetle presence). In addition, all elderberry stems one inch or greater in diameter at ground level must be tallied by diameter size class (Table 1). As outlined in Table 1, the numbers of elderberry seedlings/cuttings and associated riparian native trees/shrubs to be planted as replacement habitat are determined by stem size class of affected elderberry shrubs, presence or absence of exit holes, and whether a proposed project lies in a riparian or non-riparian area.

Elderberry plants with no stems measuring 1.0 inch or greater in diameter at ground level are unlikely to be habitat for the beetle because of their small size and/or immaturity. Therefore, no minimization measures are required for removal of elderberry plants with no stems measuring 1.0 inch or greater in diameter at ground level with no exit holes. Surveys are valid for a period of two years.

Avoid and Protect Habitat Whenever Possible

Project sites that do not contain beetle habitat are preferred. If suitable habitat for the beetle occurs on the project site, or within close proximity where beetles will be affected by the project, these areas must be designated as avoidance areas and must be protected from disturbance during the construction and operation of the project. When possible, projects should be designed such that avoidance areas are connected with adjacent habitat to prevent fragmentation and isolation of beetle populations. Any beetle habitat that cannot be avoided as described below should be considered impacted and appropriate minimization measures should be proposed as described below.

Avoidance: Establishment and Maintenance of a Buffer Zone

Complete avoidance (i.e., no adverse effects) may be assumed when a 100-foot (or wider) buffer is established and maintained around elderberry plants containing stems measuring 1.0 inch or greater in diameter at ground level. Firebreaks may not be included in the buffer zone. In buffer areas construction-related disturbance should be minimized, and any damaged area should be promptly restored following construction. The Service must be consulted before any disturbances within the buffer area are considered. In addition, the Service must be provided with a map identifying the avoidance area and written details describing avoidance measures.

Protective Measures

1. Fence and flag all areas to be avoided during construction activities. In areas where encroachment on the 100-foot buffer has been approved by the Service, provide a minimum setback of at least 20 feet from the dripline of each elderberry plant.
2. Brief contractors on the need to avoid damaging the elderberry plants and the possible penalties for not complying with these requirements.
3. Erect signs every 50 feet along the edge of the avoidance area with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs should be clearly readable from a distance of 20 feet, and must be maintained for the duration of construction.
4. Instruct work crews about the status of the beetle and the need to protect its elderberry host plant.

Restoration and Maintenance

Restore any damage done to the buffer area (area within 100 feet of elderberry

plants) during construction. Provide erosion control and re-vegetate with appropriate native plants.

Buffer areas must continue to be protected after construction from adverse effects of the project. Measures such as fencing, signs, weeding, and trash removal are usually appropriate.

No insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant should be used in the buffer areas, or within 100 feet of any elderberry plant with one or more stems measuring 1.0 inch or greater in diameter at ground level.

The applicant must provide a written description of how the buffer areas are to be restored, protected, and maintained after construction is completed.

Mowing of grasses/ground cover may occur from July through April to reduce fire hazard. No mowing should occur within five (5) feet of elderberry plant stems. Mowing must be done in a manner that avoids damaging plants (e.g., stripping away bark through careless use of mowing/trimming equipment).

Transplant Elderberry Plants That Cannot Be Avoided

Elderberry plants must be transplanted if they can not be avoided by the proposed project. All elderberry plants with one or more stems measuring 1.0 inch or greater in diameter at ground level must be transplanted to a conservation area (see below). At the Service's discretion, a plant that is unlikely to survive transplantation because of poor condition or location, or a plant that would be extremely difficult to move because of access problems, may be exempted from transplantation. In cases where transplantation is not possible the minimization ratios in Table 1 may be increased to offset the additional habitat loss.

Trimming of elderberry plants (e.g., pruning along roadways, bike paths, or trails) with one or more stems 1.0 inch or greater in diameter at ground level, may result in take of beetles. Therefore, trimming is subject to appropriate minimization measures as outlined in Table 1.

1. Monitor. A qualified biologist (monitor) must be on-site for the duration of the transplanting of the elderberry plants to insure that no unauthorized take of the valley elderberry longhorn beetle occurs. If unauthorized take occurs, the monitor must have the authority to stop work until corrective measures have been completed. The monitor must immediately report any unauthorized take of the beetle or its habitat to the Service and to the California Department of Fish and Game.
2. Timing. Transplant elderberry plants when the plants are dormant, approximately November through the first two weeks in February, after they have lost their leaves. Transplanting during the non-growing season will reduce shock to the plant and increase transplantation success.
3. Transplanting Procedure.
 - a. Cut the plant back 3 to 6 feet from the ground or to 50 percent of its height (whichever is taller) by removing branches and stems above this height. The trunk and all stems measuring 1.0 inch or greater in diameter at ground level should be replanted. Any leaves remaining on the plant should be removed.
 - b. Excavate a hole of adequate size to receive the transplant.
 - c. Excavate the plant using a Vemeer spade, backhoe, front end

loader, or other suitable equipment, taking as much of the root ball as possible, and replant immediately at the conservation area. Move the plant only by the root ball. If the plant is to be moved and transplanted off site, secure the root ball with wire and wrap it with burlap. Dampen the burlap with water, as necessary, to keep the root ball wet. Do not let the roots dry out. Care should be taken to ensure that the soil is not dislodged from around the roots of the transplant. If the site receiving the transplant does not have adequate soil moisture, pre-wet the soil a day or two before transplantation.

d. The planting area must be at least 1,800 square feet for each elderberry transplant. The root ball should be planted so that its top is level with the existing ground. Compact the soil sufficiently so that settlement does not occur. As many as five (5) additional elderberry plantings (cuttings or seedlings) and up to five (5) associated native species plantings (see below) may also be planted within the 1,800 square foot area with the transplant. The transplant and each new planting should have its own watering basin measuring at least three (3) feet in diameter. Watering basins should have a continuous berm measuring approximately eight (8) inches wide at the base and six (6) inches high.

e. Saturate the soil with water. Do not use fertilizers or other supplements or paint the tips of stems with pruning substances, as the effects of these compounds on the beetle are unknown.

f. Monitor to ascertain if additional watering is necessary. If the soil is sandy and well-drained, plants may need to be watered weekly or twice monthly. If the soil is clayey and poorly-drained, it may not be necessary to water after the initial saturation. However, most transplants require watering through the first summer. A drip watering system and timer is ideal. However, in situations where this is not possible, a water truck or other apparatus may be used.

Plant Additional Seedlings or Cuttings

Each elderberry stem measuring 1.0 inch or greater in diameter at ground level that is adversely affected (i.e., transplanted or destroyed) must be replaced, in the conservation area, with elderberry seedlings or cuttings at a ratio ranging from 1:1 to 8:1 (new plantings to affected stems). Minimization ratios are listed and explained in Table 1. Stock of either seedlings or cuttings should be obtained from local sources. Cuttings may be obtained from the plants to be transplanted if the project site is in the vicinity of the conservation area. If the Service determines that the elderberry plants on the proposed project site are unsuitable candidates for transplanting, the Service may allow the applicant to plant seedlings or cuttings at higher than the stated ratios in Table 1 for each elderberry plant that cannot be transplanted.

Plant Associated Native Species

Studies have found that the beetle is more abundant in dense native plant communities with a mature overstory and a mixed understory. Therefore, a mix of native plants associated with the elderberry plants at the project site or similar sites will be planted at ratios ranging from 1:1 to 2:1 [native tree/plant species to each elderberry seedling or cutting (see Table 1)]. These native plantings must be monitored with the same survival criteria used for the elderberry seedlings (see below). Stock of saplings, cuttings, and seedlings should be obtained from local sources. If the parent stock is obtained from a distance greater than one mile from the conservation area, approval by the Service of the native plant donor sites must be obtained prior to initiation of the revegetation work. Planting or seeding the conservation area with native herbaceous species is encouraged. Establishing native grasses and forbs may discourage unwanted non-native species from becoming established or persisting at the conservation area. Only stock from local sources

should be used.

Examples

Example 1

The project will adversely affect beetle habitat on a vacant lot on the land side of a river levee. This levee now separates beetle habitat on the vacant lot from extant Great Valley Mixed Riparian Forest (Holland 1986) adjacent to the river. However, it is clear that the beetle habitat located on the vacant lot was part of a more extensive mixed riparian forest ecosystem extending farther from the river's edge prior to agricultural development and levee construction. Therefore, the beetle habitat on site is considered riparian. A total of two elderberry plants with at least one stem measuring 1.0 inch or greater in diameter at ground level will be affected by the proposed action. The two plants have a total of 15 stems measuring over 1.0 inch. No exit holes were found on either plant. Ten of the stems are between 1.0 and 3.0 inches in diameter and five of the stems are greater than 5.0 inches in diameter. The conservation area is suited for riparian forest habitat. Associated natives adjacent to the conservation area are box elder (*Acer negundo californica*), walnut (*Juglans californica* var. *hindsii*), sycamore (*Platanus racemosa*), cottonwood (*Populus fremontii*), willow (*Salix gooddingii* and *S. laevigata*), white alder (*Alnus rhombifolia*), ash (*Fraxinus latifolia*), button willow (*Cephalanthus occidentalis*), and wild grape (*Vitis californica*).

Minimization (based on ratios in Table 1):

- Transplant the two elderberry plants that will be affected to the conservation area.
- Plant 40 elderberry rooted cuttings (10 affected stems compensated at 2:1 ratio and 5 affected stems compensated at 4:1 ratio, cuttings planted:stems affected)
- Plant 40 associated native species (ratio of associated natives to elderberry plantings is 1:1 in areas with no exit holes):

5 saplings each of box elder, sycamore, and cottonwood

5 willow seedlings

5 white alder seedlings

5 saplings each of walnut and ash

3 California button willow

2 wild grape vines

Total: 40 associated native species

- Total area required is a minimum of 1,800 sq. ft. for one to five elderberry seedlings and up to 5 associated natives. Since, a total of 80 plants must be planted (40 elderberries and 40 associated natives), a total of 0.33 acre (14,400 square feet) will be required for conservation plantings. The conservation area will be seeded and planted with native grasses and forbs, and closely monitored and maintained throughout the monitoring period.

Example 2

The project will adversely affect beetle habitat in Blue Oak Woodland (Holland 1986). One elderberry plant with at least one stem measuring 1.0 inch or greater in diameter at ground level will be affected by the proposed action. The plant has a total of 10 stems measuring over 1.0 inch. Exit holes were found on the plant. Five of the stems are between 1.0 and 3.0 inches in diameter and five of the stems are between 3.0 and 5.0 inches in diameter. The conservation area is suited for elderberry savanna (non-riparian habitat). Associated natives adjacent to the conservation area are willow (*Salix* species), blue oak (*Quercus douglasii*), interior live oak (*Q. wislizenii*), sycamore, poison oak (*Toxicodendron diversilobum*), and wild grape.

Minimization (based on ratios in Table 1):

- Transplant the one elderberry plant that will be affected to the conservation area.
- Plant 30 elderberry seedlings (5 affected stems compensated at 2:1 ratio and 5 affected stems compensated at 4:1 ratio, cuttings planted:stems affected)
- Plant 60 associated native species (ratio of associated natives to elderberry plantings is 2:1 in areas with exit holes):

20 saplings of blue oak, 20 saplings of sycamore, and 20 saplings of willow, and seed and plant with a mixture of native grasses and forbs

- Total area required is a minimum of 1,800 sq. ft. for one to five elderberry seedlings and up to 5 associated natives. Since, a total of 90 plants must be planted (30 elderberries and 60 associated natives), a total of 0.37 acre (16,200 square feet) will be required for conservation plantings. The conservation area will be seeded and planted with native grasses and forbs, and closely monitored and maintained throughout the monitoring period.

Conservation Area—Provide Habitat for the Beetle in Perpetuity

The conservation area is distinct from the avoidance area (though the two may adjoin), and serves to receive and protect the transplanted elderberry plants and the elderberry and other native plantings. The Service may accept proposals for off-site conservation areas where appropriate.

1. Size. The conservation area must provide at least 1,800 square feet for each transplanted elderberry plant. As many as 10 conservation plantings (i.e., elderberry cuttings or seedlings and/or associated native plants) may be planted within the 1800 square foot area with each transplanted elderberry. An additional 1,800 square feet shall be provided for every additional 10 conservation plants. Each planting should have its own watering basin measuring approximately three feet in diameter. Watering basins should be constructed with a continuous berm measuring approximately eight inches wide at the base and six inches high.

The planting density specified above is primarily for riparian forest habitats or other habitats with naturally dense cover. If the conservation area is an open habitat (i.e., elderberry savanna, oak woodland) more area may be needed for the required plantings. Contact the Service for assistance if the above planting recommendations are not appropriate for the proposed conservation area.

No area to be maintained as a firebreak may be counted as conservation area. Like the avoidance area, the conservation area should connect with adjacent habitat wherever possible, to prevent isolation of beetle populations.

Depending on adjacent land use, a buffer area may also be needed between the

conservation area and the adjacent lands. For example, herbicides and pesticides are often used on orchards or vineyards. These chemicals may drift or runoff onto the conservation area if an adequate buffer area is not provided.

2. Long-Term Protection. The conservation area must be protected in perpetuity as habitat for the valley elderberry longhorn beetle. A conservation easement or deed restrictions to protect the conservation area must be arranged. Conservation areas may be transferred to a resource agency or appropriate private organization for long-term management. The Service must be provided with a map and written details identifying the conservation area; and the applicant must receive approval from the Service that the conservation area is acceptable prior to initiating the conservation program. A true, recorded copy of the deed transfer, conservation easement, or deed restrictions protecting the conservation area in perpetuity must be provided to the Service before project implementation.

Adequate funds must be provided to ensure that the conservation area is managed in perpetuity. The applicant must dedicate an endowment fund for this purpose, and designate the party or entity that will be responsible for long-term management of the conservation area. The Service must be provided with written documentation that funding and management of the conservation area (items 3-8 above) will be provided in perpetuity.

3. Weed Control. Weeds and other plants that are not native to the conservation area must be removed at least once a year, or at the discretion of the Service and the California Department of Fish and Game. Mechanical means should be used; herbicides are prohibited unless approved by the Service.

4. Pesticide and Toxicant Control. Measures must be taken to insure that no pesticides, herbicides, fertilizers, or other chemical agents enter the conservation area. No spraying of these agents must be done within one 100 feet of the area, or if they have the potential to drift, flow, or be washed into the area in the opinion of biologists or law enforcement personnel from the Service or the California Department of Fish and Game.

5. Litter Control. No dumping of trash or other material may occur within the conservation area. Any trash or other foreign material found deposited within the conservation area must be removed within 10 working days of discovery.

6. Fencing. Permanent fencing must be placed completely around the conservation area to prevent unauthorized entry by off-road vehicles, equestrians, and other parties that might damage or destroy the habitat of the beetle, unless approved by the Service. The applicant must receive written approval from the Service that the fencing is acceptable prior to initiation of the conservation program. The fence must be maintained in perpetuity, and must be repaired/replaced within 10 working days if it is found to be damaged. Some conservation areas may be made available to the public for appropriate recreational and educational opportunities with written approval from the Service. In these cases appropriate fencing and signs informing the public of the beetle's threatened status and its natural history and ecology should be used and maintained in perpetuity.

7. Signs. A minimum of two prominent signs must be placed and maintained in perpetuity at the conservation area, unless otherwise approved by the Service. The signs should note that the site is habitat of the federally threatened valley elderberry longhorn beetle and, if appropriate, include information on the beetle's natural history and ecology. The signs must be approved by the Service. The signs must be repaired or replaced within 10 working days if they are found to be damaged or destroyed.

Monitoring

The population of valley elderberry longhorn beetles, the general condition of the conservation area, and the condition of the elderberry and associated native plantings in the conservation area must be monitored over a period of either ten (10) consecutive years or for seven (7) years over a 15-year period. The applicant may elect either 10 years of monitoring, with surveys and reports every year; or 15 years of monitoring, with surveys and reports on years 1, 2, 3, 5, 7, 10, and 15. The conservation plan provided by the applicant must state which monitoring schedule will be followed. No change in monitoring schedule will be accepted after the project is initiated. If conservation planting is done in stages (i.e., not all planting is implemented in the same time period), each stage of conservation planting will have a different start date for the required monitoring time.

Surveys. In any survey year, a minimum of two site visits between February 14 and June 30 of each year must be made by a qualified biologist. Surveys must include:

1. A population census of the adult beetles, including the number of beetles observed, their condition, behavior, and their precise locations. Visual counts must be used; mark-recapture or other methods involving handling or harassment must not be used.
2. A census of beetle exit holes in elderberry stems, noting their precise locations and estimated ages.
3. An evaluation of the elderberry plants and associated native plants on the site, and on the conservation area, if disjunct, including the number of plants, their size and condition.
4. An evaluation of the adequacy of the fencing, signs, and weed control efforts in the avoidance and conservation areas.
5. A general assessment of the habitat, including any real or potential threats to the beetle and its host plants, such as erosion, fire, excessive grazing, off-road vehicle use, vandalism, excessive weed growth, etc.

The materials and methods to be used in the monitoring studies must be reviewed and approved by the Service. All appropriate Federal permits must be obtained prior to initiating the field studies.

Reports. A written report, presenting and analyzing the data from the project monitoring, must be prepared by a qualified biologist in each of the years in which a monitoring survey is required. Copies of the report must be submitted by December 31 of the same year to the Service (Chief of Endangered Species, Sacramento Fish and Wildlife Office), and the Department of Fish and Game (Supervisor, Environmental Services, Department of Fish and Game, 1416 Ninth Street, Sacramento, California 95814; and Staff Zoologist, California Natural Diversity Data Base, Department of Fish and Game, 1220 S Street, Sacramento, California 95814). The report must explicitly address the status and progress of the transplanted and planted elderberry and associated native plants and trees, as well as any failings of the conservation plan and the steps taken to correct them. Any observations of beetles or fresh exit holes must be noted. Copies of original field notes, raw data, and photographs of the conservation area must be included with the report. A vicinity map of the site and maps showing where the individual adult beetles and exit holes were observed must be included. For the elderberry and associated native plants, the survival rate, condition, and size of the plants must be analyzed. Real and likely future threats must be addressed along with suggested remedies and preventative measures (e.g. limiting public access, more frequent removal of invasive non-native vegetation, etc.).

A copy of each monitoring report, along with the original field notes, photographs, correspondence, and all other pertinent material, should be deposited at the California Academy of Sciences (Librarian, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118) by December 31 of the year that monitoring is done and the report is prepared. The Service's Sacramento Fish and Wildlife Office should be provided with a copy of the receipt from

the Academy library acknowledging receipt of the material, or the library catalog number assigned to it.

Access. Biologists and law enforcement personnel from the California Department of Fish and Game and the Service must be given complete access to the project site to monitor transplanting activities. Personnel from both these agencies must be given complete access to the project and the conservation area to monitor the beetle and its habitat in perpetuity.

Success Criteria

A minimum survival rate of at least 60 percent of the elderberry plants and 60 percent of the associated native plants must be maintained throughout the monitoring period. Within one year of discovery that survival has dropped below 60 percent, the applicant must replace failed plantings to bring survival above this level. The Service will make any determination as to the applicant's replacement responsibilities arising from circumstances beyond its control, such as plants damaged or killed as a result of severe flooding or vandalism.

Service Contact

These guidelines were prepared by the Endangered Species Division of the Service's Sacramento Fish and Wildlife Office. If you have questions regarding these guidelines or to request a copy of the most recent guidelines, telephone (916) 414-6600, or write to:

U.S. Fish and Wildlife Service
Ecological Services
2800 Cottage Way, W-2605
Sacramento, CA 95825

Literature Cited

Barr, C. B. 1991. The distribution, habitat, and status of the valley elderberry longhorn beetle *Desmocerus californicus dimorphus*. U.S. Fish and Wildlife Service; Sacramento, California.

Holland, R.F. 1986. Preliminary descriptions of the terrestrial natural communities of California. Unpublished Report. State of California, The Resources Agency, Department of Fish and Game, Natural Heritage Division, Sacramento, California.

USFWS. 1980. Listing the valley elderberry longhorn beetle as a threatened species with critical habitat. Federal Register 45:52803-52807.

USFWS. 1984. Recovery plan for the valley elderberry longhorn beetle. U.S. Fish and Wildlife Service, Endangered Species Program; Portland, Oregon.

Table 1: Minimization ratios based on location (riparian vs. non-riparian), stem diameter of affected elderberry plants at ground level, and presence or absence of exit holes.

Location	Stems (maximum diameter at ground level)	Exit Holes on Shrub Y/N (quantify) 1	Elderberry Seedling Ratio ²	Associated Native Plant Ratio ³
non-riparian	stems $\geq 1"$ & $\leq 3"$	No:	1:1	1:1
		Yes:	2:1	2:1

non-riparian	stems >3" & <5"	No:	2:1	1:1
		Yes:	4:1	2:1
non-riparian	stems >=5"	No:	3:1	1:1
		Yes:	6:1	2:1
riparian	stems >=1" & <=3"	No:	2:1	1:1
		Yes:	4:1	2:1
riparian	stems > 3" & < 5"	No:	3:1	1:1
		Yes:	6:1	2:1
riparian	stems >=5"	No:	4:1	1:1
		Yes:	8:1	2:1

¹ All stems measuring one inch or greater in diameter at ground level on a single shrub are considered occupied when exit holes are present anywhere on the shrub.

² Ratios in the Elderberry Seedling Ratio column correspond to the number of cuttings or seedlings to be planted per elderberry stem (one inch or greater in diameter at ground level) affected by a project.

³ Ratios in the Associated Native Plant Ratio column correspond to the number of associated native species to be planted per elderberry (seedling or cutting) planted.



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