APPENDIX D
Plant Community and Special-status Species Descriptions

Plant Communities in the Project Area

The Los Vaqueros Watershed (Watershed) encompasses 18,535 acres of land and includes 20 distinct vegetation series (ESA, 2004; Sawyer and Keeler-Wolf, 1995). The following subsections describe plant communities both within and outside the Watershed. The analysis presents NCCP Plant Community / Habitat Type designations with Sawyer and Keeler-Wolf equivalent vegetation series in parentheses. Section 4.6 Biological Resources, Table 4.6-1, and Figure 4.6-2 of the Draft EIS/EIR describe the distribution and extent of these plant communities in the Watershed.

Lacustrine (Open Water/Tidal Perennial Aquatic)

Description

Lacustrine habitat includes permanent deep-water bodies that do not support emergent vegetation and are not subject to tidal exchange, and tidal perennial aquatic that includes deepwater aquatic (greater than 3 meters deep), shallow aquatic (less than or equal to 3 meters deep), and unvegetated intertidal zones of estuarine bays, river channels, and sloughs (CALFED Bay-Delta Program, 2000a). Such features include lakes, ponds, oxbows, gravel pits, and flooded islands. Lacustrine habitat includes areas defined as tidal and nontidal perennial aquatic habitat. Submerged and floating aquatic plant species associated with lacustrine habitats include water lilies, pondweed, duckweed, and plankton.

This habitat type is commonly used by a wide variety of birds, mammals, reptiles, and amphibians for reproduction, food, water, and cover (CALFED Bay-Delta Program, 2000a).

Historical and Current Distribution

Lacustrine habitat occurs in some low-lying areas of the Bay-Delta estuary. Historically, most wetlands in the Bay-Delta estuary were subject to tidal influence, and nontidal perennial aquatic habitats were uncommon. Naturally formed perennial aquatic habitat included isolated oxbows, and drainages that were subjected to minor tidal action. Much of the nontidal perennial aquatic habitat in the Delta was created by dike and levee construction. Once isolated, these former aquatic habitats were converted for alternate land uses, including agriculture and urban development. Converted perennial aquatic habitats mainly occur in large agricultural drains, farm and industrial ponds, wildlife and waterfowl ponds, and flooded in-stream islands (created by accidental and deliberate levee breeches) (CALFED Bay-Delta Program, 2000b).

Relationship to Project Area

Lacustrine habitat in the project area is typified by the Los Vaqueros Reservoir. This reservoir is a created water body within a stream system that is controlled by the dam and pumping facilities. Seasonal operations of the reservoir for water supply storage/release cause wide variations in surface water elevation barren shoreline areas. Lacustrine habitat occurs in Los Vaqueros Reservoir and in perennial ponds in the Los Vaqueros Watershed and along the Delta-Transfer and Transfer-Bethany pipelines.

Tidal Freshwater Emergent (Bulrush-Cattail Series)

Description

Tidal freshwater emergent habitat includes portions of the intertidal zones of the Delta that support emergent wetland plant species that are not tolerant of saline or brackish conditions. Tidal freshwater emergent habitat includes fresh emergent wetland tidal and Delta sloughs, and mid-channel islands and shoals habitats (CALFED Bay-Delta Program, 2000a). Dominant plant species in tidal freshwater emergent habitat include cattails (*Typha* spp.), tules (*Scripus* spp.), and common reedgrass (*Phragmites australis*).

Historical and Current Distribution

The extensive network of rivers and water channels commonly caused vast areas of the Sacramento-San Joaquin Valley to flood in winter by a slow- moving layer of silt-laden water. Flood control measures and land settlements around the turn of the century led to the creation of leveed Delta islands. The construction of numerous levees in addition to land use conversion resulted in the loss of fresh emergent wetlands in the Delta. Today, there are less than 15,000 acres of this habitat remaining (CALFED Bay-Delta Program, 2000b).

Relationship to Project Area

Tidal freshwater emergent habitat occurs in interrupted patches along the shoreline of Old River in the project area for the Old River Intake and Pump Station. The banks of Old River adjacent to the pump station have isolated patches of freshwater marsh dominated by common tule. The east side of Old River, outside of the project area, also supports a large expanse of diverse marsh vegetation.

Non-tidal Freshwater Permanent Emergent (Bulrush-Cattail Series and Spikerush Series)

Description

Nontidal freshwater permanent emergent includes permanent (natural and managed) wetlands and meadows dominated by wetland plant species that are not tolerant of saline or brackish conditions. Nontidal freshwater permanent emergent habitat includes fresh emergent wetland (nontidal) and nontidal perennial aquatic habitats (CALFED Bay-Delta Program, 2000a). These marshes are dominated, to varying degrees, by common tule, American tule (*Scirpus americanus*), big bulrush (*Scirpus robustus*), and cattail. Wildlife species that are associated with this habitat include black-crowned night heron (*Nycticorax nycticorax*), green heron (*Butorides virescens*), and various waterfowl. Special-status species supported by nontidal freshwater permanent emergent include California red-legged frog (*Rana draytonii*), tri-colored blackbird (*Agelaius tricolor*), and western pond turtle (*Actinemys marmorata*).

Historical and Current Distribution

During the previous 150 years, greater than 300,000 acres of fresh emergent wetlands have been lost in the Sacramento-San Joaquin Delta Ecological Management Zone. Vast areas of fresh emergent habitat occurred throughout the Central Valley prior to the mid-1800s, especially in the Delta. An intricate network of rivers, sloughs, and channels linked low-lying islands and basins that supported highly varied freshwater emergent vegetation. This freshwater emergent vegetation supported a diversity of fish and wildlife species and ecological functions (CALFED Bay-Delta Program, 2000b).

Relationship to Project Area

Within the Los Vaqueros Watershed, nontidal freshwater permanent emergent marsh is limited to the margins of perennial stock ponds and shallow, low-gradient sections of upper Kellogg Creek along the edge of the reservoir. These marshes are dominated, to varying degrees, by common tule, American tule, big bulrush, broad-leaved cattail (*Typha latifolia*), and narrow-leaved cattail. Commonly encountered smaller emergent monocots include sedges (*Carex* spp.), spikerush (*Eleocharis* spp.), rushes, and nutsedge (*Cyperus eragrostis*). Additional freshwater marsh occurs in small ponds and creek segments along the Delta-Transfer Pipeline.

Natural Seasonal Wetland (Northern Claypan Vernal Pool, Bush Seepweed Series and Salt Grass Series)

Description

Natural seasonal wetland habitat includes vernal pools and other non-managed seasonal wetlands with natural hydrologic conditions that are dominated by herbaceous vegetation and that annually pond surface water or maintain saturated soils at the ground surface for enough of the year to support facultative or obligate wetland plant species. Alkaline and saline seasonal wetlands that were not historically part of a tidal regime are included in natural seasonal wetlands. Natural seasonal wetland habitat includes vernal pool habitat (CALFED Bay-Delta Program, 2000a). Dominant natural seasonal wetland vegetation includes various sedges, rushes, and nutgrass. This habitat type supports several special-status species including alkali milk-vetch (*Astragalus tener* var. *tener*), heartscale (*Atriplex cordulata*), brittlescale (*Atriplex depressa*), recurved larkspur (*Delphinium recurvatum*), and vernal pool fairy shrimp (*Branchinecta lynchi*).

Historical and Current Distribution

Seasonal wetlands were once prevalent throughout the Central Valley. Their extent and function have substantially declined due to cumulative impacts of land use practices (e.g., disking, leveling, overgrazing, development), the use of herbicides, invasion by non-native species, flood control activities that reduce and restrict water movement onto river and stream floodplains, and lowered groundwater levels (CALFED Bay-Delta Program, 2000b).

Current wetland regulations have been in effect for decades, but development of wetlands is permitted if appropriate mitigation is provided. Compensatory compensation for loss of structure and function is typically required to offset loss of existing wetlands as a result of development. Large-scale restoration, creation, and preservation activities in areas such as the Suisun Marsh, Grasslands Resource Conservation District, Yolo Bypass, and Butte Sink have been successful in maintaining and enhancing seasonal wetlands (CALFED Bay-Delta Program, 2000b).

Relationship to Project Area

Seasonal wetland habitats in the project area include northern claypan vernal pools, valley rock outcrop intermittent pools, alkali meadows, and alkali sink scrub. Within the Los Vaqueros Watershed, vernal pools are generally confined to valley bottoms and on lowland benches in the vicinity of intermittent and ephemeral creek channels. Valley rock outcrop pools occur in depressions in sandstone outcrops along ridge tops of the Los Vaqueros Watershed and adjacent foothills to the west. In addition, known and potential vernal pool and swale habitats occur along the Delta-Transfer and Transfer-Bethany Pipelines.

Alkali meadow is a persistent emergent saline wetland that occurs on valley bottoms and alluvial slopes. This series is dominated by halophytes (salt tolerant species) including saltgrass (*Distichlis spicata*), saltbush (*Atriplex* spp.), bush seepweed (*Suaeda moquinii*), iodine bush (*Allenrolfea occidentalis*), and alkali heath (*Frankenia salina*). Other species associated with this series include pepperweed (*Lepidium* spp.), rushes (*Juncus* spp.), goldfields (*Lasthenia* spp.), and popcornflower (*Plagiobothrys* spp.). Alkali meadows occur within the northern region of the Los Vaqueros Watershed and along the Transfer-Bethany pipeline.

Alkali sink is a plant community dominated by halophytic species. This community occurs in low-lying areas with poorly drained alkaline soils that are typically supported by the occasional heavy winter rainfall that evaporates fairly quickly. Representative plants of this community include allscale saltbush (*Atriplex polycarpa*), big saltbush (*A. lentiformis*), bush seepweed, pickleweed (*Salicornia* spp.) and iodine bush. Alkali sink occurs in topographic depressions in which salts have concentrated. Alkali sink habitat in the project vicinity generally occurs on the saline-alkaline soils of the Pescadero and Solano soil series. This habitat occurs in an isolated channel on the Delta-Transfer Pipeline.

Valley/Foothill Riparian (Fremont Cottonwood Series and Valley Oak Series)

Description

Valley/foothill riparian habitat includes all successional stages of woody vegetation, commonly dominated by willow (*Salix* spp.), Fremont cottonwood (*Populus fremontii*), valley oak (*Quercus lobata*), or sycamore (*Platanus* spp.), within the active and historical floodplains of low-gradient reaches of streams and rivers generally below an elevation of 300 feet. Valley/foothill riparian habitat includes portions of riparian and riverine aquatic habitat (CALFED Bay-Delta Program, 2000a).

Historical and Current Distribution

Historically, about 922,000 acres of riparian vegetation were present in the Central Valley basin in a watershed that extended over 40,000 square miles. Currently, the remaining riparian forests occur on 100,000 acres of the Valley floor, and about half of this riparian forest is significantly disturbed or degraded. The onset of riparian forest removal occurred from 1850 to the turn of the 20th century to provide fuel for ore mining and river navigation, and accommodate agricultural land development (CALFED Bay-Delta Program, 2000b).

Relationship to Project Area

Riparian woodland, including Fremont cottonwood and valley oak woodland, grows along the banks of the perennial and larger intermittent creek channels within the Los Vaqueros Watershed. In this area, riparian woodland occurs along segments of Kellogg Creek and in small, sporadically distributed pockets along the largest, lowest-gradient streams and creeks. Riparian woodland also occurs along segments of Kellogg Creek paralleled by the Delta-Transfer Pipeline.

Grassland (California Annual Grassland Series and Purple Needlegrass Series)

Description

Grassland habitat includes upland vegetation communities dominated by introduced and native annual and perennial grasses and forbs, including non-irrigated and irrigated pasturelands. Grassland habitat includes all perennial grassland habitats and the much more extensive annual grassland vegetation. Annual grassland is dominated by nonnative Mediterranean annual grasses, native perennial bunch grasses, and an assemblage of native and non-native forbs. Scattered oak species may be present.

Historical and Current Distribution

Grasslands dominated by perennial species were once common throughout the Sacramento and San Joaquin valleys. Perennial grasslands and associated vernal pools historically were present at drier, higher elevations in the Delta. Mesic grasslands established in low-lying areas next to wetland and riparian habitats. Native grassland habitat has been substantially reduced due to development and the widespread establishment of non-native annual grasses. These annual grasses now dominate the majority of grasslands in the Central Valley. Existing perennial grassland in the Bay-Delta estuary are on the decline as this habitat continues to be converted for other land uses and displaced by non-native grasses and forbs. In addition, the suppression of fire has altered ecosystem processes upon which many perennial grasses and native forbs are dependent, again giving non-native annual species a competitive advantage (CALFED Bay-Delta Program, 2000b).

Relationship to Project Area

Grassland occurs extensively throughout the Los Vaqueros Watershed and along the Transfer-Bethany Pipeline. Grassland also occurs along the segment of the Transfer-LV Pipeline outside of the Los Vaqueros Watershed and along the western extent of the Delta-Transfer Pipeline. These grasslands occur on gently rolling hills, valley bottoms, and next to numerous ephemeral and intermittent drainages and channels. Annual grassland in the project area are dominated by nonnative Mediterranean annual grasses such as wild oats (*Avena fatua*), slender oats (*Avena barbata*), soft chess (*Bromus hordeaceus*), ripgut brome (*Bromus diandrus*), barley (*Hordeum* spp.), Italian ryegrass (*Lolium multiflorum*), rattail fescue (*Vulpia myuros*), and dogtail grass (*Cynosurus echinatus*).

Native perennial bunch grasses including purple needlegrass (*Nassella pulchra*), blue wildrye (*Elymus glaucus*), and Idaho fescue (*Festuca idahoensis*) occur sporadically throughout the annual grasslands. Native and non-native forbs commonly found in these grasslands include vetch (*Vicia* ssp.), burclover (*Medicago polymorpha*), Spanish clover (*Lotus purshianus*), clovers (*Trifolium* spp.), lupines (*Lupinus* spp.), field hedge parsley (*Torilis arvensis*), pitgland tarweed (*Holocarpha* virgata), yarrow (Achillea millefolium), filaree (*Erodium* spp.), white brodiaea (*Triteleia hyacinthina*), and mariposa lily (*Calochortu venustus*). Scattered blue oaks (*Quercus douglasii*), live oaks (*Q. agrifolia, Q. wislizeni*), and valley oaks occur sporadically throughout this habitat type, particularly along drainages, in the lowlands, and along grassland-woodland ecotones.

Perennial bunchgrass stands generally occur on protected north-facing slopes and are dominated by purple needlegrass. Mixed stands of perennial grassland also include blue wildrye, nodding needlegrass (*Nassella cernua*), California melic (*Melica californica*), pine bluegrass (*Poa secunda* ssp. *secunda*), and Idaho fescue. Within these stands, native bunchgrasses comprise 25 to 50 percent of the total plant cover. Such stands are scattered across the landscape in the Los Vaqueros Watershed.

Alkali grassland occurs in the northern and eastern regions of the Los Vaqueros Watershed and in limited portion of the Transfer-LV and Transfer-Bethany pipelines. This habitat type is characterized by low-growing halophytic species including saltgrass, low barley (*Hordeum* *depressum*), little alkali grass (*Puccinellia simplex*), sickle grass (*Parapholis incurva*), and thin tail (*Hordeum brachyantherum*), in addition to halophytic forbs such as goldfields, saltbush/spearscale, popcorn flower, alkali mallow (*Malvella leprosa*), and alkali heath. Alkali scalds, barren areas with salt-encrusted soil surfaces, are prevalent throughout the alkali grassland.

Upland Scrub (Common Manzanita Series, California Sagebrush Series and Chamise Series)

Description

Upland scrub habitat includes habitat areas dominated by shrubs characteristic of coastal scrub, chaparral, and saltbush scrub communities. Dominant species in chaparral include scrub oak (*Quercus berberidifolia*), chaparral oak (*Q. durata*), and several species of ceanothus and manzanita. Commonly associated shrubs include chamise (*Adenostoma fasciculatum*), mountain mahogany (*Cercocarpus montanus*), toyon (*Heteromeles arbutifolia*), yerba-santa (*Eriodictyon californicum*), California buckeye (*Aesculus californica*), poison oak (*Toxicodendron diversilobum*), buckthorn (*Rhamnus cathartica*), and chaparral-pea (*Pickeringia montana*) (Mayer and Laudenslayer, 1988).

Historical and Current Distribution

Upland scrub communities occur on steep, dry slopes and require periodic fire to regenerate. As development encroached upon these habitats, fire suppression was necessary. Increased urbanization and development next to and within this habitat type have resulted in fragmentation and degradation of existing stands. Without recurrent fire, scrub communities can degenerate and become less biologically active (USFWS, 2002a).

Mixed chaparral generally occurs below 5,000 feet on mountain ranges throughout California, with the exception of desert regions. Elevation ranges vary significantly with climate, aspect, and substrate. Mixed chaparral occurs throughout the Coast Ranges. Coastal scrub occurs intermittently along a narrow strip throughout the length of California, within about 20 miles of the ocean. Elevation ranges from 0 to about 3,000 feet above mean sea level (Mayer and Laudenslayer, 1988).

Relationship to Project Area

Upland scrub habitat includes areas dominated by shrubs characteristic of chaparral and coastal scrub communities. East- and north-facing steep, rocky slopes and ridge tops in the western portion of the Los Vaqueros Watershed are characterized by chaparral and, to a lesser degree, coastal scrub. Chaparral is dominated by evergreen shrubs, generally with little or no herbaceous ground cover or overstory trees. Chamise is usually the dominant or co-dominant species throughout chaparral, although in some areas it is replaced by other species. Gaps in the dense shrub community support grassland species, both from the annual grassland series and the purple needlegrass series. Coastal scrub occurs on arid south-facing slopes in the Los Vaqueros Watershed. This community is typically composed of California sagebrush (*Artemesia californica*) and chamise as co-dominants, with lesser amounts of black sage (*Salvia mellifera*), poison-oak, bush monkey flower (*Mimulus aurantiacus*), and California buckwheat (*Eriogonum fasciculatum* var. *foliolosum*). Canopy openings support annual grassland species. Upland scrub habitat is limited to the upper Kellogg Creek watershed, west of the dam.

Valley/Foothill Woodland and Forest (Blue Oak Series, Mixed Oak Series, Interior Live Oak Series, Coast Live Oak Series and California Bay Series)

Description

Valley/foothill woodland and forest habitat includes non-riparian forest, woodland, and savanna of valleys and foothills. These vegetation communities are commonly dominated by valley oak, blue oak, interior live oak (*Quercus wislizeni*), coast live oak, and foothill pine (*Pinus sabiniana*).

Historical and Current Distribution

Blue Oak woodlands occur along the western foothills of the Sierra Nevada-Cascade Ranges, the Tehachapi Mountains, and in the eastern foothills of the Coast Range, forming a nearly continuous ring around the Central Valley. The habitat is discontinuous in the valleys and on lower slopes of the interior and western foothills of the Coast Range from Mendocino County to Ventura County. It is generally found at elevations from 500 to 2,000 feet at the northern end of its range and on the western slopes of the Sierra Nevada, from 250 to 3,000 feet in the central Coast Range, and from 550 to 4,500 feet in the Transverse and Peninsular Ranges (Mayer and Laudenslayer, 1988).

Coast live oak habitat occurs in the foothills and valleys of coastal regions of the northern and southern Coast Range, and the Transverse and Peninsular Range of southern California. They primarily are found at elevations ranging from sea level to about 5,000 feet in the interior regions (Mayer and Laudenslayer, 1988). Interior live oak occurs on slopes and in valleys, on raised stream benches, and terraces where soils are shallow and moderately to excessively drained. They typically occur at elevations ranging from 500 to 4,500 in the Transverse Ranges, South Coast Ranges, Sierra Nevada, Cascade Range, and north to the Klamath and North Coast ranges (Sawyer and Keeler-Wolf, 1995). Mixed oak stands occur in valleys on gentle to steep slopes underlain by moderately deep soils. They typically occur at elevations ranging from 250 to 2,000 feet in the Sierra Nevada Range, Cascade Range, and north to the Klamath and North Coast ranges (Sawyer and Keeler-Wolf, 1995). Relic stands of valley oak woodland occur in the Central Valley from Redding south into the Sierra Nevada foothills, in the Tehachapi Mountains, and in valleys of the Coast Range from Lake County to western Los Angeles County. Generally, this vegetation occurs below 2,000 feet (Mayer and Laudenslayer, 1988).

Relationship to Project Area

The steeper hillsides and canyons throughout the western and northern portions of the Los Vaqueros Watershed support valley/foothill woodland and forest, including stands dominated by blue oak, valley oak, coast live oak, and interior live oak, as well as some stands with no single dominant oak species. Oak woodland occurs as a mosaic of the oak species mentioned above, with blue oak as the most widespread. Blue oak woodlands are the most common woodland community in the Los Vaqueros Watershed. They occur primarily on south-, west-, and east-facing slopes. The understory is fairly open and is dominated by annual grassland species such as bromes, wild oat, and clover. Small ephemeral channels flow through many blue oak woodlands, but these channels typically do not support wetland or riparian vegetation.

Coast live oak woodlands are limited to the westernmost part of the Los Vaqueros Watershed, where precipitation is higher and temperatures are cooler. These scattered woodlands are dominated by coast live oak and interior live oak with occasional occurrences of blue oak and foothill pine on drier sites. Interior live oak woodlands tend to occur in similar topographic, climatic, and edaphic (*i.e.*, related to soil) settings as the coast live oak woodlands. These woodlands are dominated by open to dense stands of interior live oak, with coast live oak, blue oak and foothill pine frequent subdominants. Mixed oak woodlands are not dominated by any single oak species but consist of a mix of blue oak, coast live oak, and interior live oak, as well as foothill pine. These woodlands are typically less open than the blue oak series, sometimes forming a nearly closed canopy. The terrain in these areas is steep and undulating to gently rolling, and in some areas is rocky. Valley oak woodland occurs as both upland woodland and riparian woodland. In upland settings, valley oak woodland occurs as oak savannah with an expansive grassland understory.

Upland Cropland (Cropland)

Description

Upland cropland habitat includes agricultural lands farmed for grain field, truck, and other crops for profit that are not seasonally flooded. Common agricultural crops in the Central Valley include wheat, corn, beans, safflower, alfalfa, cotton, tomatoes, commercial grasses, orchard fruits and nuts, and grapes. Wildlife species supported by this habitat type vary according to season, crop type, and cover. Common species occurring in cropland include small mammals such as voles and mice, and birds such as doves, pheasants, cranes, and blackbirds. Croplands are important foraging habitat for numerous raptors including the red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), and white-tailed kite (*Elanus leucurus*).

Historical and Current Distribution

Agriculture has converted natural habitats throughout California, but particularly in areas that once supported fertile wetlands and riparian forests. More than one-fourth of California is now used for agriculture, including 5 million acres of federal grazing land. About half of this is used as pasture and rangeland, about 40 percent is cropland, and the rest is divided between woodland and other land. On average, agriculture accounts for about 43 percent of the total annual ground- and surface water used in California, of which the majority is supplied by surface water. Agricultural land uses and crop types are often dictated by soil type, topography, and water availability. The more intensively managed agricultural areas are primarily in valley floors on flat or slightly rolling terrain (CALFED Bay-Delta Program, 2000b).

As many natural habitats used by wildlife species have been converted or lost in California, an increasing number of wildlife have adapted to artificial wetland and upland habitats resulting from particular agricultural practices. Many species have now become adapted to and dependant on these agricultural areas to sustain their populations (CALFED Bay-Delta Program, 2000b).

Relationship to Project Area

Upland cropland habitat includes farmed land along the Delta-Transfer Pipeline and in the vicinity of the Old River Intake and Pump Station. Crops along these corridors include tomatoes, alfalfa, corn, and hay, and orchards of English walnut and persimmon. When observed in the spring of 2007, many of the fields were plowed and lying fallow.

Special-Status Species in the Project Area

The following comprehensive list of special-status plant and wildlife species in the regional project area was compiled based on records from the California Department of Fish and Game Natural Diversity Database (CNDDB), ongoing consultation with CDFG, USFWS, and resource experts, reviews of California Native Plant Society (CNPS) literature and the CNPS electronic database, scoping letters, biological literature of the region, and focused and reconnaissance-level field surveys.

This comprehensive regional species list of special-status plant and wildlife species includes 54 special-status plants and 38 special-status wildlife species with potential to occur in the regional project vicinity. Each species' habitat requirements were compared to available habitats in the study area for each project component, for which a summarized analysis is provided in **Table D-1**. Based on this review of habitat requirements and database records, 7 special-status plant species and 36 special-status wildlife species have a moderate to high potential to occur or are known to occur within the study area that could be affected by the project. This refined list of special-status plants and wildlife species that could be affected by the project, and methods used to prepare the narrowed species list are provided in Section 4.6 and **Table 4.6-4**. Select species are described following Table D-1.

Invertebrates

Federal or State Threatened and Endangered Species

Longhorn fairy shrimp *(Branchinecta longiantenna)*

Description

Longhorn fairy shrimp are among the rarest of California's vernal pool crustaceans. These small, aquatic crustaceans feed on algae, bacteria, protozoa, rotifers, and bits of detritus (USFWS, 2003). Males can be easily identified by their extremely long second antennae; however, females are difficult to distinguish from alkali fairy shrimp (*B. mackini*). Longhorn fairy shrimp require a minimum of 23 days to reach sexual maturity, with an average maturity period of 43 days (USFWS, 2005c).

TABLE D-1
SPECIAL-STATUS SPECIES KNOWN FROM THE REGIONAL PROJECT VICINITY AND ANALYZED FOR THE PROJECT

Common Name Scientific Name	Listing Status USFWS/CDFG/ CNPS/CALFED	General Habitat	Potential for Species Occurrence in the Project Area	Period of Identification or Blooming Period	NCCP Habitat Associations
INVERTEBRATES					
Federal or State Threatened and Endangered Species					
Branchinecta longiantenna Longhorn fairy shrimp	FE/--/--/m[1]	Rock outcrop pools or other areas capable of ponding water seasonally	Absent. No longhorn fairy shrimp habitat or local occurrences occur within 500 feet of project facilities; This species would not be affected by project activities	Year-round (eggs in dry season, adult shrimp in winter)	NSW (Rock outcrop pools)
Branchinecta lynchi Vernal pool fairy shrimp	FT/--/--/m	Vernal pools or other areas capable of ponding water seasonally	Present. Occupied and potential habitat Identified in the Transfer-Bethany Pipeline alignment; possibly in a single pool on the Delta-Transfer Pipeline (ESA, 2008a). In-watershed occurrences are outside the project area.	Year-round (eggs in dry season, adult shrimp in winter)	NSW
Desmocerus californicus dimorphus Valley elderberry longhorn beetle	FT/--/--/R	Riparian habitat, levee and riprap lined stream banks containing its host plant, elderberry shrubs (*Sambucus* spp.)	Present (in-watershed). Elderberry shrubs in the Los Vaqueros Watershed show larval exit holes. Elderberry shrubs are not otherwise present in the project area.	Year round, nesting March-June	VFR, Gr, US, VFW, UC
Federal or State Species of Special Concern					
Branchinecta mesovallensis Midvalley fairy shrimp	--/--/--/-m	Vernal pools or other areas capable of ponding water seasonally	Low. Low likelihood of occurrence in created pools on the Transfer-Bethany Pipeline.	Year-round (eggs in dry season, adult shrimp in winter)	NSW
Hygrotus curvipes Curved-foot hygrotus diving beetle	FSC/--/--/--	Drainages, seeps, and wet areas; standing water in ponds or ephemeral pools	Present. Present in stock ponds and drainages in the Los Vaqueros Watershed and likely in intermittent drainages and swales on pipeline routes.	Spring months	NSW
Linderiella occidentalis California linderiella	FSC/--/--/--	Vernal pools or other areas capable of ponding water seasonally	Low. Habitat is present on the Delta-Transfer Pipeline and Transfer-Bethany Pipeline. In-Watershed occurrences are outside the project area	Year-round (eggs in dry season, adult shrimp in winter)	NSW
Lytta molesta Molestan blister beetle	FSC/--/--/--	Anthophora bee nests may serve as hosts for the molestan blister beetle	Unknown. Habitat may be present in the Los Vaqueros Watershed, Transfer-LV Pipeline and Transfer-Bethany Pipeline		Gr

1 Status codes are defined at the end of the table.

TABLE D-1 (Continued)
SPECIAL-STATUS SPECIES KNOWN FROM THE REGIONAL PROJECT VICINITY AND ANALYZED FOR THE PROJECT

Common Name Scientific Name	Listing Status USFWS/CDFG/ CNPS/CALFED	General Habitat	Potential for Species Occurrence in the Project Area	Period of Identification or Blooming Period	NCCP Habitat Associations
AMPHIBIANS					
Federal or State Threatened and Endangered Species					
Ambystoma californiense California tiger salamander	FT/CSC/--/m	Wintering sites occur in grasslands occupied by burrowing mammals; breed in ponds and vernal pools	Present. Four breeding sites in the Los Vaqueros Watershed study area; uplands throughout the Los Vaqueros Watershed provide aestivation habitat; upland habitat present on the Delta-Transfer Pipeline, Transfer-LV Pipeline, and Transfer-Bethany Pipeline.	Winter rains and March-April	NFE, NSW, VFR, Gr, VFW
Rana draytonii California red-legged frog	FT/CSC/--/m	Breed in stock ponds, pools, and slow-moving streams	Present. Eleven breeding sites in the Los Vaqueros Watershed study area, with more potential breeding habitat. Frogs may be encountered in upland habitat on the Delta-Transfer Pipeline, Transfer-LV Pipeline, and Transfer-Bethany Pipeline.	Year-round	NFE, VFR, Gr, VFW
REPTILES					
Federal or State Threatened and Endangered Species					
Masticophis laterals euryxanthus Alameda whipsnake (=Alameda striped racer)	FT/ST/--/m	Coastal ranges, in chaparral and riparian habitat and adjacent grasslands.	Present. Occupied scrub habitat present in the Los Vaqueros Watershed study area. Snakes are expected to use grasslands, woodlands, and other nonscrub habitat in the Watershed.	March-November	VFR, Gr, US, VFW
Federal or State Species of Special Concern					
Actinemys marmorata Western pond turtle	--/CSC/--/m	Lakes, ponds, reservoirs, and slow-moving streams and rivers, primarily in foothills and lowlands	Present. Present in stock ponds and drainages in the Los Vaqueros Watershed and likely in intermittent drainages and swales on pipeline routes.	Year-round	La, NFE, VFR, Gr, US, VFW
Masticophis flagellum ruddocki San Joaquin whipsnake (=coachwhip)	--/CSC/--/m	Open grassland, pasture, and alkali scrub	Present. Presumed present in grasslands in the Los Vaqueros Watershed, on pipeline routes, and at the Expanded Transfer Facility.	March-October	Gr, US, VFW
Phrynosoma coronatum *Coast horned lizard*	--/CSC/--/--	Valley woodland, coniferous forest, riparian, and grassland habitats; most commonly in sandy washes with scattered shrubs	High. Suitable habitat may be present on the Transfer-Bethany Pipeline, south of Armstrong Road, and parts of the Power Option 2 Western powerline alignment.	Year-round	VFR, US, VFW

TABLE D-1 (Continued)
SPECIAL-STATUS SPECIES KNOWN FROM THE REGIONAL PROJECT VICINITY AND ANALYZED FOR THE PROJECT

Common Name Scientific Name	Listing Status USFWS/CDFG/ CNPS/CALFED	General Habitat	Potential for Species Occurrence in the Project Area	Period of Identification or Blooming Period	NCCP Habitat Associations
BIRDS					
Federal or State Threatened and Endangered Species					
Buteo swainsoni *Swainson's hawk*	--/ST/--	Nests in large trees, often near water, open grasslands, or agricultural lands	Moderate. Historic nesting site noted at one location, 300 feet from the Delta-Transfer Pipeline; low likelihood of nesting on other pipeline alignments or in the watershed	March-July	VFR, Gr, UC
Haliaeetus leucocephalus Bald eagle	BEPA-FD/SE-CFP/--/m	Winter foraging at lakes and along major rivers	Low (nesting). The Los Vaqueros Watershed supports wintering and foraging habitat, but no active nesting	Year-round	La, NFE, VFR, VFW
Federal or State Species of Special Concern					
Accipiter cooperi Cooper's hawk	--/CSC/--/m	Nests in dense oak and riparian woodland	High. Expected to nest in wooded portions of the Los Vaqueros Watershed and on the Transfer-LV Pipeline and Transfer-Bethany Pipeline.	Year-round	VFR, VFW
Accipiter striatus Sharp-shinned hawk	--/CSC/--/--	Nests in dense stands of conifers and riparian habitats	High. Expected to nest in wooded portions of the Los Vaqueros Watershed and on the Transfer-LV Pipeline and Transfer-Bethany Pipeline.	Year-round	VFR, VFW
Agelaius tricolor Tricolored blackbird	--/CSC/--/m	Nests in freshwater marshes with dense stands of cattails or bulrushes, occasionally in willows, thistles, mustard, blackberry brambles, and dense shrubs and grains	Moderate. Nesting sites available at disjunctive locations in the Los Vaqueros Watershed and on pipeline routes.	Year-round; spring (nesting)	NFE, VFR, Gr, UC
Aquila chrysaetos Golden eagle	BEPA/CSC-CFP/--/m	Nests in canyons and large trees in open habitats	Present. Six nesting occurrences reported from the Los Vaqueros Watershed; one in the study area. Potential to occur on Transfer-LV Pipeline	Year-round	Gr, US, VFW
Athene cunicularia hypugea Western burrowing owl	--/CSC/--/m	Nests and forages in low-growing grasslands with burrowing mammals	High. Nesting habitat present in grasslands in the Los Vaqueros Watershed, on the fringes of agricultural lands and in grasslands on the Delta-Transfer Pipeline, Transfer-LV Pipeline, Transfer-Bethany Pipeline, and at the Expanded Transfer Facility.	Year-round	Gr, UC
Asio flammeus Short-eared owl	--/CSC/--/--	Inhabits open fields, meadows, and marshes	High. Nesting habitat present in grasslands in the Los Vaqueros Watershed and on the Delta-Transfer Pipeline, Transfer-LV Pipeline, and Transfer-Bethany Pipeline.	Year-round	Gr, UC

TABLE D-1 (Continued)
SPECIAL-STATUS SPECIES KNOWN FROM THE REGIONAL PROJECT VICINITY AND ANALYZED FOR THE PROJECT

Common Name Scientific Name	Listing Status USFWS/CDFG/ CNPS/CALFED	General Habitat	Potential for Species Occurrence in the Project Area	Period of Identification or Blooming Period	NCCP Habitat Associations
BIRDS (cont.)					
Federal or State Species of Special Concern (cont.)					
Circus cyaneus Northern harrier	--/CSC/--/m	Ground nester found in grasslands and in adjacent wetlands or upland/wetland areas	Moderate. Though nests have not been identified, low likelihood of nesting near marshland habitat in the Los Vaqueros Watershed; may nest in open grasslands on pipeline routes and at Expanded Transfer Facility.	Year-round	NFE, NSW, Gr, UC
Elanus leucurus White-tailed (=black shouldered) kite	--/CFP/--/m	Nests in shrubs and trees next to grasslands, forages over grasslands and agricultural lands	High. Nesting habitat available in Los Vaqueros Watershed. May nest in the few wooded areas in and near the Delta-Transfer Pipeline, Transfer-LV Pipeline, and Transfer-Bethany Pipeline.	Year-round	VFR, Gr, UC
Eremophila alpestris actica California horned lark	--/CSC/--/--	Nests and forages in short-grass prairie, mountain meadow, coastal plain, fallow fields, and alkali flats	High. May nest in short annual grasslands in the Los Vaqueros Watershed and on all pipeline segments.	Year-round	Gr, UC
Falco mexicanus *Prairie falcon*	--/CSC/--/--	Inhabits hills, canyons, and mountainous areas with grasslands; nests of cliffs or abandoned raptor nests	Low. Nesting not expected in study area	March-August	Gr, US
Lanius ludovicianus Loggerhead shrike	--/CSC/--/--	Scrub, open woodlands, and grasslands	Moderate. May nest in brush and scrub in the Los Vaqueros Watershed and on all pipeline segments.	Year-round	VFR, Gr, US, VFW
Pandion haliatus Osprey	--/CSC/--/--	Large bodies of water that produce fish and are surrounded by forested habitats	High. Nesting may occur in Los Vaqueros Watershed. Less likely elsewhere in project area.	Year-round	VFR, Gr, UC
MAMMALS					
Federal or State Threatened and Endangered Species					
Vulpes macrotis mutica San Joaquin kit fox	FE/ST/--/m	Annual grasslands or grassy open areas with shrubs, loose-textured soils for burrows and prey base	Presumed present. High-quality habitat is present in the Los Vaqueros Watershed and portions of each pipeline alignment; Low to moderate quality habitat is present at the Delta intake facilities and Expanded Transfer Facility.	Year-round	Gr, US, VFW

TABLE D-1 (Continued)
SPECIAL-STATUS SPECIES KNOWN FROM THE REGIONAL PROJECT VICINITY AND ANALYZED FOR THE PROJECT

Common Name Scientific Name	Listing Status USFWS/CDFG/ CNPS/CALFED	General Habitat	Potential for Species Occurrence in the Project Area	Period of Identification or Blooming Period	NCCP Habitat Associations
MAMMALS (Cont.)					
Federal or State Species of Special Concern					
Antrozous pallidus Pallid Bat	--/CSC/--/--	Roosts in buildings, caves, or cracks in rocks	Low. Habitat may be available in large trees in the Los Vaqueros Watershed study area, but large rock crevices are generally lacking.	February-August	La, VFR, Gr, US, VFW
Corynorhinus townsendii Townsend's big-eared bat	--/CSC/--/--	Oak and coniferous woodland and arid grasslands. Roosts in caves, buildings, etc.	Low. Habitat may be available in large trees in the Los Vaqueros Watershed study area, but large rock crevices are generally lacking.	April-October	La, VFR, Gr, US, VFW
Eumops perotis californicus Greater western mastiff-bat	FSC/CSC/--/--	Breeds in rugged, rocky canyons and forages in a variety of habitats	Low. Habitat may be available in large trees in the Los Vaqueros Watershed study area, but large rock crevices are generally lacking.	February-August	La, VFR, Gr, US, VFW
Myotis ciliolabrum Small-footed myotis bat	FSC/--/--/--	Forages over grasslands and roosts in caves and rock crevices	Low. Habitat may be available in large trees in the Los Vaqueros Watershed study area, but large rock crevices are generally lacking.	February-August	La, VFR, Gr, US, VFW
Myotis evotis Long-eared myotis bat	FSC/--/--/--	Inhabits woodlands and forests up to an about 8,200-foot elevation; generally not in Central Valley	Low. Habitat may be available in large trees and rocks in the Los Vaqueros Watershed study area, but large rock crevices are generally lacking.	February-August	La, VFR, Gr, US, VFW
Myotis thysanodes Fringed myotis bat	FSC/--/--/--	Inhabits a variety of habitats including pinyon-juniper woodland, valley-foothill hardwood, hardwood-conifer forests, and desert scrub; generally not in Central Valley	Low. Rock crevice habitat is generally lacking in the Los Vaqueros Watershed study area.	February-August	La, VFR, Gr, US, VFW
Myotis volans Long-legged myotis bat	FSC/--/--/--	Inhabits forests and woodland habitats, primarily oak and juniper woodlands	Low. Habitat may be available in large trees in the Los Vaqueros Watershed study area, but large rock crevices are generally lacking.	February-August	La, VFR, Gr, US, VFW
Myotis yumanensis Yuma myotis bat	FSC/CSC/--/--	Open forests and woodlands below 8,000-foot elevation in close association with water bodies	Low. Rock crevice habitat is generally lacking in the Los Vaqueros Watershed study area.	February-August	La, VFR, Gr, US, VFW
Perognathus inornatus inornatus San Joaquin pocket mouse	--/CSC/--/--	Annual grasslands, saltbush scrub, and oak savannah habitats; usually found in areas with friable soils	Moderate. Alkali scrub habitat on the Western alignment and grasslands with friable soils on the Transfer-Bethany Pipeline and at the Western substation site provide the best available habitat. Non-native annual grasslands throughout the project area provide potential, though lesser quality habitat.	Year-round	Gr

TABLE D-1 (Continued)
SPECIAL-STATUS SPECIES KNOWN FROM THE REGIONAL PROJECT VICINITY AND ANALYZED FOR THE PROJECT

Common Name Scientific Name	Listing Status USFWS/CDFG/ CNPS/CALFED	General Habitat	Potential for Species Occurrence in the Project Area	Period of Identification or Blooming Period	NCCP Habitat Associations
MAMMALS (Cont.)					
Federal or State Species of Special Concern (cont.)					
Taxidea taxus American badger	--/CSC/--/--	Dry, open grasslands	Present. High-quality habitat is present in the Los Vaqueros Watershed and portions of each pipeline alignment; low to moderate quality habitat is present at the Delta intake facilities and Expanded Transfer Facility.	Year-round	Gr
PLANTS					
Federal or State Threatened and Endangered Species					
Lasthenia conjugens *Contra Costa goldfields*	FE/--/1B/m	Vernal pools and seasonal wetlands in grassland and woodland	Absent based on focused botanical survey findings.	March-June	NSW
Cordylanthus palmatus Palmate-bracted bird's beak	FE/SE/1B/m	Chenopod scrub; valley and foothill grassland, in alkaline soils.	Absent. Not identified during focused botanical surveys.	May-October	US, Gr
Eryngium racemosum Delta button-celery	--/SE/1B/r	Riparian scrub, in vernally mesic clay depressions	Absent. Not identified during focused botanical surveys.	June-September	VFR
Trifolium amoenum *Showy Indian clover*	FE/--/1B/m	Annual grasslands, disturbed sites and coastal bluffs	Absent based on focused botanical survey findings.	April-June	Gr
Federal or State Species of Special Concern					
Amsinckia lunaris Bent-flowered fiddleneck	--/--/1B/--	Coastal bluff scrub, cismontane woodland and valley and foothill grassland	Absent. Not identified during focused botanical surveys.	March-June	Gr, US, VFW
Anomobryum julaceum Slender silver-moss	--/--/2/--	Broad-leafed upland forest; lower montane coniferous forest; North coast coniferous forest/damp rock and soil on outcrops, usually on roadcuts	Absent. Not identified during focused botanical surveys.	n/a	VFW
Arctostaphylos auriculata Mt. Diablo manzanita	--/--/1B/m	Chaparral/sandstone; cismontane woodlands	Absent. Not identified during focused botanical surveys.	January-March	US
Arctostaphylos manzanita ssp. *laevigata* Contra Costa manzanita	--/--/1B/m	Chaparral, rocky soil	Absent. Not identified during focused botanical surveys.	January-March; uncommonly in April	US
Astragalus tener var. tener Alkali milk-vetch	--/--/1B/r	In poor draining low ground of alkali playa, grasslands and vernal pools; usually in dry adobe soil	Absent based on focused botanical survey findings.	March-June	NSW, Gr

TABLE D-1 (Continued)
SPECIAL-STATUS SPECIES KNOWN FROM THE REGIONAL PROJECT VICINITY AND ANALYZED FOR THE PROJECT

Common Name Scientific Name	Listing Status USFWS/CDFG/ CNPS/CALFED	General Habitat	Potential for Species Occurrence in the Project Area	Period of Identification or Blooming Period	NCCP Habitat Associations
PLANTS (cont.)					
Federal or State Species of Special Concern (cont.)					
Atriplex cordulata Heartscale	--/--/1B/--	Chenopod scrub and sandy, alkaline grasslands	Low potential at a few distinct sites on the Transfer-Bethany Pipeline alignment; final survey delayed by site access.	April-October	NSW, Gr
Atriplex depressa Brittlescale	--/--/1B/m	Alkaline or clay grasslands, chenopod scrub, and playas; occasionally in riparian areas, marshes, or vernal pools	Present in Los Vaqueros Watershed. Moderate potential at a few distinct sites on the Transfer-Bethany Pipeline alignment; final survey delayed by site access.	May-October	NSW, Gr
Atriplex joaquiniana *San Joaquin spearscale*	--/--/1B/m	Alkaline seasonal wetlands and sinks in grasslands, chenopod scrub, and alkali meadows	Present outside staging area in the watershed, on portions of the Transfer-Bethany Pipeline alignment, Power Option 1 (i.e., new substation siting zone); and spanned by powerlines under Power Option 2.	April-October	NSW, Gr
Balsamorhiza macrolepis var. *macrolepis* Big-scale balsamroot	--/--/1B/--	Chaparral; cismontane woodlands; valley and foothill grasslands, sometimes in serpentine soils	Absent. Not identified during focused botanical surveys.	March-June	Gr, US, VFW
Blepharizonia plumosa Big tarplant	--/--/1B/m	In annual grasslands of dry hills and plains; soils are clay to clay-loam; often found in burned areas and usually on slopes	Absent. Not identified during focused botanical surveys.	July-October	Gr
Calochortus pulchellus Mt. Diablo fairy lantern	--/--/1B/m	Wooded or brushy hillsides, tends toward northern exposure	Low. Not present in study area	April-June	VFR, Gr, US, VFW
Campanula exigua Chaparral harebell	--/--/1B/--	Chaparral; usually rocky or serpentine soils	Absent. Not identified during focused botanical surveys.	May-June	US
Carex vulpinoidea Fox sedge	--/--/2/--	Freshwater marshes and swamps; riparian woodlands	Absent. Not identified during focused botanical surveys.	May-June	TFE, NFE
Caulanthus coulteri var. *lemmonii* Lemmon's jewelflower	--/--/1B/--	Pinon and juniper woodland; valley and foothill grassland	Absent. Not identified during focused botanical surveys.	March-May	Gr
Centromadia parryi ssp. Congdonii Congdon's tarplant	--/--/1B/m	Alkaline soils in grasslands	Absent. Not identified during focused botanical surveys.	June-November	Gr

TABLE D-1 (Continued)
SPECIAL-STATUS SPECIES KNOWN FROM THE REGIONAL PROJECT VICINITY AND ANALYZED FOR THE PROJECT

Common Name Scientific Name	Listing Status USFWS/CDFG/ CNPS/CALFED	General Habitat	Potential for Species Occurrence in the Project Area	Period of Identification or Blooming Period	NCCP Habitat Associations
PLANTS (cont.)					
Federal or State Species of Special Concern (cont.)					
Cordylanthus mollis ssp. hispidus Hispid bird's-beak	--/--/1B/m	Seasonal wetlands in alkali sinks with valley sink scrub, alkali meadows, and alkali marsh communities	Absent. Not identified during focused botanical surveys.	June-September	NSW, Gr
Cordylanthus nidularius Mt. Diablo bird's beak	--/CR/1B/m	Chaparral; serpentine soil	Absent. Not identified during focused botanical surveys.	July-August	US
Cryptantha hooveri Hoover's cryptantha	--/--/1A/--	Inland dunes; valley and foothill grassland, in sandy soils	Absent. Not identified during focused botanical surveys.	April-May	Gr
Deinandra bacigalupii Livermore tarplant	--/--/1B/--	Sandy alkaline soils, alkaline swales and drainages and associated grasslands	Absent. Not identified during focused botanical surveys.	June-October	NSW
Delphinium californicum ssp. *interius* Hospital Canyon larkspur	--/--/1B/m	Chaparral; cismontane woodland	Absent. Not identified during focused botanical surveys.	April-June	US, VFW
Delphinium recurvatum Recurved larkspur	--/--/1B/m	On alkaline soils mostly in saltbush scrub and chenopod scrub but also grasslands and woodland.	Absent. Not identified during focused botanical surveys.	March-May	NSW, Gr, VFW
Dirca occidentalis Western leatherwood	--/--/1B/--	Broadleafed upland forest; closed-cone coniferous forest; chaparral; cismontane woodland; North Coast coniferous forest; riparian forest; riparian woodland; mesic soils	Absent. Not identified during focused botanical surveys.	January-March; uncommonly in April	US, VFR, VFW
Eriastrum brandegeeae Brandegee's eriastrum	--/--/1B/m	Chaparral; cismontane woodland; volcanic or sandy soil	Absent. Not identified during focused botanical surveys.	April-August	US, VFW
Eriogonum truncatum Mt. Diablo buckwheat	--/--/1B/--	Chaparral; coastal scrub; valley and foothill grassland in sandy soil	Absent. Not identified during focused botanical surveys.	April-September; uncommonly November-December	Gr, US
Erodium macrophyllum Round-leaved filaree	--/--/2/--	Cismontane woodland; valley and foothill grassland in clay soil	Absent. Not identified during focused botanical surveys.	March-May	Gr, VFW
Eschscholzia rhombipetala Diamond-petaled California poppy	--/--/1B/m	On grassland slopes and flats; substrate clay and alkaline	Absent. Not identified during focused botanical surveys.	March-April	Gr

TABLE D-1 (Continued)
SPECIAL-STATUS SPECIES KNOWN FROM THE REGIONAL PROJECT VICINITY AND ANALYZED FOR THE PROJECT

Common Name Scientific Name	Listing Status USFWS/CDFG/ CNPS/CALFED	General Habitat	Potential for Species Occurrence in the Project Area	Period of Identification or Blooming Period	NCCP Habitat Associations
PLANTS (cont.)					
Federal or State Species of Special Concern (cont.)					
Fritillaria agrestis Stinkbells	--/--/4/--	Chaparral; cismontane woodland; pinyon and juniper woodland; valley and foothill grassland, in clay and sometimes serpentine soil	Absent. Not identified during focused botanical surveys.	March-June	Gr, US, VFW
Fritillaria liliacea Fragrant fritillary	--/--/1B/--	Cismontane woodland; coastal prairie; coastal scrub; valley and foothill grassland often in serpentine soil	Absent. Not identified during focused botanical surveys.	February-April	Gr, US, VFW
Helianthella castanea Diablo helianthella (=rock-rose)	--/--/1B/m	Forest, woodland, chaparral, coastal scrub, riparian woodland, and grassland; usually in chaparral/oak woodland ecotone	Present in Los Vaqueros Watershed, though absent from project study area	April-June	Gr, US, VFW
Hesperolinon breweri Brewer's dwarf-flax (=western flax)	--/--/1B/m	Transition between annual grassland and mixed chaparral; also near woodlands	Present. Portions of one population occur in the Los Vaqueros Watershed study area; absent from other project facilities.	May-July	Gr, US, VFW
Hesperolinon serpentinum Napa western flax	--/--/1B/--	Chaparral, in serpentine soil	Absent. Not identified during focused botanical surveys.	May-July	US
Hibiscus lasiocarpus *Rose-mallow*	--/--/2/m	Tidally influenced coastal and freshwater marsh	Present (New Intake). A population occurs at the site for the New Delta Intake and Pump Station	June-September	NFE
Lathyrus jepsonii var. *jepsonii* Delta tule pea	--/--/1B/r	Freshwater and brackish marshes and swamps	Absent. Not identified during focused botanical surveys.	May-July; uncommonly in September	NFE, TWE
Lilaeopsis masonii Mason's lilaeopsis	--/SR/1B	Tidally influenced coastal and freshwater marsh	Present (off site). Near Delta intake facilities, 5,000 feet north and 1,200 feet south of Expanded Old River Intake and Pump Station, greater than 700 feet from the New Delta Intake and Pump Station site	April-November	TFE
Limosella subulata Delta mudwort	--/--/2/--	Mud flats and bank in tidal marshlands	Absent. Not identified during focused botanical surveys.	May-August	TFE
Madia radiate Showy (=golden) madia	--/--/1B/m	Valley and foothill grasslands, cismontane woodlands, and chenopod scrub	Absent. Not identified during focused botanical surveys.	March-May	Gr, VFW

TABLE D-1 (Continued)
SPECIAL-STATUS SPECIES KNOWN FROM THE REGIONAL PROJECT VICINITY AND ANALYZED FOR THE PROJECT

Common Name Scientific Name	Listing Status USFWS/CDFG/ CNPS/CALFED	General Habitat	Potential for Species Occurrence in the Project Area	Period of Identification or Blooming Period	NCCP Habitat Associations
PLANTS (cont.)					
Federal or State Species of Special Concern (cont.)					
Malacothamnus halii Hall's bush mallow	--/--/1B/m	Chaparral and coastal scrub	Absent. Not identified during focused botanical surveys.	May-September; uncommonly in October	US
Myosurus minimus ssp. *apus* Little mousetail	--/--/3/--	Valley and foothill grasslands; vernal pools in alkaline soil	Absent. Not identified during focused botanical surveys.	March-June	NSW
Phacelia phacelioides Mt. Diablo phacelia	--/--/1B/m	Chaparral; cismontane woodland in rocky soil	Absent. Not identified during focused botanical surveys.	April-May	US, VFW
Plagiobothrys glaber Hairless popcorn flower	--/--/1A/--	Alkaline meadows and seeps; coastal salt marshes and swamps	Absent. Not identified during focused botanical surveys.	March-May	SE, NSW
Sanicula saxatilis Rock sanicle	--/SR/1B/--	Broadleafed upland forest; chaparral; valley and foothill grassland in rocky soil	Absent. Not identified during focused botanical surveys.	April-May	US, VFW
Scutellaria galericulata Marsh skullcap	--/--/2/m	Streambanks and meadows, seeps, marshes, and swamps	Absent. Not identified during focused botanical surveys.	June-September	NFE, NSW
Senecio aphanactis Rayless ragwort	--/--/2/--	Chaparral; cismontane woodland; coastal scrub sometimes in alkaline soil	Absent. Not identified during focused botanical surveys.	January-April	US, VFW
Streptanthus albidus ssp. *peramoenus* Most beautiful jewel-flower	--/--/1B/--	Chaparral; cismontane woodland; valley and foothill grassland in serpentine soil	Absent. Not identified during focused botanical surveys.	April-September; uncommonly in March and October	Gr, US, VFW
Streptanthus hispidus Mt. Diablo/Contra Costa jewel-flower	--/--/1B/--	Chaparral; valley and foothill grassland in rocky soil	Absent. Not identified during focused botanical surveys.	March-June	Gr, US
Trifolium depauperatum var. *hydrophilum* Saline clover	--/--/1B/--	Marshes and swamps; valley and foothill grassland in mesic and alkaline soil; vernal pools	Absent. Not identified during focused botanical surveys.	April-June	NFE, NSW, Gr
Tropidocarpum capparideum Caper-fruited tropidocarpum	--/--/1B/--	Grasslands in alkaline hills	Absent. Not identified during focused botanical surveys.	March-April	Gr
Viburnum ellipticum Oval-leaved viburnum	--/--/2/--	Chaparral; cismontane woodland; lower montane coniferous forest	Absent. Not identified during focused botanical surveys.	May-June	US, VFW

TABLE D-1 (Continued)
SPECIAL-STATUS SPECIES KNOWN FROM THE REGIONAL PROJECT VICINITY AND ANALYZED FOR THE PROJECT

STATUS CODES:

Federal (U.S. Fish and Wildlife Service):
BEPA = Bald Eagle Protection Act
FE = Listed as Endangered by the Federal Government
FT = Listed as Threatened by the Federal Government
FPE = Proposed for Listing as Endangered
FPT = Proposed for Listing as Threatened
FSC = Former Federal Species of Special Concern (list is no longer maintained)
FD = Federal Delisted Species
FC = Candidate for Federal listing

State (California Department of Fish and Game):
SE = Listed as Endangered by the State of California
ST = Listed as Threatened by the State of California
SR = Identified as Rare by the State of California (plants only)
CSC = California species of special concern
CFP = California fully protected species

California Native Plant Society : List 1A = Plants believed extinct; List 1B= Plants rare, threatened, or endangered in California and elsewhere; List 2= Plants rare, threatened, or endangered in California but more common elsewhere; List 3=Plants about which more information is needed; List 4 = Plants of limited distribution

SOURCES: CNPS, 2007; CDFG, 2008; USFWS, 2007; ESA, 2008a ; ESA, 2008b

CALFED: (CALFED Bay-Delta Program Multi-Species Conservation Strategy [MSCS] Species Goals)
R = Recovery. Recover species' populations within the MSCS focus area to levels that ensure the species' long term survival in nature.
r = Contribute to recovery. Implement some of the actions deemed necessary to recover species' populations within the MSCS focus area.
m = Maintain. Ensure that any adverse effects on the species that could be associated with implementation of CALFED actions will be fully offset through implementation of actions beneficial to the species.

Natural Community Conservation Plan Habitat Type
Gr = Grassland
La = Lacustrine
NFE = Nontidal Freshwater Emergent
NSW = Natural Seasonal Wetland
SE = Saline Emergent
TFE = Tidal Freshwater Emergent
UC = Upland Cropland
US = Upland Scrub
VFR = Valley/Foothill Riparian
VFW = Valley/Foothill Woodland Forest

Habitat

Although only known within a few locations, longhorn fairy shrimp are found in a variety of vernal pool habitats, ranging from small, clear, sandstone outcrop pools to large, turbid, alkaline, grassland pools. Longhorn fairy shrimp have been found at elevations ranging from 75 feet to 2,887 feet. They occur in the same vernal pool complexes as other listed vernal pool species, but only rarely co-occur with other fairy shrimp (USFWS, 2005c).

Distribution

General. It is likely that longhorn fairy shrimp were historically more widespread in the regions where they are currently known, and in adjacent areas such as the San Joaquin and Southern Sierra Foothill vernal pool regions. The known extant populations are few. These populations are in pools within a matrix of alkali sink and alkali scrub communities at Soda Lake and at Carrizo Plain National Monument; a series of sandstone outcrop pools in Contra Costa and Alameda Counties; alkaline grassland pools at Kesterson National Wildlife Refuge; and a roadside ditch 2 miles north of Los Banos (USFWS, 2005c).

Regional. Eleven longhorn fairy shrimp occurrences are reported by the CNDDB: one in Contra Costa County, one in Alameda County, three from Merced County, and six in San Luis Obispo County (CDFG, 2008). Two records of longhorn fairy shrimp from the region are included in the ECCC HCP/NCCP: Souza Ranch and Vasco Caves Regional Preserve. The first description of this species was from specimens collected at Souza Ranch. Both of these locations are shallow sandstone-rock-outcrop vernal pools within non-native grasslands (ECCCHPA, 2006). Contra Costa County has not been thoroughly surveyed for this species and the ECCC HCP/NCCP (2006) hypothesizes that additional populations may be present in natural and artificial habitats in the County. Critical habitat has been designated for longhorn fairy shrimp at the Vasco Caves Regional Preserve, south of the Los Vaqueros Watershed.

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Suitable habitat for the longhorn fairy shrimp occurs in the Los Vaqueros Watershed, though not in the project area, with occurrences known from the Vasco Caves area, about 1.25 miles east of the inundation boundary (Figure 4.6-14). The other possibly extirpated occurrence is at Souza Ranch, about 2 miles south-southwest of the dam. Designated critical habitat is present at Unit 1A, about 0.75 mile east of the inundation boundary at Vasco Caves and Unit 1B, about 2.5 miles from the inundation boundary.

Delta Intake and Pump Station. No longhorn fairy shrimp populations or potential habitat occurs near the Delta Intake Facilities (CDFG, 2008). The closest critical habitat unit to the Old River Intake and Pump Station is Unit 1A, about 8 miles southwest of the Old River Intake and Pump Station. Suitable habitat is not present at this location.

Delta-Transfer Pipeline. Suitable habitat does not occur in the study area. The nearest described population occurs about 4.5 miles south of the pipeline.

Transfer-LV Pipeline. Suitable habitat for longhorn fairy shrimp does not occur in or near the study area for the project component. The nearest population occurs about 2.3 miles south of the Transfer-LV Pipeline.

Transfer-Bethany Pipeline. An extant longhorn fairy shrimp population occurs roughly 5 miles from the Expanded Transfer Facility, (CDFG, 2008). A February 2008 field reconnaissance identified 16 vernal pools within and next to the proposed alignment along Armstrong Road (ESA, 2008a). It is estimated that at least four created pools west of Armstrong Road would be directly affected by the Transfer-Bethany Pipeline. However, longhorn fairy shrimp have not been documented from this location, are locally known only from rock outcrop pools (not claypan vernal pools), and are therefore unlikely to be affected by project activities in the study area.

Expanded Transfer Facility. Suitable habitat does not occur in the study area. The nearest described population occurs about 4.5 miles south of the Transfer Facility.

Power Supply Infrastructure. No longhorn fairy shrimp populations or potential habitat were identified in or near the proposed facilities (CDFG, 2008).

Vernal pool fairy shrimp *(Branchinecta lynchi)*

Description

Vernal pool fairy shrimp are small, aquatic crustaceans. They feed on algae, bacteria, protozoa, rotifers, and bits of detritus (USFWS, 2005a). One important adaptation vernal pool fairy shrimp have acquired is the ability for their cysts to remain dormant in the soil when vernal pool habitats are dry. When temperature conditions are appropriate, after a brief period of rainfall, vernal pool fairy shrimp can reach sexual maturity in as little as 18 days and can complete their life cycle in 9 weeks. In larger pools, vernal pool fairy shrimp have been observed to have multiple hatching events in the same season (USFWS, 2005c).

Habitat

Vernal pool fairy shrimp are found in a variety of vernal pool habitats, ranging from small, clear, sandstone rock pools to large, turbid, alkaline, grassland valley floor pools. Although the species has been collected from large vernal pools, it tends to occur in smaller pools. Most commonly they occur in pools in grass- or mud-bottomed swales, or basalt flow depression pools in unplowed grasslands (USFWS, 2005a). Vernal pool fairy shrimp have been collected with other vernal pool crustaceans, but only rarely. In pools where they did co-occur, the pools were large and long-lived, with the vernal pool fairy shrimp less abundant than the other vernal pool crustaceans found. It is thought that vernal pool fairy shrimp may be competitively excluded from these pools by other fairy shrimp, or tadpole shrimp, which are known to consume vernal pool fairy shrimp (USFWS, 2005c).

Distribution

General. This species is known to occupy a wide range of vernal pool types and its historic distribution likely coincided with the historic distribution of Central Valley, southern California, and southern Oregon vernal pools. In California, current known populations extend from Shasta

County through most of the Central Valley into Tulare County. They range in coastal valleys from northern Solano County to the Carrizo Plain in San Luis Obispo County. A few additional isolated populations exist in southern California, including in Los Angeles, Santa Barbara, and Ventura Counties. Although vernal pool fairy shrimp are distributed more widely than other listed vernal pool species, they are generally uncommon throughout their range and are rarely abundant where they are found (USFWS, 2005c). As of 2007, there were 400 vernal pool fairy shrimp occurrences reported by the CNDDB (CDFG, 2008).

Regional. Of the 400 reported vernal pool fairy shrimp locations reported by the CNDDB, 14 are from Alameda and Contra Costa Counties (CDFG, 2008). The ECCC HCP/NCCP notes six records for vernal pool fairy shrimp within the ECCC inventory area. Contra Costa County has not been thoroughly surveyed for this species and the ECCC HCP/NCCP (2006) hypothesizes that vernal pool fairy shrimp may be found elsewhere in the area where habitat is appropriate. Critical habitat for vernal pool fairy shrimp occurs within the region.

In-Watershed Facilities. Vernal pool fairy shrimp are known to occur within the regional vicinity, with eight CNDDB records occurring within 10 miles. One occurrence is known within the Los Vaqueros Watershed (CDFG, 2008). Before Los Vaqueros Reservoir was built, Jones and Stokes (1990) found vernal pool fairy shrimp in a rock outcrop vernal pool roughly 0.20 mile east and upslope from the inundation boundary (ESA, 2004) (Figure 4.6-14). Habitat for vernal pool fairy shrimp at the Vasco Caves vernal pool complex is 0.90 mile east of the inundation boundary (Figure 4.6-14). No other known vernal pool fairy shrimp populations or potential habitat are documented in the local reservoir vicinity or the vicinity of the Los Vaqueros Watershed and Recreational Facilities.

Delta Intake and Pump Station. An extant vernal pool fairy shrimp population occurs about 2.1 miles northwest of the Old River Intake and Pump Station. The study area does not provide suitable habitat for vernal pool fairy shrimp.

Delta-Transfer Pipeline. The nearest vernal pool fairy shrimp occurrence is about 1 mile north of the pipeline. Another occurrence is reported about 2.5 miles to the south in vernal pool fairy shrimp Potential habitat is present in an alkali scrub swale/ditch that occurs along the alignment. This area will be evaluated for vernal pool fairy shrimp during winter 2007 surveys.

Transfer-LV Pipeline. Much of this pipeline is within the Los Vaqueros Watershed. Habitat for vernal pool fairy shrimp at the Vasco Caves vernal pool complex is 2 miles from the pipeline. Another occurrence is about 1.8 miles to the north of the pipeline. The nearest critical habitat for vernal pool fairy shrimp are Unit 19B (USFWS, 2006a) 1.8 miles to the east of the pipeline, and Unit 19A, 2 miles north of the pipeline. This pipeline segment does not contain suitable habitat for this species.

Transfer-Bethany Pipeline. An extant population occurs in the local vicinity of the Byron Airport within vernal pool fairy shrimp critical habitat unit 19B (CDFG, 2008; USFWS, 2006a). The Transfer-Bethany Pipeline alignment traverses a roughly 4-mile portion of the unit. A May 21-22, 2007 field reconnaissance verified that potential habitat occurs within 16 pools within the

Transfer-Bethany Pipeline alignment, of which four are known or suspected to support vernal pool fairy shrimp (ESA, 2008a). These features would be directly affected by the proposed Transfer-Bethany Pipeline.

Expanded Transfer Facility. The nearest vernal pool fairy shrimp occurrence to the Expanded Transfer Facility is 2 miles to the northeast. The nearest critical habitat unit for vernal pool fairy shrimp is Unit 19A (USFWS, 2006a), 3 miles to the northeast of the Expanded Transfer Facility. Habitat for this species does not occur at the Expanded Transfer Facility.

Power Supply Infrastructure. During biological surveys in spring 2008, high-quality vernal pool habitat was noted in multiple pools in the Western alignment, just north of the Bureau of Reclamation's Skinner Delta Fish Protective Facility. This area would be spanned under Power Option 2 (with no activities in this area under Power Option 1). Habitat is absent from the new Western substation siting zone associated with Power Option 1 and the PG&E facilities associated with Power Option 2.

Valley elderberry longhorn beetle *(Desmocerus californicus dimorphus)*

Description

Valley elderberry longhorn beetles are unique insects that spend most of their lives within the stems of elderberry (*Sambucus* spp.) shrubs. Females lay their eggs within the bark, where larvae hatch and bore into the stems. Larvae remain within the stems for 1 to 2 years. In March, when the elderberries begin to flower, they pupate and emerge as adults. Mating usually occurs in June. Often, the only indicators of their presence are the distinctive small oval openings that are left after larvae pupate and emerge (UC Berkeley, 2005; USFWS, 2005a).

Habitat

Valley elderberry longhorn beetles use elderberry shrubs with a stem diameter of at least 1 inch (at ground level) as a host plant (USFWS, 2005a). In the Central Valley, elderberry shrubs are fairly common in riparian forests and adjacent uplands (UC Berkeley, 2005). Elderberry shrubs are typically found growing in association with other riparian species, but they also occur as isolated shrubs in upland areas. All elderberry shrubs within the Los Vaqueros Watershed with stem diameters of at least 1 inch represent potential habitat for valley elderberry longhorn beetles.

Distribution

General. Historically, valley elderberry longhorn beetles ranged throughout the Central Valley. Currently, they are locally common in scattered populations from Redding to Bakersfield where historical riparian forests still exist (USFWS, 2005a). The *USFWS Conservation Guidelines for the Valley Elderberry Longhorn Beetle* considers the range of the valley elderberry longhorn beetle to include habitat up to 3,000 feet in elevation at the eastern boundary, and habitat within watersheds that drain into the Central Valley at the western range boundary (USFWS, 1999a). The CNDDB notes a total of 194 occurrences of the valley elderberry longhorn beetle scattered throughout the Central Valley.

Regional. The eastern portions of Contra Costa County and Alameda County are included within the range of the valley elderberry longhorn beetle; this includes the project area (USFWS, 1999a). No Valley elderberry longhorn beetle occurrences are reported in Contra Costa or Alameda Counties (CDFG, 2008). The nearest occurrences are in San Joaquin County, where 16 occurrences are reported (CDFG, 2008). Critical habitat for valley elderberry longhorn beetle is designated along the American River in Sacramento County, more than 40 miles from the project area (USFWS, 2002b).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. In the Los Vaqueros Watershed, beetle exit holes were noted in elderberry shrubs in several drainages within the proposed inundation area. An inventory of the Watershed found 85 elderberry shrubs in 2005 (ESA, 2005). The 275 TAF inundation zone supports 45 elderberry shrubs with 249 stems measuring more than 1 inch in diameter (ESA, 2005). Of these, six shrubs exhibited beetle exit holes. An additional two elderberry shrubs (with 24 stems greater than 1 inch in diameter) occur within 100 feet of the inundation zone (ESA, 2005), with no beetle activity. The Inlet/Outlet Zone study area supports 10 elderberry shrubs with 53 stems more than 1 inch in diameter (ESA, 2005).

Delta Intake and Pump Station. The nearest CNDDB occurrence of valley elderberry longhorn beetle is about 9 miles east of the Delta Intake Facilities. The next nearest CNDDB occurrences are over 20 miles away (CDFG, 2008). The nearest known elderberry shrub within the Los Vaqueros Watershed is about 7 miles west of the Delta Intake Facilities. The habitat in the vicinity of the study area is well-developed for agricultural use and generally lacks riparian vegetation, especially shrubs and trees. Elderberry shrubs, and hence, the valley elderberry longhorn beetle, do not occur within this study area.

Delta-Transfer Pipeline. Elderberry shrubs were not found in this alignment during a May, 2007 reconnaissance survey of this study area, thus, the valley elderberry longhorn beetle does not occur in the study area.

Transfer-LV Pipeline. A survey for elderberry shrubs was conducted within at least 500 feet of the portion of the pipeline alignment that is within the Los Vaqueros Watershed boundary (ESA, 2007). Several elderberry shrubs are known to occur in the Inlet-Outlet Pipelines construction area within the Los Vaqueros Watershed; the nearest occurrence is within 100 feet of the alignment. Because appropriate habitat is present, valley elderberry longhorn beetles may be present in the project area.

Transfer-Bethany Pipeline. The alignment does not support elderberry shrubs.

Expanded Transfer Facility. No elderberry shrubs occur at the Expanded Transfer Facility.

Power Supply Infrastructure. Elderberry shrubs do not occur near the facilities proposed for Power Options 1 and 2.

Federal or State Species of Special Concern

Midvalley fairy shrimp *(Branchinecta mesovallensis)*

Description

Midvalley fairy shrimp are small, aquatic crustaceans that feed on phytoplankton, detrital bacterial colonies, rotifers, protozoa, and small larvae (USFWS, 2005a). Their life-cycle is especially suited for the short and unpredictable conditions of vernal pool habitats, they have been observed to reach maturity in as few as 8 days, and they reproduce as quickly as 16 days after hatching. Multiple hatching events are possible during a single rainy season (USFWS, 2005a; USFWS, 2005c).

Habitat

Midvalley fairy shrimp have been found in small, shallow, short-lived vernal pools, vernal swales, and artificial ephemeral wetland habitats. They prefer shallow cool pools with low to moderate dissolved salts. Midvalley fairy shrimp have only been collected with one other fairy shrimp, vernal pool fairy shrimp; possibly because it occupies short-lived pools that are not inundated long enough to support other fairy shrimp species (USFWS, 2005a; USFWS, 2005c).

Distribution

General. Midvalley fairy shrimp are known to occur in Sacramento, Solano, Yolo, Contra Costa, San Joaquin, Madera, Merced, and Fresno Counties. Due to their resemblance to the conservancy fairy shrimp (*Branchinecta conservatio*) and their relatively recent formal description, it has been suggested that the range and distribution of the midvalley fairy shrimp is larger than the distribution of the known occurrences. This is because much of the vernal pool habitat in this region has been converted to agricultural uses, and to the fact that they can occur in swales and short-lived pools which often are not detected in dry years (USFWS, 2005a). Species occurrences are mostly concentrated in the Central Valley between Yolo and Merced Counties (CDFG, 2008).

Regional. Of 65 reported occurrences, three are from Contra Costa County, eight from Solano County, and eight from San Joaquin County. No occurrences are recorded from Alameda County (CDFG, 2008). The three records for midvalley fairy shrimp are in the regional vicinity of the project. The ECCC HCP/NCP (2006) hypothesizes that midvalley fairy shrimp could occur throughout the inventory area in appropriate habitats but because of their brief life cycle they could be overlooked during aquatic surveys.

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. The three records for midvalley fairy shrimp are about 5.5 miles to the northeast, 5.5 miles to the east, and 3.8 miles to the east of the inundation boundary (CDFG, 2008). No other midvalley fairy shrimp populations are known in the vicinity of the reservoir. This species has not been described in rock outcrop pools, which provide the only available potential habitat in the Los Vaqueros Watershed. Based on known range and available habitat, this species is likely absent from the Los Vaqueros Watershed.

Delta Intake and Pump Station. The nearest extant midvalley fairy shrimp populations occur about 4 to 5 miles from the Delta Intake Facilities. The lack of suitable habitat indicates that this species is absent from the study area.

Delta-Transfer Pipeline. The nearest midvalley fairy shrimp occurrence is about 1 mile north of the alignment. Another occurrence is about 2.5 miles to the south (USFWS, 2006a). This species is absent from the study area based on the lack of suitable habitat.

Transfer-LV Pipeline. Much of this pipeline is within the Los Vaqueros Watershed, which is unlikely to support midvalley fairy shrimp. The nearest midvalley fairy shrimp occurrence to this pipeline is about 2.3 miles to the northeast. This species is absent from the study area based on the lack of suitable habitat.

Transfer-Bethany Pipeline. Midvalley fairy shrimp have not been documented in or near the Transfer-Bethany study area or from the vernal pool complex at the Byron Airport. A May 21-22, 2007 field reconnaissance verified that potential habitat occurs within 16 pools within the Transfer-Bethany Pipeline alignment (ESA, 2008a). These features would be directly affected by the proposed Transfer-Bethany Pipeline.

Though potentially suitable habitat is present, the likelihood of encountering midvalley fairy shrimp in the study area is considered low based on the described range of this species and reconnaissance-level fairy shrimp survey findings (ESA, 2008a).

Expanded Transfer Facility. The nearest midvalley fairy shrimp occurrence to the Expanded Transfer Facility is 2 miles to the northeast. Suitable habitat does not occur in the study area.

Power Supply Infrastructure. Habitat for this species does not occur in the study areas for the Power Options 1 and 2.

Curved-foot hygrotus diving beetle *(Hygrotus curvipes)*

Description

Very little information is available on the life history of the curved-foot hygrotus diving beetle. This beetle belongs to the Dytiscidae family with identifying characteristics including a distinctive elongated-oval shape, 1.2 to 40 mm long, and hind legs fringed for swimming. Hygrotus beetles are predatory diving beetles both in their adult and larval stages that feed on small aquatic invertebrates (Borror and White, 1970).

Habitat

Curved-foot hygrotus diving beetles are aquatic insects and have been found in stock ponds, irrigation channels, roadside drainages, slow moving creeks, ponds, and alkali pools.

Distribution

General. This is an aquatic insect known to occur in Alameda and Contra Costa counties.

Regional. CDFG (2008) documents 21 extant occurrences in Contra Costa and Alameda Counties. This aquatic insect occurs in several wetland sites and stock ponds within the Los Vaqueros Watershed, favoring alkaline vernal pools and drying portions of slow-moving creeks (Hafernik, 1988). In a 1988 survey, individuals were found in stock ponds throughout the Los Vaqueros Watershed, though not in flowing portions of creeks (Hafernik, 1988).

California linderiella *(Linderiella occidentalis)*

Description

California linderiella are a small (about 0.4 inch long) fairy shrimp crustacean in the Linderiellidae family. They have delicate elongate bodies, large stalked compound eyes, no carapaces, and eleven pairs of swimming legs. Average time to maturity is about 45 days with adults collected from late December to early May.

Habitat

California linderiella tend to live in large, fairly clear vernal pools and lakes. However, they can survive in clear to turbid water with pH from 6.1 to 8.5, and they have been found in very small pools. They are tolerant of water temperatures from 41° to 85° F, making them the most heat tolerant fairy shrimp in California (USFWS, 2007).

Distribution

The California linderiella is the most common fairy shrimp in the Central Valley. It has been documented on most land forms, geologic formations and soil types supporting vernal pools in California, at altitudes as high as 3,800 feet above sea level. Their range extends from Shasta County south to Fresno County and across the valley to the Coast and Transverse Ranges from Willits in Mendocino County south to near Sulfur Mountain in Ventura County (USFWS, 2007).

There is a low likelihood that this species may be present in a single pool on the Delta-Transfer Pipeline and up to 16 pools on the Transfer-Bethany Pipeline (as identified for vernal pool fairy shrimp). In-Watershed occurrences are outside the project area.

Molestan blister beetle *(Lytta molesta)*

Description

Molestan blister beetle is in the Meloidae family. Blister beetles are soft-bodied beetles with elongate, slender abdomens and broad heads. Molestan blister beetles can be found on the flowers and foliage of various plants. Adults are plant eaters while the larvae are parasitic and eat grasshopper or bee eggs (Borror and White, 1970).

Habitat

Blister beetles are found on flowering plants and plant foliage. There is some evidence that Molestan blister beetles are associated with vernal pool vegetation.

Distribution

Molestan blister beetles are found in the central valley of California from Contra Costa to Kern and Tulare Counties. The presence of this species in the project area is unknown.

CDFG (2008) documents 2 extant occurrences in Contra Costa County and none from Alameda County. Both local collections are historic (1945 and ca. 1960) from near the City of Brentwood. Little is known of this species' distribution in the regional area. The project would not affect either of the two locally described populations.

Amphibians

Federal or State Threatened and Endangered Species

California tiger salamander *(Ambystoma californiense)*

Description

California tiger salamanders are amphibians that spend much of their life cycle in underground refuges. Eggs and larvae require aquatic habitats that persist for at least 10 weeks. During their larval stage, they feed on algae and small invertebrates, incorporating larger items, including tadpoles of other amphibians, as they grow. Adults consume earthworms, snails, insects, fish, and small mammals, but rarely feed during the non-breeding season (Zeiner et al., 1988-1990; USFWS, 2005a).

Habitat

California tiger salamanders occur in annual grasslands and in the grassy understory of valley-foothill hardwood habitats in central and northern California. They require underground refuges (usually ground squirrel or other small mammal burrows and occasionally human-made refugia), where they spend the majority of their annual cycle. During the fall and winter, California tiger salamanders migrate from their refugia to breeding sites. Adults are known to travel distances greater than 1 kilometer (0.62 mile) from breeding ponds and have been documented at distances of 2 kilometers (1.2 miles) or more (Orloff, 2007). After breeding, eggs are laid in seasonal and perennial water sources such as vernal pools, streams, and stockponds. Common breeding sites include stock ponds and vernal pools, while streams are rarely used (Stebbins, 2003; Zeiner et al., 1998-1990).

Distribution

General. California tiger salamanders occur in suitable habitat across central and northern California. Currently, they range from Kings and Tulare Counties north to Butte County in the Central Valley, and from Santa Barbara County north to Sonoma County along the coast (Zeiner et al., 1988-1990). It is estimated that they have disappeared from nearly 55 percent of their historic range (Stebbins, 2003).

Regional. California tiger salamanders are known from foothill grasslands of the Mt. Diablo Range and within the Los Vaqueros Watershed. More than 267 California tiger salamander occurrences are reported from Alameda, Contra Costa, and San Joaquin Counties (CDFG, 2008). Within Contra Costa County, many of these records are from the vicinity of the Los Vaqueros Watershed, south of the Cities of Clayton and Brentwood, between Discovery Bay and San Ramon, and Alamo; the rest are from the grasslands of the Diablo Ridge north of the Los Vaqueros Watershed (CDFG, 2008). Exhaustive surveys for California tiger salamanders have not been conducted in eastern Contra Costa County and its current distribution in this area is still being studied. However, two-thirds of the ECCC HCP/NCCP inventory area is considered potential habitat for California tiger salamanders; this area is mostly in the hilly portions of the western side of the inventory area (ECCCHPA, 2006).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Surveys have detected tiger salamander larvae in ponds and creeks throughout the Los Vaqueros Watershed (Jones & Stokes, 1990) (see **Figures 4.6-7 and 4.6-8** and **Table 4.6-10**). Potential upland habitat for California tiger salamander includes grasslands and woodland habitats found throughout the Watershed. These grasslands and woodland areas provide sheltering and dispersal areas.

Delta Intake and Pump Station. There is no California tiger salamander habitat near the Delta Intake Facilities. The occurrence is a 2000 sighting 3.4 miles west of the study area (CDFG, 2008). No tiger salamander occurrences are reported east of the Byron Highway. In the vicinity of the Delta Intake Facilities, there are no suitable breeding ponds or upland habitat that would support this species.

Delta-Transfer Pipeline. The Delta-Transfer Pipeline traverses cultivated and agricultural lands and ruderal areas that do not provide aquatic breeding habitat for California tiger salamander; however, at least four agricultural impoundments within 1 mile of the study area. Of these, three impoundments occur in close proximity to the Expanded Transfer Facility (the closest of these are 0.15 mile north and south of the alignment, just east of the Expanded Transfer Facility); another is in a walnut orchard 0.75 mile east of the Expanded Transfer Facility, and a channelized portion of Kellogg Creek managed by the Byron Bethany Irrigation District parallels the alignment within 100 feet for 2.4 miles. The portion of Kellogg Creek that parallels the Delta-Transfer Pipeline alignment is managed as an irrigation canal and can be characterized as a fast-flowing, maintained channel with no backwater areas or off-channel breeding habitat.

Transfer-LV Pipeline. CDFG (2008) documents a robust California tiger salamander population along the southernmost 4-mile portion of the Transfer-LV Pipeline that parallels Walnut Boulevard and terminates at the Reservoir. This species may occur in moderate to high densities in the study area. The 0.4-mile pipeline segment that runs from Walnut Boulevard to the Expanded Transfer Facility (at the east end of the Transfer-LV Pipeline) also provides suitable upland conditions for California tiger salamander. Thus, this species may be expected in all upland portions of the alignment at any time of the year. Breeding habitat is present in slow-moving portions of Kellogg Creek upstream from Walnut Boulevard, but is not generally present at the two stream crossing locations. Aside from Kellogg Creek, potential breeding habitat in the study area is present in at least five created mitigation ponds below the dam. Potential breeding habitat occurs in at least two and possibly more stock ponds within 0.25 mile of the alignment.

Transfer-Bethany Pipeline. Five California tiger salamander populations are noted within 0.25 mile of the Transfer-Bethany Pipeline (CDFG, 2008), and three additional breeding sites were identified during biological surveys in spring 2008 (B. Pittman, pers. obs.). One known breeding site and four potential breeding sites near Armstrong Road are within the immediate project area. In winter 2008, California tiger salamander larvae were also collected from a roadside ditch on the northern portion of Armstrong Road, but this feature dried before larvae could metamorphose (ESA, 2008a). Most of the Transfer-Bethany Pipeline alignment traverses grasslands that may support this species in some capacity (e.g., aestivation, foraging, or migration). Known and potential California tiger salamander breeding sites are present within 0.5 mile of the alignment along Vasco Road, Armstrong Road, and areas further south (CDFG, 2008).

Expanded Transfer Facility. CDFG (2008) reports that the California tiger salamander distribution in the local area includes the Camino Diablo road corridor and Kellogg Creek downstream to Camino Diablo, 0.25 mile southwest of the Expanded Transfer Facility. Additionally, potential breeding habitat is present in seasonal pools 0.15 mile north and west of the study area. This species would be presumed present at low to moderate densities in undisturbed annual grasslands habitat at the Expanded Transfer Facility. Breeding habitat is absent at this location.

Power Supply Infrastructure. California tiger salamander habitat is not present at the Western substation facilities under Power Option 1 or Western powerline alignments under Power Options 1 and 2. Upland aestivation habitat is present at the PG&E substation site under Power Option 2.

California red-legged frog *(Rana draytonii)*

Description

California red-legged frogs are largely aquatic frogs found at ponds and slow-moving streams with permanent or semipermanent water. This species opportunistically migrates into upland habitats, due to normal dispersal behavior. This species may aestivate in upland environments when aquatic sites are unavailable or environmental conditions are inhospitable. If water is unavailable, they shelter from dehydration in a variety of refuges, including boulders, downed wood, moist leaf litter, and small mammal burrows.

California red-legged frogs generally lay their eggs on emergent vegetation in standing or slow-moving water, but they are known to use unvegetated pools (USFWS 2005d). After hatching, the herbivorous larvae take 11 to 20 weeks to mature, depending on water temperatures. Adults will consume essentially any invertebrate or vertebrate prey they can capture (Jennings and Hayes, 1994; USFWS, 2005a; Zeiner et al., 1988-1990).

Habitat

Habitat for this species consists of slow moving streams and ponds, often with dense shrubby or emergent vegetation such as cattails. Adjacent uplands may be used for foraging, aestivation, and dispersal. California red-legged frogs are known to make straight-line dispersal movements when conditions allow, rather than following drainages. Little is specifically known, however, about how California red-legged frogs use upland habitats (Jennings and Hayes, 1994; USFWS, 2005a).

Distribution

General. Historically, the California red-legged frog occurred along the coast from the vicinity of Point Reyes National Seashore, Marin County, and inland from Redding, Shasta County southward to northwestern Baja California, Mexico (Jennings and Hayes, 1994). Currently, this species occurs in isolated areas of the Sierra Nevada, northern Coast Ranges, and northern Transverse ranges. It was believed to be extirpated from the southern Transverse and Peninsular ranges until recently when two populations were discovered. It is still locally common in the San Francisco Bay area and along the central coast (USFWS, 2004).

Regional. The majority of known California red-legged frog occurrences in the San Francisco Bay Area occur within Contra Costa and Alameda counties. However, this species is in danger of extirpation from the western lowland portions of these counties, particularly near urbanized areas (USFWS, 2002c). Two-thirds of the ECCC HCP/NCCP inventory area is considered potential habitat for California red-legged frogs; this area is mostly in the hilly portions of the western side of the inventory area (ECCCHPA, 2006).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. California red-legged frogs have been documented in suitable locations throughout the Los Vaqueros Watershed. The CNDDB records a total of 96 occurrences of California red-legged frogs within the vicinity of the Watershed. Additionally, up to five of the wetlands and six of the stockponds that were created or enhanced for the original Los Vaqueros project are within the inundation zone (Figure 4.6-13A). Stockponds in the Watershed support some of the highest known densities of California red-legged frog in the region (ECCCHPA, 2006). Adult, sub-adult, and juvenile frogs are expected to migrate intermittently through annual grasslands and other upland habitats. Therefore, frogs are expected to intermittently migrate in low numbers across Walnut Blvd., and they may temporarily reside within the Stockpile Area. The CCWD actively manages habitat for this species within the Watershed, including non-native predator (American bullfrog, *Lithobates catesbeianus*) exclusion and control.

Delta Intake and Pump Station. No California red-legged frog occurrences are recorded in the vicinity of the Delta Intake Facilities. The nearest CNDDB occurrence of California red-legged frog is a 2003 sighting 4 miles southwest of the Delta Intake Facilities (CDFG, 2008). The study area provides no suitable breeding habitat or upland habitat that would support California red-legged frogs.

Delta-Transfer Pipeline. The Delta-Transfer Pipeline alignment traverses cultivated and agricultural lands and ruderal areas that do not provide aquatic breeding habitat for California red-legged frog; however, at least four agricultural impoundments within 1 mile of the alignment, and Kellogg Creek provide potentially suitable breeding habitat. Of these, three impoundments occur in close proximity to the Expanded Transfer Facility at the western end of the pipeline alignment (the closest of these are 0.15 mile north and south of the alignment, just east of the Expanded Transfer Facility); another is in a walnut orchard 0.75 mile east of the Expanded Transfer Facility, and a channelized portion of Kellogg Creek managed by the Byron Bethany Irrigation District parallels the alignment within 100 feet for a linear distance of 2.4 miles.

The portion of Kellogg Creek that parallels the Delta-Transfer Pipeline is managed as an irrigation canal and can be characterized as a fast-flowing, maintained channel with no backwater areas or off-channel amphibian refugia. Kellogg Creek in this area is not expected to support breeding California red-legged frogs. East of the Expanded Transfer Facility, for a distance of 1.2 miles, the pipeline alignment crosses designated critical habitat for California red-legged frog. The critical habitat boundary is generally defined by the interface between grazed annual grasslands in the hills to the west and agricultural lands to the east. This species could be encountered in the 1.2-mile stretch that traverses annual grasslands during normal animal movements, but frogs are not expected to inhabit the barren upland portions of the alignment on a sustained basis.

Transfer-LV Pipeline. California red-legged frogs are expected to occur year-round in any aquatic or semi-aquatic environments in or near this pipeline alignment. This would include the entirety of Kellogg Creek from near the Expanded Transfer Facility to the Dam, natural and artificial ponds (including the two settling ponds near and to the west of the Expanded Transfer Facility) and alkali meadows, seeps, or drainages in the local area. Red-legged frogs would generally use ephemeral drainages on a seasonal basis. Additionally, adult, sub-adult, and juvenile frogs are expected to migrate intermittently through annual grasslands and other upland habitats. Breeding habitat is present in slow-moving portions of Kellogg Creek upstream from Walnut Blvd, but is not generally present at the two crossing locations. Potential red-legged frog breeding habitat in the study area is present in at least five created mitigation ponds directly below the dam. Potential breeding habitat occurs in at least two and possibly more stock ponds within 0.25 mile of the alignment.

Transfer-Bethany Pipeline. At least ten California red-legged frog breeding sites were identified within 0.5 mile of the Transfer-Bethany Pipeline. Occupied sites are documented from both instream impoundments and stock ponds along the alignment. This species generally requires long periods of standing water and is not expected to breed in many of the ephemeral pools along Armstrong Road (but may be otherwise present at these sites). One known breeding site and potential breeding habitat in Brushy Creek could be directly affected by this project component. The entire alignment traverses upland habitat that could support this species. Known and potential California red-legged frog breeding sites are present at regular intervals along Vasco Road, Armstrong Road, and areas further south (CDFG, 2008).

Expanded Transfer Facility. The Expanded Transfer Facility study area is within annual grassland communities that lack aquatic habitat. CDFG (2008) reports an extant population of California red-legged frogs in Kellogg Creek, for which the nearest ponded areas that provide suitable breeding habitat are 0.34 mile west of the Expanded Transfer Facility. Potential breeding habitat may be present in seasonal pools 0.15 mile north and west of the Expanded Transfer Facility. This species could be encountered during transient migrations through the Expanded Transfer Facility, but is not expected to inhabit the site on a continual basis.

Power Supply Infrastructure. Based on their known range and available habitat, California red-legged frogs are not expected to appear in the Western study area.

The PG&E substation site supports upland habitat and California red-legged frogs are not expected at this site.

Reptiles

Federal or State Threatened and Endangered Species

Alameda whipsnake *(Masticophis lateralis euryxanthus)*

Description

Alameda whipsnake is one of two subspecies of the California whipsnake (*Masticophis lateralis*). Alameda whipsnakes are slender, diurnal snakes that are quick and active predators, especially on western fence lizards (*Sceloporus occidentalis*), although they will take other small vertebrates. They hunt by holding their head high off the ground, looking over grass and rocks for potential prey (USFWS, 1997a). Alameda whipsnakes are most active during the breeding season and in late fall; retreating to hibernacula during most of the winter. Courtship and mating occurs from late-March to mid-June, at this time males move throughout their home ranges and females remain at their hibernacula where mating occurs (CDFG, 2005; Jones & Stokes, 1990; USFWS, 2005a).

Habitat

Alameda whipsnakes are known to associate closely with open chaparral, sage scrub, and coastal scrub. Recent telemetry data indicate that although home ranges are centered on shrub communities, they venture up to 4 miles into adjacent habitats, including grassland, oak savanna, and occasionally oak-bay woodland (Swaim, pers. comm.). These data also indicate that Alameda whipsnakes use grassland habitats for periods of up to several weeks; with males using grassland habitats more frequently in the mating season and females using grassland habitats after mating occurs. Rock outcrops are an important feature of Alameda whipsnake habitat because they provide retreat opportunities and promote prey populations (CDFG, 2005; USFWS, 2002a).

Distribution

General. Historically, Alameda whipsnakes were probably found in coastal scrub, and nearby annual grasslands and oak woodland communities of the East Bay in Contra Costa, Alameda, western San Joaquin, and northern Santa Clara Counties (USFWS, 2002a). Currently, they are only found in the inner Coast Range in western and central Contra Costa and Alameda counties (USFWS, 2000a). Five isolated populations of Alameda whipsnake are now recognized within its historical range: Tilden–Briones, Oakland–Las Trampas, Hayward–Pleasanton Ridge, Sunol–Cedar Mountain, and Mt. Diablo–Black Hills (USFWS, 1997a).

Regional. All 73 CNDDB occurrences for the Alameda whipsnake occur within Contra Costa and Alameda Counties. The CNDDB considers all of these occurrences extant (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. The Los Vaqueros Watershed falls within the range of the Mt. Diablo-Black Hills population of

Alameda whipsnake. This species has been documented from and is presumed extant in the chaparral habitats of the southwestern portion of the Watershed, and adjoining non-scrub habitat. Alameda whipsnakes have been recorded in upland scrub habitat in the southwestern portion of the Watershed where the high quality scrub habitat is present (Jones and Stokes, 1990; CDFG, 2008). In 2003 and 2004, field surveys found Alameda whipsnakes in all age classes (adult, sub-adult, and young of the year) within the Watershed (D. McGriff, pers. com). Additional occurrences have been documented from at least three grassland areas that are not associated with chaparral habitat (ESA, 2004).

Delta Intake and Pump Station. The habitats within the Delta are mostly cropland, potential wetlands, grassland, and aquatic habitats that are not suitable habitat for Alameda whipsnake. Alameda whipsnake do not occur in this study area.

Delta-Transfer Pipeline. The habitats within the study area are mainly cropland, potential wetlands, grassland, and aquatic habitat. These habitats are not near scrub habitat and are not suitable for Alameda whipsnake. Alameda whipsnake do not occur in this study area.

Transfer-LV Pipeline. The habitats in the study area include cropland, potential wetlands, grassland, and aquatic habitats. These habitats are not near scrub habitat and are not suitable for Alameda whipsnake. Alameda whipsnake do not occur in this study area.

Transfer-Bethany Pipeline. The habitats in the study area include mainly wetlands, grasslands, and limited riparian. These habitats are not near scrub habitat and are not suitable for Alameda whipsnake. Alameda whipsnake do not occur in this study area.

Expanded Transfer Facility. The Expanded Transfer Facility is within grassland habitat that is not near scrub habitat and is not suitable for Alameda whipsnake. Alameda whipsnake do not occur in this study area.

Power Supply Infrastructure. The habitats in the study area are not near scrub habitat and are not suitable for Alameda whipsnake. Alameda whipsnake do not occur in this study area.

Federal or State Species of Special Concern

Western pond turtle *(Actinemys marmorata)*

Description

Western pond turtles are moderate-sized aquatic turtles that feed on plants, insects, worms, amphibians, crustaceans, and carrion. Mating usually occurs in late April or early May, but may occur year-round. Hatchling turtles are thought to emerge from the nest and move to aquatic sites in the spring (Jennings and Hayes, 1994; Stebbins, 2003; Zeiner et al., 1998-1990).

Habitat

Western pond turtles are commonly found in ponds, lakes, marshes, rivers, streams, and irrigation ditches with rocky or muddy substrates surrounded by aquatic vegetation. These watercourses usually are within woodlands, grasslands, and open forests, between sea level and 6,000 feet in elevation. Turtles bask on logs or other objects when water temperatures are lower than air temperatures. Nests are at upland sites, often up to 0.25 mile from aquatic sites (Jennings and Hayes, 1994; Stebbins, 2003; Zeiner et al., 1988-1990).

Distribution

General. Western pond turtles are uncommon and discontinuously distributed throughout California west of the Cascade-Sierran crest with isolated populations in the Mojave River area and Andreas Canyon (Jennings and Hayes, 1994).

Regional. There are 83 western pond turtles occurrences noted for Alameda, Contra Costa, and San Joaquin Counties (CDFG, 2008). The western pond turtle is known throughout the inventory area for the East Contra Costa County HCP/NCCP. Turtle populations are noted throughout the Marsh Creek watershed and the Los Vaqueros Watershed (ECCCHPA, 2006).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. A variety of habitats such as creeks, ponds, and drainages, as well as semi-permanent marsh, alkali marsh, riparian woodland, and some grassland within the Los Vaqueros Watershed provide suitable habitat for western pond turtle. These correspond to lacustrine, nontidal freshwater permanent emergent, and valley/foothill riparian NCCP habitats within the Watershed. Western pond turtles are known throughout the Watershed. Data collected by Jones and Stokes Associates, Los Vaqueros Watershed biologists and CNDDB data reveal western pond turtle populations in Adobe Creek (west arm of Kellogg Creek), along Upper and Lower Kellogg Creek, in several created wetlands and stockponds, and in drainages within the Los Vaqueros Watershed (Jones & Stokes, 1990; CDFG, 2008).

A total of six stockponds, five created wetlands, and several drainages are within the 275 TAF inundation zone. Of these, one stockpond, one created wetland, and two drainages are known to support western pond turtle. The stockpond is along Horseshoe Creek in a southeastern arm of the reservoir; the created wetland is along an unnamed drainage in an eastern arm of the reservoir; and the drainages are Upper and Lower Kellogg Creek.

Within the construction easement for the dam and associated Intake/Outlet pipelines five occurrences of western pond turtle within created wetlands are known, and there is suitable habitat throughout Lower Kellogg Creek. One stockpond along Adobe Creek is within the construction easement for the proposed Westside access road, and another occurrence is within the Stockpile study area. Pond turtles may be present in aquatic habitats and upland areas within roughly 0.25 to 0.5 mile of aquatic sites.

Delta Intake and Pump Station. No CNDDB occurrences of western pond turtle are recorded within the study area of the Delta Intake Facilities; however, Old River and Middle River may provide suitable aquatic habitat, and adjacent levee banks may provide suitable basking and egg-laying habitat for this species. The occurrence nearest to the Old River Intake and Pump

Station is almost 2 miles south at Clifton Court Forebay (CDFG, 2008). Western pond turtle may sporadically occur in and near the study area.

Delta-Transfer Pipeline. The Delta-Transfer Pipeline traverses mostly cropland, but several aquatic sites occur within the study area that may be used by western pond turtle. No CCWD or CNDDB pond turtle occurrences are reported within the study area; the occurrence nearest to the study area is 1.5 miles south (CDFG, 2008). Western pond turtles can be expected to occur in association with Kellogg Creek and the numerous larger irrigation canals (e.g., the Byron-Bethany Canal) that occur in agricultural portions of the study area.

Transfer-LV Pipeline. Three CNDDB-reported pond turtle occurrences are recorded within the study area (CDFG, 2008). These occurrences include areas along Lower Kellogg Creek where several stockponds and created wetlands support western pond turtle. All wetlands, including the Kellogg Creek and stockponds, and adjacent upland habitat are suitable habitat for western pond turtle. Western pond turtle are likely to occur in these habitats within the study area.

Transfer-Bethany Pipeline. No CNDDB-reported pond turtle occurrences are recorded in the study area. The nearest occurrence is about 0.3 mile to the west, near the eastern boundary of the Los Vaqueros Watershed (CDFG, 2008). The Transfer-Bethany Pipeline crosses several small creeks, including Brushy Creek, that support wetlands and provide habitat for western pond turtle. This species is expected to occur in and near aquatic sites that provide suitable habitat.

Expanded Transfer Facility. The Expanded Transfer Facility is in a grassland community that does not provide suitable aquatic habitat for western pond turtle. No CNDDB occurrences of western pond turtle are recorded within the study area. The occurrence nearest to the Expanded Transfer Facility is more than 1 mile south-southwest of the Expanded Transfer Facility (CDFG, 2008) and the closest potential habitat is over 900 feet away. Pond turtles are unlikely to occur in the study area.

Power Supply Infrastructure. Pond turtles may be present in irrigation and drainage features within the Western powerline alignment under Power Options 1 and 2, with breeding and movement in project area upland habitat potentially within the alignments and at the Western substation siting zone under Power Option 1. An occurrence is noted near Italian Slough, west of the Skinner Delta Fish Protective Facility (CDFG, 2008). Aquatic habitat dose not occur at the Western substation site. Because pond turtles can persist with unpredictable water sources, they may be present in and near agricultural ditches that parallel and cross the alignment at various locations. Pond turtles may be present in upland habitat near the proposed PG&E substation under Power Option 2.

San Joaquin whipsnake *(Masticophis flagellum ruddocki)*

Description

San Joaquin whipsnakes are energetic diurnal foragers. They become active later in the spring than other snakes, and are mostly active during warm periods of the day. They forage primarily on lizards, bird eggs and young, and small mammals, occasionally foraging on carrion. Mating is thought to occur in May, and oviposition in June or early July. Life history information on this subspecies is poorly known and much information has been taken from similar subspecies (Jennings and Hayes, 1994).

Habitat

San Joaquin whipsnakes use open, dry, areas with little or no tree cover. In the western San Joaquin Valley, they occur in valley grassland and saltbush scrub associations and are known to climb shrubs and bushes to view prey and potential predators. They use small mammal burrows for refuge and probably for oviposition sites as well (Jennings and Hayes, 1994).

Distribution

General. San Joaquin whipsnakes occur from the eastern edge of the San Joaquin Valley from Colusa County southward to the Kern County into the inner South Coast Ranges, with an isolated population in the Sutter Buttes; populations range in elevation from 65 to 2,955 feet (Jennings and Hayes, 1994). Most records in the CNDDB are from San Benito County and western Merced County, with scattered records in other San Joaquin Valley counties (CDFG, 2008).

Regional. Of the 65 occurrences recorded in the CNDDB, five are from Alameda, Contra Costa, and San Joaquin Counties (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. One sighting reported in the Los Vaqueros Watershed in 1980 was at the current location of the Los Vaqueros Reservoir dam (CDFG, 2008). The next closest CNDDB records are about 11.5 miles south and southeast of the dam, in San Joaquin County (CDFG, 2008). The Watershed provides suitable open grassland habitat for San Joaquin whipsnake; therefore, San Joaquin whipsnake are expected in grasslands habitat throughout the study area where habitat conditions are suitable.

Delta Intake and Pump Station. The Delta region is largely developed for agriculture and does not provide suitable habitat for San Joaquin whipsnake. Therefore, San Joaquin whipsnake are not expected in this area.

Delta-Transfer Pipeline. The alignment traverses a limited amount of open grassland habitat suitable that could support San Joaquin whipsnake. The absence of standing cover in heavily grazed grasslands likely reduces habitat quality for San Joaquin whipsnake, resulting in a low likelihood of occurrence in the study area.

Transfer-LV Pipeline. The nearest CNDDB occurrence to the Transfer-LV Pipeline is near the existing dam (CDFG, 2008). The alignment traverses open grassland habitat suitable for San Joaquin whipsnake. Therefore, San Joaquin whipsnake may occur in low densities within the study area where annual grassland habitat is available.

Transfer-Bethany Pipeline. The nearest reports of San Joaquin whipsnake to the Transfer-Bethany Pipeline are from the Los Vaqueros Dam and another site almost 5 miles southeast of the alignment (CDFG, 2008). The alignment traverses open grassland habitat that is suitable for San Joaquin whipsnake. San Joaquin whipsnake are expected to occur at low densities in annual grasslands habitat in the study area.

Expanded Transfer Facility. The nearest CNDDB occurrence within the vicinity of this facility is about 3 miles to the southwest, near the existing dam (CDFG, 2008). The Expanded Transfer Facility is in open grassland habitat that is suitable for San Joaquin whipsnake. San Joaquin whipsnake may occur in low densities within the study area where habitat conditions are suitable.

Power Supply Infrastructure. Based on the availability of suitable habitat, this species may also occur in grasslands in the study areas for Power Option 2.

Near the PG&E substation, San Joaquin whipsnakes are known from similar habitat in the Los Vaqueros Watershed, and may be encountered in upland areas during construction.

Coast horned lizard *(Phrynosoma coronatum frontale)*

Description

The coast horned lizard is a large flattened lizard with five backward-pointing head spines, a large shelf above the eyes, and two parallel rows of pointed scales fringing each side of the body. The back color is highly variable, but typically gray, tan, reddish-brown, or whitish, and usually resembles the prevailing soil color. The belly is yellow to white with discrete, dark spots (Jennings and Hayes, 1994). Coast horned lizards primarily eat insects such as ants and beetles. Their population decline is mainly attributed to conversion of land for agricultural purposes. The human introduction of non-native Argentine ants (*Iridomyrmex humilis*), which are inedible to horned lizards and tend to displace the native carpenter ants (*Camponotus* spp.), is another attributed factor in their decline.

Habitat

The coast horned lizard seems to occur in several habitat types including areas with an exposed gravelly-sandy substrate containing scattered shrubs, clearings in riparian woodlands, dry uniform chamise chaparral, and annual grassland with scattered perennial seepweed (*Suaeda fruticosa*) or saltbush. Horned lizard reaches its maximum abundance in sandy loam areas and on alkali flats often dominated by iodine bush. Coast horned lizards use small mammal burrows or burrow into loose soils under surface objects during extended periods of inactivity or hibernation (Jennings and Hayes, 1994).

Distribution

This California endemic has a patchy distribution from below Lake Shasta in Shasta County southward along the edges of the Sacramento Valley into much of the South Coast Ranges, San Joaquin Valley, and Sierra Nevada foothills to northern Los Angeles, Santa Barbara, and Ventura counties. The known elevational range for this species extends from near sea level at Monterey, Pacific Grove, and Seaside to 1,980 m at Breckenridge on Breckenridge Mountain (Jennings and Hayes, 1994).

Alkali areas with sandy loam soils and alkali flats have limited distribution in the project area. High-quality habitat is present in the Power Option 2 Western powerline alignment, just north of the Skinner Delta Fish Protective Facility and would be spanned by powerlines.

Birds

Federal or State Threatened and Endangered Species

Swainson's hawk *(Buteo swainsoni)*

Description

Swainson's hawks are medium-sized hawks that are opportunistic predators, feeding on rodents, rabbits, bats, large arthropods, amphibians, reptiles, birds, and, rarely, fish (Woodbridge, 1998; Zeiner et al., 1988-1990). In the Central Valley, the majority of their diet is composed of California voles (*Microtus californicus*) (CDFG, 2000). Swainson's hawks begin arriving in California in late February and depart for their wintering grounds in early September (Woodbridge, 1998). Swainson's hawks reside in the Central Valley from March though October, with eggs typically laid in April and early May (peaking in late April).

Habitat

Swainson's hawks reside in a wide variety of open habitats, from prairie and shrub-steppe to deserts and intensive agricultural matrices (Woodbridge, 1998). Nests are usually constructed in habitats with scattered trees or along riparian corridors that are next to agricultural fields or pastures (Woodbridge, 1998).

Distribution

General. Swainson's hawks were historically distributed throughout the lowlands of California, absent only from the Sierra Nevada, north Coast Ranges and Klamath Mountains, and portions of the southern California deserts. Currently, they are only found in portions of the Central Valley and Great Basin regions; where suitable habitat is still present (Shuford and Gardali, 2005). The highest density currently is in the Central Valley, between Sacramento and Modesto, and in the northern San Joaquin Valley (Woodbridge, 1988). There are 1,462 Swainson's hawk nesting occurrences recorded in the CNDDB (CDFG, 2008).

Regional. The CNDDB reports 280 nesting occurrences from Contra Costa and San Joaquin Counties. No occurrences are reported from Alameda County (CDFG, 2008). Swainson's hawks have been documented nesting within the ECCC HCP/NCCP inventory area, but they are not regular breeders. Most have been observed nesting in eucalyptus groves in the inventory area and the potential habitat model conducted for the HCP/NCCP identified areas within the northeast portion of the inventory area that were suitable for Swainson's hawk nesting (ECCCHPA, 2006).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Neither the CCWD nor CNDDB report Swainson's hawk nesting in the Los Vaqueros Watershed. The nearest CNDDB-reported nesting site is more than 5 miles from the dam and about 3 miles from the Stock Pile area (CDFG, 2008). However, the Contra Costa Breeding Bird Atlas (2005) notes breeding in the area northeast of the Los Vaqueros Watershed. CCWD staff have also observed non-breeding Swainson's hawks in the Watershed. Grassland and riparian communities in the Watershed may provide suitable foraging and breeding habitats for this species, but nesting is not anticipated in the Watershed.

Delta Intake and Pump Station. A few occurrences of nesting Swainson's hawk are recorded near the Delta Intake Facilities. The nearest CNDDB report is about 2 to 3 miles from the Old River Intake and Pump Station (CDFG, 2008). Habitat in the vicinity of the study area is developed for agricultural uses and does not provide nesting opportunities for Swainson's hawk.

Delta-Transfer Pipeline. There is one recent Swainson's hawk nest reported near the Delta-Transfer Pipeline, from a large cottonwood tree on an active farm facility roughly 300 feet from the alignment (CDFG, 2008). The habitat in the vicinity of the study area is developed for agricultural use. Scattered clumps of trees along the alignment and in the Kellogg Creek corridor provide suitable breeding sites for Swainson's hawk. Swainson's hawks may breed in the study area where suitable nesting habitat is present.

Transfer-LV Pipeline. The nearest Swainson's hawk nest to the study area is about 3 miles east of the Transfer -LV Pipeline alignment (CDFG, 2008). The habitat in the vicinity of the study area is agricultural and grassland which provides potential foraging habitat. The patchy cottonwood riparian corridor of Kellogg Creek may provide suitable nesting habitat for Swainson's hawk, but nesting has not been documented from this area. There is a low likelihood that Swainson's hawks may breed in riparian portions of the study area.

Transfer-Bethany Pipeline. Swainson's hawk has not been documented near the Transfer-Bethany Pipeline. The nearest documented occurrence is about 3 miles east of the alignment (CDFG, 2008). The habitat in the study area is grassland and potential nesting sites are generally limited.

Expanded Transfer Facility. Swainson's hawk has not been documented near the Expanded Transfer Facility. The closest reported nest is about 3 miles east of the study area (CDFG, 2008). Nesting sites are not available near the Expanded Transfer Facility.

Power Supply Infrastructure. Nesting habitat is not present at the Delta Intake Facilities, Expanded Transfer Facility, or within the study areas for Power Options 1 and 2 and nesting is unlikely near other facilities.

Bald eagle *(Haliaeetus leucocephalus)*

Description

Bald eagles are large raptors and opportunistic foragers. They usually feed on fish or waterfowl, but also prey on other small animals and eat carrion. Bald eagles nest in large stick nests constructed in a variety of trees, with size and height appearing to be more important than species. In Arizona, bald eagles have been documented nesting on cliffs. A breeding pair may re-use a nest from the previous year, or construct new nests within their territory, often resulting in multiple nests per territory. In California, resident breeding pairs usually remain in the vicinity of their breeding territory during winter. Hundreds of migratory bald eagles winter in California, arriving each year from the north during the fall and early winter (CDFG, 2005; USFWS, 1999c; Zeiner et al., 1988-1990).

Habitat

Bald eagles occupy a wide range of habitats, including woodlands, forests, grasslands, and wetlands. They winter throughout California near lakes, reservoirs, rivers, and some rangelands and coastal wetlands. Breeding is usually restricted to mountainous habitats near reservoirs, lakes, and rivers. Bald eagles usually nest in large coniferous trees within 1 mile of permanent water. They forage on large water bodies or rivers with easily-approached snags and other perches (CDFG, 2005; Zeiner et al., 1988-1990).

Distribution

General. Bald eagles are distributed throughout North America. In California they occur over much of the state, except in desert areas. They breed in the northern half of the state, in the southern Sierra Nevada, the Central Coast Range, in inland southern California, and on Santa Catalina Island. Currently 231 records appear in the CNDDB for bald eagle (CDFG, 2008).

Regional. There is one CNDDB occurrence (1996) of nesting bald eagles in Alameda County, at Del Valle Reservoir, southeast of the City of Livermore. In 2006 a bald eagle pair nested at San Pablo Reservoir in Contra Costa County (CDFG, 2008). No nesting occurrences are recorded in San Joaquin or Solano Counties (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Bald eagles winter in small numbers near the Reservoir. Trees and snags within the Los Vaqueros Watershed provide suitable roosting and foraging habitat for bald eagles. Several observations are reported of bald eagles perched in trees and snags along the edge of the reservoir. Winter roosting sites within the Watershed have been observed generally in the valley/foothill woodland and forest habitats. Before the establishment of the existing reservoir, bald eagles were not documented as occurring in the Watershed, although there is anecdotal information that they at least occasionally used the Kirker Creek drainage in winter (D. Sterner, pers. com).

As of 2007, bald eagles were not breeding within the Los Vaqueros Watershed. Habitat suitability within the Watershed is limited by the relative lack of tall conifers available for nesting. The

Contra Costa Breeding Bird Atlas (2005) does not report bald eagles in the regional project vicinity. The closest known nesting bald eagles occur in Del Valle Regional Park in Alameda County, about 15 miles to the southeast of the inundation boundary. The pair near San Pablo Reservoir in Contra Costa County is about 25 miles west of the inundation boundary (CDFG, 2008).

Delta Intake and Pump Station. The nearest bald eagle nesting occurrence is about 20 miles south of the Delta Intake Facilities (CDFG, 2008). The habitat in the Delta Intake Facilities vicinity is well-developed for agricultural use and generally lacks appropriate bald eagle breeding habitat. Suitable nesting habitat is absent from the study area.

Delta-Transfer Pipeline. The nearest CNDDB occurrence of bald eagle is about 20 miles south of the Delta-Transfer Pipeline (CDFG, 2008). The habitat in the vicinity of the Delta-Transfer Pipeline is well-developed for agricultural use and generally lacks appropriate bald eagle breeding habitat. Suitable nesting habitat is absent from the study area.

Transfer-LV Pipeline. The nearest CNDDB occurrence of bald eagle is about 15 miles south of the Transfer-LV Pipeline (CDFG, 2008). The habitat in the vicinity of the Transfer-LV Pipeline is generally lacks appropriate bald eagle breeding habitat. Nesting habitat does not occur in the study area.

Transfer-Bethany Pipeline. The nearest CNDDB occurrence of breeding bald eagles is about 15 miles south of the Transfer-Bethany Pipeline (CDFG, 2008). The habitat in the vicinity of the Transfer-Bethany Pipeline is annual grassland and generally lacks appropriate bald eagle breeding habitat. Bald eagle nesting sites are not present in the study area.

Expanded Transfer Facility. The nearest CNDDB occurrence of bald eagle is about 20 miles south of the Expanded Transfer Facility (CDFG, 2008). The habitat in the vicinity of the Expanded Transfer Facility is grazed annual grassland and generally lacks appropriate bald eagle breeding habitat.

Power Supply Infrastructure. The study area is in agricultural use and lacks bald eagle breeding and foraging habitat. Suitable nesting habitat is absent from the study area.

This species is not expected to nest in or near the proposed PG&E facilities.

Federal or State Species of Special Concern

Cooper's hawk *(Accipiter cooperii)*

Description

Cooper's hawks nest in dense forested habitats near freshwater and forage mostly on small birds and mammals, although they will take reptiles and amphibians. Peak breeding season is May through July, although it can occur anywhere from March to August (Zeiner et al., 1988-1990).

Habitat

Cooper’s hawks use dense wooded stands for breeding and patchy to open woodlands and habitat edges for foraging. They can often be found in live oak and riparian deciduous habitats. Other habitats used frequently include forested habitats near water (Zeiner et al., 1988-1990).

Distribution

General. A total of 92 occurrences of nesting Cooper’s hawks, scattered throughout California, have been recorded in the CNDDB (CDFG, 2008). Their elevational range is anywhere from sea level to 9,000 feet (Zeiner et al., 1988-1990).

Regional. Of these 92 occurrences, eight were recorded in Contra Costa and Alameda Counties. No occurrences of Cooper’s hawk breeding are recorded in San Joaquin County (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Woodland habitat in the Los Vaqueros Watershed is known to support Cooper’s hawk. A nesting location is described in Brady and Associates (1996) within the Watershed and next to (but outside) the western administrative boundary (about 2.75 miles west from the existing dam). It is likely that Cooper’s hawks also use wooded portions of the Watershed during the non-breeding season. The Contra Costa Breeding Bird Atlas (2005) indicates that Cooper’s hawks are a possible breeder in the western portion of the Watershed; and confirms breeding farther to the west. The CNDDB does not record any breeding occurrences near the Los Vaqueros Watershed, conveyance corridors, or the Delta or Los Vaqueros Watershed facilities (CDFG, 2008), but this species is typically underreported. The nearest recorded breeding occurrences in the CNDDB are 16 to 18 miles away from the Los Vaqueros Watershed, in Alameda County (CDFG, 2008). Cooper’s hawk are expected to breed in dense wooded habitat in the Los Vaqueros Watershed.

Delta Intake and Pump Station. The Delta region is characteristically open cropland habitat with few and sparse stands of trees. The study area provides no habitat for Cooper’s hawk.

Delta-Transfer Pipeline. The Delta-Transfer Pipeline traverses open cropland grassland. The nearest known occurrence of Cooper’s hawk is about 5.5 miles to the southwest of the alignment (Brady and Associates, 1996). Cooper’s hawk is not likely to breed in the study area.

Transfer-LV Pipeline. The Transfer-LV Pipeline alignment traverses open grassland, but also riparian habitat suitable for nesting or roosting Cooper’s hawk. The nearest known occurrence of Cooper’s hawk is about 3 miles east of the alignment (Brady and Associates, 1996). Cooper’s hawk may breed in wooded portions of the study area in association with Kellogg Creek.

Transfer-Bethany Pipeline. The Transfer-Bethany Pipeline traverses open grassland, but also small groups of trees suitable for nesting or roosting Cooper’s hawk. The nearest known occurrence of Cooper’s hawk is about 5.5 miles east of the alignment (Brady and Associates, 1996). Cooper’s hawk may breed in the study area where habitat conditions are appropriate.

Expanded Transfer Facility. The Expanded Transfer Facility is located in open grassland, which is not suitable for Cooper's hawk.

Power Supply Infrastructure. The Western alignment supports open cropland habitat with few and sparse stands of trees. The study area provides no habitat for Cooper's hawk.

Cooper's hawk are not expected near the PG&E substation due to the lack of trees, but may be encountered in wooded areas (i.e., near Kellogg Creek) that are identified on the Transfer-LV pipeline.

Sharp-shinned Hawk *(Accipiter striatus)*

Habitat

The sharp-shinned hawk occupies a wide variety of forests and woodland habitats, ranging from mixed deciduous forests, riparian woodlands, to oak woodlands, among others. Like the Cooper's hawk, this species forages in dense forested habitats near freshwater and forage mostly on small birds, though they will take small mammals, frogs, lizards, and insects.

Distribution

This species was not described in the Los Vaqueros Resource Management Plan (Brady and Associates, 1996), which characterized special status wildlife species known to occur in the Los Vaqueros Watershed. The *Contra Costa Breeding Bird Atlas* (2005) indicates that Cooper's hawks are a possible breeder west of the Los Vaqueros Watershed, but does not identify nest sites in the watershed. Similarly, the CNDDB reports no nesting occurrences within 10 miles of the Los Vaqueros Watershed. However, suitable nesting and foraging habitat is present throughout woodlands in the Los Vaqueros Watershed and this species may be present.

Sharp-shinned hawks are expected to nest in the wooded portions of the Transfer-LV Pipeline and Transfer-Bethany Pipeline. Nesting habitat is not present at the Delta intake facilities, Expanded Transfer Facility, or within the power supply project areas, and nesting is unlikely near other facilities.

Tricolored blackbird *(nesting colony) (Agelaius tricolor)*

Description

Tricolored blackbirds are a colonial species that nest in dense vegetation in and around freshwater wetlands. They are opportunistic foragers, during the breeding season consuming mostly small animal material such as insects, while in the non-breeding season consuming seeds and cultivated grain (Hamilton, 2004; Zeiner et al., 1988-1990). Breeding season is usually mid-April to late-July, but breeding has been reported as late as November (Orians, 1960).

Habitat

During breeding, tricolored blackbirds require freshwater wetland areas large enough to support colonies of 50 pairs or more. They prefer freshwater emergent wetlands with tall, dense cattails or tules for breeding, but will also breed in thickets of willow, blackberry, wild rose, or tall herbs.

During the non-breeding season flocks are highly mobile and forage in grasslands, croplands, and wetlands (Zeiner et al., 1988-1990).

Distribution

General. Tricolored blackbirds are locally common throughout the Central Valley and coastal areas south of Sonoma County. Historically, they were restricted to California and northern Baja California, and generally found in the valleys and areas with agricultural production (Zeiner et al., 1988-1990). Recently, tricolored blackbirds have expanded their breeding ranges into Oregon, Washington, and British Columbia (Hamilton, 2004). It appears that the size of tricolored blackbird breeding colonies has decreased in recent years, however, the distribution in California has remained relatively stable (USFWS, 1999b). CNDDB records a total of 421 nesting colonies (CDFG, 2008).

Regional. Of the 421 nesting colonies recorded by the CNDDB, 36 are in Alameda, Contra Costa, and San Joaquin Counties (CDFG, 2008). The ECCC HCP/NCCP (2006) considered tricolored blackbirds a sporadic resident of their inventory area.

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. The CNDDB notes four occurrences of tricolored blackbirds near the Los Vaqueros Watershed. Two of these are about 3 miles from the existing dam and the other two occurrences are about 3 and 5 miles, respectively, southeast of the Watershed. Grasslands and freshwater permanent wetlands in the Watershed provide suitable breeding habitat for tricolored blackbirds. Tricolored blackbirds are known to use the Los Vaqueros Watershed during the non-breeding season (Jones and Stokes, 1990). During surveys for the Los Vaqueros Reservoir Project, no nesting colonies were found in the Watershed (Jones and Stokes, 1989); however, the Contra Costa Breeding Bird Atlas (2005) documents breeding within the Watershed and confirmed breeding east and south of the Watershed. Therefore, tricolored blackbird may breed in the Los Vaqueros Watershed where suitable habitat is available.

Delta Intake and Pump Station. The nearest reported tricolored blackbird breeding site is about 5.4 miles west of the Delta Intake Facilities. The Delta is abundant with wetland, marsh, and cropland habitats that provide suitable breeding habitat for tricolored blackbird. Potentially suitable breeding habitat is present on the opposite side of Old River from the Delta Intake Facilities, but this species has not been observed nesting at this location.

Delta-Transfer Pipeline. The closest reported tricolored blackbird breeding site is about 0.5 mile west from the Expanded Transfer Facility (at the west end of the Delta-Transfer Pipeline) (CDFG, 2008). These wetland, marsh, and cropland habitats may occur within the study area and may provide suitable habitat for tricolored blackbird. Suitable breeding sites may occur on the fringes of agricultural areas and in unmaintained irrigation canals that occur throughout the study area.

Transfer-LV Pipeline. The nearest known occurrences of tricolored blackbird are less than 1 mile southeast and about 1 mile northwest from the Expanded Transfer Facility (at the east end of the Transfer-LV Pipeline). In addition to multiple nesting sites that are available in Kellogg Creek, cropland habitats occur within the study area that may provide suitable nesting sites for tricolored blackbird. Tricolored blackbirds could potentially nest at numerous locations where suitable habitat is available.

Transfer-Bethany Pipeline. A tricolored blackbird breeding colony was documented about 800 feet west of the Transfer-Bethany Pipeline (CDFG, 2008). Two more occurrences are reported within 2.5 miles of the southern end of this alignment. In addition, numerous foraging tricolored blackbirds were observed at a large impoundment within the study area during reconnaissance surveys conducted by ESA in May, 2007. This alignment mostly traverses annual grassland communities; numerous stock ponds and creek drainages which may provide habitat for tricolored blackbird. Therefore, this species should be presumed present in the study area wherever suitable habitat is available.

Expanded Transfer Facility. The nearest known occurrences of tricolored blackbird are 0.5 mile to 2 miles from the Expanded Transfer Facility. The Expanded Transfer Facility is within annual grassland communities that may provide foraging habitat for tricolored blackbird; however, breeding habitat is not present at this location.

Power Supply Infrastructure. Tricolored blackbird nesting could occur in mustard fields and annual grassland communities on the Western powerline alignment under Power Options 1 and 2, or in association with agricultural drainages on these alignments. Breeding may occur locally to the Western substation siting zone under Power Option 1. This species is not expected at new PG&E facilities under Power Option 2.

Golden eagle *(Aquila chrysaetos)*

Description

Golden eagles are large raptors that have a varied diet of mostly terrestrial vertebrates such as rabbits and ground-squirrels. They frequently soar while hunting and occasionally hunt from perches. They nest in open areas on cliffs and in large trees, often constructing multiple nests in one breeding territory (Zeiner et al., 1988-1990).

Habitat

Golden eagles prefer open habitats such as rolling grasslands, deserts, savannahs, and early successional forest and shrub habitats, with cliffs or large trees for nesting and cover (Zeiner et al., 1988-1990).

Distribution

General. Golden eagles are a widespread resident and migrant species throughout much of North America. The only area of California where they do not occur is the center of the Central Valley (Zeiner et al., 1988-1990). The CNDDB tracks both nesting and wintering locations of golden eagles, and has 112 total occurrences recorded (CDFG, 2008).

Regional. Of the 112 reported CNDDB golden eagle nest sites, 15 are from Alameda and Contra Costa Counties. No occurrences are recorded in San Joaquin County (CDFG, 2008). The Altamont Pass region is known for its particularly high density of golden eagles. Golden eagle numbers in the Altamont area are unusually high relative to other areas in California; however, population modeling in the Altamont pass area suggests that the local golden eagle population may be declining (Hunt et al., 1998; NWCC, 2001).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Golden eagles are a resident breeder within the Los Vaqueros Watershed and the Watershed is also used by migrant eagles during the non-breeding season. Both the Contra Costa County Breeding Bird Atlas (2005) and CCWD staff report golden eagle nesting in the Watershed. The CNDDB notes six breeding occurrences within the Watershed (CDFG, 2008). Golden eagle nesting success has been monitored regularly within the general vicinity of the Watershed (ECCCHPA, 2006).

Portions of seven breeding territories have been documented in the Los Vaqueros Watershed. Four of these territories were active in 2002; two failed and three young were fledged from the other two nests (CCWD, 2002). The Watershed breeding territories are likely an important component of the Altamont area breeding population. No golden eagle breeding sites occur within the inundation boundary, but one recently active nest is 16 feet from the edge of the westside access road. Several nest sites occur within 2 miles of the inundation boundary and other in- Watershed facilities (e.g., the Dam, Inlet/Outlet Pipeline Zone and Recreational Facilities).

Delta Intake and Pump Station. The habitat in the vicinity of the Delta Intake Facilities study area is developed or is used for agriculture and lacks appropriate golden eagle breeding habitat, such as tall trees on hillsides or cliff faces. Therefore, golden eagles are not likely to breed in the study area.

Delta-Transfer Pipeline. Habitat in the study area is well-developed for agricultural use and generally lacks appropriate golden eagle breeding habitat, such as tall trees on hillsides or cliff faces. The closest recorded occurrence is about 1.2 miles from the Delta-Transfer Pipeline (CDFG, 2008). Golden eagles are unlikely to breed in the study area.

Transfer-LV Pipeline. Several CNDDB occurrences of golden eagle are recorded within the Los Vaqueros Watershed, and the Transfer-LV Pipeline is mostly contained within the Watershed boundary. The nearest recorded occurrence is about 0.2 mile from the study area (CDFG, 2008). The habitat in the vicinity of the study area is mostly grassland and oak savanna and may provide suitable breeding and foraging habitat for golden eagle. Therefore, both breeding and non-breeding golden eagles may occur in the study area.

Transfer-Bethany Pipeline. Several CNDDB occurrences of golden eagle are recorded within the project region. The nearest recorded occurrence is about 1.7 miles from the Transfer-Bethany Pipeline (CDFG, 2008). The habitat in the vicinity of the study area is mostly grassland and breeding sites are generally absent.

Expanded Transfer Facility. Several CNDDB occurrences of golden eagle are recorded within the project region. The nearest recorded occurrence is about 1.7 miles from the Expanded Transfer Facility (CDFG, 2008). The habitat in the vicinity of the study area is generally annual grassland and does not provide suitable nesting sites for golden eagle.

Power Supply Infrastructure. The Western alignment supports open cropland habitat with few and sparse stands of trees that would provide nesting sites. As such, the study area does not provide golden eagle nesting habitat.

Golden eagles are not expected to nest near the PG&E substation due to the lack of trees. There is a low likelihood that this species may be encountered in wooded areas (e.g., near Kellogg Creek) on the transmission line alignment.

Western burrowing owl *(Athene cunicularia)*

Description

Western burrowing owls are relatively small, semi-colonial owls, and are mostly residents of open dry grasslands and desert areas. As their name suggests, they occupy burrows for both breeding and roosting. They use burrows excavated by ground squirrels and other small mammals and will use man-made burrows and cavities. Burrowing owls hunt from perches and are opportunistic feeders. They will consume arthropods, small mammals (e.g., meadow voles), birds, amphibians, and reptiles. Insects (e.g., crickets) are often taken during the day, while small mammals are taken at night (Zeiner et al., 1988-1990).

Habitat

This species uses grasslands, vernal pool grasslands, fallow agricultural fields, and open oak woodlands for foraging and breeding. They use burrows excavated by mammals, including ground squirrels, badgers, and skunks. Where the number and availability of natural burrows is limited, owls will occupy man-made burrows such as drainage culverts, cavities under piles of rubble, discarded pipe, and other tunnel-like structures (Zeiner et al., 1988-1990).

Distribution

General. Western burrowing owls occur in the western half of North America, south of southern Canada. They occur throughout non-mountainous regions of California. Some populations (e.g., in coastal areas) are experiencing declines (DeSante and Ruhlen, 1995). A total of 857 wintering and burrow sites are recorded for burrowing owls in CNDDB (CDFG, 2008).

Regional. Of the 857 wintering and burrow sites recorded for western burrowing owls, 160 of these occurrences are from Alameda, Contra Costa, and San Joaquin Counties (CDFG, 2008). Forty-two breeding occurrences are reported in Contra Costa County (CDFG, 2008), but comprehensive surveys have not been conducted recently in the County. The location database compiled for the ECCC HCP/NCCP (2006) includes 17 data records from 1989 to 2000. Of these, 13 are from the last 10 years, with accurate enough information to locate five of them within the inventory area.

Only one of these is within developed areas. The remaining locations are from nonnative annual grassland habitats, or next to roads or irrigation canals in agricultural fields.

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. The Los Vaqueros Watershed provides suitable open grassland habitat for burrowing owl. The Contra Costa Breeding Bird Atlas (2005) confirms owl breeding within and just to the east of the Watershed, but not near the Reservoir. Surveys conducted before the development of the Los Vaqueros Reservoir documented up to 10 pairs of owls within the Los Vaqueros Watershed (Jones & Stokes, 1989), mostly in the eastern portion of the Watershed. A few occurrences are reported in the south end of the Los Vaqueros Watershed, and several owls observed in the northern end of the Los Vaqueros Watershed (nesting status unknown). Burrowing owl has been seen but not mapped in other areas of the Watershed as well. These occurrences are all within 1 to 2 miles of the inundation zone. The nearest CNDDB occurrence is about 1 mile east of the inundation zone.

Delta Intake and Pump Station. The Delta Intake Facilities are in developed or agricultural areas that lack suitable burrows or other nesting features. As such, this species is not expected at this location. The nearest occurrence is about 3.5 miles to the southwest of the Old River Intake.

Delta-Transfer Pipeline. The Delta-Transfer Pipeline traverses agricultural and grassland areas that provide suitable burrowing owl nesting habitat. A May 2007 biological reconnaissance survey during the breeding season did not identify burrowing owls within short annual grasslands habitat. The nearest reported occurrence is about 2 miles south of the alignment. The Contra Costa Breeding Bird Survey (2003) indicates that burrowing owls breed in the general area between the Los Vaqueros Watershed and the Delta. The availability of suitable habitat and their local distribution indicates that burrowing owls could potentially be present on the fringe of agricultural lands and in annual grasslands in the study area.

Transfer-LV Pipeline. The Transfer-LV Pipeline traverses mostly grassland habitat that provides suitable burrowing owl nesting opportunities. The closest occurrence is 1 mile southeast of the pipeline alignment, within the Los Vaqueros Watershed. Burrowing owls should be presumed present on the fringes of agricultural lands and in annual grasslands in the study area.

Transfer-Bethany Pipeline. The Transfer-Bethany Pipeline traverses mostly grassland habitat. The CNDDB notes numerous burrowing owl occurrences near the study area (CDFG, 2008). The CNDDB documents eight occurrences of burrowing owl within 1.5 miles, east of the alignment.

Expanded Transfer Facility. The Expanded Transfer Facility is in grassland habitat that may support burrowing owls to a limited degree. Observed in May 2007, the ungrazed annual grasslands throughout much of this area were generally too tall to support owl breeding, but small pockets of shorter grass were available. The nearest CNDDB occurrence is about 3.3 miles to the southeast of the Expanded Transfer Facility.

Power Supply Infrastructure. A CDFG-documented population was observed within the Western powerline alignment under Power Option 2 (CDFG, 2008). Though nesting habitat is unavailable over most of the study areas for Power Options 1 and 2, due to agricultural activities and pasture irrigation, burrowing owls are presumed present on the fringes of agricultural lands and in uncultivated annual grasslands in both alignments.

Short-eared owl *(Asio flammeus)*

Description

The short-eared owl is a bird of open country that is seen most often at dawn and dusk. Short-eared owls will usually nest on dry ground in a depression that is concealed by vegetation. Also, nesting within burrows has been observed. Breeding is from early March through July with a usual clutch size of five to seven eggs. This owl is a widespread winter migrant but breeding has severely declined over most of the range in recent decades because of destruction and fragmentation of grasslands and riparian habitats (CDFG, 1995). The short-eared owl is a California Species of Special Concern.

Habitat

The short-eared owl was formerly a resident throughout the state, excluding the higher mountains. They are usually found in open areas with few trees such as annual and perennial grasslands, prairies, meadows, dunes, irrigated lands, and saline and fresh emergent marshes. This owl requires dense vegetation for roosting and resting cover. This includes tall grasses, brush, ditches, and wetlands.

Distribution

The short-eared owl is one of the most widely distributed owls in the world. It is found across North America, South America, and Eurasia, and on many oceanic islands. Summer breeding occurs across Alaska and Canada, southward to northern California, Kansas, northern Ohio, and northern Maine, but breeding has declined in the United States. Winter range occurs from southern Canada to Mexico and the southern United States (Roberson, 2008). This species is expected to occur sporadically in annual grasslands and other suitable habitat throughout the project area.

Northern harrier *(Circus cyaneus)*

Description

Northern harriers forage primarily on voles and other small mammals, birds, frogs, small reptiles, crustaceans, insects, and, rarely, fish. They forage by making low flights above open ground, diving from flight or hover to capture prey. The northern harrier rarely captures prey from perches. Nests are built on the ground of sticks in wet areas and grasses in dry areas (Zeiner et al., 1988-1990).

Habitat

Northern harriers are found in a wide variety of habitats from annual grasslands up to lodgepole pines and alpine meadow habitats. Known to frequent meadows, grasslands, open rangelands, desert sinks, fresh and saltwater emergent wetlands; harriers are seldom found in wooded areas.

Nests are constructed amid shrubby vegetation, usually in emergent wetlands or near a river or lake may nest in grasslands, grain fields, or sagebrush flats several miles from water (Zeiner et al., 1988-1990).

Distribution

General. Northern harriers are permanent residents of the northeastern plateau, the Central Valley, low-elevations of the Sierra Nevada, and coastal areas. Northern harriers can be found throughout California in suitable habitat during the winter (Zeiner et al., 1988-1990). The CNDDB records a total of 40 occurrences of nesting northern harriers, these occurrences are clustered in the greater San Francisco Bay area (CDFG, 2008).

Regional. Of the 40 occurrences of nesting northern harriers recorded in CNDDB, eight are from Alameda and Contra Costa Counties (CDFG, 2008). Northern harriers are most commonly observed foraging over croplands, marshlands, or grasslands within the project region.

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. The Los Vaqueros Watershed provides suitable open grassland habitat for northern harrier. The nearest occurrences are 8 to 9 miles from the existing dam (CDFG, 2008). The Contra Costa Breeding Bird Atlas (2005) indicates that breeding is probable within the Watershed, confirmed east of the Watershed, and possible north of the Watershed. This species may nest near marshland habitats in the Los Vaqueros Watershed.

Delta Intake and Pump Station. The Delta region provides suitable open cropland habitat for foraging northern harriers. The nearest nesting occurrence to the Delta Intake Facilities is south of Clifton Court Forebay, about 5 miles south of the Delta Intake Facilities (CDFG, 2008). There is a low likelihood they may nest in tall grasslands in the study area.

Delta-Transfer Pipeline. The Delta-Transfer Pipeline traverses open cropland and grassland habitat suitable for northern harrier nesting. The nearest nesting occurrence is south of Clifton Court Forebay, about 5 miles south of the Old River Intake and Pump Station (CDFG, 2008). This species may nest in alkali grasslands and tall fields in the study area.

Transfer-LV Pipeline. The Transfer-LV Pipeline traverses open grassland habitat suitable for foraging northern harriers. The nearest occurrences are 8 to 9 miles from the existing dam (CDFG, 2008). This species may nest in grasslands in the study area.

Transfer-Bethany Pipeline. The Transfer-Bethany Pipeline traverses open grassland habitat suitable for northern harrier nesting. The nearest occurrence is south of Clifton Court Forebay, and about 4 miles directly east of the study area (CDFG, 2008). This species may nest in alkali grasslands and tall grasslands in the study area.

Expanded Transfer Facility. The Expanded Transfer Facility is in open grassland habitat suitable for foraging, but the grasslands are generally too tall and weedy to support harrier nesting.

Power Supply Infrastructure. study areas for Western powerlines under Power Options 1 and 2 traverse open grassland habitat that is suitable for northern harrier foraging and nesting.

This species is not expected to nest in or near the proposed PG&E facilities.

White-tailed kite *(Nesting) (Elanus leucurus)*

Description

White-tailed kites are a unique species that hovers up to 100 feet above the ground in search of prey. Typical prey includes voles and other small mammals, but they will occasionally eat birds, insects, reptiles, and amphibians. Nesting begins as early as February when nests of loosely piled sticks and twigs lined with grass, straw, or roots are built. Nesting is usually complete by August (Zeiner et al., 1988-1990).

Habitat

White-tailed kites forage in open grasslands, meadows, farmlands, and emergent wetlands. They typically nest in oak woodlands or trees, especially along marsh or river margins, although they will use any suitable tree or shrub that is of moderate height. They are rarely found far from agricultural areas (Zeiner et al., 1988-1990).

Distribution

General. White tailed kites are year-round residents in coastal and valley lowlands, particularly in Central California (Zeiner et al., 1988-1990). They can be found in most lowlands of California west of the Sierra Nevada and southeast deserts. They are commonly found along the California coast and in the Central Valley (Moore, 2000). There are 108 occurrences of nesting white-tailed kites recorded by the CNDDB, generally concentrated in the vicinity of San Francisco Bay (CDFG, 2008).

Regional. Of the 108 occurrences recorded in the CNDDB, 11 were recorded within Contra Costa and Alameda Counties. There is one kite nesting occurrence reported in San Joaquin County (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. The Los Vaqueros Watershed provides suitable open foraging and nesting habitat for white-tailed kite. The Contra Costa County Breeding Bird Atlas (2005) reports kite breeding in the Watershed. The CNDDB occurrence closest to the Watershed is about 7.5 miles southeast of the inundation boundary, in Contra Costa County (CDFG, 2008). This species may nest in oaks, cottonwoods, and other trees within the Los Vaqueros Watershed.

Delta Intake and Pump Station. The Delta Intake and Pump Station provides suitable foraging habitat for foraging white-tailed kite, but nesting sites are not present.

Delta-Transfer Pipeline. The Delta-Transfer Pipeline traverses open cropland and grassland habitat suitable for foraging, and wooded areas suitable for nesting or roosting white-tailed kites. This species may nest in the few wooded portions of the study area.

Transfer-LV Pipeline. The Transfer-LV Pipeline traverses open grassland habitat suitable for kite foraging, and riparian habitat suitable for nesting and roosting. The nearest CNDDB occurrence within the vicinity of the study area is about 8 miles southeast of the alignment (CDFG, 2008). This species may nest in the few wooded portions of the study area.

Transfer-Bethany Pipeline. The Transfer-Bethany Pipeline traverses open grassland habitat suitable for foraging, and small groups of trees suitable for nesting or roosting white-tailed kites. The nearest CNDDB occurrence to the study area is about 2 to 3 miles east of the alignment (CDFG, 2008). This species may nest in the few wooded portions of the study area.

Expanded Transfer Facility. The Expanded Transfer Facility is in open grassland habitat suitable for kite foraging, but nesting sites are not present.

Power Supply Infrastructure. The Western alignment provides suitable open cropland habitat for white-tailed kite foraging, but nesting trees are not available in the study area.

This species is not expected to nest in or near the proposed PG&E facilities.

California horned lark *(Eremophila alpestris)*

Description

California horned larks breed from March through July, with peak activity in May. After breeding they form large flocks for foraging and roosting. Horned larks build grass-lined nests directly on the ground, in dry, open habitats with sparse vegetation.

Habitat

Horned larks are common to abundant resident songbirds in a variety of open habitats. Range-wide, California horned larks breed in level or gently sloping shortgrass prairie, montane meadows, barren hills, opens coastal plains, fallow grain fields, row crops, and alkali flats.

Distribution

Horned larks range across North America from Alaska and the Canadian arctic southward to southern Mexico.

This species is persistently present in portions of the Altamont Hills in Alameda and Contra Costa counties where regular grazing helps to maintain annual grasses at a short height (B. Pittman, pers. obs.). This species is expected to breed and forage in short annual grasslands within the Los Vaqueros Watershed and at the following facilities: the westernmost 1.2 miles of the Delta-Transfer Pipeline; the entirety of the Transfer-Bethany Pipeline and Transfer-LV Pipeline alignments.

This species is expected to breed and forage in short annual grasslands within the Western powerline alignment under both Power Options and at proposed PG&E facilities under Power Option 2.

Prairie falcon *(Falco mexicanus)*

Description

A large falcon of the arid American west, the prairie falcon is pale brown, and exhibits a whitish chest with brown streaking and a dark mustache mark.

Habitat

Habitat use of the prairie falcon includes annual grasslands to alpine meadows, but they are also associated primarily with perennial grasslands, savannahs, rangeland, some agricultural fields, and desert scrub areas. Typically they are in dry environments of western North America, where cliffs or bluffs are available for nest sites.

Distribution

General. Prairie falcons range from southwestern Canada southward to northern Mexico, and eastward to Saskatchewan, Nebraska, and central Texas. In California it is a year-round resident in suitable habitat throughout most of the state. In the central valley prairie falcons have not been observed during the breeding season and only occur during the winter (CDFG, 1983).

Regional. Eastern Contra Costa and Alameda Counties are within the known year-round range of the prairie falcon. Breeding habitat, which includes cliffs and bluffs, is extremely limited near proposed project facilities.

Loggerhead shrike *(Lanius ludovicianus)*

Description

Loggerhead shrikes are medium-sized grey, white, and black songbirds with a prominent black eye mask. Shrikes are unique among songbirds in that their diet regularly includes vertebrate prey. Shrikes typically hunt from dead trees, tall shrubs, utility wires and fences. Shrikes generally build their nests in shrubs in fairly open areas.

Habitat

Loggerhead shrikes are common in low densities in a variety of habitats, including grasslands, woodlands, and scrub.

Distribution

General. This species ranges from central Canadian prairie provinces and the Canadian border southward to Florida and southern Mexico.

Regional. Loggerhead shrikes are common throughout California. Shrikes are common throughout California and are expected to occur in moderate to high densities throughout the project area where shrubby wooded habitat provides adequate cover and nesting sites.

Within the Los Vaqueros Watershed, loggerhead shrike may be encountered near wooded drainages or areas with moderate to dense shrub cover. Habitat in the watershed occurs sporadically in and adjacent to Kellogg Creek and tributary drainages. Due to the lack of perch sites and cover, this species is not expected to breed near the Delta intake facilities, but may be encountered sporadically on each of the pipeline alignments where shrubby vegetation is present.

This species may breed sporadically within the study areas for Power Option 1 and 2.

Osprey *(Pandion haliatus)*

Description

Ospreys are a unique species that build stick platform nests on top of large dead-topped trees or snags. Nests are occasionally built on cliffs, human-made structures or on the ground. They generally catch fish from near the water's surface by diving from flight, from a hover, or a perch. They will also occasionally prey on mammals, birds, reptiles, amphibians, or invertebrates. Ospreys arrive in California beginning in March, with most departing for wintering grounds by October (Zeiner et al., 1988-1990).

Habitat

Ospreys are closely associated with large bodies of clear water that produce fish and are surrounded by ponderosa pine or mixed conifer habitats. Tall trees and snags are required for breeding, foraging, and cover. Nests are usually built within 1,500 feet of fish-productive water, but may be built up to a mile from water (Zeiner et al., 1988-1990).

Distribution

General. During the breeding season ospreys can be found in northern California from the Cascade Ranges south to Lake Tahoe and along the coast south to Marin County. They are also uncommonly found breeding along the Colorado River (Zeiner et al., 1988-1990). Historically they bred throughout much of California (Remsen, 1978). There have been a total of 410 occurrences of osprey recorded in the CNDDB. These occurrences are scattered throughout northern California, with concentrations in Humboldt and Lassen Counties (CDFG, 2008).

Regional. The CNDDB reports one breeding occurrence from San Joaquin County, along the Mokelumne River. None are reported from Contra Costa or Alameda Counties (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Though not reported by the CNDDB, the Contra Costa County Breeding Bird Atlas (2005) cites osprey breeding in the Los Vaqueros Watershed and areas east of the Watershed. No evidence of nesting has been observed in the Watershed by CCWD staff. There is a potential that they may breed in oak woodlands or large snags (i.e. dead trees) in the Los Vaqueros Watershed.

Delta Intake and Pump Station. The nearest osprey breeding record is from San Joaquin County, greater than 30 miles northeast of the Delta Intake Facilities (CDFG, 2008). The study area generally lacks appropriate osprey breeding habitat.

Delta-Transfer Pipeline. The habitat in the vicinity of the study area is well-developed for agricultural use and lacks appropriate osprey breeding habitat. No CNDDB occurrences are recorded within 30 miles (CDFG, 2008).

Transfer-LV Pipeline. The habitat in the vicinity of the study area lacks appropriate osprey breeding habitat. No known CNDDB occurrences are recorded within 30 miles of the alignment (CDFG, 2008).

Transfer-Bethany Pipeline. The habitat in the vicinity of the study area is grazed annual grassland and lacks appropriate osprey breeding habitat. No known CNDDB occurrences are recorded within 30 miles of the alignment (CDFG, 2008).

Expanded Transfer Facility. The habitat in the vicinity of the study area is grazed annual grassland and lacks appropriate osprey breeding habitat. Osprey are unlikely to breed in this study area due to lack of suitable nesting habitat such as large snags or cliffs.

Power Supply Infrastructure. The Western study area is in agricultural use and lacks nesting sites. Suitable nesting habitat is absent from the study area.

This species is not expected to nest in or near the proposed PG&E facilities.

Mammals

Federal or State Threatened and Endangered Species

San Joaquin kit fox *(Vulpes macrotis mutica)*

Description

San Joaquin kit foxes are one of two subspecies of the kit fox that still exist in California. They are a permanent resident of arid grasslands or open scrubland, where friable soils are present. Dens are usually dug, but San Joaquin kit foxes will use dens constructed by other animals or use human-made structures. Dens are required year-round for reproduction, shelter, temperature regulation, and protection from predators (USFWS, 1998; USFWS, 2005a).

Habitat

San Joaquin kit foxes require open grassland and savannah habitats for foraging and dispersal. Historically their habitat included native alkali marsh and saltbush scrub of the valley floor, but the availability of such habitats has diminished markedly due to agricultural conversion. Grasslands with friable soils are considered the principal habitat for denning, foraging, and dispersal, while open oak woodlands provide lower quality foraging and dispersal habitat. Kit foxes will use habitats that have been extensively modified by humans, including grasslands and scrublands with active oil fields, wind turbines, and agricultural matrices (USFWS, 1998).

San Joaquin kit foxes are principally nocturnal predators that feed on small mammals such as black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audubonii*), California ground squirrel (*Spermophilus beecheyi*) and various mice. The kit fox diet may also include small birds, reptiles, insects, and vegetation (USFWS, 1998; USFWS, 2005a). In the northern portion of its range, California ground squirrels are a chief component of the kit fox diet (Hall, 1983).

Distribution

General. San Joaquin kit foxes occur only in and around the Central Valley, inhabiting open habitat in the San Joaquin Valley and surrounding foothills. In the northern portion of its range, the kit fox occurs primarily in foothill grasslands, since much of their former habitat on the valley floor has been eliminated. Historically, the San Joaquin kit fox ranged in the San Joaquin Valley from near Tracy, San Joaquin County on the west to La Grange, Stanislaus County on the east, and south to southern Kern County. Their current range includes the foothills of the Coast Ranges, Sierra Nevada, and Tehachapi Mountains, from Contra Costa County south to Kern County, and from Alameda and San Joaquin Counties east to Stanislaus County. Kit fox population densities are greatest in the southern portion of their range. Kit fox populations in the northern portion of their range are highly fragmented and sparsely distributed (Orloff, Hall, and Spiegel, 1986; USFWS, 2005a). The CNDDB reports a total of 204 kit fox occurrences from 1972 to 2007 (CDFG, 2008).

Regional. The CNDDB reports 21 kit fox occurrences from Contra Costa, San Joaquin, and Alameda Counties, and numerous others are reported from other sources. Since 1967, 53 San Joaquin kit fox sightings are documented from the northern range of this species from the Black Diamond Mines Regional Preserve and Lone Tree Valley to the north, to Round Valley, Los Vaqueros, Vasco Caves, and Brushy Creek (H.T. Harvey & Associates, 1997). North of Interstate 580, data show that most occurrences are concentrated along a movement corridor that follows foothill grasslands and undeveloped grasslands habitat to the east.

About two-thirds of the ECCC inventory area is considered suitable habitat for San Joaquin kit foxes, and while populations generally have sporadic distribution and cannot be accurately pinpointed, they are considered to present at low densities (ECCCHPA, 2006).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. The Los Vaqueros Watershed is in the northwestern extent of the San Joaquin kit fox range. Nine occurrences of the San Joaquin kit fox have been recorded in the Watershed vicinity, the most recent from August 2008 (H.T. Harvey & Associates, 1997; Howard, 2008; CDFG, 2008). As a requirement of the 1993 Biological Opinion (BO) for the Los Vaqueros Project, CCWD has been undertaking a long-term mitigation monitoring program for San Joaquin kit fox in the Los Vaqueros Watershed area.

In the upper Kellogg Creek portion of the Los Vaqueros Watershed, two potential north-to-south kit fox movement corridors are generally recognized. Such migration corridors serve to maintain connectivity between blocks of annual grasslands habitat. Kit fox have not been documented to use these corridors, but as identified previously, detection can be difficult in areas with sparse populations.

The corridor to the west of the Reservoir is composed of annual grasslands, roughly 500 to 1,800 feet wide, on a moderate east-facing slope. The corridor is interrupted in two locations by oak woodlands that measure roughly 80 feet and 300 feet wide. Suitable topography generally consists of low to moderate hills with slopes of less than 40 degrees (Morrell 1972), though more recent attention has focused on kit fox use of slopes of between 0 to 15 degrees (Larsen, pers. comm.).

Annual grasslands east of the Reservoir provide a considerably wider potential migration pathway, though again, kit fox use has not been identified in this area. From the base of the Dam to the northeastern edge of the Los Vaqueros Watershed, the width of this corridor is about 2 miles.

Recent kit fox observations near the Los Vaqueros Watershed include a sighting at Brushy Peak in 2002 and Vasco Caves in 2001 and 2002 (CDFG, 2003).

Delta Intake and Pump Station. The Delta Intake Facilities and associated habitats do not provide suitable habitat for San Joaquin kit fox. The Old River embankments and access road are constructed from imported engineered fill. Though consisting of friable soils, both ongoing facility maintenance activities and the control of small mammals along the embankment reduces opportunities for kit fox denning and distribution. Impacts to kit fox are not anticipated as a result of the proposed expanded intake facilities.

Delta-Transfer Pipeline. Open grassland and agricultural lands south of State Route 4 along the Delta-Transfer Pipeline may provide San Joaquin kit fox habitat. This portion of the alignment, which runs from Route 4 to the Expanded Transfer Facility, provides varying degrees of habitat quality for kit foxes. The highest quality areas are annual grasslands within 1.2 miles of the Expanded Transfer Facility, followed by moderate quality areas further east that support walnut orchards and fallow agricultural fields. The lowest quality portion of this alignment for kit fox is a roughly 1-mile segment that traverses corn fields, though this area may provide moderate quality habitat during the non-growing season.

Transfer-LV Pipeline. The Transfer–LV Pipeline traverses annual grassland habitats that could support kit fox denning, foraging, or dispersal. The linear extent of potential San Joaquin kit fox habitat in this alignment is 4.4 miles.

Transfer-Bethany Pipeline. Nearly the entire Transfer-Bethany Pipeline traverses annual grassland or alkali meadow habitats that could be used for kit fox denning, foraging, or dispersal. This alignment traverses the eastern kit fox dispersal corridor where kit foxes have been sighted within the last 15 years (CDFG, 2008; USFWS file data). The linear extent of San Joaquin kit fox habitat in this alignment is 7.5 miles in Contra Costa County and 1.4 miles in Alameda County (tunnel portion of alignment).

Expanded Transfer Facility. The Expanded Transfer Facility provides low to moderate quality habitat for the San Joaquin kit fox.

Power Supply Infrastructure. The Western powerline alignments and substation under Power Options 1 and 2 are located in moderate to high-quality kit fox habitat and suitable habitat is similarly available at the proposed PG&E facilities under Power Option 2.

Federal or State Species of Special Concern

Pallid bat *(Antrozous pallidus)*

Description

Pallid bats are pale to light brown in color, with long prominent ears, a blunt snout, and pinkish-brown or gray wing and tail membranes, and, at about 24 grams, one of the state's largest bats. Pallid bats are known for their unique habit of feeding from the ground, but also glean prey off of surfaces. Its most common prey includes crickets, beetles, grasshoppers, and even scorpions (BCI, 2007). Mating occurs from October to February, birthing from late April to July, and weaning in August. Females have one to two pups per year. Maternity colonies disperse between August and October (WBWG, 2005).

Habitat

Pallid bat inhabits low elevation (< 6,000 feet) rocky arid deserts and canyonlands, shrub-steppe grasslands, and higher elevation coniferous forests (> 7,000 feet). It is most abundant in xeric (dry) ecosystems, including the Great Basin, Mojave, and Sonoran Deserts (WBWG, 2005). Pallid bats roost in rock crevices, unoccupied buildings, hollows in large trees, and under bridges.

Distribution

Pallid bat ranges throughout western North America, from British Columbia 's southern interior, south to Queretaro and Jalisco, and east to Texas. This is the most widely described special status bat species in central California and in the project region, with the nearest occurrences located 6 miles north of the Los Vaqueros Watershed (CDFG, 2008). Though not verified within the Los Vaqueros Watershed, habitat for this species is available in large hollow trees, snags, or under loose bark in the watershed study area. Though rock outcrops are common along ridgelines, open rock crevices that could support bat roosts are uncommon in the 275-TAF zone and in project study areas.

Pallid bat habitat is considered limited in portions of the project area outside the watershed, thus, this species is only expected within the watershed.

Townsend's big-eared bat *(Corynorhinus townsendi)*

Description

Townsend's big-eared bats are agile fliers that travel long distances to forage. In winter, these bats hibernate in caves and abandoned mines. Summer maternity colonies range in size from a few individuals to several hundred individuals. Maternity colonies form between March and June, with a single pup born between May and July. They are extremely sensitive to disturbance at their roosting sites and have suffered severe population declines throughout much of the U.S (BCI, 2007). This species has been listed as vulnerable to extinction (VU) by the World Conservation Union's 2004 IUCN Red List of threatened species and is a California Department of Fish and Game Species of Special Concern (WBWG, 2005).

Habitat

Townsend's big-eared bat has been reported in a wide variety of habitat types including coniferous forests, mixed meso-phytic forests, deserts, native prairies, riparian communities, active agricultural areas, and coastal habitat, ranging from sea level to 3,300 meters (WBWG, 2005). Their most typical habitat is arid western desert scrub and pine forest regions.

Distribution

Townsend's big-eared bats occur throughout the west with their distribution strongly correlated with the availability of caves and cave-like roosting habitat, including abandoned mines. Habitat may be available in large trees in the watershed study area, but their more typical cave habitat is absent from this area. Cave habitat in eastern portion of the Los Vaqueros Watershed is not open to public access and is greater than 500 feet from the project study area.

Though not verified within the Los Vaqueros Watershed, habitat for this species is available in large hollow trees, snags, or under loose bark in the watershed study area. Though rock outcrops are common along ridgelines, open rock crevices that could support bat roosts are uncommon in the 275-TAF zone and in project study areas.

Habitat for this species does not occur in study areas located outside the watershed.

Greater western mastiff bat *(Eumops perotis californicus)*

Description

The greater western mastiff bat is the largest bat in the United States. Greater western mastiff bats do not hibernate, but will go into a daytime torpor during the winter, emerging at night to feed. They forage for insects between 100 and 2,000 feet above the ground, catching them in flight (Williams, 1986; Zeiner et al., 1988-1990).

Habitat

This species prefers open, semi-arid to arid habitats with low elevation and rugged, rocky areas that have suitable crevices for roosting. These crevices must open downward to allow bats to launch into flight and are usually found in granite or sandstone. They will roost in buildings and trees, provided they have adequate drops to allow them to take flight (Williams, 1986; Zeiner et al., 1988-1990).

Distribution

General. The greater western mastiff bat is the only subspecies of *Eumops perotis* to occur in North America. This species occurs from central California southward to central Mexico. They have been recorded from Butte County southward including lowland valleys of coastal southern California and western portions of the southern California deserts. Most have been recorded from low-lying areas, although they have been recorded in Yosemite Valley and the area near Hetch Hetchy Reservoir. Greater western mastiff bats are uncommon, widespread residents of the San Joaquin and Salinas Valleys and coastal lowlands south of San Francisco Bay (Williams, 1986; Zeiner et al., 1988-1990). A total of 185 occurrences of the greater western mastiff bat were recorded in the CNDDB. These occurrences are scattered throughout central and southern California (CDFG, 2008).

Regional. No CNDDB occurrences of greater western mastiff bat are recorded within Contra Costa County, but there is one in Alameda County and one in San Joaquin County (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. The nearest documented occurrences are an 1899 collection near Hayward and a 1957 observation from near Oakdale, both greater than 20 miles from the study area (CDFG, 2008). Open grassland, canyons, and woodland communities in the watershed provide habitat for greater western mastiff-bats; however, based on available species distribution data that identifies low densities in the project region, this species appears is considered unlikely in the project area. Habitat for this species does not occur in study areas located outside the watershed.

Delta Intake and Pump Station. The nearest CNDDB occurrence is about 17.5 miles south of the Delta Intake Facilities (CDFG, 2008). Suitable roosting habitat is absent from the study area.

Delta-Transfer Pipeline. The nearest CNDDB occurrence is about 18 miles south of the alignment (CDFG, 2008). The study area does not provide suitable roosting habitat for greater western mastiff bat.

Transfer-LV Pipeline. The nearest CNDDB occurrence is about 18.5 miles southeast of the existing dam (CDFG, 2008). Suitable roosting habitat is absent from the study area.

Transfer-Bethany Pipeline. The nearest CNDDB occurrence is about 12 miles southeast of the alignment (CDFG, 2008). The Transfer-Bethany Pipeline may traverse limited riparian and oak woodland communities but the habitat quality is not likely to support greater western mastiff bat. Therefore, greater western mastiff bats are considered unlikely within the study area.

Expanded Transfer Facility. The nearest CNDDB occurrence is about 18 miles southeast of the Expanded Transfer Facility (CDFG, 2008). The study area is mostly annual grassland and does not support suitable roosting habitat. Therefore, greater western mastiff bat is unlikely within the study area.

Power Supply Infrastructure. The nearest CNDDB occurrence is about 17.5 miles to the south of the Western study area (CDFG, 2008). Suitable roosting habitat is absent from the study area.

This species is not expected to roost in or near the proposed PG&E facilities due to the absence of suitable roost sites in the study area.

Small-footed myotis bat *(Myotis ciliolabrum)*

Description

Small-footed myotis is a small bat with a keeled calcar, small foot, black ears, and a black mask across the eyes and nose. Body color varies from brown to pale yellow. The western small-footed myotis rears its young in cliff-face crevices, erosion cavities, and beneath rocks on the ground. Some females care for their pups alone, while others form small groups. These bats can also be found hibernating in caves or mines, but little else is known about them; they are among America's least-studied animals (BCI, 2007). They forage early in the evening, feeding on various small insects. Copulation takes place in the fall, with sperm being stored in females until spring when ovulation occurs. Females produce one young per year in late spring or early summer.

Habitat

Small-footed myotis occurs in deserts, chaparral, riparian zones, and western coniferous forest; it is most common above pinon-juniper forest. Individuals are known to roost singly or in small groups in cliff and rock crevices, buildings, concrete overpasses, caves, and mines.

Distribution

The range of the small-footed myotis includes much of the State of California and the western half of North America (CDFG, 2005). Roost sites are not documented within 100 miles of the Los Vaqueros Watershed (CDFG, 2008). Based on the described distribution of roost sites and lack of cliffs and rock crevices in the Los Vaqueros Watershed study area, there is a low likelihood that this species would be encountered in the watershed.

Due to the lack of suitable structural habitat in study areas located outside the watershed, this species is not expected in these areas.

Long-eared myotis bat *(Myotis evotis)*

Description

The relatively long black ears of the long-eared myotis are dramatic in contrast with its paler body fur. Long-eared myotis capture prey in flight, but also glean stationary insects from foliage or the ground. Their main diet appears to consist of moths, and their relatively quiet echolocation calls are well suited for sneaking up on prey undetected as well as for maneuvering through cluttered habitats (BCI, 2007). Females give birth to one young per year in late spring to early summer. For the size this mammal has a long life with individuals having lived up to 22 years.

Habitat

Long-eared myotis are found predominantly in coniferous forests, typically only at higher elevations in southern areas (between 7,000 and 8,500 feet). Individuals roost under exfoliating tree bark, and in hollow trees, caves, mines, cliff crevices, sinkholes, and rocky outcrops on the ground. They also sometimes roost in buildings and under bridges. Pregnant long-eared myotis often roost at ground level in rock crevices, fallen logs, and even in the crevices of sawed-off stumps, but they cannot rear young in such vulnerable locations.

Distribution

These bats are endemic to the west, ranging from southwestern Canada, south through California into Baja, eastward through northern Arizona and New Mexico, and north into the Dakotas (WBWG, 2005). The nearest described sightings are about 60 miles to the north in Chiles Valley (Napa County) and 95 miles to the east in Stanislaus National Forest (Tuolumne County) (CDFG, 2008). Based on this species' described range, which includes much of California, it cannot be ruled out from the project area. Thus, there is a low likelihood that it may roost in trees and rocky outcrops in the watershed.

Due to the lack of suitable structural habitat in study areas located outside the watershed, this species is not expected in these areas.

Fringed myotis bat *(Myotis thysanodes)*

Description

The fringed myotis got its name from the conspicuous fringe of hair along the posterior edge of its tail membrane. Fur color is variable (brown to reddish brown) and often noticeably lighter on belly. These bats are not caught commonly in great numbers, but may be widely dispersed. Nursery colonies of dozens to hundreds of individual bats have been encountered (BCI, 2007). Fringed myotis capture insects in flight using tail cupping as well as glean prey from plants and ground surfaces. Females produce one pup per year in late June. Fringed myotis is a Species of Special Concern in California.

Habitat

Distribution of fringed myotis is patchy and occurs from sea-level to 2850 m but is most common at middle elevations. It appears to be most common in drier woodlands (oak, pinyon-juniper, ponderosa pine) but is found in a wide variety of habitats including desert scrub, mesic coniferous forest, grassland, and sage-grass steppe. Night and day roosts include caves, mines, and buildings (typically abandoned). Hibernacula include caves and buildings, but not much is known about their wintering whereabouts (WBWG, 2005).

Distribution

Fringed myotis ranges through much of western North America from southern British Columbia, Canada south to Chiapas, Mexico, and from Santa Cruz Island in California east to the Black Hills of South Dakota.

The nearest described occurrence is a 2005 observation near Crystal Springs Reservoir (San Mateo County), about 40 miles west of the Los Vaqueros Watershed (CDFG, 2008). Based on this species' described range, which includes much of California, it cannot be ruled out in the project area. Thus, there is a low likelihood that it may roost in rocky outcrops in the watershed.

Due to the lack of suitable structural habitat in study areas located outside the watershed, this species is not expected in these areas.

Long-legged myotis bat *(Myotis volans)*

Description

Long-legged myotis is distinguished by its short rounded ears, small hind feet, long legs, distinctly keeled calcar, and long, dense fur on the underside of the wing membrane that extends from the body to a line joining the elbow and the knees. Although some variation in color exists, it is typically dark brown. Long-legged myotis forage over ponds, streams, water tanks, and in forest clearings, often on moths. Individuals copulate in autumn, with females storing the sperm overwinter, ovulating in the spring, and giving birth from May through August. Individuals have lived a minimum of 21 years (WBWG, 2005).

Habitat

Long-legged myotis are especially dependent on wooded habitats from pinon- juniper to coniferous forests, usually at elevations of 4,000 to 9,000 feet. This species uses abandoned buildings, cracks in the ground, cliff crevices, exfoliating tree bark, and hollows within snags as summer day roosts; caves and mine tunnels as hibernacula (WBWG, 2005). Radio-tracking studies have identified maternity roosts beneath bark and in other cavities. Most nursery colonies live in at least 100 year-old trees that provide crevices or exfoliating bark (BCI, 2007)

Distribution

The long-legged myotis is one of western America's most widely distributed bat species. Long-legged myotis ranges across western North America from southeastern Alaska, British Columbia and Alberta in Canada to Baja California and central Mexico. It occurs throughout the western United States from the Pacific coast to the Great Plains and central Texas.

The nearest described observation is a 1999 sighting from Don Pedro Reservoir (Tuolumne County), 75 miles east of the Los Vaqueros Watershed (CDFG, 2008). However, based on this species' geographic range, which is described as much of California, it cannot be ruled out from the project area. Thus, there is a low likelihood that it may roost in trees and rocky outcrops in the watershed.

Due to the lack of suitable structural habitat in study areas located outside the watershed, this species is not expected in these areas.

Yuma myotis bat *(Myotis yumanensis)*

Description

Yuma myotis is a small bat that is usually gray or brown to pale tan on the back and light on chest and belly; ears and membranes are frequently pale brown to gray. Although Yuma myotis feed predominantly over water, they eat a variety of insects that includes moths, froghoppers, leafhoppers, June beetles, ground beetles, midges, mosquitoes, muscid flies, caddisflies, and crane flies. Mating is typically in the fall and females give birth to one young from mid-spring to mid-summer in maternity colonies that may range in size up to several thousand. Yuma myotis are threatened by loss of riparian habitats and the decline in permanent water sources in the southwest (BCI, 2007).

In general, the long term persistence of North American bat species is threatened by the loss of clean, open water; modification or destruction of roosting and foraging habitat; and, for hibernating species, disturbance or destruction of hibernacula. Chemicals in the environment that affect bats or their prey are also a threat. Because of low fecundity, high juvenile mortality, and long generational turnover, many bat populations may be vulnerable to human-induced pressures.

Habitat

Yuma bats are usually associated with permanent sources of water, but Yuma myotis also use tinajas in the arid West (WBWG, 2007). It occurs in a variety of habitats including riparian, arid scrublands, deserts, and forests. Occasionally roosting in mines or caves, these bats are most often found in buildings or bridges. Bachelors also sometimes roost in abandoned cliff swallow nests, but tree cavities were probably the original sites for most nursery roosts.

Distribution

The Yuma myotis is found throughout western North America, from British Columbia through Washington, Idaho, and western Montana, southern Wyoming, Colorado, New Mexico, West Texas and into Mexico (BCI, 2007).

The nearest described observation is a 2003 sighting in the City of Pleasanton (Alameda County), 12 miles southwest of the Los Vaqueros Watershed (CDFG, 2008). Based on this species' described range, which is described as much of California, it cannot be ruled out from the project area. Thus, there is a low likelihood that it may roost in trees and rocky outcrops in the watershed.

Due to the lack of suitable structural habitat in study areas located outside the watershed, this species is not expected in these areas.

American badger *(Taxidea taxus)*

Description

American badgers are rather large, robust, short-legged mammals with broad bodies. They have a short bushy tail, small eyes and ears, shaggy grayish fur, and distinct white and black markings on the face. Badger front feet are large, with claws 25 mm or more long used for digging. Badgers prey primarily on gophers, ground squirrels, marmots, and kangaroo rats, but will also eat a variety of other animals, including mice, woodrats, reptiles, birds and their eggs, bees and other insects, etc. Badgers were reduced in numbers over almost all of their range in California by 1937 (Williams, 1986). Deliberate killings and agricultural and urban developments have been the primary causes of decline and extirpation of populations of badgers in California.

Habitat

In California, Badgers occupy a diversity of habitats; grasslands, savannas, and mountain meadows near timberline are preferred, though they can be found in deserts as well. The principal requirements seem to be sufficient food, friable soils, and relatively open, uncultivated ground.

Distribution

American Badgers occur from northern Alberta southward to central Mexico. They range from the Pacific Coast eastward through Ohio. They are absent from the humid coastal forests and from other regions with dense forests. In California, Badgers ranged throughout the state except for the humid coastal forests of northwestern California in Del Norte Co. and the northwestern portion of Humboldt Co (Williams, 1986). This species is expected to occur in low densities throughout the project area.

San Joaquin pocket mouse *(Perognathus inornatus inornatus)*

Habitat

The San Joaquin pocket mouse lives in dense annual grasslands, saltbush scrub, and oak savannah habitats, exploiting the topography of flat ground and low hills. It is usually found in areas with friable soils, constructing its small burrows in sandy soil near bases of bushes. Microhabitats include dense grass, dirt roadsides, and rock outcroppings.

Distribution

Sparse iodine bush scrub and short grasslands habitat in the Western alignment provide the best available habitat in the project area for this species, and provides the only described local occurrence of this species (CDFG, 2008).

Grasslands with friable soils on the Transfer-Bethany Pipeline and at the Western substation site provide high quality habitat where this species could occur. Non-native annual grasslands throughout the project area provide potential, though lesser quality habitat.

Plants

Federal or State Threatened and Endangered Species

Contra Costa goldfields *(Lasthenia conjugens)*

Description

Contra Costa goldfields is a small spring annual in the sunflower family (Asteraceae). The species typically ranges from 4 to 12 inches high, is somewhat fleshy, and has simple to freely branched stems. Its linear leaves are opposite and stem leaves are often one to two-lobed with thin fissures that extend greater than halfway toward the stem (USFWS, 2005c; Hickman, 1993). From March to June the species produces solitary golden-yellow flowers (CNPS, 2008). This species is distinguished from similar species *L. burkei* and *L. fremontii* by its flowers. Contra Costa goldfields has partially fused phyllaries (less than half their length) and its fruits lack a pappus.

The similar genus *Blennosperma* is differentiated by having alternate leaves, clustered flower heads, and paler yellow ligules (USFWS, 2005c).

Habitat

Habitat for this species occurs in vernal pools, swales and moist flats within alkaline playas, valley and foothill grasslands, and cismontane woodland below 1,500 feet in elevation (CNPS, 2008). The species is often found in association with other endemic vernal pool plants such as coyote thistle, smooth goldfields (*Lasthenia glaberrima*), flatface downingia (*Downingia pulchella*), and common mousetail (CDFG, 2008).

Distribution

General. Historically, Contra Costa goldfields were known within the north coast, the southern Sacramento Valley, the San Francisco Bay Area, and south coast. Currently, it is known to occur in Mendocino, Napa, Marin, Contra Costa, Alameda, Solano, Sonoma, and Monterey counties, and is believed to be extirpated from Santa Barbara and Santa Clara counties (CNPS, 2008).

Regional. CDFG (2008) reports four occurrences in Contra Costa County and four in Alameda County. One of the occurrences in Contra Costa County and three of the occurrences in Alameda County are presumed extant (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. No occurrences of Contra Costa goldfields are known within the Los Vaqueros Watershed. The nearest occurrence is about 11 miles north of the existing dam (CDFG, 2008). This occurrence is originally from a herbarium collection in 1884 in the vicinity of Byron Hot Springs, but surveys conducted in the Los Vaqueros Watershed in 1988 and 2005 did not find any plants (CDFG, 2008). The CNDDB considers this recorded occurrence extirpated. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta Intake and Pump Station. Contra Costa goldfields is not known to occur in the vicinity of the Delta Intake Facilities. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. Contra Costa goldfields is not known to occur in the vicinity of the Delta-Transfer Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. The Transfer-LV Pipeline alignment is about 9.5 miles southeast of the nearest recorded Contra Costa goldfields population and critical habitat is within 2 miles east of the alignment (CDFG, 2008; USFWS, 2006a). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. Vernal pool wetlands along the Transfer-Bethany Pipeline provide suitable habitat for Contra Costa goldfields; the nearest occurrence is 9.5 miles northwest of the alignment (CDFG, 2008). This alignment passes through critical habitat for Contra Costa goldfields; however, the goldfields population appears to have been extirpated prior to 1920 (CDFG, 2008). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. The nearest known occurrence of Contra Costa goldfields to the Expanded Transfer Facility is about 9.5 miles northwest of the Transfer Facility (CDFG, 2008). within the study area is mainly disturbed annual grassland and lacks vernal pool wetlands that support this species; therefore, Contra Costa goldfields is not likely to occur in the study area.

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

Federal or State Species of Special Concern

Large-flowered fiddleneck *(Amsinckia grandiflora)*

Description

Large-flowered fiddleneck is an herbaceous annual in the borage family (Boraginaceae) that ranges from 1 to 2 feet high. This species germinates in the fall or early winter after the onset of the rainy season and continues to develop throughout the winter until early spring (Carlsen et al., 1999). The typical blooming period for this species is April to May (CNPS, 2008). The plant dies after it sets seed in early summer (Carlsen et al., 1999).

Habitat

The species is restricted to steep slopes ranging from 900 to 1,800 feet in elevation in valley grasslands that are typically bordered by blue oak woodland and coastal sage scrub communities (CNPS, 2008; Carlsen et al., 1999). Historically, the species occurred in native perennial bunchgrass plant communities dominated by species such as purple needlegrass (USFWS, 1997b). Currently, the species is found growing in association with non-native annual grasses such as wild oats and ripgut brome, native lupines and fiddlenecks, and blue oak (CDFG, 2008).

Distribution

General. The species is known within the Altamont Hills in the northern Diablo Range and a portion of the inner south Coast Range.

Regional. The first reported occurrence of this species was in 1887 at a mining camp on the northeast slope of Mt. Diablo, but this population has since been extirpated (CDFG, 2008). Three natural occurrences have been reported within and next to Lawrence Livermore Laboratory Site 300, south of Tracy in San Joaquin County. Re-establishment at historic and other appropriate locations within the region is ongoing; however the majority of all reintroduced populations are declining and few to none of these individuals have been seen since the 1990’s (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. The nearest large-flowered fiddleneck populations that are presumed extant are near Lawrence Livermore Laboratory, which is also where the critical habitat is designated (CDFG, 2008; USFWS, 2006a). Two experimental re-introductions occurred in the Los Vaqueros Watershed, about 2 miles south of Round Valley; however, these reintroductions failed and no individuals have been seen since 1995 (CDFG, 2008). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta Intake and Pump Station. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Power Supply Infrastructure. A known population is present in the Western substation study area (Power Option 1), which is spanned by powerlines under Power Option 2.

Mt. Diablo manzanita *(Arctostaphylos auriculata)*

Description

Mt. Diablo manzanita is a tall (3 to 15 feet), evergreen shrub in the heath family (Ericaceae). The shrub has erect stems, densely white-tomentose twigs with long bristles, and oblong-ovate to round-ovate leaves. The blooming period for this species extends from January to March (CNPS, 2008).

Habitat

Mt. Diablo manzanita occurs on dry sandstone slopes primarily in chemise and manzanita chaparral plant communities at elevations ranging from 440 to 2130 feet (CNPS, 2008; ECCCHPA, 2006). The shrub also occurs as an understory component in coast live oak woodlands (ECCCHPA, 2006). It commonly grows in association with manzanita (*Arctostaphylos* spp.), chamise, chaparral pea, buckbrush (*Ceanothus cuneatus*), sticky monkeyflower, black sage, oak (*Quercus* spp.), and knobcone pine (*Pinus attenuata*).

Distribution

General. This species is endemic to Mt. Diablo and the surrounding hills. It is locally rare and plants are generally sparsely scattered or found in small clumps.

Regional. CDFG (2008) reports 18 extant populations within Contra Costa County and one possibly extirpated occurrence.

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. There are three CNDDB-reported occurrences of Mt. Diablo manzanita in the Los Vaqueros Watershed, totaling about 740 individual plants. These occurrences are all in the vicinity of Morgan Territory Regional Park and associated with the common manzanita plant series (CDFG, 2008). They are clustered into a relatively well-defined area 0.35 mile west of the 275 TAF reservoir expansion inundation zone.

The distribution of chaparral and manzanita plant series are well described within the 275 TAF inundation area and within the Los Vaqueros Watershed. Less 4.41 acres of chamise habitat would be inundated and an additional 0.86 acre (consisting of 0.75 acre of chamise, 0.07 acre of wedgeleaf ceanothus and 0.04 acre of common manzanita) (ESA, 2004) would be impacted. Based on botanical surveys (ESA, 2004), Mt. Diablo manzanita does not occur in the inundation or facilities construction area (ESA, 2007).

Delta Intake and Pump Station. This species does not occur in this study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. This species does not occur in this study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. This species does not occur in this study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. This species does not occur in this study area (ESA, 2007; 2008b).

Expanded Transfer Facility. This species does not occur in this study area (ESA, 2007; 2008b).

Power Supply Infrastructure. This species does not occur in this study area (ESA, 2007; 2008b).

Contra Costa manzanita *(Arctostaphylos manzanita ssp. laevigata)*

Description

Contra Costa manzanita is a bushy evergreen shrub in the heath family (Ericaceae). The plant is low with intricately branched smooth to finely tomentose twigs (USFWS, 2002a). Leaves are glossy and smooth and range from widely ovate to oblong-ovate with rounded to wedge-shaped bases (USFWS, 2002a; Hickman, 1993). Its drooping, branched inflorescences have small, white flowers that are urn-shaped (USFWS, 2002a). Its blooming period extends from January to February and fruits from July to August (CNPS, 2008; USFWS, 2002a). The bright red fruits resemble miniature apples. Unlike some in the genus, Contra Costa manzanita does not re-sprout after fires and is therefore an obligate seeder (USFWS, 2002a).

Habitat

Contra Costa manzanita occurs on rocky slopes within chemise, manzanita, and mixed chaparral plant communities at elevations ranging from 1,600 to 3,610 feet (CNPS, 2008; Hickman, 1993; CDFG, 2008). It is typically found on southern exposures from 500 to 2,600 feet in elevation (USFWS, 2002a). Common associates include manzanita, chamise, chaparral pea, buckbrush, sticky monkeyflower, toyon, linear-leaved goldenbush (*Ericameria linearifolia*), California sagebrush, Mt. Diablo helianthella (*Helianthella castanea*), coast live oak, and interior live oak (CDFG, 2008).

Distribution

General. The species is restricted to the Mt. Diablo Range in the San Francisco Bay region and the Vaca Mountains in the inner north Coast Ranges (Hickman, 1993).

Regional. Currently, eight occurrences of Contra Costa manzanita are reported, all within the vicinity of Mt. Diablo in Contra Costa County. Known occurrences are within Mt. Diablo State Park and on East Bay Regional Park District lands (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. The CNDDB reports one known occurrence, about 0.2 mile just west of and next to the Los Vaqueros Watershed boundary, in Morgan Territory Regional Park (CDFG, 2008). There is potential for this species to occur within chaparral communities in the Los Vaqueros Watershed, but based on botanical surveys (ESA, 2004), Contra Costa manzanita does not occur in the study area.

Delta Intake and Pump Station. This species does not occur in this study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. This species does not occur in this study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. This species does not occur in this study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. This species does not occur in this study area (ESA, 2007; 2008b).

Expanded Transfer Facility. This species does not occur in this study area (ESA, 2007; 2008b).

Power Supply Infrastructure. This species does not occur in this study area (ESA, 2007; 2008b).

Alkali milk-vetch *(Astragalus tener var. tener)*

Description

Alkali milk-vetch is an inconspicuous annual herb in the legume family (Fabaceae). Upright plants reach 12-inches high and are smooth to covered with stiff, straight hairs that hug the stem. Each pinnately compound leaf has seven to 12 separated, oval leaflets with notched tips. Flowers are pink to purple (sometimes fading to white) and occur in dense clusters of three to 12. Its typical blooming period occurs from March to June (CNPS, 2008).

Habitat

Alkali milk-vetch occurs on adobe clay playas, vernal flats, and moist grasslands with alkali or heavy clay soils in the Central Valley up to 200 feet in elevation (CNPS, 2008). Plant associates of this taxon are Italian ryegrass, wooly marbles (*Psilocarphus tenellus*), stalked popcornflower (*Plagiobothrys stipitatus* var. *micranthus*), and coyote thistle (*Eryngium aristulatum* var. *aristulatum*) (CDFG, 2008).

Distribution

General. Alkali milk-vetch was historically found in the southern Sacramento Valley, the northern San Joaquin Valley, and the eastern San Francisco Bay region (Hickman, 1993). Occurrences are recorded for thirteen counties in California; however it is now known only from Merced, Solano, and Yolo Counties (CDFG, 2008). Of the 67 recorded occurrences in the CNDDB, 38 are presumed extant (CDFG, 2008).

Regional. Only one of the 13 known occurrences within the region is presumed extant, and this population is in Alameda County west of Fremont (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Two known occurrences of alkali milk-vetch are in the vicinity of the Los Vaqueros Watershed, but no occurrences are recorded within the watershed. Both occurrences are within 2.5 miles of the Watershed, one to the east and one to the south. One of the occurrences was first reported in 1988 at the junction Byron Hot Springs Road and Armstrong Road northeast of Livermore. This site was surveyed in 2002 and the species was not observed. The other occurrence is a record from 1938 in the east end of Livermore Valley, but this area is mostly developed now. Both occurrences are possibly extirpated (CDFG, 2008). This species was not observed during focused surveys for rare plants conducted in the Los Vaqueros Watershed in 2005, 2007, and 2008 (ESA, 2007; 2008a).

Delta Intake and Pump Station. Alkali milk-vetch is not known to occur in the study area. The nearest recorded occurrence is about 3.8 miles southwest of the Delta Intake Facilities (CDFG, 2008). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. Alkali milk-vetch is not known to occur in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. The Transfer-LV Pipeline is about 4 miles northwest of the nearest recorded alkali milk-vetch population (CDFG, 2008). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. Vegetation within the study area is mainly disturbed annual grassland and lacks alkali wetland and alkali grassland to support this species.

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

Heartscale *(Atriplex cordulata)*

Description

Heartscale is a low-growing annual herb in the goosefoot family (Chenopodiaceae). This monoecious species has few erect, rigid stems from the base that grow from 4 to 20 inches. The ascending-to-erect branches are gray-scaly with tips covered with densely interwoven, generally matted hairs (Hickman, 1993). Heartscale blooms from April to October, but the plant is most easily identified when in fruit (CNPS, 2008).

Habitat

Heartscale grows in sandy, saline or alkaline flats or scalds, in chenopod scrub, meadows, and valley and foothill grassland at elevations less than 1,230 feet (CNPS, 2008). It often grows in association with other atriplex, saltgrass, alkali heath, and common tarweed (*Hemizonia pungens*) (CDFG, 2008). *Atriplex* species are relatively tolerant of disturbance.

Distribution

General. Heartscale is known within the southern Sacramento Valley to the San Joaquin Valley. Its current distribution ranges from Glenn and Butte Counties in the north to Kern County in the south (CNPS, 2008). The CNDDB has identified 58 occurrences of heartscale, of which 53 are presumed extant (CDFG, 2008).

Regional. Of the 53 extant CNDDB occurrences, two are recorded in the vicinity of Livermore in Alameda County. No reported occurrences are recorded in Contra Costa or San Joaquin Counties (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. No occurrences of heartscale are recorded within the Los Vaqueros Watershed; however two occurrences are reported in the vicinity, south of the Watershed (CDFG, 2008). Alkali flats and alkali grasslands within the Watershed provide suitable habitat for this species. During a 2005 focused survey for these species, there was one location where potential individuals of this species were discovered; however, these plants had not yet fully formed their fruits and therefore were not definitively identified to species. Therefore, pending verification of these plants, heartscale may potentially occur within the study area.

Delta Intake and Pump Station. Heartscale is not known to occur in the vicinity of the Delta Intake Facilities and was not detected during focused surveys. This species is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. Heartscale is not known from the Delta-Transfer Pipeline alignment, and was not detected during focused surveys. This species is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. Heartscale is not known from the Transfer-LV Pipeline alignment, and was not detected during focused surveys. This species is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. Alkali wetlands and alkali grasslands in the vicinity of the Transfer-Bethany Pipeline provide suitable habitat for heartscale, although no occurrences have been recorded in the study area. The nearest occurrence is about 7 miles south of the existing dam (CDFG, 2008). Potential habitat is only available at a few distinct sites on the Transfer-Bethany Pipeline alignment, where final botanical surveys were delayed due to site access constraints. Based on the spring 2008 survey findings (ESA, 2008), which did not identify this species and the species' described distribution there is a low likelihood that this species may be encountered in this area.

Expanded Transfer Facility. The nearest known occurrences of heartscale to the Expanded Transfer Facility are south of the Los Vaqueros Watershed (CDFG, 2008). Vegetation within the study area is mainly disturbed annual grassland and lacks alkali wetland and alkali grassland to support this species. Therefore, heartscale is not likely to occur within the study area.

Power Supply Infrastructure. Heartscale is not known from the Power Facilities study areas, and was not detected during focused surveys. This species is considered absent from the study area (ESA, 2007; 2008b).

Brittlescale *(Atriplex depressa)*

Description

Brittlescale is a low-growing annual herb in the goosefoot family (Chenopodiaceae). This monoecious species has prostrate, scaly stems that are white and brittle and that grow to less than 8 inches (Hickman, 1993). The species blooms from May to October, but is best identified when in fruit (CNPS, 2008).

Habitat

Brittlescale is associated with alkaline or clay soils in chenopod scrub, playas, vernal pools, or seeps and in valley grassland at elevations less than 1,050 feet (CNPS, 2008). It is often associated with the alkali soils of the Pescadero and Solano series (ECCCHPA, 2006). Populations occur in semi-barren areas of saline and alkaline meadows with other atriplex, alkali heath, salt grass, alkali mallow, meadow barley (*Hordeum brachyantherum*), common tarweed, and bush seepweed. Brittlescale is sometimes associated with other rare plants such as palmate-bracted bird's-beak and San Joaquin saltbush (*Atriplex joaquiniana*) (CDFG, 2008).

Distribution

General. Brittlescale is known within the southern end of the Sacramento Valley through the San Joaquin Valley. It is currently known within Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kern, Madera, Merced, Solano, Tulare, and Yolo Counties. There are 52 known occurrences in the CNDDB and all are presumed extant (CDFG, 2008). However, it is believed that some of these occurrences may be misidentified lesser saltscale (*Atriplex miniscula*) (ECCCHPA, 2006).

Regional. There are 17 reported occurrences distributed throughout Alameda and Contra Costa Counties for this species (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Brittlescale has been recorded within the Watershed, within the Lower Kellogg Creek watershed (CDFG, 2008). Three populations were identified during surveys conducted in the Los Vaqueros Watershed in 1988. About 500 plants were found 0.8 mile south of Marsh Creek Road, another 500 were observed about 0.6 mile north of Vasco Road, and 150 plants were found on the west side of the reservoir spillway south of the dam (Jones and Stokes Associates, Inc., 1988).

Delta Intake and Pump Station. Agricultural lands within the study area does not provide habitat for this species. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. Agricultural lands within the study area does not provide habitat for this species. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. Alkali wetlands and alkali grasslands within the study area provide suitable habitat for brittlescale. Several known populations are recorded within the vicinity of the study area, and three populations occur within the study area. Alkali wetlands and alkali grasslands north and south of Vasco Road and along Armstrong Road provide suitable habitat for this species. These locations were verified during focused surveys (ESA, 2007; 2008b). Final botanical surveys of these areas were delayed in 2008 due to site access constraints, thus, there remains a moderate potential that several additional, small brittlescale populations occur in this area.

Expanded Transfer Facility. Vegetation within the study area is mainly disturbed annual grassland and lacks alkali wetland and alkali grassland which would support this species. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2008b).

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

San Joaquin spearscale *(Atriplex joaquiniana)*

Description

San Joaquin spearscale is an annual herb in the goosefoot family (Chenopodiaceae). This species ranges in height from 1 to 3 feet and has erect, striate stems. Leaf blades are ovate to triangular, finely gray-scaly or green above, and wavy-toothed. Upper stem leaves are abruptly reduced. Female inflorescence fruiting bracts are fused below the middle, round-deltate, and ribbed (Hickman, 1993). The species blooms from April through October (CNPS, 2008), but is best identified when in fruit.

Habitat

San Joaquin spearscale occurs in seasonal alkali wetlands or sink scrub within chenopod scrub, meadows, and grasslands. It is typically found at lower elevations, but is reported to grow up to 2,740 feet elevation (CNPS, 2008). The species is commonly found in association with other atriplex, saltgrass, alkali heath, Italian ryegrass, alkali mallow, and nitgrass (*Lepidium nitidum*) (CDFG, 2008). Members of the *Atriplex* genus are relatively tolerant of disturbance.

Distribution

General. San Joaquin saltbush is known within the east side of the southern inner Coast Ranges, the southern end of the Sacramento Valley, and San Joaquin Valley. Historically, the species' range extended from Glenn County in the north to Tulare County in the south, but it is currently assumed to be extirpated from Santa Clara, San Joaquin, and Tulare Counties (CNPS, 2008).

Regional. The CNDDB reports 43 occurrences throughout the region, in Alameda, Contra Costa, and San Joaquin Counties. The majority of occurrences are within Contra Costa County. San Joaquin County has one occurrence; this record is from 1927 and the occurrence has not been seen since (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities

This species is known to occur within the Watershed, in alkali wetlands and along alkaline watercourses. The occurrences recorded from the Kellogg Creek watershed include the largest recorded populations for this species (Jones and Stokes Associates, Inc., 1988). Populations of San Joaquin spearscale were noted in this area during surveys conducted in 2005. The majority of occurrences is along the Lower Kellogg Creek watershed and is within 1 to 2.5 miles of the dam (CDFG, 2008). No occurrences are recorded within the inundation zone. The Stockpile Area is next to one population (CDFG, 2008).

Delta Intake and Pump Station. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. The Transfer-LV Pipeline generally follows Lower Kellogg Creek to the existing dam. Several populations of San Joaquin spearscale occur in alkali wetlands and alkali grasslands in this area, although San Joaquin spearscale populations do not occur within the study area (CDFG, 2008; ESA 2008b).

Transfer-Bethany Pipeline. For the Transfer-Bethany Pipeline, several San Joaquin spearscale populations were identified in alkali wetlands and alkali grasslands south of Armstrong Road, in alkali grasslands habitats that were outside the pipeline study area (CDFG, 2008; ESA 2008b).

Expanded Transfer Facility. Vegetation within the study area is mainly disturbed annual grassland and lacks alkali wetland and alkali grassland to support this species. Therefore, San Joaquin spearscale is not likely to occur within the study area.

Power Supply Infrastructure. Several populations were also identified in the Western alignment study area that can be avoided by project design (ESA, 2008b).

San Joaquin spearscale does not occur in the PG&E study area.

Big Tarplant *(Blepharizonia plumosa)*

Big tarplant is an annual herb in the sunflower family (Asteraceae) that is endemic to California. This species ranges from 1 to 4 feet high and it occurs in grasslands of eastern Contra Costa County. At least four occurrences, all considered extant, are documented near the north entrance to the Los Vaqueros Watershed. No occurrences are documented in the Los Vaqueros Watershed study area. Focused surveys failed to identify this species in out-of-watershed study areas.

Mt. Diablo fairy lantern *(Calochortus pulchellus)*

Description

Mt. Diablo fairy-lantern is a bulbiferous, perennial herb in the lily family (Liliaceae). This species ranges from about 4 to 12 inches high, has persistent basal leaves, and two to three cauline leaves. From April to June, plants produce one to many showy, light yellow nodding flowers with thick hairs on the petals. Plants become dormant in winter persisting only as bulbs below the soil surface.

Habitat

Mt. Diablo fairy-lantern occurs in chaparral, cismontane woodland, riparian woodland, and valley and foothill grassland at elevations ranging from 650 to 2,600 feet (CNPS, 2008). It is typically found on wooded or brushy slopes in association with oaks, foothill pine, common manzanita, chamise, California buckeye, poison oak, California bay laurel (*Umbellularia californica*), Diablo helianthella, baby blue eyes (*Nemophilla heterophylla*), blue-eyed grass (*Sisyrinchium bellum*), shooting-stars (*Dodecatheon* spp.), California goldfields (*Lasthenia californica*), and Torrey melic (*Melica torreyana*) (CDFG, 2008; ECCHPA, 2006).

Distribution

General. The species was believed to be restricted to the Diablo Range (Hickman, 1993) in Contra Costa and Alameda counties, but one new occurrence was discovered in Solano County in 2004. This new occurrence significantly extends the species' range (CDFG, 2008).

Regional. Mt. Diablo fairy-lantern has a total of 31 occurrences in the region, with 30 in Contra Costa County and one in Alameda County.

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Mt. Diablo fairy-lantern has two reported occurrences in the Los Vaqueros Watershed – about 0.6 and 1.8 miles from the inundation boundary (CDFG, 2008). Ten plants were found in 1991 in the southwest section of Round Valley, and the other occurrence was reported in 1935 about 10 miles north of Livermore on Morgan Territory Road and has not been surveyed for since. This species was observed in two distinct populations totaling about 105 individuals during special-status plant surveys conducted for this project (ESA, 2007). Both populations are west of and south of the reservoir, along oak woodland-chaparral ecotones. One of these populations is within 180 feet of the inundation boundary and 80 feet from the westside access road; another population is within 390 feet of the inundation boundary and a proposed picnic area, and within 350 feet of the westside access road. These populations would not be impacted by the project.

Delta Intake and Pump Station. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. No occurrences of Mt. Diablo fairy-lantern are known in the study area; the nearest occurrence is within the Los Vaqueros Watershed, over 5 miles southwest of the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. No occurrences of Mt. Diablo fairy-lantern are known in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. No occurrences of Mt. Diablo fairy-lantern are known in the study area; the nearest occurrence is within the Watershed, about 6 miles west of the alignment. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. No occurrences of Mt. Diablo fairy-lantern are known in the study area; the nearest occurrence is about 5.8 miles southwest of the existing Expanded Transfer Facility.

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

Congdon's tarplant *(Centromadia parryi ssp. congdonii)*

Description

Congdon's tarplant is a summer annual in the sunflower family (Asteraceae). Plants grow prostrate to erect, range from 4 to 28 inches high, and lack hairs and glands. This much branched species have short, spine-tipped leaves that are entire to few toothed. Inflorescences are borne in leaf axils with yellow ray flowers and disk flowers with yellow anthers. Disk flower fruits have a pappus of three to five scales. The species closely resembles the more widespread common spikeweed (*Hemizonia pungens*), but common spikeweed lacks a pappus on disk fruits (Hickman, 1993). The species blooms from May through November (CNPS, 2008).

Habitat

Congdon's tarplant occurs in valley and foothill grasslands in alkali soils below elevations of 760 feet (CNPS, 2008). It is often found in ruderal grassland habitat in association with common knotweed (*Polygonum arenastrum*), annual bromes (*Bromus* spp.), horseweed (*Conyza bonariensis*), bristly ox-tongue (*Picris echioides*), annual beard grass (*Polypogon monspeliensis*), shortpod mustard (*Hirschfeldia incana*), Italian ryegrass, yellow star-thistle (*Centaurea solstitialis*), lamb's quarters (*Chenopodium album*), Russian thistle (*Salsola tragus*), fiddle dock (*Rumex pulcher*), and alkali mallow (CDFG, 2008).

Distribution

General. This species' range is described as the central and southern regions of Central Western California in Santa Clara, Contra Costa, and Alameda counties and from San Luis Obispo to Santa Cruz counties (Hickman, 1993; LSA Associates, 2004). Known occurrences in Santa Cruz and Solano counties are believed to be extirpated. Out of 76 known occurrences, 62 are presumed extant and the majority of these are distributed throughout Monterey, Contra Costa, and Alameda counties (CDFG, 2008).

Regional. Within the region, 15 presumed extant populations are recorded in Alameda County and 16 in Contra Costa County (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. This species is not known to occur in the Los Vaqueros Watershed. The nearest occurrence is about 6 miles south of the existing dam (CDFG, 2008). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta Intake and Pump Station. Congdon's tarplant is not known to occur within the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. Congdon's tarplant is not known to occur within the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. Congdon's tarplant is not known to occur within the study area. The nearest occurrence is about 6 miles south of the existing dam (CDFG, 2008). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. Congdon's tarplant is not known to occur within the study area. The nearest occurrence is about 3 miles southwest of the terminus of the pipeline at the Bethany Reservoir (CDFG, 2008). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. The nearest known occurrences of Congdon's tarplant to the study area are within the Los Vaqueros Watershed (CDFG, 2008). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

Hispid bird's-beak *(Cordylanthus mollis spp. hispidus)*

Description

Hispid bird's-beak is an annual herb in the figwort family (Scrophulariaceae). This highly-branched plant is gray-green with tinges of purple and covered in stiff, bristly hairs. It ranges from 4 to 16 inches high. Its small leaves are oblong and entire to seven lobed. Corollas are whitish, sparsely tomentose, and two-lipped with an upper lip that is shaped like a bird's beak and a lower lip that is inflated. Flowers are mostly hidden by green leaf-like outer bracts, and inner bracts are pinnately lobed three to seven times. This species is physically similar to soft bird's-beak (*C. mollis* ssp. *mollis*), but the later is distinguished by the presence of soft hairs, fewer stem branches, and a densely tomentose corolla pouch and tube (Hickman, 1993). Hispid bird's-beak blooms from June through September (CNPS, 2008).

Habitat

Hispid bird's-beak grows in damp saline or alkaline soils in meadows, sinks, playas, and grasslands at elevations below 510 feet (CNPS, 2008). It is often found in alkaline meadows and sinks in association with salt grass. Other halophytic plant associates include alkali heath, spearscale, and iodine bush, and it co-occurs with palmate-bracted birds-beak at one site (CDFG, 2008).

Distribution

General. Historically, the range for hispid bird's-beak was described as the central and southern regions of the Central Valley in Solano, Merced, and Kern counties (Hickman, 1993). Currently, there are 28 extant occurrences, the majority of which are in Merced County. One known occurrence has been documented in each of Alameda, Kern, Placer, Fresno, and Solano Counties (CDFG, 2008).

Regional. Within the region, one population occurs in the Springtown Alkali Sink Ecological Reserve, which is north of Livermore in Alameda County. In 1999, over 200 individuals were estimated at this location (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. This species is not known to occur in the Los Vaqueros Watershed. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta Intake and Pump Station. Hispid bird's-beak is not known to occur within the study area. The nearest occurrence is about 14 miles southwest of the dam (CDFG, 2008). Agricultural land and disturbed annual grassland within the facilities area do not provide habitat for this species. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. Hispid bird's-beak is not known to occur within the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. This species is not known to occur within the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. Vegetation within the study area is mainly disturbed annual grassland and lacks alkali wetland and alkali grassland to support this species. Based on focused survey findings, Hispid bird's-beak is not present in the study area.

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

Recurved larkspur *(Delphinium recurvatum)*

Description

Recurved larkspur is a perennial herb in the buttercup family (Ranunculaceae). This medium-sized plant ranges from 7 to 33 inches high and has a smooth stem with a base that is narrower than the root. Leaves are palmately lobed (three to 11 lobes) and generally basal leaves are much larger than cauline leaves. From March to May, this species produces showy, light blue flowers that generally have reflexed sepals and white lower petals (Hickman, 1993; CNPS, 2008).

Habitat

Recurved larkspur occurs in chenopod scrub, cismontane woodland, and valley and foothill grasslands with poorly drained, alkaline soils between 100 to 2,500 feet elevation (CNPS, 2008; Hickman, 1993). The species occurs in association with salt grass, alkali barley, alkali heath, California goldfields, and common spikeweed (CDFG, 2005; Jones & Stokes, 1990).

Distribution

General. Recurved larkspur was historically distributed throughout the Central Valley, from Butte to Kern County (ECCCHPA, 2006). The majority of known occurrences are within Kern, San Luis Obispo, and Tulare counties, but extant populations are reported for Alameda, Contra Costa, Merced, Fresno, Kings, Solano, Kern, Monterey, San Joaquin, Colusa, and Madera counties (CDFG, 2008).

Regional. The CNDDB reports six presumed extant occurrences in the region: four in Contra Costa County, one in Alameda County, and one in San Joaquin County (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. No occurrences of recurved larkspur are known within the Los Vaqueros Watershed. The nearest occurrences are 5.5 to 7 miles east of the Watershed (CDFG, 2008). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta Intake and Pump Station. Vegetation within the study area is mostly disturbed and developed for agriculture, and is not likely to support this species. Recurved larkspur considered absent from the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. Four known occurrences of recurved larkspur are in the vicinity of the study area (CDFG, 2008); however, this species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. No known occurrences of recurved larkspur are reported from the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

Diamond-petaled California poppy *(Eschscholzia rhombipetala)*

Description

The diamond-petaled California poppy is a small annual herb in the poppy family (Papaveraceae). This erect, hairless species grows from a taproot and ranges from 2 to 12 inches high. Its finely dissected linear leaves generally have obtuse segments and fleshy bases. Within the genus, the fleshy leaf bases are unique to diamond-petaled California poppy (Cypher, 2005). From March through April, the species produces small yellow flowers with four petals and barrel-shaped receptacles and buds are erect (Hickman, 1993; Cypher, 2005). Fruits are cylindrical and can be nearly equal in length to the entire plant and have tiny, rounded black seeds (Hickman, 1993). This small species is typically difficult to see at a distance and this may account for its infrequent observation (Clark, 2000).

Habitat

The species occurs in fallow fields and open spaces in valley and foothill grasslands and alkali scrub below 3,200 feet in elevation and typically on clay and alkaline soils. The species is known to occur in association with pine bluegrass, bromes, slender wild oats, wind poppy (*Stylomecon heterophylla*), Douglas microseris (*Microseris douglasii*), San Benito thornmint (*Acanthomintha obovata*), large-leaved filaree (*Erodium macrophyllum*), spinescale saltbush (*Atriplex spinifera*), common mousetail (*Myosurus minimus*), purple owl's clover (*Castilleja exserta*), and goldfields (CDFG, 2008). The plant is also known to occur in small vernal pools at Carrizo Plain in association with goldfields and phacelia *(Phacelia* spp.) (Clark, 2005).

Distribution

General. Historically, Diamond-petaled California poppy was known within seven sites in the northern inner Coast Range, the eastern San Francisco Bay Area, eastern portion of the outer southern Coast Range, and the inner southern Coast Range in Alameda, Colusa, Contra Costa, San Luis Obispo, and Stanislaus counties (Hickman, 1993; Cypher, 2005). This species was thought to be extinct until it was rediscovered at Carrizo Plain in 1992. Since then it was also found at Lawrence Livermore Laboratory Site 300 in 1997. An occurrence in San Luis Obispo County is thought to be a misidentified Lemmon's poppy (*E. lemmonii* ssp. *lemmonii*) and the occurrence at Carrizo Plain has not been seen since its discovery (CNPS, 2008).

Regional. Within the region, CDFG (2008) reports two occurrences each in Contra Costa and Alameda Counties and one occurrence in San Joaquin County that are all presumed extant. However, the three occurrences in Contra Costa and San Joaquin Counties are historical collections and have not been seen since. The two occurrences in Alameda County are at Lawrence Livermore Laboratory Site 300.

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. The one broad known occurrence in the region overlaps with the Los Vaqueros Watershed (CDFG, 2008). This is a historical occurrence dated from 1888, and the location was generally reported as “near Byron” (CDFG, 2008). Potential exists for this species to occur throughout the Kellogg Creek watershed, but no populations were discovered during past and recent field surveys (Jones and Stokes Associates, Inc., 1988; ESA, 2007). Intensive long-term livestock grazing, fire suppression, and competition from non-native annual grasses are a few reasons that may be why the diamond-petaled California poppy has been absent from suitable habitat in the region (Jones and Stokes Associates, Inc., 1988). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta Intake and Pump Station. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

Mt. Diablo helianthella *(=rock-rose) (Helianthella castanea)*

Description

Mt. Diablo helianthella is a perennial herb in the sunflower family (Asteraceae). This medium-sized plant ranges from 4 to 20 inches high and grows from a stout taproot and caudex. Leaves are mostly basal but stems have few leaves with long petioles and narrowly to widely elliptic blades. Yellow flowers are produced on long, stout stems from March through June (CNPS, 2008; Hickman, 1993). The outer phyllaries of the flower are generally enlarged, appear to be leaves, and are incurved and the involucre (group of phyllaries) is 1 to 1.5 inches wide. Its smooth fruits are thick and have 0 to two pappus awns (Hickman, 1993). Plants become dormant in winter, persisting only at or below the soil surface. The species is similar to California helianthella (*H. californica*), but is distinguished by wider leaves, more leafy-bracted phyllaries, and thick fruits (Hickman, 1993).

Habitat

Diablo helianthella occurs in grassy openings within valley and foothill grasslands, broadleafed upland forests, chaparral, cismontane woodland, coastal scrub, and riparian woodland from 190 to 4,200 feet in elevation (CNPS, 2008). It is found in association with annual grasses, mule-ears

(*Wyethia* spp.), purple needlegrass, yarrow, California sagebrush, sticky monkeyflower, chamise, coyotebrush (*Baccharis pilularis*), poison oak, and blue oak (CDFG, 2008; ECCCHPA, 2006).

Distribution

General. The species is endemic to the northern San Francisco Bay Area (Hickman, 1993). Currently, 81 occurrences of this species are known to be distributed throughout Alameda, Contra Costa, Marin, San Francisco, and San Mateo Counties. Many of these occurrences are on State Park and East Bay Regional Park District lands (CDFG, 2008).

Regional. The majority of these are in the Project Area region, with 68 occurrences recorded in Contra Costa County and ten in Alameda County (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Four populations of Diablo helianthella have been identified in the Watershed (CDFG, 2008). None are within the inundation boundary. One location is 130 feet from inundation boundary, and within 90 feet of the westside access road. Another location is about 450 feet from the inundation boundary, and about 380 feet from the westside access road. These two locations are included within a CNDDB occurrence that is generally about 1 to 4 miles south of Round Valley and consists of 32 colonies and greater than 2,296 individuals (CDFG, 2008). This occurrence was last surveyed in 1991. The other three CNDDB occurrences are between 0.3 and 0.7 mile east of Morgan Territory Road and consist of five colonies with about 130 plants (CDFG, 2008).

In addition, during special-status plant surveys conducted in June, 2004, Diablo helianthella was observed in one distinct population totaling about 85 individuals. This population is southwest of the reservoir along an oak woodland-chaparral ecotone, about 400 feet outside the inundation boundary and about 360 feet from the westside access road. This population has not been documented in the CNDDB. While occurrences are documented from the Los Vaqueros Watershed, this species is considered absent from the study area.

Delta Intake and Pump Station. No occurrences of Diablo helianthella are known in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. No occurrences of Diablo helianthella are known in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. No occurrences of Diablo helianthella are known in the study area. The nearest occurrence is within Round Valley Regional Park, about 1.3 miles northwest of the dam. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. No occurrences of Diablo helianthella are known in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. No occurrences of Diablo helianthella are known in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

Brewer's dwarf-flax *(=western flax) (Hesperolinon breweri)*

Description

Brewer's dwarf-flax is a low-growing annual in the flax family (Linaceae). The species ranges from about 2 to 8 inches high and has alternately arranged linear leaves. Its short, dense inflorescences produce numerous small yellow flowers with gland-toothed sepals (Hickman, 1993). The species typically blooms from May through July (CNPS, 2008).

Habitat

Brewer's dwarf flax occurs on serpentine, sandstone, and volcanic soils in chaparral, woodlands, and valley foothill grasslands between 100 and 2,300 feet elevation (CNPS, 2008; ECCCHPA, 2006). The species is generally found on slopes in areas with low growing vegetation and in association with toyon, manzanita, chamise, foothill pine, buckbrush, scrub oak, sticky monkeyflower, yarrow, Mt. Diablo fairy lantern (*Calochortus pulchellus*), purple needlegrass, and slender wild oats (CDFG, 2008).

Distribution

General. The species range is described as the Vaca Mountains at the southern end of the inner North Coast Range in Napa and Solano counties and Contra Costa County (Hickman, 1993).

Regional. Twenty-two known occurrences are recorded in the CNDDB in Contra Costa, Napa, and Solano Counties; and 16 occurrences are known in Contra Costa County, with one historic occurrence that is believed to have been extirpated (CDFG, 2008; ECCCHPA, 2006). About half of these occurrences are on State Park and Regional Park lands (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Multiple records for this species are documented in and near the Watershed. One occurrence was reported in the southern portion of Round Valley in 1987 with greater than 1,000 individuals. The other five occurrences were found during surveys of the Watershed conducted in 1988. One of these occurrences was found along Vasco Road (about 0.25 mile north of the reservoir) and had about 4,500 individuals. The other four were off of Morgan Territory Road at distances ranging from 0.8 to 1.8 mile with a total of about 4,375 individuals (CDFG, 2008). This species was observed during special-status plant surveys conducted for this project in six distinct populations totaling about 1,850 individuals (ESA, 2004). Population sizes range from 100 to 500 plants. All populations are west or south of the reservoir within oak woodlands (five populations) or grasslands (one population) and on north- and northeast-facing slopes. Typical associates include blue oak, buckeye, yarrow, and along ecotones with open grasslands or dense chaparral within the oak woodlands (Jones and Stokes Associates, Inc., 1988). These populations are important as they are not growing on serpentinite substrate, which is typical of the species (CNPS, 2008).

One population identified by CDFG is within the inundation boundary and westside access road alignment, and two mapped populations are known to occur within 150 feet of the westside access road (CDFG, 2008). Another population observed during field surveys consists of about 200 plants that would be inundated by the project. A population of about 85 individuals observed during rare plant surveys lies 350 feet west of the proposed westside access road, near the southern tip of the reservoir (ESA, 2004). In total, the species has up to eight known occurrences in the vicinity of the Los Vaqueros Watershed (CDFG, 2008).

Delta Intake and Pump Station. No occurrences of Brewer's dwarf-flax are known in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. No occurrences of Brewer's dwarf-flax are known in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. No occurrences of Brewer's dwarf-flax are known in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. No occurrences of Brewer's dwarf-flax are known in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. No occurrences of Brewer's dwarf-flax are known in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

Rose-mallow *(Hibiscus lasiocarpus)*

Rose-mallow is a perennial, rhizomatous herb in the mallow family (Malvaceae). This species ranges from 3 to 6 feet high. This species produces large, showy white flowers during the July to October blooming period.

Habitat for this species occurs in freshwater wetlands and freshwater marshes in California and elsewhere in North America. This species range includes the northern and central Sacramento Valley. It is currently known from San Joaquin, Solano, Contra Costa, Sacramento, Sutter, Colusa, Glenn and Butte Counties (CNPS, 2007).

Habitat for this species in the project area only occurs on the banks of Old River, near the Delta intake facilities. Two populations were identified locally to the Expanded Old River Intake and Pump Station, both outside the project study area. Two plants occur within a 1-square-meter area roughly 1,400 feet north of the Delta intake facilities, a colony with fewer than 15 plants occurs 1,100 feet south of the facilities, and a single plant occurs across Old River (CDFG, 2008). These populations are outside the Expanded Old River Intake and Pump Station project area. A colony consisting of fewer than 15 plants occurs at the site for the New Delta Intake and Pump Station. No other populations are known or were identified during focused botanical surveys in spring 2008 (ESA, 2008b).

Mason's lilaeopsis *(Lilaeopsis masonii)*

Description

Mason's lilaeopsis is a rhizomotous perennial herb in the carrot family (Apiaceae). This small plant generally grows prostrate and produces solitary to tufted leaves. Its cylindrical, thread-like leaves range from 0.6 to 3 inches long and are segmented. Flowering occurs from April to November and plants produce simple, open umbels with tiny white or maroon flowers (Hickman, 1993). Plants become dormant in winter persisting only as rhizomes below the soil surface. Many populations of this species are ephemeral, and they generally colonize newly deposited or exposed sediments (CNPS, 2008).

Habitat

Mason's lilaeopsis occurs on tidally influenced mudflats and mud-banks of sloughs and rivers, freshwater and brackish marsh, and riparian scrub. The species typically grows in saturated clay substrates that are inundated by tidal action or waves on a regular basis. Common associates of this species include bulrush, bugleweed (*Lycopus* spp.), marsh pennywort (*Hydrocotyle* spp.), rushes, spikerush, loosestrife (*Lythrum* spp.), dock (*Rumex* spp.), coyote thistle, willow, cattail, and horsetail (*Equisetum* spp.) (CDFG, 2008). It is often found in association with other special-status plants including Delta mudwort, Delta tule pea, and Suisun Marsh aster (*Aster lentus*) (CDFG, 2005).

Distribution

General. Mason's lilaeopsis occurs in the Sacramento-San Joaquin River Delta and sloughs, Suisun Marsh, and Lower Napa River.

Regional. Numerous occurrences are recorded in the region: 59 in Contra Costa County, 37 in San Joaquin County, and one in Alameda County (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. Mason's lilaeopsis is not known from the Los Vaqueros Watershed. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta Intake and Pump Station. Mason's lilaeopsis has been documented in the vicinity of the Delta Intake Facilities site on the banks of Old River. Two small colonies were identified on the banks of Old River near the Delta Intake Facilities, 5,000 feet north and 1,200 feet south of Expanded Old River Intake and Pump Station. The south population is located about 700 feet north of the New Delta Intake and Pump Station site. This species was not detected during focused surveys and is considered absent from the project area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. No occurrences are known within this study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. No occurrences are known within this study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. The Expanded Transfer Facility study area is within annual grassland communities that do not support habitat for Mason's lilaeopsis.

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

Delta mudwort *(Limosella subulata)*

Description

Delta mudwort is a stoloniferous perennial herb in the figwort family (Scrophulariaceae). This tufted creeping plant has short cylindrical to awl-shaped leaves that resemble grass blades. Leaves are linear and range from 0.4 to 1.2 inches long. From May through August, plants produce solitary white to lavender-blue flowers with five rounded petal lobes (Hickman, 1993; LSA Associates, 2004). According to Jepson (1993), Delta mudwort is not native to California, but CNPS (2008) considers it native but in need of further study.

Habitat

Delta mudwort grows in muddy or sandy intertidal flats in freshwater and brackish marsh and riparian scrub communities below elevations of 10 feet (Hickman, 1993; CDFG, 2008). This species is tolerant of complete submergence under high tides. It is often associated with the special-status plant Mason's lilaeopsis. Other common associates include water pygmy weed (*Crassula aquatica*), common reed, dallis grass (*Paspalum dilatatum*), broad-leaved cattail, rush, bulrush, willow, whorled marsh-pennywort (*Hydrocotyle verticillata*), and bugleweed (CDFG, 2008).

Distribution

General. Within California, Delta mudwort is restricted to the Delta region of the Central Valley in Contra Costa, Sacramento, San Joaquin, and Solano Counties. Outside of California, it is known to occur in Oregon, southern British Columbia, and along the East Coast (Hickman, 1993). There are 42 extant occurrences in the state and all reported within the last 25 years (CDFG, 2008). The Calflora database reports one sighting in Sierra County in a ditch along a roadway, which was reported to San Jose State Herbarium (Calflora, 2005). It is also reported to occur at Jepson Prairie Preserve (Jepson Prairie, 1998). No occurrences are recorded in Sierra County and at Jepson Prairie Preserve in the CNDDB.

Regional. The majority of known occurrences are within the region. Contra Costa County has 16 occurrences and 14 are reported for San Joaquin County (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. No occurrences of Delta mudwort are known within the Los Vaqueros Watershed. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta Intake and Pump Station. This species is known to occur in the Delta, along Victoria Canal, just upstream from Clifton Court Forebay and about 2 to 2.5 miles southeast of the Delta Intake Facilities (CDFG, 2008). The Delta Intake Facilities are on Old River where no occurrences of Delta mudwort are known. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. No occurrences of Delta mudwort are known within the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. No occurrences of Delta mudwort are known within the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. No occurrences of Delta mudwort are known within the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. No occurrences of Delta mudwort are known within the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

Showy (=Golden) madia *(Madia radiata)*

Description

Showy madia is an annual herb in the sunflower family (Asteraceae). The plant ranges from 4 to 35 inches high and is generally branched throughout. Yellow to brown colored glands cover stems and leaves. Leaves are 0.7 to 4 inches long, sometimes clasping the stem, entire or serrate, and often covered in short, bristly hairs. Flowers have glandular phyllaries, golden yellow ray flowers, and disk flowers with yellow to black anthers. Fruits lack a pappus and ray fruits are strongly curved, black, and beaked (Hickman, 1993). Showy madia blooms from March through May (CNPS, 2008).

Habitat

Showy madia occurs in valley and foothill grasslands, cismontane woodlands, and chenopod scrub from 80 to 4,000 feet in elevation. The species mostly grows in grasslands or among shrubs in adobe clay soils. Associated plant species include non-native annual grasses, Great Valley phacelia (*Phacelia ciliata)*, cupped monolopia (*Monolopia major*), silvery lupine (*Lupinus argenteus* var. *argenteus*), yellow mustard (*Guillenia flavescens*), dwarf white milk-vetch (*Astragalus didymocarpus*), chia sage (*Salvia columbariae*), larkspur (*Delphinium* spp.), pine bluegrass, interior goldenbush (*Ericameria linearifolia*), allscale saltbush, common groundsel (*Senecio vulgaris*), red-stemmed filaree (*Erodium cicutarium*), California goldfields, and another special-status plant Kern mallow (*Eremalche parryi* ssp. *kernensis*) (CDFG, 2008).

Distribution

General. Showy madia is known within scattered occurrences in the western San Joaquin Valley, eastern San Francisco Bay Area, and inner South Coast Ranges from Contra Costa, Fresno, Kings, Kern, Monterey, Santa Barbara, San Benito, San Joaquin, and San Luis Obispo Counties (Hickman, 1993; CDFG, 2008). The CNDDB reports 41 occurrences in the state, the majority of which are historical (CDFG, 2008).

Regional. Five historical occurrences in the region were all reported during or prior to 1941. Three occurrences in Contra Costa were reported from the vicinity of Antioch and Lone Tree Valley and two occurrences in San Joaquin County were reported from Lower Hospital Canyon and Corral Hollow (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. There are no records of this species in the vicinity of the Los Vaqueros Watershed (CDFG, 2008). The nearest occurrences in the region are the historical regional occurrences, about 7 to 12 miles northwest of the dam (CDFG, 2008). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta Intake and Pump Station. The nearest known occurrences of showy madia are more than 10 miles northwest of the Delta Intake Facilities (CDFG, 2008). Habitat within the study area is mostly disturbed and developed for agriculture, and is not suitable for this species. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta-Transfer Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

Marsh skullcap *(Scutellaria galericulata)*

Description

Marsh skullcap is a perennial herb in the mint family (Lamiaceae). Plants grow from slender rhizomes and its smooth to short-hairy stems are more or less descending and range from 8 to 32 inches long. Leaves are mostly along the stem with lanceolate to narrowly oblong-ovate blades, entire to crenate margins, truncate to lobed bases, and acute tips. The species typically flowers from June through September and produces tiny (0.06 to 0.08 inch), violet-blue to blue irregular flowers with white-mottled lower lips and inner surfaces with small protuberances (papillae) (Hickman, 1993; CNPS, 2008).

Habitat

Marsh skullcap occurs along streambanks and in lower montane coniferous forest, meadows, seeps, marshes, and swamps from near sea level up to 6,900 feet in elevation (CNPS, 2008). It occurs in association with common tule, water smartweed (*Polygonum* spp.), rushes, California loosestrife (*Lythrum californicum*), and umbrella sedge (*Cyperus eragrostis*) (CDFG, 2008).

Distribution

General. Marsh skullcap is found throughout North America. The species is relatively rare in California, which represents the southernmost distribution of the species. Marsh skullcaps are known to occur in Lake Tahoe Basin and Modoc Plateau in California (Hickman, 1993).

Regional. Three known occurrences are recorded in the south Delta in San Joaquin County. These occurrences represent a significant increase in the extent of this species' range (CDFG, 2008).

Project Area Distribution

Los Vaqueros Reservoir Expansion, In-Watershed Facilities, and Recreational Facilities. No occurrences of marsh skullcap are known within the Los Vaqueros Watershed. The nearest occurrence is in the Delta, along Middle River, more than 12 miles east-northeast of the dam (CDFG, 2008). This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Delta Intake and Pump Station. One occurrence last seen in 1978 is reported from Middle River between Victoria Island and Upper Jones Tract and is in the vicinity of the Delta Intake Facilities, about 3.4 miles northeast (CDFG, 2008). The Old River Intake and Pump Station are on Old River, where an historic occurrence was recorded in 1949, nearly 10 miles upstream (CDFG, 2008). Tidal marsh along Old River provides suitable habitat for marsh skullcap. However, this species was not identified during focused botanical surveys in May 2007 and April 2008, and is considered absent from the study area.

Delta-Transfer Pipeline. No occurrences of marsh skullcap are known within the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-LV Pipeline. No occurrences of marsh skullcap are known in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Transfer-Bethany Pipeline. No occurrences of marsh skullcap are known within the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Expanded Transfer Facility. No occurrences of marsh skullcap are known in the study area. This species was not detected during focused surveys and is considered absent from the study area (ESA, 2007; 2008b).

Power Supply Infrastructure. Focused protocol-level surveys failed to identify this species in the Western and PG&E study areas.

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APPENDIX E
Policies Relevant to Project Analysis

E-1 Alameda County

East County Area Plan (ECAP) Goals, Policies, and Programs

ALAMEDA COUNTY –
EAST COUNTY AREA PLAN (ECAP) GOALS, POLICIES, AND PROGRAMS

Element		
Land Use		
Open Space Goal Agriculture Goal Agriculture Policies	71	To protect regionally significant open space and agricultural land from development. To maximize long-term productivity of East County's agricultural resources. The County shall conserve prime soils (Class I and Class II, as defined by the USDA Soil Conservation Service Land Capability Classification) and Farmland of Statewide Importance and Unique Farmland (as defined by the California Department of Conservation Farmland Mapping and Monitoring Program) outside of the Urban Growth Boundary.
	72	The County shall preserve the Mountain House area for intensive agricultural use.
	73	The County shall require buffers between those areas designated for agricultural use and new non-agricultural uses within agricultural areas or abutting parcels. The size, configuration and design of buffers shall be determined based on the characteristics of the project site and the intensity of adjacent agricultural land uses, and if applicable, the anticipated timing of future urbanization of adjacent agricultural land where such agricultural land is included in a phased growth plan. The buffer shall be located on the parcel for which a permit is sought and shall provide for the protection of the maximum amount of arable, pasture, and grazing land feasible.
	74	The County shall require that, where conflicts between a new use and existing use are anticipated, the burden of mitigating the conflicts be the responsibility of the new use.
	75	The County shall enforce the provisions of the Alameda County Right-to-Farm Ordinance on all lands within and adjacent to agricultural areas.
	76	The County shall work with San Joaquin, Contra Costa, and Santa Clara Counties to ensure that any development adjacent to Alameda County agricultural land mitigates impacts on agricultural land including air quality, water quality and incompatibilities with agricultural uses. In particular, measures to mitigate growth-inducing impacts of development on agricultural land in Alameda County shall be addressed through cooperative efforts among the counties. The County shall ensure that land uses within Alameda County adjacent to San Joaquin, Contra Costa, and Santa Clara Counties are compatible with adjacent agricultural uses in these other counties.
Watershed Goal Scenic Viewsheds Goal Sensitive Viewsheds Policies	110	To protect watershed land from the direct and indirect effects of development. To preserve unique visual resources and protect sensitive viewsheds. The County shall require that developments are sited to avoid or, if avoidance is infeasible, to minimize disturbance of large stands of mature, healthy trees and individual healthy trees of notable size and age. Where healthy trees will be removed, the County shall require a tree replacement program which includes a range of tree sizes, including specimen-sized trees, to achieve immediate visual effect while optimizing the long-term success of the replanting effort.
	112	The County shall require development to maximize views of the following prominent visual features: 1. The major ridgelines listed in Policy 105; 2. Brushy Peak, Donlan Peak, and Mount Diablo; and 3. Cresta Blanca, near Arroyo Road South of Livermore.
	113	The County shall review development proposed adjacent to or near public parklands to ensure that views from parks and trails are maintained.

ALAMEDA COUNTY –
EAST COUNTY AREA PLAN (ECAP) GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
Land Use (cont.)		
	114	The County shall require the use of landscaping in both rural and urban areas to enhance the scenic quality of the area and to screen undesirable views. Choice of plants should be based on compatibility with surrounding vegetation, drought-tolerance, and suitability to site conditions; and in rural areas, habitat value and fire retardance.
	116	To the maximum extent possible, development shall be located and designed to conform with rather than change natural landforms. The alteration of natural topography, vegetation, and other characteristics by grading, excavating, filling or other development activity shall be minimized. To the extent feasible, access roads shall be consolidated and located where they are least visible from public view points.
	117	The County shall require that where grading is necessary, the off-site visibility of cut and fill slopes and drainage improvements is minimized. Graded slopes shall be designed to simulate natural contours and support vegetation to blend with surrounding undisturbed slopes.
	118	The County shall require that grading avoid areas containing large stands of mature, healthy vegetation, scenic natural formations, or natural watercourses.
	119	The County shall require that access roads be sited and designed to minimize grading.
Biological Resources Goal Biological Resources Policies	125	To preserve a variety of pant communities and wildlife habitat. The County encourages preservation of areas known to support special-status species.
	126	The County encourages no net loss of riparian and seasonal wetlands.
	129	The County encourages the preservation of East County oak woodland plant communities and riparian woodland habitat present along Arroyo Mocho, Arroyo Las Positas, Alamo Canal, and Tassajara and Alameda Creeks.
Hazard Zones Policies	134	The County shall not approve new development in areas with potential natural hazards (flooding, geologic, wildland fire, or other environmental hazards) unless the County can determine that feasible measures will be implemented to reduce the potential risk to acceptable levels, based on site-specific analysis.
Airports Policies	148	The County shall work with cities to ensure that all new uses approved within the Livermore Airport Land Use Commission referral area are consistent with the Airport Land Use Commission Policy Plan.
	150	The County shall recognize the Byron (East Contra Costa County) Airport as a regional resource, and shall work with Contra Costa County to ensure that land uses approved in Alameda County within the Byron Airport's referral area are compatible with the airport's operations.
Solid Waste and Hazardous Waste Facilities	154	The County shall abide by the policies and Siting Criteria in the Alameda County Hazardous Waste Management Plan to ensure the responsible handling of hazardous waste in the County.
Transportation Systems		
General Transportation Goal General Transportation Policies	178 180	To create and maintain a balanced, multi-modal transportation system that provides for the efficient and safe movement of people, goods, and services. The county shall cooperate with cities and regional agencies to design transportation facilities and programs to accommodate East County Area Plan land uses. The County shall require that all new development in areas that are unincorporated as of the adoption of the East County Area Plan shall contribute their fair share towards the costs of transportation improvements shown on the Transportation Diagram, subject to confirmation in subsequent traffic studies, as a condition of project approval.

ALAMEDA COUNTY –
EAST COUNTY AREA PLAN (ECAP) GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
Transportation Systems (cont.)		
Transportation Demand Management	183	The County shall seek to minimize traffic congestion levels throughout the East County street and highway system.
	184	The County shall seek to minimize the total number of Average Daily Traffic (ADT) trips throughout East County.
	190	The County shall require new non-residential developments in unincorporated areas to incorporate Transportation Demand Management (TDM) measures and shall require new residential developments to include site plan features that reduce traffic trips such as mixed use development and transit-oriented development projects.
	193	The County shall ensure that new development pays for roadway improvements necessary to mitigate the exceedance of traffic Level of Service standards (as described below) caused directly by the development. The County shall further ensure that new development is phased to coincide with roadway improvements so that (1) traffic volumes on intercity arterials significantly affected by the project do not exceed Level of Service D on major arterial segments within unincorporated areas, and (2) that traffic volumes on Congestion Management Program designated roadways (e.g., Interstate Highways 580 and 680 and State Highway 84) significantly affected by the project do not exceed Level of Service E within unincorporated areas. If LOS E is exceeded, Deficiency Plans for affected roadways shall be prepared in conjunction with the Congestion Management Agency. LOS shall be determined according to Congestion Management Agency adopted methodology. The County shall encourage cities to ensure that these levels of Service standards are also met within unincorporated areas.
Streets and Highways Policies	194	The County shall require traffic impact studies for all detailed development plans (e.g., specific plans) and major projects to determine compliance with Level of Service standards.
Bicycle and Pedestrian Trails Programs	83 212	The County shall work with the East Bay Regional Park District and the Livermore Area Recreation and Park District to complete a regional trail system consistent with their respective Master Plans and shall work with Zone 7 to complete the trail system identified in its Arroyo Management Plan. The County shall create and maintain a safe and convenient pedestrian system that links residential, commercial, and recreational uses and encourages walking as an alternative to driving.
Public Services and Facilities		
Infrastructure and Services Policies	218	The County shall allow development and expansion of public facilities (e.g. parks and recreational facilities; schools; child care facilities; police, fire, and emergency medical facilities; solid waste, water, storm drainage, flood control, subregional facilities; utilities etc.) in appropriate locations inside and outside of the Urban Growth Boundary consistent with the policies and Land Use Diagram of the East County Area Plan.
Park and Recreational Facilities Policies	224	The County shall require new developments to provide trails consistent with EBRPD and LARPD regional trail plans.
Police, Fire, and Emergency Medical Services Policies	241	The County shall provide effective law enforcement, fire, and emergency medical services to unincorporated areas.
Solid Waste Facilities Goal Water Goal	243	The County shall require new developments to pay their fair share of the costs for providing police, fire, and emergency medical services and facilities. To ensure the safe and efficient disposal or recycling of wastes. To provide an adequate, reliable, efficient, safe, and cost-effective water supply to the residents, businesses, institutions, and agricultural uses in East County.
Water Policies	252	The County shall encourage Zone 7 to pursue new water supply sources and storage facilities only to the extent necessary to serve the rates and levels of growth established by the Initiative and by the general plans of the cities within its service area.

ALAMEDA COUNTY –
EAST COUNTY AREA PLAN (ECAP) GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
Public Services and Facilities (cont.)		
Water Policies (cont.)	253	The County shall approve new development only upon verification that an adequate, long-term, sustainable, clearly identified water supply will be provided to serve the development, including in times of drought.
Sewer Goals Utilities	254 285	The County shall encourage Zone 7 and local water retailers to require new developers to pay the full cost of securing, conveying, and storing new sources of water. To provide efficient and cost-effective sewer facilities and services. The County shall facilitate the provision of adequate gas and electric service and facilities to serve existing and future needs while minimizing noise, electromagenetic, and visual impacts on existing and future residents.
Environmental Health and Safety		
Noise Goals		To minimize East County residents' and workers' exposure to excessive noise.
Noise Policies	288 289	The County shall endeavor to maintain acceptable noise levels throughout East County. The County shall limit or appropriately mitigate new noise-sensitive development in areas exposed to projected noise levels exceeding 60 dB based on the *California Office of Noise Control Land Use Compatibility Guidelines*.
	290	The County shall require noise studies as part of development review for projects located in areas exposed to high noise levels and in areas adjacent to existing residential or other sensitive land uses. Where noise levels show that noise levels in areas of existing housing will exceed "normally acceptable" standards, major development projects shall contribute their prorated share to the cost of noise mitigation measures such as those described in Program 100[1].
Soils and Slope Stability Policies	307	The County shall encourage Zone 7, cities, and agricultural groundwater users to limit the withdrawal of groundwater in order to minimize the potential for land subsidence.
	308	The County shall not permit development within any area outside the Urban Growth Boundary exceeding 25 percent slopes to minimize hazards associated with slope instability.
Seismic and Geologic Hazards Policies	309	The County shall not approve new development in areas with potential for seismic and geologic hazards unless the County can determine that feasible measures can be implemented to reduce the potential risk to acceptable levels, based on site-specific analysis. The County shall review new development proposals in terms of the risk caused by seismic and geologic activity.
	310	The County, prior to approving new development, shall evaluate the degree to which the development could result in the loss of lives or property, both within the development and beyond its boundaries, in the event of a natural disaster.
	311	The County shall ensure that new major public facilities, including emergency response facilities (e.g., hospitals and fire stations), and water storage, wastewater treatment and communications facilities, are sited in areas of low geologic risk.
	312	The County shall ensure that new major transportation facilities and pipelines are designed, to the extent feasible, to avoid or minimize crossings of active fault traces and to accommodate fault displacement without major damage that could result in long-term disruption of service.
	313	The County shall require development in hilly areas to minimize potential erosion and disruption of natural slope stability which could result from grading, vegetation removal, irrigation, and drainage.

1 Program 100 is an East County Implementation Program for noise standards. Under Program 100, the County shall require the use of noise reduction techniques (such as buffers, building design modifications, lot orientation, soundwalls, earthberms, landscaping, building setbacks, and real estate disclosure notices) to mitigate noise impacts generated by transportation-related and stationary sources as specified in Figure 3.11-2.

ALAMEDA COUNTY –
EAST COUNTY AREA PLAN (ECAP) GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
Environmental Health and Safety (cont.)		
Seismic and Geologic Hazards Policies (cont.)	314	The County shall prohibit the construction of any structure intended for human occupancy within 50 feet on either side of the Calaveras, Greenville, or Verona earthquake fault zones as defined by the Alquist-Priolo Earthquake Fault Zoning Act.
	315	The County shall require that buildings be designed and constructed to withstand ground shaking forces of a minor earthquake without damage, of a moderate earthquake without structural damage, and of a major earthquake without collapse of the structure. The County shall require that critical facilities and structures (e.g., hospitals, emergency operations centers) be designed and constructed to remain standing and functional following an earthquake.
Seismic and Geologic Hazard Implementation Programs	111	The County shall delineate areas within East County where the potential for geologic hazards (including seismic hazards, landslides, and liquefaction) warrants preparation of detailed site specific geologic hazard assessments. Areas shall be delineated based upon data from published sources and field investigations. Maps shall be maintained and updated as new data become available. These maps shall not be used by the County to determine where hazardous conditions exist, but instead to identify the presence of conditions which warrant further study.
	112	The County shall develop detailed guidelines for preparation of site-specific geologic hazard assessments. These guidelines shall be prepared in consultation with the County Building Official, the County Engineer, County Geologist, County Counsel, and the County Risk Manager, and shall ensure that site-specific assessments for development requiring discretionary permits are prepared according to consistent criteria.
Fire Hazards Policies	319	The County shall adhere to the provisions of the Alameda County Fire Protection Master Plan and Fire Hazard Mitigation Plan.

SOURCE: Alameda County. 2002. *East County Area Plan.* As amended May 2002.

E-2 Contra Costa County

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS

Element		
3 - Land Use		
Policies for the Southeast County Area	3-68	Many of the specific policy statements of this plan support the concept of allowing for multiple uses, compatible with the predominantly agricultural watershed and public purposes of the area. The policies stress the need to preserve designated agricultural lands for agricultural use, and also to allow certain other uses in the area such as wind energy farms, mineral extraction, and reservoirs.
	3-69	The southeast area is almost exclusively planned for agricultural, watershed, or public purposes. New land uses within this plan area should be limited to those which are compatible to the primary agricultural and watershed purposes of the area (farming, ranching, poultry raising, animal breeding, aviaries, apiaries, horticulture, floriculture, and similar agricultural uses and structures) and consistent with the multiple use philosophy enumerated by this plan. Subject to specific project review and the policies listed within this plan, the following uses are generally consistent with the planned agricultural areas: a) Public and private outdoor recreational facilities; b) Dude ranches, riding academies, and stables; c) Wind energy conversion systems; d) Single family residences on larger lots; e) Mineral resources quarrying; f) Oil and gas wells; g) Pipelines and transmission lines; and h) Veterinarian offices and kennels. i) Public purpose uses including those uses described in policy 3-88 below (airport, reservoir)
	3-70	Southeastern Contra Costa County contains a range of natural and cultural resources which warrant special recognition in the General Plan. Mineral and meteorological resources exist which have the potential to be developed as additional uses within this essentially agricultural area. Multiple uses of the land which assist in its long-term protection as an agricultural area are to be encouraged. Policies regarding these specific natural and cultural resources are briefly summarized below. However, a more detailed discussion and additional policies should be referred to in other elements of this General Plan, separated into the following topics: • Wind turbine development or wind energy “farms” (policies are found in the Conservation Element); • Mineral resource areas (policies are found in the Conservation Element); • Archaeological and wildlife resources (policies are also found in the Conservation Element); • Contra Costa Water District reservoir(s) planned in this area (policies are found in the Public Facilities/Services Element); • General circulation uses (policies are found in the Transportation/Circulation Element); and • Policies and implementation measures regarding the wildlife and archaeological resources of the area are included in the Conservation Element. The southeastern portion of the County is blessed with archaeological and wildlife resources which are unique and worthy of long term protection and preservation. While in certain portions of the planning area multiple uses of the land may conflict with the need for environmental protection and enhancement, there are other areas where multiple use may reinforce preservation. As a practical matter, it should be recognized that historically it has been the agriculturalists who have protected the unique environmental resources of the area. Their continued efforts in this regard are critical to the long-range preservation of the area’s resources.

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
3 - Land Use (cont.)		
Policies for the Southeast County Area (cont.)	3-73	Public agencies are in the process of acquiring substantial portions of the planning area to serve the needs of the growing population of the East Bay. Two major public works projects have been approved that are reflected in this plan the East Contra Costa County Airport and the Los [sic] Vaqueros Reservoir. Each is discussed further in the Circulation Element and the Public Facilities/Services Element, respectively. The general location of the airport is shown on the land use element plan map. As the airport project proceeds, land developments in the area must take into account safety, noise, aviation easements, and preservation of the area’s agricultural and biological resources.
5 - Transportation and Circulation		
Roadway and Transit Goals	5-A	To provide a safe, efficient, and balanced transportation system.
	5-C	To balance transportation and circulation needs with the desired character of the community.
	5-D	To maintain and improve air quality standards.
	5-E	To permit development only in locations of the County where appropriate traffic level of service standards are ensured.
	5-G	To provide access to new development while minimizing conflict between circulation facilities and land uses.
Roadway and Transit Policies	5-2	Appropriately planned circulation system components shall be provided to accommodate development compatible with policies identified in the Land Use Element.
	5-4	Development shall be allowed only when transportation performance criteria are met and necessary facilities and/or programs are in place or committed to be developed within a specified period of time.
	5-5	Right of way shall be preserved to meet requirements of the Circulation Element and to serve future urban areas indicated in the Land Use Element.
	5-13	Physical conflicts between vehicular traffic, bicyclists, and pedestrians shall be minimized.
	5-16	Emergency response vehicles shall be accommodated in development project design.
	5-25	Planning and provision for a system of safe and convenient pedestrian ways, bikeways, and regional hiking trails shall be continued as a means of connecting community facilities, residential areas, and business districts as well as well as points of interest outside the communities utilizing existing public and semi-public right-of-way.
	5-30	Roads developed in hilly areas shall minimize disturbance of the slope and natural features of the land.
	5-34	Consolidation of utility/drainage/transportation corridors shall be considered, where appropriate.
Scenic Routes Goals	5-R	To identify, preserve and enhance scenic routes in the County.
Scenic Routes Policies	5-35	Scenic corridors shall be maintained with the intent of protecting attractive natural qualities adjacent to various roads throughout the county
	5-37	Scenic views observable from scenic routes shall be conserved, enhanced, and protected to the extent possible.
	5-43	Provide special protection for natural topographic features, aesthetic views, vista, hills and prominent ridgelines at “gateway” sections of scenic routes. Such “gateways” are located at unique transition points in topography or land use, and serve as entrances to regions of the County.

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
5 - Transportation and Circulation (cont.)		
Scenic Routes Policies (cont.)	5-44	Aesthetic design flexibility of development projects within a scenic corridor shall be encouraged.
Scenic Routes Implementation Measures	5-ak	Develop and enforce guidelines for development along scenic routes to maintain the visual quality of those routes.
	5-am	Consider the visual qualities and character of the corridor in reviewing plans for new roads, road improvements, or other public projects. This should include width, alignment, grade, slope and curvatures of traffic islands and side paths, drainage facilities, additional setbacks, and landscaping.
7 - Public Facilities/Services		
Water Service Goals	7-F	To assure potable water availability in quantities sufficient to serve existing and future residents.
	7-G	To encourage the development of locally controlled supplies to meet the growth needs of the County.
	7-H	To encourage the conservation of water resources available to the County and to the State.
	7-I	To protect and enhance the quality of the water supplied to County residents.
Water Service Policies	7-16	Water service systems shall be required to meet regulatory standards for water delivery, water storage and emergency water supplies.
	7-17	Water service agencies shall be encouraged to establish service boundaries and to develop supplies and facilities to meet future water needs based on the growth policies contained in the County and cities' General Plans.
	7-18	Water service agencies should generally be discouraged from constructing new water distribution infrastructure which exceeds future water needs based on the buildout projections of the County General Plan and city general plans.
	7-22	Water service agencies shall be encouraged to meet all regulatory standards for water quality prior to approval of any new connections to that agency.
Drainage and Flood Control Goals	7-O	To protect and enhance the natural resources associated with creeks and the Delta, and their riparian zones, without jeopardizing the public health, safety, and welfare.
	7-P	To protect creeks and riparian zones identified as valuable from damage caused by nearby development activity.
	7-Q	To employ alternative drainage systems improvements which rely on increased retention capacity to lessen or eliminate the need for structural modifications to watercourses, whenever economically possible.
	7-R	To enhance opportunities for public accessibility and recreational use of creeks, streams, drainage channels and other drainage system improvements.
Drainage and Flood Control Policies	7-38	Watershed management plans shall be developed which encourage the development of detention basins and erosion control structures in watershed areas to reduce peak stormwater flows, as well as to provide wildlife habitat enhancement.
	7-41	Aesthetic, environmental, and recreational benefits shall be taken into full consideration when determining the cost and benefits of alternative drainage system improvements.
	7-45	Onsite water control shall be required of major new developments so that no significant increase in peak flows occurs compared to the site's pre-development condition, unless the Planning Agency determines that offsite measures can be employed which are equally effective in preventing adverse downstream impacts expected from the development or the project is implementing an adopted drainage plan.

**CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)**

Element		
7 - Public Facilities/Services (cont.)		
Drainage and Flood Control Policies (cont.)	7-46	Regional detention basins shall be favored over smaller, onsite detention basins.
	7-51	Detention basins shall be designed for multiple uses such as parks and playing fields when not used for holding water, if liability and maintenance issues can be satisfactorily resolved.
	7-55	As appropriate and to the extent allowed by law, assess all new development projects at least $0.35 per square foot of improvements surface created. This drainage fee is to be collected through existing County Flood Control drainage area fee ordinances, newly adopted drainage area fee ordinances, existing and new assessment districts, or other financial entities. The fee may be applied to the cost of any developer-sponsored regional flood control improvements on- or offsite which mitigate the project's flooding impacts. Regional facilities are defined as systems sized to handle at least 15 cubic feet per second and suitable for public agency maintenance, i.e., 24 – inch diameter and larger storm drains.
	7-56	All residential and non-residential uses proposed in areas of special flood hazards, as shown on FEMA maps, shall conform to the requirements of County Floodplain management applied to all ordinances, approved entitlements (land use permits, tentative, final, and parcel maps, development plan permits, and variances) and ministerial permits (building and grading permits).
Drainage and Flood Control Implementation Measures	7-aa	Encourage gabion-type construction, instead of extensive riprap or concrete lining, to stabilize creek banks.
	7-ab	Utilize check dams and drop structures to control erosion within natural watercourses, where creek capacity and bank stability permits.
	7-ac	Utilize bypass culverts, detention basins, and floodplain easements acquisition, when such means are available, as alternatives to structural modifications of watercourses.
Fire Protection Goals	7-AD	To provide special fire protection for high-risk land uses and structures.
Fire Protection Policies	7-65	Needed upgrades to fire facilities and equipment shall be identified as part of project environmental review and area planning activities, in order to reduce fire risk and improve emergency response in the County.
	7-70	The effectiveness of existing and proposed fire protection facilities shall be maximized by incorporating analysis of optimum fire and emergency service access into circulation system design.
	7-71	A set of special fire protection and prevention requirements shall be developed for inclusion in development standards applied to hillside, open space, and rural area development.
	7-80	Wildland fire prevention activities and programs such as controlled burning, fuel removal, establishment of fire roads, fuel breaks and water supply, shall be encouraged to reduce wildland fire hazards.
	7-81	All structures located in Hazardous Fire Areas, as defined in the Uniform Fire Code, shall be constructed with fire resistant exterior materials, such as fire safe roofing, and their surroundings are to be irrigated and landscaped with fire resistant plants, consistent with drought resistance and water conservation policies.
Solid Waste Management Goals	7-AG	To reduce the amount of waste disposed of in landfills by: 1) reducing the amount of solid waste generated (waste reduction); 2) reusing and recycling as much of the solid waste as possible; 3) utilizing the energy and nutrient value of the solid waste (waste to energy composting); and 4) properly disposing of the remaining solid waste (landfill disposal).

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
7 - Public Facilities/Services (cont.)		
Solid Waste Management Goals (cont.)	7-AH	To divert as much waste as feasible from landfills through recovery and recycling.
Solid Waste Management Implementation Measures	7-bk	Require that all proposed solid waste management facilities manage truck traffic to minimize peak-hour trips; upgrade and improve identified pavement sections of roadway; limit facility hours of operation; manage access routes to facilities; and require mufflers on trucks and equipment.
8 - Conservation		
Vegetation and Wildlife Goals	8-D	To protect ecologically significant lands, wetlands, plant and wildlife habitats.
	8-E	To protect rare, threatened and endangered species of fish, wildlife and plants, significant plant communities, and other resources which stand out as unique because of their scarcity, scientific value, aesthetic quality or cultural significance. Attempt to achieve a significant net increase in wetland values and functions within Contra Costa County over the life of the General Plan. The definition of rare, threatened and endangered includes those definitions provided by the federal ESA, CESA, the California Native Plant Protection Act and CEQA.
	8-F	To encourage the preservation and restoration of the natural characteristics of the San Francisco Bay/Delta estuary and adjacent lands, and recognize the role of Bay vegetation and water area in maintaining favorable climate, air and water quality, and fisheries and migratory waterfowl.
Vegetation and Wildlife Policies	8-6	Significant trees, natural vegetation, and wildlife populations generally shall be preserved.
	8-7	Important wildlife habitats which would be disturbed by major development shall be preserved, and corridors for wildlife migration between undeveloped lands shall be retained.
	8-8	Significant ecological resource areas in Contra Costa County shall be identified and designated for compatible low-intensity land uses. Setback zones shall be established around the resource areas to assist in their protection.
	8-9	Areas determined to contain significant ecological resources, particularly those containing endangered species, shall be maintained in their natural state and carefully regulated to the maximum legal extent. Acquisition of the most ecologically sensitive properties within Contra Costa County by appropriate public agencies shall be encouraged.
	8-10	Any development located or proposed within significant ecological resource areas shall ensure that the resource is protected.
	8-11	The County shall utilize performance criteria and standards that seek to regulate uses in and adjacent to significant ecological resource areas.
	8-12	Natural woodlands shall be preserved to the maximum extent possible in the course of land development.
	8-13	The critical ecological and scenic characteristics of rangelands, woodlands, and wildlands shall be recognized and protected.
	8-14	Development on hillsides shall be limited to maintain valuable natural vegetation, especially forests and open grasslands, and to control erosion. Development on open hillsides and significant ridgelines throughout Contra Costa County shall be restricted, and hillsides with a grade of 26 percent or greater shall be protected through implementing zoning measures and other appropriate actions.
	8-15	Existing vegetation, both native and non-native, and wildlife habitat areas shall be retained in the major open space areas sufficient for the maintenance of a healthy balance of wildlife populations.

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
8 – Conservation (cont.)		
Vegetation and Wildlife Policies (cont.)	8-16	Native and/or sport fisheries shall be preserved and re-established in the streams within Contra Costa County wherever possible.
	8-17	The ecological value of wetland areas, especially the salt marshes and tidelands of the Bay and Delta, shall be recognized. Existing wetlands in Contra Costa County shall be identified and regulated. Restoration of degraded wetland areas shall be encouraged and supported whenever possible.
	8-19	The County shall actively oppose any and all efforts to construct a peripheral canal or any other water diversion system that reduces Delta water flows unless and until it can be conclusively demonstrated that such a system would, in fact, protect, preserve and enhance water quality and fisheries of the San Francisco Bay-Delta estuary system.
	8-21	The planting of native trees and shrubs shall be encouraged in order to preserve the visual integrity of the landscape, provide habitat conditions suitable for native wildlife, and ensure that a maximum number and variety of well-adapted plants are sustained in urban areas.
	8-22	Applications of toxic pesticides and herbicides shall be kept at a minimum and applied in accordance with the strictest standards designed to conserve all the living resources of Contra Costa County. The use of biological and other non-toxic controls shall be encouraged.
	8-24	The County shall strive to identify and conserve remaining upland habitat areas which are adjacent to wetlands and are critical to the survival and nesting of wetland species.
	8-25	The County shall protect marshes, wetlands, and riparian corridors from the effects of potential industrial spills.
	8-26	The environmental impacts of using poisons to control ground squirrel populations in grasslands shall be thoroughly evaluated by the County.
	8-27	Seasonal wetlands in grassland areas of Contra Costa County shall be identified and protected.
	8-28	Efforts shall be made to identify and protect Contra Costa County's mature native oak, bay, and buckeye trees.
Vegetation and Wildlife Implementation Measures	8-p	Cooperate with, encourage and support the plans of appropriate public agencies to acquire privately-owned lands in order to provide habitat protection for the maintenance of rare, threatened or endangered plant and animal species.
	8-q	Expand the range of uses or inclusion of land in the Agricultural Preserve Program to include "wildlife habitat area," in compliance with the amended Land Conservation Act of 1965, or the Open Space Easements Program.
	8-r	Encourage the revegetation of native grass species on lands which have been modified for agriculture, where appropriate.
	8-s	Require a demonstration that the eradication and control program is necessary to protect agricultural crops and Delta levees, or to prevent or control outbreak plague in an area, and require that the environmental impacts of the program upon other wildlife species are adequately analyzed and documented.
	8-u	Encourage the propagation of native oaks in foothill woodlands, where appropriate, by limiting cattle grazing to compatible light or moderate levels, and/or encouraging the replanting of native oak species. Proper planting and maintenance techniques are necessary to ensure the long term survival of newly establish oaks.
Agricultural Resources Goals	8-G	To encourage and enhance agriculture, and to maintain and promote a healthy and competitive agricultural economy.
	8-H	To conserve prime productive agricultural land outside the Urban Limit Line exclusively for agriculture.
	8-I	To minimize conflicts between agricultural and urban uses.

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
8 – Conservation (cont.)		
Agricultural Resources Goals (cont.)	8-J	To encourage cooperation between the County and cities in the preservation of agricultural lands.
Agricultural Resources Policies	8-29	Large contiguous areas of the County shall be encouraged to remain in agricultural production as long as economically viable.
	8-30	In order to reduce adverse impacts on agricultural and environmental values, and to reduce urban costs to taxpayers, the County shall not designate land located outside the ULL for an urban land use.
	8-31	Urban development in the future shall take place within the Urban Limit Line and areas designated by this plan for urban growth.
	8-32	Agriculture shall be protected to assure a balance in land use. The policies of Measure C -1990 shall be enforced.
	8-33	The County shall encourage agriculture to continue operating adjacent to developing urban areas.
	8-34	Urban developments shall be required to establish effective buffers between them and land planned for agricultural uses.
	8-35	Residents in or near agricultural areas shall be informed and educated regarding the potential nuisances and hazards associated with nearby agricultural practices.
	8-36	Agriculture shall be protected from nuisance complaints from non-agricultural land uses.
	8-37	The use of toxic and nutritive chemicals by agricultural operators shall be minimized.
	8-38	Agricultural operations shall be protected and enhanced through encouragement of Williamson Act contracts to retain designated areas in agricultural use.
	8-39	A full range of agriculturally-related uses shall be allowed and encouraged in agricultural areas.
	8-40	A 40-acre minimum parcel size for prime productive agricultural land (Class I and II soils per SCS Land Use Capability Classification) shall be established by the County for land outside the designated Urban Limit Line. To the extent feasible, the County shall enter into preservation agreements with cities in the County designed to preserve land for agriculture.
	8-41	The promotion and marketing of locally grown agricultural products shall be encouraged.
	8-42	The importance of the agricultural production, processing, and services industry within the County, shall be recognized, and agriculture shall be integrated into the County's overall economic development programs.
	8-43	The physical and service infrastructure, public and private, which supports agriculture shall be promoted.
	8-44	Agricultural processing and service businesses in agriculturally designated areas may be permitted.
	8-45	Efforts to assure an adequate, high quality, and fairly priced water supply to irrigated agricultural areas shall be supported.
	8-46	Maintenance and reconstruction of Delta levees shall be encouraged to ensure the continued availability of a valuable agricultural land protected by the existing network of levees and related facilities.
	8-47	The County shall ensure that its fiscal policies and practices provide the maximum lawful protection to owners of agricultural lands.
	8-48	Farm workers and farm family housing may be permitted in agricultural areas to meet the needs of locally employed transient and permanent farm workers and family farm workers. In addition to the 40-acre minimum parcel size, and preservation agreements, other standards and policies to protect the economic viability of agricultural land shall be established. These may include conservation easements, an agricultural soils trust fund, and agricultural mitigation fees.

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
8 – Conservation (cont.)		
Soil Resources Goals	8-P	To encourage the conservation of soil resources to protect their long-term productivity and economic value.
	8-Q	To promote and encourage soil management practices that maintain the productivity of soil resources.
Soils Resources Policies	8-63	Erosion control procedures shall be established and enforced for all private and public construction and grading projects.
	8-67	Lands having a prevailing slope above 26 percent shall require adequate special erosion control and construction techniques.
	8-68	Lands having a high erosion potential as identified in the Soil Survey shall require adequate erosion control methods for agricultural and other uses.
Soils Resources Implementation Measures	8-cd	Include erosion control measures for any discretionary project involving construction of grading near waterways or on lands with slopes exceeding 10 percent.
	8-cf	Require a soil conservation program to reduce soil erosion impacts for discretionary projects which could increase waterway or hillside erosion. Design improvements such as roads and driveways to retain natural vegetation and topography to the extent feasible.
Water Resources Goals	8-T	To conserve, enhance and manage water resources, protect their quality, and assure an adequate long-term supply of water for domestic, fishing, industrial and agricultural use.
	8-U	To maintain the ecology and hydrology of creeks and streams and provide an amenity to the public, while at the same time preventing flooding, erosion and danger to life and property.
	8-V	Preserve and restore natural waterways
	8-W	To employ alternative drainage system improvements which rely on increased retention capacity to lessen or eliminate the need for structural modifications to watercourses, whenever economically possible.
	8-X	To enhance opportunities for public accessibility and recreational use of creeks, streams, drainage channels and other drainage system improvements.
General Water Resources Policies	8-74	Preserve watersheds and groundwater recharge areas by avoiding the placement of potential pollution sources in areas with high percolation rates.
	8-75	Preserve and enhance the quality of surface and groundwater resources.
	8-78	Where feasible, existing natural waterways shall be protected and preserved in their natural state, and channels which already are modified shall be restored. A natural waterway is defined as a waterway which can support its own environment of vegetation, fowl, fish and reptiles, and which appears natural.
	8-79	Creeks and streams determined to be important and irreplaceable natural resources shall be retained in their natural state whenever possible to maintain water quality, wildlife diversity, aesthetic values, and recreation opportunities.
	8-80	Wherever possible, remaining natural watercourses and their riparian zones shall be restored to improve their function as habitats.
	8-81	Fisheries in the streams within the County shall be preserved and re-established wherever possible.
	8-82	Riparian habitat shall be protected by providing for channel cross-sections adequate to carry 100-year flows, as per policies contained in the Public Facilities/Services Element. If it is not possible to provide a channel cross-section sufficient to carry the 100-year flow, then detention basins should be developed.
	8-84	Riparian resources in the Delta and along the shoreline shall be protected and enhanced.
	8-85	Natural watercourses shall be integrated into new development in such a way that they are accessible and provide a positive visual element.

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
8 – Conservation (cont.)		
General Water Resources Policies (cont.)	8-86	Onsite water control shall be required of major new developments so that no increase in peak flows occurs relative to the site's pre-development condition, unless the Planning Agency determines that offsite measures can be employed which are equally effective in preventing adverse downstream impacts.
	8-89	Setback areas shall be provided along natural creeks and streams in areas planned for urbanization. The setback areas shall be of a width adequate to allow maintenance and to prevent damage to adjacent structures, the natural channel and associated riparian vegetation. The setback area shall be a minimum of 100 feet; 50 feet on each side of the centerline of the creek.
	8-91	Grading, filling and construction activity near watercourses shall be conducted in such a manner as to minimize impacts from increased runoff, erosion, sedimentation, biochemical degradation or thermal pollution.
Air Resources Goals	8-AA	To meet Federal Air Quality Standards for all air pollutants.
	8-AB	To continue to support Federal, State and regional efforts to reduce air pollution in order to protect human and environmental health.
Air Resources Policies	8-103	When there is a finding that a proposed project might significantly affect air quality, appropriate mitigation measures shall be imposed.
	8-104	Proposed projects shall be reviewed for their potential to generate hazardous air pollutants.
	8-105	Land uses which are sensitive to air pollution shall be separated from sources of air pollution.
9 - Open Space Element		
Overall Open Space Goals	9-A	To preserve and protect the ecological, scenic, and cultural/historic, and recreational resource lands of the County.
Overall Open Space Policies	9-2	Historic and scenic features, watersheds, natural waterways, and areas important for the maintenance of natural vegetation and wildlife populations shall be preserved and enhanced.
Scenic Resources Goals	9-10	Preserve and protect areas of identified high-scenic value, where practical, and in accordance with the Land Use Element map.
	9-11	Protect major scenic ridges, to the extent practical, from structures, roadways, or other activities which would harm their scenic qualities.
	9-12	To preserve the scenic qualities of the San Francisco Bay/Delta estuary system and the Sacramento/San Joaquin River Delta shoreline.
Scenic Resources Policies	9-14	High quality engineering of slopes shall be required to avoid soil erosion, downstream flooding, slope failure, loss of vegetative cover, high maintenance costs, property damages and damages to visual quality. Particularly vulnerable areas shall be avoided for urban development. Slopes of 26 percent or more should generally be protected and are generally not desirable for convention cut-and-fill pad development. Development on open hillsides and significant ridgelines shall be restricted.
	9-15	In order to conserve the scenic beauty of the County, developers shall generally be required to restore the natural contours and vegetation of the land after grading and other land disturbances. Public and private projects shall be designed to minimize damages to significant trees and other visual landmarks.
	9-18	In areas along major scenic ridges which are designated for open space use, the principals outlined in 9-19 through 9-26 shall apply.
	9-20 9-21	New power lines shall be located parallel to existing lines in order to minimize their visual impact. The construction of new structures on the top of major scenic ridges or within 50 feet of the ridgeline shall be discouraged.

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
9 - Open Space Element (cont.)		
Scenic Resources Policies (cont.)	9-22	When development is permitted to occur on hillsides, structures shall be located in a manner which is sensitive to available natural resources and constraints
	9-24	Any new development shall be encouraged to generally conform with natural contours to avoid excessive grading.
	9-25	All new land uses which are located below a major scenic ridge shall be reviewed with an emphasis on protecting the visual qualities of the ridge.
	9-28	Maintaining the scenic waterways of the County shall be ensured through public protection of the marshes and riparian vegetation along the shorelines and delta levees, as otherwise specified in this Plan.
Scenic Resource Implementation Measures	9-b	Carefully study and review and development projects which would have the potential to degrade the scenic qualities of major significant ridges in the County or the bay and delta shoreline.
	9-c	Develop hillside and ridgeline design guidelines to provide better guidance for development, particularly as it relates to grading, massing, and relationship of structures to ridgelines.
	9-d	Where possible, structures shall not be built on top of any designated scenic ridgeline.
	9-e	Develop and enforce guidelines for development along scenic waterways to maintain the visual quality of these areas.
Historic and Cultural Resource Goals	9-32	Areas which have identifiable and important archaeological or historic significance shall be preserved for such uses, preferably in public ownership.
	9-34	Development surrounding areas of historic significance shall have compatible and high quality design in order to protect and enhance the historic quality of the area.
Parks and Recreation Facilities Policies	9-36	To develop a sufficient amount of conveniently located, properly designed park and recreational facilities to serve the needs of all residents.
	9-37	To develop a system of interconnected hiking, riding, and bicycling trails and paths suitable for both active recreational use and for the purpose of transportation/circulation.
	9-38	To promote active and passive recreational enjoyment of the County's physical amenities for the continued health, safety, and welfare of the citizens of the County.
	9-39	To achieve a level of park facilities of four acres per 1,000 population.
	9-40	Major park lands shall be reserved to ensure that the present and future needs of the County's residents will be met and to preserve areas of natural beauty or historical interest for future generations. Apply the parks and recreation performance standards in the Growth Management Element.
	9-43	Regional-scale public access to scenic areas on the waterfront shall be protected and developed, and water-related recreation, such as fishing, boating, and picnicking, shall be provided.
	9-46	Public trail facilities shall be integrated into the design of flood control facilities and other public works whenever possible.
	9-47	Recreational development shall be allowed only in a manner which complements the natural features of the area, including the topography, waterways, vegetation, and soil characteristics.
Park and Recreation Facilities Implementation Measures	9-v	Develop a comprehensive and interconnected series of hiking, biking and riding trails in conjunction with cities, special districts, public utilities and county service areas.

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
10 - Safety Element		
Seismic Hazard Goals	10-B	To reduce to a practical minimum injuries and health risks resulting from the effects of earthquake ground shaking on structures, facilities, and utilities.
Seismic Hazard Policies	10-4	In areas prone to severe levels of damage from ground shaking (i.e., Zone IV on Map 10-4), where the risks to life and investments are sufficiently high, geologic-seismic and soils studies shall be required as a precondition for authorizing public or private construction.
	10-5	Staff review of applications for development permits and other entitlements, and review of applications to other agencies which are referred to the County, shall include appropriate recommendations for seismic strengthening and detailing to meet the latest adopted seismic design criteria.
	10-6	Structures for human occupancy, and structures and facilities whose loss would substantially affect the public safety or the provision of needed services, shall not be erected in areas where there is a high risk of severe damage in the event of an earthquake.
	10-7	The County should encourage cooperation between neighboring government agencies and public and private organizations to give appropriate attention to seismic hazards to increase the effectiveness of singular and mutual efforts to increase seismic safety.
	10-12	Prohibit construction of structures for human occupancy, and structures whose loss would affect the public safety or the provision of needed services, over the trace of an active fault.
	10-13	In areas where active or inactive earthquake faults have been identified, the location and/or design of any proposed buildings, facilities, or other development shall be modified to mitigate possible danger from fault rupture or creep.
	10-14	Preparation of a geologic report shall be required as a prerequisite before authorization of public capital expenditures or private development projects in areas of known or suspected faulting.
	10-15	To the extent practicable, the construction of structures requiring a high degree of safety and other critical structures shall not be allowed in an active or potentially active fault zone.
	10-16	When such a critical structure must be located in a fault zone, the structure shall be carefully sited, designed and constructed to withstand the anticipated earthquake stresses.
	10-18	This General Plan shall discourage urban or suburban development in areas susceptible to high liquefaction dangers and where appropriate subject to the policies in 10-20 below, unless satisfactory mitigation measures can be provided, while recognizing that there are low intensity uses such as water-related recreation and agricultural uses that are appropriate in such areas. (For the Bethel Island Area, the adopted specific plan policies will apply.)
	10-19	To the extent practicable, the construction of critical facilities, structures involving high occupancies, and public facilities shall not be sited in areas identified as having a high liquefaction potential, or in areas underlain by deposits classified as having a high liquefaction potential.
	10-20	Any structures permitted in areas of high liquefaction danger shall be sited, designed and constructed to minimize the dangers from damage due to earthquake-induced liquefaction.
	10-21	Approvals to allow the construction of public and private development projects in areas of high liquefaction potential shall be contingent on geologic and engineering studies which define and delineate potentially hazardous geologic and/or soils conditions, recommend means of mitigating these adverse conditions; and on proper implementation of the mitigation measures.
Seismic Hazard Implementation Measures	10-c	Require comprehensive geologic and engineering studies for any critical structure, whether or not it is located within a Special Studies Zone.

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
10 - Safety Element		
Seismic Hazard Implementation Measures (cont.)	10-d	Through the environmental review process, require geologic, seismic, and/or soils studies as necessary to evaluate proposed development in areas subject to groundshaking, fault displacement, or liquefaction.
	10-e	Evaluate and, where necessary, upgrade water distribution, sewage disposal, gas and electricity, communications and other service facilities in areas subject to seismic hazards.
Ground Failure and Landslide Hazard Goals	10-E	To minimize the risk of loss of life or injury due to landslides, both ordinary and seismically-induced.
	10-F	To minimize economic losses and social disruption from landslides, both ordinary and seismically-induced.
Ground Failure and Landslide Hazard Policies	10-22	Slope stability shall be a primary consideration in the ability of land to be developed or designated for urban uses.
	10-23	Slope stability shall be given careful scrutiny in the design of developments and structures, and in the adoption of conditions of approval and required mitigation measures.
	10-24	Proposed extensions of urban or suburban land uses into areas characterized by slopes over 15 percent and/or generally unstable land shall be evaluated with regard to the safety hazard prior to the issuance of any discretionary approvals. Development on very steep open hillsides and significant ridgelines throughout the County shall be restricted, and hillsides with a grade of 26 percent or greater shall be protected through implementing zoning measures and other appropriate actions.
	10-26	Approvals of public and private development projects in areas subject to slope failures shall be contingent on geologic and engineering studies which define and delineate potentially hazardous conditions and recommend adequate mitigation.
	10-27	Soil and geologic reports shall be subject to the review and approval of the County Planning Geologist.
	10-29	Significant very steep hillsides shall be considered unsuitable for types of development which require extensive grading or other land disturbance.
	10-30	Development shall be precluded in areas when landslides cannot be adequately repaired.
Ground Failure and Landslide Hazard Implementation Measures	10-p	Refer development proposals in areas of potential land instability or geologic hazards to a registered engineering geologist for review and recommendation.
	10-q	Through the environmental review process, require geologic and engineering studies as necessary to evaluate proposed development in areas subject to potential landslide hazards.
Flood Hazard Goals	10-G	To ensure public safety by directing development away from areas which may pose a risk to life from flooding, and to mitigate flood risks to property.
	10-H	To mitigate the risk of flooding and hazards to life, health, structures, transportation and utilities due to subsidence, especially in the San Joaquin-Sacramento Delta area.
General Policies	10-33	The areas designated on Figure 10-8 shall be considered inappropriate for conventional urban development due to unmitigated flood hazards as defined by FEMA. Applications for development at urban or suburban densities in areas where there is a serious risk to life shall demonstrate appropriate solutions or be denied.
	10-34	In mainland areas affected by creeks, development within the 100-year flood plain shall be limited until a flood management plan can be adopted, which may include regional and local facilities if needed. The riparian habitat shall be protected by providing a cross section of channel suitable to carry the 100-year flow. Flood management shall be accomplished within the guidelines contained in the Open Space/Conservation Element.

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
10 - Safety Element (cont.)		
General Policies (cont.)	10-38	Flood-proofing of structures shall be required in any area subject to flooding; this shall occur both adjacent to watercourses as well as in the Delta or along the waterfront.
	10-55	The potential effects of dam or levee failure are so substantial that geological and engineering investigation shall be warranted as a prerequisite for authorizing public and private construction of either public facilities or private development in affected areas.
Flood Hazard Policies	10-58	Dams and levees should be designed to withstand the forces of anticipated (design) earthquakes at their locations.
	10-59	Important dams and coastal levees shall be regarded as critical facilities that should not be sited over the trace of an active or potentially active fault.
Flood Hazard Implementation Measures	10-s	Revise the creek setback ordinance for residential and commercial structures in order to prevent property damages from bank failure along natural water courses.
Hazardous Materials Goals	10-I	To provide public protection from hazards associated with the use, transport, treatment and disposal of hazardous substances.
Hazardous Materials Policies	10-61	Hazardous waste releases from both private companies and from public agencies shall be identified and eliminated.
	10-62	Storage of hazardous materials and wastes shall be strictly regulated.
	10-63	Secondary containment and periodic examination shall be required for all storage of toxic materials.
Water Supply Goals	10-J	To ensure a continuous supply of safe water to county residents.
	10-K	To protect the quality, quantity, and productivity of water resources as vital resources for maintaining the public, ecological and economic health of the region.
	10-L	The safety of valuable underground water supplies for present and future users shall be ensured by preventing contamination.
Water Supply Policies	10-71	The County shall support local, regional, State, and Federal government efforts to improve water quality.
	10-72	The County shall support water quality standards adequate to protect public health in importing areas as a priority at least equal in status to support of Bay/Delta estuary water standards.
	10-73	Point sources of pollution shall be identified and controlled to protect adopted beneficial uses of water.
	10-74	Public ownership of lands bordering reservoirs shall be encouraged to safeguard water quality.
	10-81	New water storage reservoirs shall be encouraged in appropriate locations subject to adequate mitigation of environmental impacts.
Water Supply Implementation Measures	10-al	Encourage all water districts in their efforts to provide water supply safety for emergency and disaster uses by the most practicable means.
Public Protection Services and Disaster Planning Implementation Measures	10-as	Require projects which encroach into areas which are determined to have a high or extreme fire hazard, or which incorporate wildfire hazard areas, to be reviewed by the appropriate Fire Bureau to determine if special fire prevention measures are advisable.
11 - Noise Element		
Goals	11-A	To improve the overall environment in the County by reducing annoying and physically harmful levels of noise for existing and future residents and for all land uses.
	11-B	To maintain appropriate noise conditions in all areas of the County.

CONTRA COSTA COUNTY –
GENERAL PLAN GOALS, POLICIES, AND PROGRAMS (Continued)

Element		
11 - Noise Element		
Goals (cont.)	11-C	To ensure that new developments will be constructed so as to limit the effects of exterior noise on the residents.
	11-D	To recognize the economic impacts of noise control and encourage an equitable distribution of these costs.
	11-E	To recognize citizen concerns regarding excessive noise levels, and to utilize measures through which the concerns can be identified and mitigated.
Policies	11-1	New projects shall be required to meet acceptable exterior noise level standards as established in the Noise and Land Use Compatibility Guidelines contained in Figure 11-6. These guidelines, along with the future noise levels shown in the future noise contours maps, should be used by the county as a guide for evaluating the compatibility of “noise sensitive” projects in potentially noisy areas.
	11-2	The standard for outdoor noise levels in residential areas is a DNL of 60 dB. However, a DNL of 60 dB or less may not be achievable in all residential areas due to economic or aesthetic constraints. One example is small balconies associated with multi-family housing. In this case, second and third story balconies may be difficult to control to the goal. A common outdoor use area that meets the goal can be provided as an alternative.
	11-6	If an area is currently below the maximum “normally acceptable” noise level, an increase in noise up to the maximum should not be allowed necessarily.
	11-7	Public projects shall be designed and constructed to minimize long-term noise impacts on existing residents.
	11-8	Construction activities shall be concentrated during the hours of the day that are not noise-sensitive for adjacent land uses and should be commissioned to occur during normal work hours of the day to provide relative quiet during the more sensitive evening and early morning periods.
	11-11	Noise impacts upon the natural environment, including impacts on wildlife, shall be evaluated and considered in review of development projects.
Implementation Measures	11-e	Noise mitigation features shall be incorporated into the design and construction of new projects or be required as conditions of project approval.

SOURCE: Contra Costa County. 2005a. *General Plan 2005-2020*. January 18, 2005.

E-3 Byron Airport Policies

Contra Costa County Airport Land Use Compatibility Plan

The following policies apply to the compatibility zones around Byron Airport:

6.3 Compatibility Zone 'B1' Criteria

6.3.2 Nonresidential Development

(a) Except as indicated in Byron Airport Policy 6.9.1, nonresidential uses within Compatibility Zone B1 shall be limited to:

(1) An average intensity of no more than 25 people per gross acre on the site at any time.

(2) A maximum intensity on any single acre (measured as a square) of no more than 50 people at any time.

(3) In no case shall a proposed development be designed to accommodate more than the average number of people per acre indicated in Paragraph (1) above times the gross acreage of the project site. A project site may include multiple parcels.

(b) Multi-story retail uses, fast-food establishments, large shopping centers (500,000 or more square feet), theaters, motels, and similar uses typically do not comply with the above intensity criteria, but are acceptable if the usage is limited through building design, use permit, and/or other mechanisms.

(c) Buildings shall be located as far as practical from the extended runway centerline and shall be limited to a maximum of two stories in height.

6.3.3 Uses Specifically Prohibited — The following uses are prohibited regardless of their usage intensity:

(a) Children's schools and day care centers.

(b) Hospitals and nursing homes.

(c) Aboveground bulk storage of hazardous materials with the exception of:

(1) On-airport storage of aviation fuel and other aviation-related flammable materials.

(2) Up to 2,000 gallons of nonaviation flammable materials.

(d) Highly noise-sensitive uses (for example, outdoor theaters).

6.3.4. Height Limitations — Unless a specific exemption is granted (see Countywide Policy 4.3.2.), the height of objects within *Compatibility Zone B1* shall be limited in accordance with the Byron Airport Airspace Protection Surfaces drawing (Figure 4A).

(a) Generally, there is no concern with regard to any object up to 35 feet tall.

(b) ALUC review is required for any proposed object taller than 35 feet.

6.3.5. Other Development Conditions — Proposed development within *Compatibility Zone B1* shall meet the following additional conditions:

(a) Open land characteristics as described in Byron Airport Policy 6.9.4 shall be provided on at least 30% of the land within Compatibility Zone B1.

(b) Dedication of an avigation easement to Contra Costa County shall be required as a condition for approval of any development in this zone. See Countywide Policy 4.3.3.

6.4 Compatibility Zone 'B2' Criteria

6.4.2. Nonresidential Development

(a) Except as indicated in Byron Airport Policy 6.9.1, nonresidential uses within *Compatibility Zone B2* shall be limited to:

(1) An average intensity of no more than 50 people per gross acre on the site at any time.

(2) A maximum intensity on any single acre (measured as a square) of no more than 100 people at any time.

(3) In no case shall a proposed development be designed to accommodate more than the average number of people per acre indicated in Paragraph (1) above times the gross acreage of the project site. A project site may include multiple parcels.

(b) Fast-food establishments, large shopping centers (500,000 or more square feet), theaters, motels, and similar uses typically do not comply with these intensity criteria, but are acceptable if the usage is limited through building design, use permit, and/or other mechanisms.

6.4.3. Uses Specifically Prohibited — The following uses are prohibited regardless of their usage intensity:

(a) Children's schools and day care centers.

(b) Hospitals and nursing homes.

(c) Aboveground bulk storage of hazardous materials with the exception of:

(1) On-airport storage of aviation fuel and other aviation-related flammable materials.

(2) Up to 2,000 gallons of nonaviation flammable materials.

(d) Highly noise-sensitive uses (for example, outdoor theaters).

6.4.4. Height Limitations — Unless a specific exemption is granted (see Countywide Policy 4.3.2.), the height of objects within *Compatibility Zone B2* shall be limited in accordance with the Byron Airport Airspace Protection Surfaces drawing (Figure 4A).

(a) Generally, there is no concern with regard to any object up to 70 feet tall unless it is located on high ground or it is a solitary object (e.g., an antenna) more than 35 feet taller than other nearby objects.

(b) ALUC review is required for any proposed object taller than 70 feet.

6.4.5. Other Development Conditions — Proposed development within *Compatibility Zone B2* shall meet the following additional conditions:

(a) Open land characteristics as described in Byron Airport Policy 6.9.4 shall be provided on at least 20% of the land within Compatibility Zone B2.

(b) A deed notice shall be required as a condition for approval of any development in this zone. See Countywide Policy 4.4.3.(b) "Buyer Awareness Measures – Deed notices."

6.5 Compatibility Zone 'C1' Criteria

6.5.2. Nonresidential Development

(a) Except as indicated in Byron Airport Policy 6.9.1, nonresidential uses within Compatibility Zone C1 shall be limited to:

  (1) An average intensity of no more than 100 people per gross acre on the site at any time.

  (2) A maximum intensity on any single acre (measured as a square) of no more than 300 people at any time.

  (3) In no case shall a proposed development be designed to accommodate more than the average number of people per acre indicated in Paragraph (1) above times the gross acreage of the project site. A project site may include multiple parcels.

(b) Large shopping centers (500,000 or more square feet), theaters, stadiums, multistory motels or hotels with conference centers, and similar uses typically do not comply with these intensity criteria, but are acceptable if the usage is limited through building design, use permit, and/or other mechanisms.

6.5.3. Uses Specifically Prohibited — The following uses are prohibited regardless of their usage intensity:

(a) Children's schools.

(b) Hospitals and nursing homes.

6.5.4. Height Limitations — Unless a specific exemption is granted (see Countywide Policy 4.3.2.), the height of objects within *Compatibility Zone C1* shall be limited in accordance with the Byron Airport Airspace Protection Surfaces drawing (Figure 4A).

(a) Generally, there is no concern with regard to any object up to 100 feet tall unless it is located on high ground or it is a solitary object (e.g., an antenna) more than 35 feet taller than other nearby objects.

(b) ALUC review is required for any proposed object taller than 100 feet.

6.5.5. Other Development Conditions — Proposed development within *Compatibility Zone C1* shall meet the following additional conditions:

(a) Open land characteristics as described in Byron Airport Policy 6.9.4 shall be provided on at least 10% of the land within *Compatibility Zone C1*.

(b) A deed notice shall be required as a condition for approval of any new residential development in this zone. See Countywide Policy 4.4.3.(b) “Buyer Awareness Measures – Deed notices”.

6.6 Compatibility Zone ‘C2’ Criteria

6.6.2. Nonresidential Development — See criteria for *Compatibility Zone C1*.

6.6.3. Uses Specifically Prohibited — See criteria for *Compatibility Zone C1*.

6.6.4. Height Limitations — See criteria for *Compatibility Zone C1*.

6.6.5. Other Development Conditions — See criteria for *Compatibility Zone C1*.

6.7 Compatibility Zone ‘D’ Criteria

6.7.2. Nonresidential Development — Allowable intensities for nonresidential activities are not limited.

6.7.3. Uses Specifically Prohibited — No uses are specifically prohibited.

6.7.4. Height Limitations — See criteria for *Compatibility Zone C1*.

6.7.5. Other Development Conditions — None.

6.9 Compatibility Criteria – All Zones

6.9.1 Usage Intensity Exceptions — The intensity (people per acre) limits for nonresidential uses cited in the preceding policies may be exceeded under the following circumstances:

(a) The buildings incorporate special risk-reduction design features in accordance with Countywide Policy 4.2.4, “Risk Reduction Through Building Design”. In such cases, an intensity bonus of up to 1.5 times the basic intensity criterion may be permitted. Specifically:

(1) A maximum of 75 people per single acre within *Compatibility Zone B1*.

(2) A maximum of 150 people per single acre within *Compatibility Zone B2*.

(3) A maximum of 450 people per single acre within *Compatibility Zones C1* or *C2*.

(b) During rare special events. Rare special events are ones (such as an air show at the airport) for which a facility is not designed and normally not used and for which extra safety precautions can be taken as appropriate.

6.9.2. Acceptable Noise Exposures for Residential and Other Land Uses — The acceptable levels of airport-related noise exposure for proposed land use development in the airport environs are taken into account in the compatibility zone criteria listed above.

(a) The noise compatibility criteria specifically applicable to evaluation of future development near Byron Airport are indicated in Table 4A. Table 4A is intended to serve as an additional reference in instances where specific noise compatibility issues are apparent, but not fully addressed by the preceding compatibility zone criteria.

(b) The extent of outdoor activity associated with a particular land use is an important factor to be considered in evaluating its compatibility with airport noise, particularly for those uses listed in Table 4A as “marginally acceptable.”

(c) For the purposes of evaluating the noise compatibility of proposed land uses in the Byron Airport vicinity, the projected cumulative noise contours depicted in Figure 4C shall be used.

6.9.3. Hazards to Flight — No land use which would result in an increased attraction of birds or would create a visual or electronic hazard to flight shall be permitted anywhere within the Byron Airport influence area. (See Countywide Policy 4.3.6. "Other Flight Hazards")

References – E-3 Byron Airport Policies

Contra Costa County Airport Land Use Commission, 2000. *Contra Costa County Airport Land Use Compatibility Plan*. December 13, 2000.

E-4 CCWD Policies Re: Recreation

CCWD – RECREATION PROGRAM GOALS, POLICIES, OBJECTIVES

Element		
Ordinance 01-01		
Article 3 – Protection of Persons, Resources and Property	3.11	Unlawful to operate a vessel without a permit.
	3.27	Unlawful to make body or clothing contact with water in any District water body
	3.29	Unlawful to permit any animal to come into bodily contact with any water body.
	3.35	Unlawful to make a fire, have a barbecue or operate a campstove on District property except at designated locations.
	3.41	Unlawful to hunt on District property.
	3.50	Unlawful to consume alcoholic beverages on District property.
	3.86	Unlawful to moor or dock a vessel on the eastern shoreline of Los Vaqueros Reservoir.
	3.113	Unlawful to operate a kayak, canoe, rowing scull or racing shell without a permit.
	3.114	Unlawful to hang-glide, parachute, para-sail or engage in any human flight on, over, or onto District lands except by written permission of the District.

SOURCE: CCWD, 2001. Ordinance 01-01 of the Contra Costa Water District Board of Directors, 2001.

Watershed Management Program		
Goal D	Recreation and Public Access	Provide recreation facilities and programs and public access at reasonable cost that are distributed equitably among users.
Objectives	D1	Provide opportunities for both passive and active recreational uses.
	D2	Provide recreational activities, including water-based recreation, within the watershed at a level consistent with maintaining the District's primary water quality and reliability goals.
	D3	Stage development of recreational facilities and programs to ensure cost-effectiveness and affordability.
	D4	Provide opportunity for recreational activities and programs that conform with the standards of the Americans with Disabilities Act.
	D5	Provide recreational facilities and programs that are designed, operated and maintained in a safe manner.
	D6	Provide recreational facilities and programs that are consistent with the protection of the watershed's natural and cultural resources.
	D7	Incorporate unique features of the watershed into recreation use areas in a manner consistent with the protection of such resources.
	D8	Provide recreational facilities and programs that are compatible with continued operation of wind farms and agricultural uses.
	D9	Provide a trail network within the watershed that has connections to regional trails.
	D10	Establish and manage trails for pedestrians, bicyclists and equestrians in a manner that minimizes conflicts among trail users and impacts on natural and cultural resources.
	D11	Provide recreational facilities and programs that minimize impacts on neighbors and surrounding communities.

CCWD – RECREATION PROGRAM GOALS, POLICIES, OBJECTIVES (Continued)

Element		
Watershed Management Program (cont.)		
Objectives (cont.)	D12	Coordinate with appropriate transit providers to extend public transit service into the Los Vaqueros watershed.
	D13	Identify alternative methods for allocating the costs of recreational facilities and uses equitably among users.

SOURCE: Brady and Associates, 1997*Final Watershed Management Program. Los Vaqueros Resources Management Plan.* May. Berkeley California. Report prepared for Contra Costa Water District, Concord, California.

Resource Management Plan		
Guiding Policies	R-1	No swimming or sports that entail body contact with reservoir water. These sports include water skiing, jet skiing, para-sailing, windsurfing, and snorkeling and scuba diving.
	R-2	No gas-powered boats based on water quality risks associated with fuel additives.
	R-3	No motorized off-road vehicles because of erosion potential, water pollution and noise.
	R-4	No dogs in watershed due to erosion potential, microbial contaminants and habitat protection.
	R-5	No introduction of domesticated animals to prevent interference with and mortality of native species.
	R-6	No hunting due to public safety risks within the watershed and in adjacent properties.
	R-7	No access to watershed areas between Los Vaqueros Road and Vasco Road due to property ownership and land use issues, protection of water quality, steep terrain, and protection of biological and cultural resources.
	R-8	Paved, public vehicular road access from the west through EBRPD lands will not be allowed.
	R-9	No access to eastern portions of watershed due to protection of biological resources, public safety, and land use issues.
Operating Policies	R-10	Reservoir management and operations for supply of drinking water shall take precedence over recreation uses.
	R-19	Make reasonable accommodations for disabled persons in compliance with the Americans with Disabilities Act legislation wherever possible.
	R-20	Pursue and establish partnerships with volunteer groups, adjacent recreation districts, and nonprofit organizations.
	R-21	Pursue contracts with concessionaires for operation of recreation facilities.
	R-23	Coordinate with other agencies for fire suppression responsibilities.
	R-24	Establish an education, interpretive and community outreach program for the watershed. Interpretation of the watershed resources shall be incorporated into the design of the Visitor Interpretive Center.
	R-25	Incorporate water conservation measures into planning and design of facilities.
	R-27	Prepare an infrastructure and utilities plan as part of the design and construction of the recreation program.
Trails Program Policies	T-2	No horseback riding, hiking or bicycling off designated trails.
	T-3	Coordinate with EBRPD and LARPD regarding management of regional trails.
	T-4	Institute a trails permit system designed to educate users about watershed and resource protection.

CCWD – RECREATION PROGRAM GOALS, POLICIES, OBJECTIVES (Continued)

Resource Management Plan (cont.)		
Trails Program Policies (cont.)	T-6	Institute a multiple-use trails pilot program, including evaluation criteria for operating, maintaining, patrolling and monitoring trails.
	T-7	Improve existing trails, develop new trails, and maintain all trails to minimize erosion and other impacts to water quality in the watershed. Trails should be set back a minimum of 100 feet from the reservoir to minimize sediment transport.
	T-8	Only permit equestrian and bicycle use when they would not contribute to erosion and trail degradation as determined by watershed staff.
	T-13	To mitigate impacts on fenced wetland mitigation areas where seasonal grazing occurs, CCWD shall reroute trails during the design phase wherever possible to pass outside of but adjacent to the fence line of mitigation areas, giving visitors views of the areas.
Fishing Program Policies	FI-2	Fishing shall be permitted in designated reservoir areas only during posted park operating hours. A per-day-per-person fish catch limit shall be established and enforced by CCWD.
	FI-5	CCWD shall identify best management practices for… allowable shoreline fishing operations and fish cleaning.
Boating Program Policies	BP-3	Boating may be restricted by Watershed staff when winds exceed 15 miles per hour, or if recreation staff determine that other unsafe climatic conditions warrant restrictions.
	BP-4	To protect water quality from microbial contamination and shoreline erosion: post signs prohibiting body contact activities; provide restroom facilities; prohibit shoreline access by boaters except at marina docks, fishing piers and at designated shoreline areas. Mooring is not permitted.
	BP-7	For safety and habitat protection purposes, boating shall be prohibited in the following areas: within 1,500 feet of the dam, intake and spillway structures at the north end of the reservoir and in designated wildlife habitat areas.
Recreation and Public Access Goals	D1	Provide opportunities for both passive and active recreational uses.
	D2	Provide recreational activities, including water-based recreation, within the watershed at a level consistent with maintaining the District's primary water quality and reliability goals.
	D3	Stage development of recreational facilities and programs to ensure cost-effectiveness and affordability.
	D4	Provide opportunity for recreational activities and programs that conform with the standards of the Americans with Disabilities Act.
	D5	Provide recreational facilities and programs that are designed, operated and maintained in a safe manner.
	D6	Provide recreational facilities and programs that are consistent with the protection of the watershed's natural and cultural resources.
	D7	Incorporate unique features of the watershed into recreation use areas in a manner consistent with the protection of such resources.
	D8	Provide recreational facilities and programs that are compatible with continued operation of wind farms and agricultural uses.
	D9	Provide a trail network within the watershed that has connections to regional trails.
	D10	Establish and manage trails for pedestrians, bicyclists and equestrians in a manner that minimizes conflicts among trail users and impacts on natural and cultural resources.
	D11	Provide recreational facilities and programs that minimize impacts on neighbors and surrounding communities.
	D12	Coordinate with appropriate transit providers to extend public transit service into the Los Vaqueros watershed.

SOURCE: Brady/LSA, 1999 *Los Vaqueros Resource Management Plan*. In conjunction with Jones & Stokes Associates, la Cuesta Consulting, Rem & Associates, Montgomery Watson, Wilbur Smith Associates, Sonoma State University, Economics Research Associates, 2M Associates. Submitted to Contra Costa Water District, Concord, California.

APPENDIX F

EIS/EIR Distribution List

The public distribution of the Los Vaqueros Reservoir Expansion Project Draft EIS/EIR emphasizes the use of electronic media to ensure cost-effective, broad availability to the public and interested parties. The Draft EIS/EIR is available on the Internet at the CCWD project website, www.lvstudies.com, and the Reclamation project website, www.usbr.gov/mp/vaqueros. The Draft EIS/EIR is also available for review at the locations listed below.

All persons, agencies, and organizations listed in this chapter will be informed of the availability of and locations to obtain the Draft EIS/EIR, as well as the timing of the 60-day public/agency comment period. Parties listed below will receive either the full Draft EIS/EIR and an electronic copy of the appendices, or the executive summary and an electronic copy of the Draft EIS/EIR and appendices.

Document Availability

Copies of the Draft EIS/EIR are available for public review at the following locations:

Contra Costa Water District

1331 Concord Avenue
Concord, CA 94520

Bureau of Reclamation

2800 Cottage Way
Sacramento, CA 95825

Antioch Public Library

501 W. 18th Street
Antioch, CA 94509

Brentwood Public Library

751 Third Street
Brentwood, CA 94513

Concord Public Library

2900 Salvio Street
Concord, CA 94519

Dublin Public Library

200 Civic Plaza
Dublin, CA 94568

Livermore Civic Center Library

1188 South Livermore Avenue
Livermore, CA 94550

Agencies and Organizations Receiving Copies of the Draft EIS/EIR

Copies of the Draft EIS/EIR were sent to the following agencies and organizations:

Federal and State Agencies

California Bay-Delta Authority
California Department of Boating and Waterways
California Department of Conservation
California Department of Fish and Game (Regions 2 and 3)
California Department of Health Services
California Department of Parks and Recreation
California Department of Transportation (Districts 4 and 10)
California Department of Transportation, Division of Aeronautics
California Department of Water Resources
California Department of Water Resources, Division of Safety of Dams
California Environmental Protection Agency
California Natural Resources Agency
California Regional Water Quality Control Board (Region 2 and Region 5)
California State Lands Commission
California State Water Resources Control Board (Water Quality and Water Rights)
Central Valley Flood Protection Board
Delta Protection Commission
Federal Aviation Administration
Native American Heritage Commission
National Marine Fisheries Service (Central Valley Area and Southwest Division)
Natural Resources Conservation Service
Office of Historic Preservation
Office of Planning and Research, State Clearinghouse
U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service (Sacramento Office)
U.S. Environmental Protection Agency

Regional/Local Entities

Alameda County
Alameda County Resource Conservation District
Alameda County Water District
Association of Bay Area Governments
Bay Area Air Quality Management District
Bay Area Water Supply and Conservation Agency

Byron Airport
Byron Bethany Irrigation District
Central Contra Costa Sanitary District
Central Delta Water Agency
City and County of San Francisco Public Utilities Commission
City of Antioch
City of Brentwood
City of Clayton
City of Concord
City of Livermore
City of Martinez
City of Oakley
City of Pittsburg
City of Pleasant Hill
City of Stockton
City of Walnut Creek
Contra Costa County
Contra Costa County Flood Control and Water Conservation District
Contra Costa County Water Agency
Contra Costa County Airport Land Use Commission
Delta Diablo Sanitation District
Diablo Water District
Dublin San Ramon Services District
East Bay Municipal Utility District
East Bay Regional Park District
East Contra Costa Irrigation District
East Contra Costa County Habitat Conservancy
Golden State Water Company
Ironhouse Sanitary District
Pacific Gas & Electric
Reclamation District 2040
Reclamation District 800
San Joaquin County
San Joaquin Valley Air Pollution Control District (Northern and Central Regions)
Santa Clara Valley Water District
South Delta Water Agency
Town of Discovery Bay
Zone 7 Water Agency

Other Interested Parties

Association of California Water Agencies
California Alliance for Jobs
California Native Plant Society

California Sportfishing Protection Alliance
California Striped Bass Association, Stockton Chapter
California Trout
California Urban Water Agencies
California Waterfowl Association
Central Valley Project Water Association
Clean Water Action
Environmental Defense Fund
Environmental Water Caucus
FPL Energy
Friant Water Authority
Friends of the River
Galvan, Andrew
Heinritz, Waltraud
Kern County Water Agency
Kjeldson, Sinnock and Neudeck
Latter Day Saints Property Reserve, Inc.
League of Women Voters
Metropolitan Water District of Southern California
Mt. Diablo Audubon Society
Natural Heritage Institute
Natural Resources Defense Council
Negrete, John
Northern California Water Association
Osborn, Katherine
Pacific Coast Federation of Fishermen's Association
Pacific Institute
Planning and Conservation League
Sacramento Regional County Sanitation District
San Luis-Delta Mendota Water Authority
Save Mount Diablo
Save the Bay
Sierra Club (Delta Group and San Francisco Bay Chapter)
State Water Contractors
The Bay Institute
The Nature Conservancy
Victoria Island Farms
Westlands Water District

APPENDIX G
Cultural Resources Technical Report

Cultural Resources Assessment of the Los Vaqueros Reservoir Expansion Project Alameda and Contra Costa Counties, California

Prepared for:

Environmental Science Associates
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San Francisco, CA 94104

Prepared by:

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February 2009

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Appendices

* Figures 3 through 6 and Appendix A are confidential and not available for Public Review

Management Summary

William Self Associates, Inc. (WSA) has been contracted by Environmental Science Associates (ESA) to perform a cultural resource assessment of the Contra Costa Water District's (CCWD) proposed expansion of the Los Vaqueros Reservoir (project). The project will involve expansion of the existing dam, expansion of the reservoir pool from the current capacity of 100,000 acre ft. (TAF) to 275 TAF, and construction of new water pipelines, electrical power lines, and associated facilities. This report has been prepared pursuant to the requirements of the National Environmental Protection Act (NEPA), Section 106 of the National Historic Preservation Act (NHPA), as amended, and the California Environmental Quality Act (CEQA). The U.S. Bureau of Reclamation (Reclamation) is the lead federal agency, and CCWD is the lead state agency.

The Cultural Resources Technical Report (report) defines the study area for the project, identifies cultural resources within the study area, evaluates their significance, assesses the potential impacts from the project to each resource listed or eligible for listing on the National Register of Historic Places (NRHP) and the California Register of Historical Resources (CRHR), and recommends mitigation to reduce impacts to a less-than-significant level (CEQA) and reduce adverse effects (Section 106).

The identification phase included a records search and cultural resources survey. The records search at the Northwest Information Center included a study area of a ¼-mile radius of the project. Fifty-nine previous cultural resources studies have been undertaken in some portion of the study area. A mixed strategy archaeological survey focused on the Area of Potential Effects (APE) relocated previously recorded cultural resources and identified and recorded previously unrecorded cultural resources. The proposed expansion of the Los Vaqueros Reservoir could adversely impact 41 cultural resources listed, or eligible for listing on the NRHP and the CRHR, the Kellogg Creek Historic District, and one sensitive location. A consultation with the Native American Heritage Commission (NAHC) July 10, 2008 revealed no known sites in the sacred lands file.

Mitigation strategies are proposed to offset adverse effects to individual historic properties and to the Historic District during project construction, operation, and maintenance. Should any resources be discovered during construction, their significance would have to be determined in relation to the criteria for eligibility to the NRHP and to the CRHR.

1.0 Introduction

William Self Associates, Inc. (WSA) has been contracted by Environmental Science Associates (ESA) to perform a cultural resources assessment of Contra Costa Water District's (CCWD) proposed expansion of the 100,000 acre ft. (100 TAF) Los Vaqueros Reservoir to a capacity of 275 TAF. The Cultural Resources Technical Report (report) defines the study area for the project, identifies cultural resources within the study area, defines the Area of Potential Effects (APE) and evaluates the significance of resources within the APE, assesses the potential impacts from the project to individual resources listed or eligible for listing on the National Register of Historic Places (NRHP) and the California Register of Historical Resources (CRHR), and to the Kellogg Creek Historic District. The report recommends mitigation strategies to reduce project and cumulative impacts to a less-than-significant level (CEQA) and reduce adverse effects (Section 106).

The project is subject to both state and federal regulations. The Contra Costa Water District (CCWD) is the lead state agency for the project. The U.S. Bureau of Reclamation (Reclamation) is the lead federal agency. The Western Area Power Administration (Western) serves as a cooperating federal agency. This report is conducted pursuant to the requirements of Section 106 of the National Historic Preservation Act (NHPA) as amended, the National Environmental Policy Act (NEPA), and the California Environmental Quality Act (CEQA) and serves as a supporting document for the combined Environmental Impact Statement (NEPA) and Environmental Impact Report (CEQA).

Cultural resources studies related to the installation of the 100 TAF Los Vaqueros Reservoir in the late 1990s resulted in the documentation of 75 historic properties[1] and one sensitive location[2] within the Upper Kellogg Creek Watershed. Large portions of the study area have been previously surveyed. In 1992, the Upper Kellogg Creek Watershed was declared a Historic District eligible for listing on the National Register of Historic Places (NRHP), and many contributing historic properties were identified and adverse project effects mitigated as a result of the installation of the 100 TAF Los Vaqueros Reservoir. Geoarchaeological studies conducted under the auspices of CCWD for the original 100 TAF Los Vaqueros Reservoir identified areas with a high potential to yield prehistoric cultural deposits and human burials that have been buried beneath alluvium and are not visible on the modern ground surface (Meyer 1996; Meyer and Rosenthal 1997) and the results are used as a predictive model in this report.

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1 *Historic properties* are districts, sites, buildings, structures, and objects that are listed or eligible for listing in the NRHP.

2 The sensitive location is the reburial site for Native American human remains displaced during the construction of the original Los Vaqueros reservoir project.

WSA implemented a complete record search of a ¼-mile radius surrounding all proposed project components, and conducted an archaeological field survey and impact assessment within a more restricted study area including those areas that would be impacted during project construction, operation, and maintenance, for all project components and alternatives under consideration. In May, June, and November 2007, and February and April 2008, WSA staff conducted a mixed strategy pedestrian survey of the reservoir expansion area, the proposed pipeline corridors, the electrical power corridors, and associated facilities. In the reservoir expansion area, surveyors targeted known historic properties between the existing 100 TAF reservoir and the proposed 275 TAF expansion area with an additional buffer of 200 ft. All previously recorded and evaluated sites were relocated and examined for evidence of disturbance. Any new cultural resources were mapped and recorded. Each of the proposed pipeline corridors (Delta-Transfer, Transfer-LV, and Transfer-Bethany), power line corridors, Delta intake sites and associated facilities that had not been previously surveyed (Transfer Facility expansion area, staging and borrow areas north of the dam) were examined on foot using 4-m transect intervals. Archaeologists searched for evidence of past cultural activities older than 50 years, including concentrations of flaked stone, groundstone, charcoal, fire-affected rock, locally dark soil, shell and/or bone fragments, shards of ceramic or glass, and other historic-era materials such as brick, nails, wire, foundations, fencerows, and irrigation ditches.

CCWD will conduct Native American consultation once the Area of Potential Effects of the project has been finalized. This report presents the results of the research conducted to identify and evaluate cultural resources within the study area. Those cultural resources that are either listed on the NRHP (or CRHR) or recommended as eligible for listing on the NRHP (or CRHR) are further assessed in terms of the project description and potential adverse impacts from project construction, maintenance, and use. Mitigation strategies are recommended for each significant cultural resource (historic property) and the Historic District that would serve to reduce the adverse impacts to a less than significant level (CEQA) or provide no adverse effect with mitigation (Section 106).

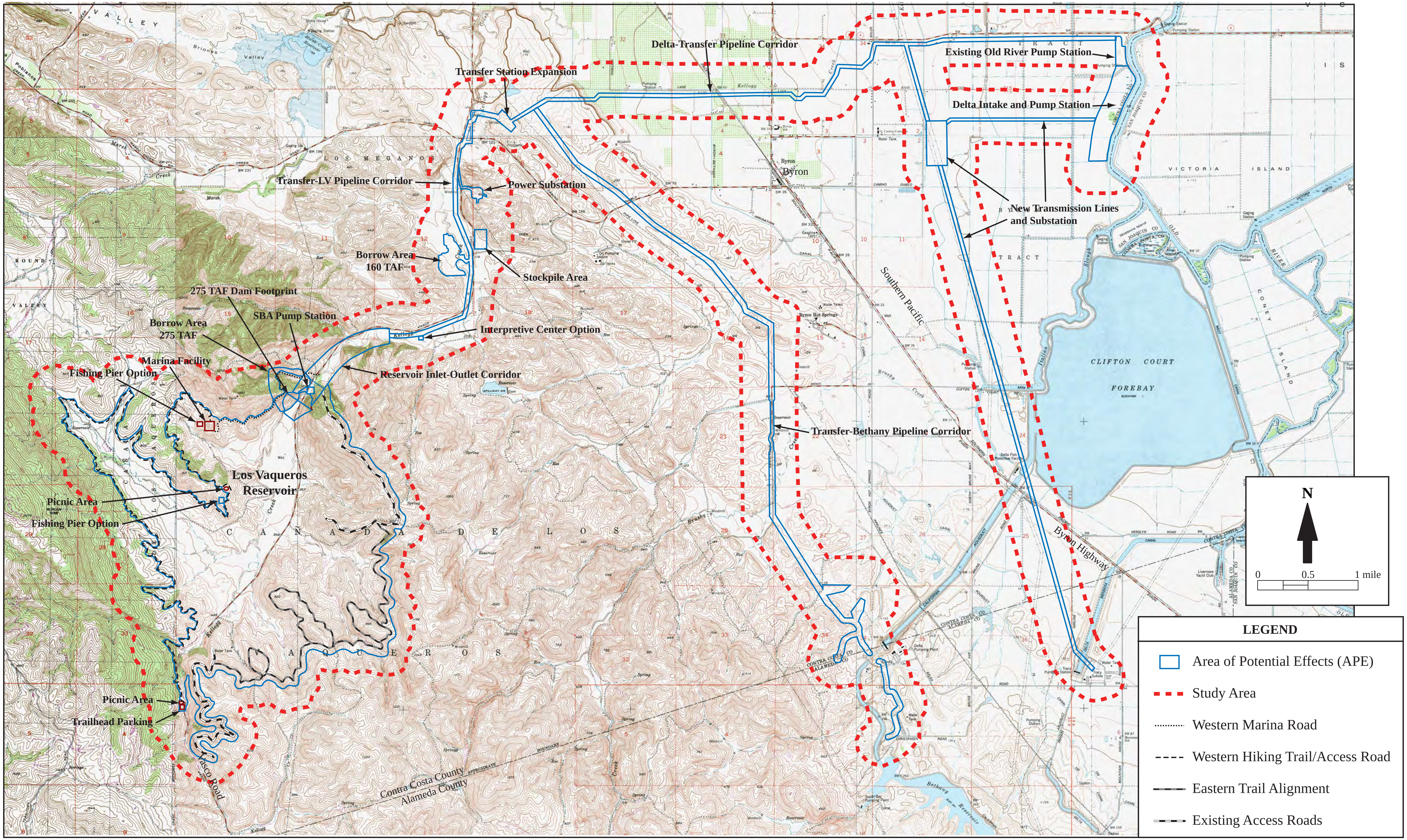
1.1 Project Description

The proposed Los Vaqueros Reservoir Expansion Project is located in parts of Alameda and Contra Costa counties (Figures 1 and 2: Vicinity and Location Maps). The reservoir and associated facilities fall within the Upper Kellogg Creek Watershed. Some proposed facilities and proposed pipelines designed to bring water to and from the Los Vaqueros Reservoir cross reclaimed delta and swamp lands between the Watershed and the Old River to the east. The study area, which includes the proposed Area of Potential Effects (APE), is depicted on portions of six U.S. Geological Survey 7.5 minute topographic quadrangle maps including Brentwood (1978), Byron Hot Springs (1953, photorevised 1968), Clifton Court Forebay (1978), Tassajara (1991), and Woodward Island (1978).

Project Vicinity

Figure 1

ESA
Los Vaqueros Reservoir Expansion
Alameda & Contra Costa Counties



USGS Clifton Court Forebay 1978, Brentwood 1978, Byron Hot Springs 1968, Woodward Island 1978, Tassajara 1996

WSA

Project Location, Study Area and Project Components

Figure 2

ESA
Los Vaqueros Reservoir Expansion
Alameda & Contra Costa Counties

The following project description provides information relevant to evaluating potential project impacts to cultural resources. For the Cultural Resource Assessment, WSA mapped and assessed the Area of Potential Effect (APE) of the reservoir expansion project. The maximum potential impact area includes all the 275 TAF reservoir expansion and associated facilities proposed under Alternative 1, expansion of the Old River Intake and Pump Station proposed under Alternative 3, and a borrow site proposed under Alternative 4. There is not a separate assessment for a 160 TAF reservoir alternative (Alternative 4) or the other project alternatives in this report. The project description below summarizes facility and construction information from Chapter 3 Project Description found in the project EIS/EIR. Please refer to Figure 2 of this report for locations of the project components discussed in the text.

Expansion of the Los Vaqueros Reservoir from the existing storage capacity of 100 TAF to 275 TAF would involve raising the dam by building over the existing facility to raise and strengthen it to support the larger reservoir. The capacity of CCWD's existing Old River Intake and Pump Station would be expanded, or a new Delta Intake and Pump Station would be constructed along the Old River channel. The capacity of the existing conveyance facilities that move water from the Delta to the Los Vaqueros Reservoir would also be expanded by: a) installing an additional pipeline parallel to the existing pipeline that extends from the Delta to the Transfer Facility and then from the Transfer Facility to the reservoir; and, b) adding expanded facilities at the existing Transfer Facility site (which includes a pump station, surge tanks, regulating reservoir and flow control station). Finally, a new conveyance pipeline would be constructed between the Transfer Facility and the South Bay Aqueduct Pumping Plant, located at Bethany Reservoir. Additional electrical power supply would need to be extended to proposed project facilities from the existing Western Area Power Authority (Western) and/or Pacific Gas and Electric (PG&E) power utilities that serve existing CCWD facilities. Existing recreation facilities within the Los Vaqueros Watershed that are disturbed or displaced by the reservoir expansion project would be relocated if necessary, replaced and augmented.

<u>Dam Reconstruction</u>

Raising the existing dam for expansion to 275 TAF would require building on top of both the upstream and downstream shells of the dam. The dam axis would move approximately 45 ft. upstream. Upstream work would require that the reservoir be empty during construction. The majority of the materials required for the 275 TAF dam raise are claystone and sandstone that comprise the upstream and downstream shells. These materials would be obtained from an approximately 36-acre borrow area that would be developed on the south facing slope of the left abutment ridge immediately upstream from the dam. This borrow area would be an extension of the borrow area developed for the construction of the existing dam. The clay for the central core of the 275 TAF reservoir dam would be excavated from the alluvial clay deposits naturally occurring on the floor of the reservoir from the general vicinity that the core materials for the existing dam were obtained. This area is currently inundated by the existing reservoir.

Once the remaining water has been removed, a groundwater cutoff trench would be installed upstream of the dam footprint to enable excavation of the foundation upstream of the toe of the existing dam. A temporary cofferdam would be constructed upstream of the cutoff trench. A temporary diversion pipe would be installed to divert any inflows from Kellogg Creek to the bottom port of the existing dam. About 1,000,000 cubic yards of wet alluvium and spoil from the existing dam would be excavated between the groundwater cutoff and the upstream shell of the dam. Excess earthen materials would be disposed within the reservoir inundation zone at a suitable distance from the dam to avoid interference with reservoir operations.

Intake and Pump Station

CCWD's existing Old River Intake and Pump Station is located on an approximately 17-acre site along Old River east of Byron and immediately south of State Route 4. The five existing pumps will be replaced and additional fish screens will be installed. The motor control center building and electrical transformer yard will be enlarged. All expansion work would occur within the existing facility site.

Delta Intake and Pump Station

The new Delta Intake and Pump Station facility would be located along Old River south of CCWD's existing Old River Intake and Pumping Station. An approximately 20-acre site would be required to accommodate this new intake and pump station facility. Additional engineering and geotechnical investigation is required to select the final site location. Therefore a broader siting zone has been evaluated within which the 20-acre facility would be located. A pipeline connecting the Delta Intake and Pump Station to the Old River Intake and Pump Station as well as an access road and a 69 kV electrical transmission line would need to be installed within this siting zone. The access road may be co-located with the existing levee along the east side of the siting zone.

The Delta Intake and Pump Station would include a trapezoidal concrete water intake structure with fish screens. An inlet channel and wet well would be located downstream from the intake structure. An earthen setback levee would be installed to provide protection during construction of the intake and maintain continuity of the road system along the dike following construction. Additional components include five pumps, approximately five 40-ft. tall-surge tanks, a motor control center building, a control building, an electrical transformer yard, and a new permanent access road from State Route 4 or another secondary road.

The subsurface conditions in the siting zone for the Delta Intake and Pump Station are likely comprised of a series of fine sands, silts, clays, and peat that are highly compressible and of low strength. Accordingly the facility would need to be supported on a foundation system such as driven concrete or steel piles or stone columns. A preliminary plan includes piles that would be founded at an approximate elevation of -50 ft. msl and spaced approximately 15 ft. apart on a square grid. In addition to the piles, soil densification would likely be required beneath the intake and setback levee to reduce the liquefaction potential of the soil and to improve its lateral strength during seismic events. Preloading of the soils beneath the levee may also be required to reduce long-term settlement of the levee. For the Delta Intake and Pump Station as well as the Expanded Transfer Facility, the ground would be completely cleared and excavated, if required. Excavation for a new tank would remove 270,000 cubic yards of material.

Delta-Transfer Pipeline

An additional pipeline would be necessary to connect the Expanded Old River Intake and Pump Station or the New Delta Intake and Pump Station to the Expanded Transfer Facility. The pipeline would extend approximately 6.5 miles and would generally parallel the Old River Pipeline alignment **w**ithin the existing Old River Pipeline permanent right-of-way for a majority of the route. The pipe would be approximately 78 inches in diameter. Where unrestricted, the total construction easement for this pipeline would be approximately 200 ft. wide. Pipeline materials (e.g., piping, backfill material, etc.) would be stored along the pipeline route within the construction easement. The active work area would generally be 25 to 50 ft. on both sides of the trench. The minimum right-of-way for construction would be 85 ft. wide. Details of pipeline installation are provided below.

Transfer Facility Expansion

At the existing Transfer Facility the motor control center building and transformer yard would be expanded. The new facilities would be located on the northern portion of the CCWD-owned property, adjacent to the existing Transfer Facility and would include a pumping station with five pumps, new surge tanks, an additional steel reservoir, and permanent access roads to the new facilities and around the steel reservoir. The existing and new steel reservoirs would also be interconnected. The steel tank would be built on a reinforced concrete ring footing foundation with a layer of asphaltic cement (AC) pavement laid beneath the tank in the area encompassed by the ringwall footing. For the Expanded Transfer Facility, the ground would be completely cleared and excavated, if required. Excavation for a new tank would remove 270,000 cubic yards of material.

Transfer-LV Pipeline

An additional pipeline, the Transfer-LV Pipeline, would be necessary to convey water from the Transfer Facility to and from the expanded Los Vaqueros Reservoir. The Transfer-LV Pipeline would generally parallel the existing Transfer Pipeline alignment within the existing Transfer Pipeline permanent easement right-of-way for a majority of the route. The additional pipeline, about 3.7 miles in length, would be 72-inches in diameter.

Inlet and Outlet Pipelines

The Transfer-LV Pipeline would connect to the inlet pipeline that would deliver water through the dam and into the reservoir. In the same corridor, an outlet pipeline would deliver water out of the reservoir. Construction of the inlet and outlet pipelines would require an 85-foot construction corridor.

Transfer-Bethany Pipeline

The approximately 9.0 miles, 132-inch pipe of the new Transfer-Bethany pipeline would connect the Expanded Transfer Facility to the Bethany Reservoir in one of the following two ways:

(1) Water would be diverted from the Delta through the new Delta Intake and Pump Station, Old River Intake and Pump Station and/or AIP, conveyed though the Delta-Transfer Pipeline to the Expanded Transfer Facility and then delivered directly to the Bethany Reservoir via the Transfer-Bethany Pipeline.

(2) Water would be released from the expanded Los Vaqueros Reservoir through the Transfer Pipeline to the Expanded Transfer Facility and then delivered to Bethany Reservoir via the Transfer-Bethany Pipeline.

Water could then be pumped from the Bethany Reservoir into the SBA via the South Bay Pumping Plant, or could be transferred downstream via the California Aqueduct to the San Luis Reservoir for delivery to SCVWD.

Where unrestricted, the total construction easement for this pipeline would be about 300 ft. wide. The work area has been restricted along a portion of Armstrong Road. Pipeline materials (e.g., piping, backfill material, etc.) would be stored along the pipeline route within the construction easement. The active work area would generally be 25 to 50 ft. on both sides of the trench. The minimum right-of-way for construction is generally 85 ft. wide, with the exception of the 70-ft. wide portion along Armstrong Road. CCWD would likely need to acquire an 85-ft. wide permanent easement for this pipeline alignment.

Tunnel Portals, Access, Staging and Spoils Disposal

The tunnel entry portal site would be approximately three acres. Access to the site would be via an existing gravel road, approximately 35 ft. wide, which begins at the terminus of Byron Hot Springs Road, heads south past a large gravel pad before it traverses westward. Approximately 2,000 ft. past the existing gravel pad, the access road makes a hairpin turn and traverses down a hill. From the bottom of the hill, a new temporary access road would need to be installed to the entry portal site. The existing access roads would be widened to approximately 35 ft. and a new approximately 1,150-ft. long segment would also be installed to the tunnel entry portal site.

The exit portal would be approximately one acre. Access to the site would be via existing access roads in and around the Bethany Reservoir. No new temporary access roads are anticipated to be installed.

An approximately 4.5 acre existing gravel pad near the terminus of Byron Hot Springs Road would be used as a staging area for the boring and/or pipeline construction activities associated with the Transfer-Bethany Pipeline. The site would be used to accommodate the tunnel boring, excavation equipment, pipeline and other materials storage as well as temporary housing/parking for crews, trucks, and other requirements. Two spoil disposal areas, occupying approximately 22-acres, have been sited near the terminus of Byron Hot Springs Road for disposal of tunnel waste rock and spoils.

For the Tunnel/Trench Option, the pipeline would include two smaller tunnel segments under the SBA. Access to the entry and exit pits for both tunnels would be via existing roads. Modification/widening of these roads may be required. The staging area and spoil disposal areas associated with the Tunnel Only Option, discussed above, would also be used for this option.

Blow Off and Air Valves

Blow off and air valves would be required along the new pipelines. Blow off valves and air valves are permanent release valves for water and or air during abnormal operating conditions that are installed at low points and high points respectively. The actual location of these valves will be dependent on the pipeline alignment; however, for purposes of this analysis, approximately one air valve would be installed every 1,000 ft. and one blow off valve every 2,000 ft. The valve structures have a concrete base with a medium diameter pipe extending about two feet above the base for a total height of about 2-4 feet above the ground.

Pipeline Construction

Installation of pipelines would use open-trench construction methods for pipeline installation and bore-and-jack methods for crossings where trenching methods are not feasible or where restrictions warrant other construction methods (e.g., major roadways and intersections, railroad lines, flood control channels, or sensitive wetlands/sloughs).

The trench width for the conveyance pipeline installation would range from 35 to 70 ft.; trench depth would range from 15 to 55 ft., depending on the size of the pipeline being installed, but would typically be 20 ft. The minimum soil coverage required is approximately 4 to 6 ft. Trenches would be braced with a trench box or speed shoring to minimize their width and to provide a safe working environment. The active work area along the open trench would generally extend about 25 to 50 ft. to both sides of the trench. The minimum construction right-of-way would be approximately 85 ft.; the maximum construction easement would be 300 ft. wide.

Staging areas would be set up along the pipeline alignment, and construction equipment and other materials would be located at selected locations to facilitate the movement of materials, equipment, and construction crews. Staging areas would be selected to minimize hauling distances and long-term disruption and avoid sensitive environmental resources that may be present.

Boring and Jacking
Bore-and-jack construction techniques would be used for crossing flood control channels, major roadways, railroad crossings, and wetlands, sloughs, and other environmentally sensitive locations. The bore-and-jack method involves using a horizontal boring machine or auger to drill a hole and a hydraulic jack to push a casing through the hole. As the boring proceeds, a steel casing pipe is jacked into the hole; the pipeline is then installed in the casing. The casing is pushed using a large hydraulic jack in a pit located at one end of the crossing. In some cases, the pits would extend below the water table, requiring the use of sheetpiles and dewatering pumps. Bore-and-jack undercrossings below the water table would require enclosure of the jacking pits with sheetpiles and special bulkheads at the jacking portals.

Pipeline Tunneling
The Transfer-Bethany Pipeline includes two options, both of which would have 12-ft. wide tunnel segments. The tunnels would be constructed using a tunnel-boring machine or other tunneling machine for the shorter segments that would operate between boring pits constructed at the ends of the tunnel segment. Diesel generators would be required. For the Tunnel Only Option, the access portal would occupy an approximately three-acre area, while the exit portal would require approximately one acre to accommodate the tunnel boring,

excavation equipment, pipeline and materials storage, pipeline connectors, and temporary housing/parking for crews, trucks, and other requirements. For the Trench and Tunnel Options, the northern 700-ft. long tunnel entry and exit pits would be no larger than 1,800 square ft. (i.e. 30 by 60 ft.). For the southern, approximately 4,000 ft. tunnel, the exit pit, on the east side of the SBA pits would be no larger than 1,800 square ft. (i.e. 30 by 60 ft.), however, as discussed above, the entry pit area would be approximately one acre to accommodate the tunnel boring, excavation equipment, pipeline and materials storage, pipeline connectors, and temporary housing/parking for crews, trucks, and other requirements.

The construction of the Westside Option would create about 60,000 cubic yards of waste rock and tunnel spoils and the Eastside Option would generate about 35,000 cubic yards of waste rock and tunnel spoils. The spoils would consist of a fine, flour-like waste that would be hauled from the tunnel excavation for temporary onsite storage and/or subsequent, final disposal. Larger waste rock and tunnel muck would be disposed at three potential locations: (1) at two designated disposal area occupying up to 22 acres near the terminus of Byron Hot Springs Road, or (2) along project access roads where it would be consolidated and used as a roadway sub-base or surface.

Power Supply Infrastructure

There are four existing transmission lines in the project vicinity. The westernmost line traversing near the Transfer Facility is a 230 kV line operated by Pacific Gas & Electric (PG&E). The lines to the east between Vasco Road and Old River are two 500 kV line operated by PG&E as well as a 230 kV line operated by Western Area Power Administration (Western), a federal agency, which transmit 69 kV to the existing Old River Intake and Pump Station. There are two options under consideration, and both were included in the cultural resources assessment.

Option 1

Western would use its existing 230 kV transmission line from the Tracy substation to supply power to a new substation. This new substation site would require approximately 2 acres near the terminus of Camino Diablo Road and would need to have the capacity to step power down from 230 kV to 69 kV and 21 kV. Like the proposed Delta Pump Station, the exact location for the new substation has not been determined; therefore a siting zone has been defined for purposes of this impacts analysis. It is assumed that permanent impacts would not exceed 2-acres for the facility and that a permanent access road to the facility most likely from Camino Diablo Road or another auxiliary road would be required.

From the new substation, an existing single-circuit power line to Old River Intake and Pump Station would be upgraded to a double-circuit power line by one of the following methods: (1) placing new insulator arms and additional conductors on the existing poles; (2) pole for pole replacement of the existing power line with collocation of the existing single-circuit line; or (3) a new set of pole and conductors would be installed parallel to the existing power line. For the Expanded Transfer Facility, a new 21 kV distribution line would be installed from the new substation paralleling the existing 230 kV Transmission Line until it intersects with the Delta-Transfer Pipeline alignment. At that point the new power line would head westward, generally traversing the same alignment as the Delta-Transfer Pipeline to the Expanded Transfer Facility. For both power and distribution alignments it is assumed that if new poles would be required, they would be approximately 50 ft. tall and installed in up to 300-ft. spans.

Option 2
To provide power to the Delta and/or Old River Intake and Pump Stations, a new 69kV double-circuit power line would be constructed from the Western substation (adjacent to the CVP's Jones Pumping Plant) to the intersection of the existing 69 kV single-circuit power line that extends to the Old River Intake and Pump Station. The existing single-circuit portion of the power line would be upgraded to a double-circuit power line by one of the following methods: (1) placing new insulator arms and additional conductors on the existing poles; (2) pole for pole replacement of the existing power line and collocation of the existing single-circuit power line; or (3) a new power line would be installed paralleling the existing power line.

The power line would begin at the Tracy Switchyard near the Jones Pumping Plant and traverse north within the existing right of way of the eastern most 230 kV transmission line. Near the eastern terminus of Camino Diablo Road, the power line would continue in a northeasterly direction to the delta intake facilities within an existing right of way.

For the Expanded Transfer Facility, a new PG&E distribution substation would be located in the Watershed with the capacity to step power down from an existing 230 kV PG&E transmission line to 21 kV. The substation would require approximately two acres and would be enclosed with fencing. The approximately 1.5 mile distribution line would follow an existing distribution line route to the Expanded Transfer Facility property. The existing distribution line would be upgraded by one of the following methods: (1) placing new insulator arms and additional conductors on the existing poles; (2) pole for pole replacement of the existing distribution line and collocation of existing distribution on the new poles; or (3) a new distribution line would be installed paralleling the existing distribution line. If new poles were required, they would be approximately 50 ft. tall and installed in increments of 200-300 ft. apart. Six (6) conductors would be installed on each wood pole.

Power/Distribution Line Construction Methods
Typical construction sequencing for both the Western power line and the PG&E distribution line would include vegetation removal at the pole site, auguring the pole holes, setting the framed poles, backfilling as necessary and stringing the overhead distribution lines. Pole removal would consist of loosening, removing and disposing of the pole in accordance with Contra Costa County regulations.

Installation of the conductors would require pull and tension sites as well as work areas within the construction corridor and/or right of way. Pull and tension sites could temporarily disturb approximately 6,250 square ft. per site (assumed 125 by 50 ft.). Work areas would be limited to 25 ft. on either side of centerline for installation of the new power/distribution line and would also be sited to avoid sensitive resources.

For both the proposed Western power facilities and the PG&E power facilities, access to and from the power/distribution line corridors and substation locations would generally be from existing roadways within the project area. Depending on the final site locations for the substations, some overland access may be required. Typical construction methods for the proposed substations would include vegetation removal, grading, excavation, and construction of subsurface footings and concrete slabs for aboveground structure and equipment.

Recreational Facilities

Recreational facilities would be provided to replace and/or expand the recreational facilities that would be displaced with the reservoir expansion. A replacement marina would be composed of a parking and staging area, a picnic area, a pier, a marina, and a connected dock providing access to the reservoir. This marina site would be about 1,500 ft. west of the new dam on the site of the dam material borrow area that would be excavated in the adjacent hillside. A flat zone of about 11 acres would be created during borrow area excavation to accommodate the marina, dock, and the parking, staging, and picnic areas. Movable floating docks would connect to the appropriate bench, depending on the reservoir surface elevation. The new marina facility would be accessed from a new road constructed over the top of the raised dam and extended westward along the reservoir edge to the marina site.

Interpretive Center
Construction activities associated with the reservoir expansions in the vicinity of the existing interpretive center would require that the facility be closed during the construction period. During construction the interpretive parking could be used for worker parking, minor staging and/or materials/equipment storage. Upon completion of construction, the interpretive center would be reopened to the public.

Fishing Piers
Four fishing piers would need to be relocated due to the 275 TAF reservoir expansion. Two additional fishing pier locations have been proposed. One pier would be located at the marina and one would be located on the peninsula south of the marina.

Day-Use Facilities
In addition to inundating the existing facilities at the marina, increasing the reservoir to 275 or 160 TAF water levels would inundate the Los Vaqueros staging area, the Oak Point Picnic Area, and the Knoll Picnic Area. For a 275 TAF expansion one replacement picnic area would be located at the new northern marina, and a second would be located at the fishing pier on the peninsula south of the new marina facility. A third picnic area would be established at the new parking area, and hiking trail access would be provided at the south end of the reservoir. Under the 160 TAF reservoir expansion, replacement facilities would be located generally upslope of the existing facilities.

User Parking
Under the 275 TAF reservoir expansion, parking would be provided at the marina facility, the westside trail access point, and the south end of the reservoir. Under a 160 TAF expansion, parking would be provided generally upslope of the existing parking.

Access Roads
Under the 275 TAF reservoir expansion, approximately 2.25 miles of paved access road to the existing marina would be inundated. A total of 12.5 miles of an unpaved non-public all-weather service road along the western shoreline would also be inundated and would require relocation to provide access to the western area of the watershed for fire prevention and suppression activities, public safety, and environmental compliance. This westside access road would remain closed to the public. Under the 160 TAF reservoir expansion, approximately 0.93 mile of paved access road would be inundated along with just over 5 miles of the unpaved west side access road. These roadway segments would be relocated along the perimeter of the expanded reservoir.

Hiking Trails
Under the 275 TAF reservoir expansion, approximately 8.1 miles of the existing Los Vaqueros, Peninsula, Canada, Adobe, and Oak Savannah Trails (hiking-only) would be inundated in the northwest portion of the reservoir. Due to steep topography and hot, windy climate, the hiking trails are lightly used. Southern access to the westside trail would be available from Vasco Road. A parking lot would be located near the upper inundation limit and would provide direct access to the trailhead. The site would have picnic tables, toilets, and a water station. A new eastside hiking trail could be installed to link existing access roads at the southeast and northeast ends of the reservoir.

1.2 Regulatory Setting

The project is subject to both state and federal regulations. The Contra Costa Water District (CCWD) is the lead state agency for the project. The U.S. Bureau of Reclamation (Reclamation) is the lead federal agency. The Western Area Power Administration (Western) serves as a cooperating federal agency. Cultural resource studies have been conducted in compliance with Section 106 of the National Historic Preservation Act (NHPA) and the California Environmental Quality Act (CEQA).

The major cultural resource protection and management documents that were prepared for the construction and operation of the 100 TAF Los Vaqueros Reservoir, associated facilities and recreation elements are listed below. This series of agreement documents and plans follow from compliance with NEPA, and in some cases, with CEQA. These documents must be updated and/or renegotiated for the Los Vaqueros Reservoir Expansion Project.

- *Programmatic Agreement* among the Bureau of Reclamation, Contra Costa Water District, California State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Implementation of the Los Vaqueros Project (Bureau of Reclamation 1992)

- *Evaluation, Request for Determination of Eligibility, and Effect for the Los Vaqueros Project*, Alameda and Contra Costa Counties, California (Sonoma State University Academic Foundation (SSUAF), 1992)

- *Memorandum of Understanding* regarding the Respectful Treatment of Native American Graves and Human Remains Discovered During Pre-Construction and Construction of the Los Vaqueros Project (CCWD 1993a)

- *Agreement for Curation* of Archaeological Collections from the Los Vaqueros Project Area between the Anthropological Studies Center and the Contra Costa Water District (SSUAF 1993a)

- *Final Stage 2 Environmental Impact Report/Environmental Impact Statement* for the Los Vaqueros Project (CCWD 1993b)

- *Historic Property Treatment Plans* (SSUAF 1993b, 1994, 1995, 1998, 1999)

- *Los Vaqueros Cultural Resource Management Plan* (Brady and Associates, Inc. and LSA 1999)

The Programmatic Agreement (PA) is the basis for the protection of historic properties within the Area of Potential Effect (APE) for the 100 TAF Los Vaqueros Reservoir Project. The PA stipulates that the project be defined, and that historic properties that will be affected by the project will be identified, evaluated, and managed through the development and implementation of Historic Property Treatment Plans (HPTPs). Reclamation served as the lead federal agency for the existing Los Vaqueros Project and was responsible for establishing the PA. CCWD, the lead state agency, is responsible for implementing the PA. The PA commits CCWD to manage properties deemed eligible for the NRHP within the project APE in a manner consistent with the preservation of these resources. The PA also establishes that no further consideration need be given properties Reclamation, the State Historic Preservation Officer (SHPO), and the responsible and/or cooperating agencies agree are not eligible for inclusion in the NRHP. The Corps and the SWRCB were the cooperating federal and state agencies, respectively. The SHPO and the Advisory Council on Historic Preservation (Council) were parties to the agreement. All of the subsequent management documents follow from the PA. The existing PA is still in effect, and the PA may be renegotiated among the cooperating agencies, with Reclamation as the lead agency, for the Los Vaqueros Reservoir Expansion Project.

The Los Vaqueros Watershed was extensively surveyed for cultural resources and the results were presented in the *Evaluation, Request for Determination of Eligibility, and Effect for the Los Vaqueros Project* (Evaluation) (SSUAF 1992), an inventory and evaluation of all cultural resources within the project area known at that time. This evaluation served as the basis for consultation by Reclamation with the SHPO to determine which properties were eligible for listing on the NRHP; the effect of the project on eligible resources; and procedures for the management and mitigation of effects on the NRHP-eligible properties within the Los Vaqueros Watershed as required by the PA. The SHPO's comments or concerns were addressed to Reclamation. The results of the evaluation were presented in the Final Stage 2 Environmental Impact Report/Environmental Impact Statement (CCWD 1993b) in order to satisfy NEPA and CEQA requirements. Reclamation must prepare an updated *Evaluation, Request for Determination of Eligibility, and Effect* for the Los Vaqueros Reservoir Expansion Project and consult with SHPO for concurrence with a Determination of Effect.

The Memorandum of Understanding (MOU) between CCWD and interested tribal entities of Contra Costa and San Joaquin Counties lays out the role of all parties during construction and Watershed management and the responsibilities of all parties regarding the treatment of and disposition of Native American burials, funerary objects, and other cultural resources on Watershed lands. Reclamation is only involved in such MOUs if and when federally recognized tribal entities have interests in the project area. In this case, although there were several Native American individuals and groups with ties to the project area, none of them belong to federally recognized tribal entities, and thus the MOU was established by CCWD with no Reclamation involvement. The existing MOU remains in effect, however with the federal recognition of the Ione Band of Miwok Indians, Reclamation may take a more active role and renegotiate or reformulate an MOU for the Los Vaqueros Reservoir Expansion Project.

The Curation Agreement details documentation, inventory, and packaging requirements for curated collections, assesses curation fees, and provides curation policies for cultural materials recovered in connection with the Los Vaqueros Project. CCWD is responsible for establishing and following the Curation Agreement. The Curation Agreement remains in effect.

A series of phased HPTPs were created for the 100 TAF Reservoir Project to avoid or minimize project effects on historic properties (SSUAF 1993a, 1994, 1995, 1998, 1999). HPTPs are required in accordance with the PA when Project plans affect NRHP-eligible properties. The HPTPs detail specific mitigation measures that, when followed, result in a Determination of No Adverse Effect under Section 106 of the NHPA. These measures may protect and conserve sites or detail the kinds of data recovery and analysis that will be undertaken for those sites subject to adverse effects. Reclamation was responsible for creating the HPTPs, which were reviewed by the SHPO. CCWD is responsible for carrying out the HPTPs. Once the new Evaluation has SHPO concurrence, Reclamation must prepare new HPTPs appropriate for the new project effects associated with the Los Vaqueros Reservoir Expansion Project.

The Cultural Resources Management Plan (CRMP) incorporates and updates the Evaluation (Brady and Associates, Inc. and LSA 1999) and is presented by CCWD as part of the Resource Management Plan. The CRMP summarizes the cultural resources that are eligible for listing on NRHP and details plans for their management. The CRMP remains in effect, but may be updated to reflect the results of mitigation from the 100 TAF Reservoir, and the addition of cultural resources eligible for listing on the NRHP, and implications for cultural resource management.

In summary, Reclamation as lead federal agency established the PA with the SHPO, Council, and CCWD as signatories for the 100 TAF Reservoir. Reclamation presented the Evaluation to the SHPO for review and addressed any concerns raised by the SHPO. That document established which properties would be protected and how they would be impacted by the project. In the meantime, CCWD made use of the materials in the Evaluation to prepare the EIR/EIS to comply with CEQA and NEPA, established an MOU and a Curation Agreement, and developed a CRMP as part of the Resource Management Plan. Pursuant to the PA, Reclamation oversaw the preparation of a series of HPTPs. Reclamation's responsibility ended once the HPTPs were in place. CCWD remains responsible for carrying out the HPTPs and adhering to the PA. Reports resulting from work done in accordance with these agreement documents are submitted to Reclamation and the SHPO for review. In association with the Los Vaqueros Reservoir Expansion Project, Reclamation must prepare a new Evaluation, negotiate an updated PA, and prepare new HPTPs to reflect a new set of project impacts. They may negotiate a new MOU. CCWD must prepare a new EIR/EIS. They may renegotiate an updated MOU with non-federally-recognized tribal entities, and they may update their Curation Agreement, and CRMP.

1.3 Study Area and Area of Potential Effect

The Los Vaqueros Expansion Study Area (study area) includes the expanded reservoir, new pipelines including two alternatives under consideration, and new and expanded facilities, surrounded by a ¼-mile buffer (refer to Figure 2). The study area has been designed to capture all anticipated impacts from construction, operation, and maintenance of the expanded 275 TAF Los Vaqueros Reservoir, pipelines, and facilities. The ¼-mile buffer was used in the records search ensuring a broad research domain in order to develop a representative prehistoric and historical context for the study area. The survey area more closely followed the Area of Potential Effects (APE).

As defined in 36 CFR 800.16(d), an APE is "the geographical area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist." The minimum APE for archaeological properties is generally the required right of way, plus areas subject to ground-disturbing activities, such as equipment staging areas, storage, disposal, or borrow sites. The APE is more constrained than the study area.

When filled to maximum capacity, the 275 TAF Reservoir should reach an elevation of 560 ft. amsl. The APE includes this area plus a buffer of 200 ft. upslope to allow for any disturbance due to construction, operation, and maintenance of the expanded reservoir, including construction of a replacement hiking trail and access road around the western side of the reservoir. Expanding the APE beyond the maximum water line also allows for analysis of the potential for increased erosion, and the potential for vandalism and illegal collecting due to increased access. The APE includes 200-ft. corridors centered on the proposed pipeline alignments, with the exceptions of a 300-ft. corridor for the Transber-Bethany alignment, and the inlet and outlet pipelines corridor of 1,000-ft. to allow for staging and storage areas, access roads, and facilities. The study includes two alternatives for the intake facility (expand the existing Old River Intake, or build a new Delta intake facility). The final APE will include only one of these.

2.0 Setting

2.1 Environmental Setting

The Los Vaqueros study area is located within southeastern Contra Costa County and northeastern Alameda County. Large portions of the study area are within the unsectioned Cañada de los Vaqueros land grant (USGS Byron Hot Springs, California, 7.5' series topographic quadrangle, 1953, photorevised 1968).

Los Vaqueros Reservoir lies within the upper section of the Kellogg Creek watershed. A pipeline conveys water from the Old River Pump Station on the west side of Old River within the Sacramento-San Joaquin Delta, to the reservoir. Kellogg Creek headwaters flow through a deep canyon that opens onto the broad valley near the center of the watershed, which was inundated to create the reservoir. The valley system is surrounded by hills varying in height from approximately 130 to 1,100 ft. amsl, while further to the north the topography flattens out, with elevation ranging from sea level in the east to 125 ft. amsl in the west.

Springs exist throughout the watershed, and attracted both prehistoric hunters and gatherers, and historic period ranchers. The most well-known of these springs emanated from the lower hills south of the Vasco Adobe site (CA-CCO-470H), and was referred to as the *Poso*, Spanish for ‘watering hole’.

The following discussion summarizes the extensive research and writing conducted for the original 100 TAF Los Vaqueros Reservoir project, drawing primarily from Sonoma State University Academic Foundation, Inc. (SSUAF) (1992), Meyer and Rosenthal (1997), and Praetzellis et al. (1997).

<u>Climate</u>

The Mediterranean climate of the study area undergoes mild to moderately cold, wet winters, and hot, dry summers. High winds blow through the hill country within this area, and are strongest during the winter. The Kellogg Creek valley provided some shelter from the strong winds, and, as a result, was preferred by early stock raisers who would bring their cattle to the area to graze. Rockshelters also provided protection from the weather, and those at Vasco Caves (just outside of the study area) and in the upland areas were used by both settlers and their stock.

Approximately 90% of the annual precipitation occurs from November through April. Seasonal averages range from 13 to 17 inches. This relative aridity has influenced the history of land use and occupation of the watershed. Pasture grasses are scarce and forage is meager during the summer and fall. Dry-farming could be practiced in certain portions of the watershed, though neither irrigated agriculture nor small truck gardens were economically viable.

Geology

The Kellogg Creek watershed terrain ranges from flat to hilly and mountainous. Upper Cretaceous marine sedimentary rocks approximately 65 million years old underlie most of the uplands (SSUAF 1992:8). These rocks of the Panoche Formation consist of concretionary sandstone, shale, siltstone and conglomerate lenses that exhibit massive weathering. The Meganos, Moreno, and Deer Creek formations are also present in the study area. These are similar to the Panoche Formation. Bedrock is relatively shallow, lying at depths of 8 m or less below the ground surface, and outcropping on ridges and hilltops. The bedrock ranges from soft and fractured to hard, massive formations. The Piper Formation, consisting of sandy loam and loamy sand, can be found in the northern lowlands of the study area, and may be buried beneath the Oakley sand (Cook and Elsasser 1956; Praetzellis et al. 1997:8). Low lying areas have accumulated recent alluvial deposits from the adjacent upland materials. The sandstone outcrops were of importance to Native Americans as locations for shelter and bedrock milling stations.

Soils

Soils found within the Kellogg Creek watershed include the Altamont-Diablo-Fontana and the Brentwood-Rincon-Zamora soil associations. The Altamont-Diablo-Fontana soils, formed on steep slopes, include well-drained clays and silty clays. The Brentwood-Rincon-Zamora soils, found in the nearly level surfaces of the lowlands, include well-drained clay loams and silty clay loams (Praetzellis et al. 1997:8).

Within the Los Vaqueros area, extensive and frequently deep Holocene alluvium and fan deposits cover lowland areas. Archaeological deposits and human burials have been located at depths of greater than 12 m (40 ft.) within indurated Piper sands in lowlands in the project vicinity.

Vegetation and Associated Wildlife

The study area encompasses a biogeographical transition zone, ranging from lowland grasslands to higher elevation woodland and chaparral environments. Geoarchaeological and archaeobotanical studies have suggested that during a large part of the late Holocene period, the study area was more wooded than it is today. Intensive grazing and logging activities through the 1850s and 1860s significantly altered this landscape. While the study area is less wooded than formerly, paleobotanical analyses suggest that many of the same species exist today as in the past, including manzanita, buckeye, acorn, wild cucumber and gray pine. A more detailed discussion of the vegetation and wildlife can be found in Praetzellis et al. (1997:9-13).

The range of topographic and soil settings influence the variety and type of plant communities within the study area. Annual grasslands and valley needlegrass grasslands cover hillsides and uplands with well-drained soils, as well as bordering alkali wetlands. Buckeye, blue and interior live oak, or occasional shrubs, may also sparsely occupy the grasslands. Grassland habitats support a range of animal species, including frogs, lizards and snakes, a range of birds, and mammals such as black-tailed deer, coyotes, desert cottontails, deer mice, California ground squirrels and striped skunks.

Oak woodlands inhabit valley bottoms, and gently to steeply sloping hillsides and uplands with well-drained soils. Communities include live oak woodland, valley oak woodland, blue oak woodland, and mixed north slope cismontane woodland. Oak woodlands provide food, shelter and nesting habitats for a range of birds, amphibians and reptiles. Mammals, such as the black-tailed deer and western gray squirrels, are also present.

Chaparral communities cover the rocky east and north facing ridge slopes west of Vasco Road, as well as other dry, rocky slopes and ridges, and disturbed areas. Diabloan sage scrub and northern mixed chaparral communities consist of "evergreen, woody shrubs with a subshrub layer, and a variety of annual and perennial herbs" (Praetzellis et al. 1997:10). A range of amphibians, reptiles, birds and small mammals use the chaparral communities. Black-tailed deer and gray foxes also share this environment.

An assortment of seasonal alkali wetland communities grow on valley floors, where flat or gently sloped alkali soils form on deep alluvium. Drainages and northern claypan vernal pools also occur in this context. Along Brushy and Kellogg Creeks alkali marshes intermingle with alkali meadows. These marshes support halophytic species as well as common freshwater marsh species such as tule and cattail. Alkali wetland communities are located within the study area in the northeast and south-central areas of the Kellogg Creek watershed. A variety of shorebirds, waterfowl, songbirds and northern harriers rely on the alkali marsh habitats, and several species of amphibians use the vernal pools for reproduction and rearing their young. During the dry season, alkali meadows also support various small mammals.

Meandering, deeply incised intermittent creeks cut through the valley floors. Marsh vegetation occupies the channels, and rarely willow or cottonwood trees, or small stands of riparian woodlands exist along the creek banks. The riparian woodland communities are located along Kellogg and Brushy Creeks, and include central coast live oak riparian woodland, willow-cottonwood riparian woodland, and mixed riparian woodland. Riparian woodlands support a wide variety of animal species, including several amphibians and reptiles, insectivorous birds, and small mammals. Raptors use the trees to nest in, as do bats, squirrels and raccoons. Striped skunks, badgers, black-tailed deer, raccoons, and red and gray foxes use the woodlands to forage and for cover and travel.

2.2 Paleoenvironment

<u>Development of the Bay and Delta System</u>

During the last glacial maximum, the San Francisco Bay was a broad inland valley, referred to as the ‘Franciscan Valley’. The runoff from the Sacramento and San Joaquin Rivers converged to form the ‘California River’ which flowed through the Carquinez Straits, into the Franciscan Valley. Runoff from smaller streams and rivers draining this valley merged into the river, and emptied into the Pacific Ocean near the current location of the Farallon Islands. The melting of the ice sheets and concurrent rising of the oceans pushed the Californian coastline eastwards. Between 11,000 and 8,000 calibrated years before present (cal B.P.), rising sea levels inundated the lower areas of the Franciscan Valley and California River. Sediments carried by the California River were deposited on the floor of the valley. Continued rising of the sea level resulted in the development of freshwater marshes (Praetzellis 2004:9).

Between 7,000 and 6,000 cal B.P. there was a decline in the rate of sea level rise worldwide, and flooding of the Franciscan Valley continued more gradually. This more gradual rise permitted the development of extensive tidal-marsh deposits during the middle Holocene. It was during this period that the extensive saltwater/ freshwater tidal marshland of the Sacramento-San Joaquin Delta began to develop. Large alluvial floodplains were also formed at this time as a result of accumulated materials spilling from the lower reaches of streams and river channels onto existing fans and floodplains. As a result of these changes, bay and marsh deposits now covered several previously stable Holocene-age land surfaces. Throughout the late Holocene, the San Francisco Bay grew in size, marshlands expanded, and large tidal mudflats and peat marshes were formed. This promoted the continued deposition of sediment around the Bay margins (Praetzellis 2004:11; Ziesing 2000:29).

Studies within the Bay region confirm that several late Pleistocene and early Holocene land surfaces were covered by alluvium that was generally deposited within the last 6,000 years. These deposits average 2 to 3 m in thickness but can exceed 10 m thick in a few areas. They often exhibit well-developed buried soil profiles (paleosols) which show a marked stratigraphic boundary. Archaeological deposits older than 6,000 years would likely have been inundated by sea level rise and/or buried by sediment deposition (Praetzellis 2004:11).

Although the timing of lowlands development surrounding the Sacramento-San Joaquin Delta is not well dated, it is thought to have followed the same basic pattern as the San Francisco Bay Area. Water, sediment, and marsh plants began to be deposited on the lowlands following a period of non-deposition during the late Pleistocene and early Holocene. This raised the base level of streams and rivers flowing into the Delta during the mid-Holocene, causing active channels to change alignments and depositing a large amount of sediment onto older land surfaces. These active channels, including Kellogg Creek, caused the formation of large alluvial fans and levee deposits. These Holocene deposits range in thickness from an estimated 3 m near the Delta and Bay margins to approximately 15 m near the heads of alluvial fans (Meyer and Rosenthal 1997:II.7).

<u>Geology and Subsurface Archaeological Testing</u>

Meyer (1996) undertook geoarchaeological research in the Los Vaqueros area for his thesis submitted as part of a Master of Arts in Cultural Resources Management at Sonoma State University. He reasoned that subsurface archaeological materials could be predicted by identifying paleosols (buried land surfaces) that may have been available for occupation in the past. Meyer conducted a subsurface survey program that was designed to assess the accuracy of previously reported geological data, to identify and date any existing paleosols or previous watercourses that may have been used prehistorically, to find and date subsurface archaeological materials, and to establish the sequence of landform-sediment assemblages within various valleys in eastern Contra Costa County (Meyer 1996:iv). His work has since been used as a predictive aid to avoid and/or mitigate for areas with high potential for undiscovered buried cultural deposits and human burials.

Meyer’s thesis work was undertaken as part of the original Los Vaqueros Project, which involved construction of a water conveyance system extending from the northern end of the Los Vaqueros Reservoir to the Neroly Blending Facility, near Antioch. The Los Vaqueros Project included the Old River Pipeline (from the Old River to the Reservoir) though Meyer discounted subsurface archaeological testing within this portion of the study area because:

> (1) the route consists primarily of thick deposits of relatively recent alluvium that are unlikely to contain paleosols…; (2) the thickness of the alluvium exceeds that depth that can be reached using a backhoe; (3) the high ground water levels along the route would likely prohibit the subsurface deposits to be examined safely or effectively; and (4) the design specifications suggest that the depth of the pipeline excavation is not likely to exceed the depth of the relatively recent alluvium (Meyer 1996:41).

Meyer conducted test trenching in Upper Kellogg Creek (upstream, midstream and downstream sections), Middle Kellogg Creek and Lower Kellogg Creek. Figure 3 depicts the

Figure 3: Geoarchaeological Testing Areas and Areas of Archaeological Sensitivity
CONFIDENTIAL; NOT AVAILABLE FOR PUBLIC REVIEW

locations of Meyer's testing with relation to the current Reservoir Expansion study area. No testing was conducted within the Camino Diablo Hillfront area as the hillslope deposits were formed prior to human existence. In addition, the slope deposits were formed by erosive forces, and the overlying soil is a mix of in-situ weathering of deposits and colluvium that has moved downslope. As such, any archaeological deposits are likely to have been disturbed and displaced by the movement of deposits due to erosion (Meyer 1996:40).

Meyer excavated seven backhoe trenches within the area closest to the dam in Upper Kellogg Creek. Intact prehistoric archaeological deposits were located in association with a paleosol in an area north (downstream) of the dam footprint in the spillway and stilling basin area. The prehistoric deposit, CA-CCO-637, which included 24 Native American burials, extended from 60 to 150 cm below the present ground surface within a gently sloping alluvial fan. Radiocarbon dates obtained from a hearth feature produced a date of 2585 cal B.P. Meyer determined that there was a high potential for more archaeological remains within this area (Meyer 1996:47-49).

Three other alluvial fan deposits were tested within the upstream portion of the Upper Kellogg Creek, north of the existing dam, though no paleosols or archaeological deposits were encountered. These deposits were thought to be at least Pleistocene in age, and subsurface archaeological potential within this area was considered to be lacking (Meyer 1996:49). Test trenches were also excavated near CA-CCO-447/H to confirm the presence of prehistoric materials at that site. Possible prehistoric remains had previously been identified at 250 cm below surface in a geotechnical test pit. Sparse naturally occurring shell was found, and some flaking debris was located within the upper alluvium though no formal artifacts or high concentrations of archaeological materials were found at this time. A paleosol that had been truncated through erosion was found at 275 cm below surface. By removing materials, erosion reduced the potential of finding subsurface archaeological deposits in this area. In addition, testing revealed two stream terraces along the upstream portion of the Upper Kellogg Creek with no potential for archaeological deposits (Meyer 1996:49-50). The entire upstream of Upper Kellogg Creek was deemed to have high subsurface archaeological potential as a result of this testing.

The expectation for subsurface prehistoric deposits in this area later proved to be accurate. In 1998, excavation of a waterline trench through CA-CCO-447/H exposed the remains of two individuals. The burials were located around 60 cm below surface. In addition, heat-affected rock, chert and obsidian flakes, and a rim fragment of an andesite, groundstone, bowl mortar were excavated. A hearth feature and a rock line indicative of relatively intact remains of a living surface were also exposed (Meyer and Meyer 2000:42, 44, 46, 47).

To the northeast, within the midstream section of the Upper Kellogg Creek, two more stream terraces bordering Kellogg Creek were located. The lower, younger terrace contained some historic debris most likely associated with the historic period ranch site CA-CCO-446H. Meyer judged that there was no potential for prehistoric archaeological materials within this terrace given its relatively young age. Although the older, upper terrace exhibited a single, well-developed soil profile signifying that it had remained stable for an extended period of time, no paleosols were found within the terrace profiles and hence there is little to no potential for prehistoric archaeological materials associated with the stream terraces in the midstream portion of Upper Kellogg Creek (Meyer 1996:52).

Along the cutbank on the south side of Kellogg Creek in the midstream section, a paleosol was identified roughly 120 to 180 cm below surface. The paleosol was covered by recent alluvial deposits and appeared to be limited to the floodplain to the south of Kellogg Creek. The paleosol appeared to be intact within this area and Meyer (1996:52-54) considered the area to have low to moderate potential for subsurface archaeological deposits. However this southern area of midstream Upper Kellogg Creek was subsequently excluded from the proposed pipeline route as a result of design changes and was not included in Meyer's summary of archaeological potential for the midstream section of Upper Kellogg Creek (Meyer 1996:54).

No test trenches were excavated in the downstream section of the Upper Kellogg Creek, as it exhibited the same landform-sediment assemblages that had already been tested. Most of the downstream section has low potential for prehistoric archaeological materials. There was a small area described as being "near the base of the hillslope west of the former Vasco Road and southwest of Kellogg Creek" (Meyer 1996:54) that resembled the midstream portion of Upper Kellogg Creek, which had a paleosol (the floodplain that was subsequently excluded from Meyer's study area). As this area may also contain a paleosol the archaeological potential is considered low to moderate.

Five test trenches were excavated within the Middle Kellogg Creek portion of the pipeline route. Small areas of elevated landforms consist of older alluvium with a single, well-developed soil profile. This alluvium was found to be Pleistocene in age, and while archaeological potential within the alluvium was considered low, Meyer (1996:55) believed that deposits may exist on the portions of these landforms that are now covered by younger alluvium.

An intact paleosol was found within the almost level floodplain that constitutes the majority of the Middle Kellogg Creek area. The paleosol, dated to 8775 cal B.P., was found approximately 137 cm below surface in the middle reaches of the floodplain. The overlying alluvium was dated to 2970 cal B.P. indicating that the paleosol was available for occupation for approximately 5000 years. Meyer (1996:57) identified a moderate potential for subsurface archaeological deposits within this area.

The Lower Kellogg Creek portion of the pipeline route, where the Old River Pipeline (Delta-Transfer Station Pipeline) intersects the Transfer Pipeline (Transfer Station-Los Vaqueros Pipeline), was found to be similar to the Middle Kellogg Creek segment. The upper 240 cm of soil was excavated revealing a single, moderately developed soil profile within alluvium considered to be late Holocene in age. Based on the likelihood of related depositional histories between the Lower and Middle Kellogg Creek areas, Meyer (1996:57-58) predicts that a paleosol may exist deeper than 240 cm below surface, and there is therefore a moderate potential for subsurface archaeological deposits in this area.

Meyer's test trenching continued north of the current study area. In all, Meyer identified paleosols in five of the six valleys that he tested, ranging in depth from 70 to 440 cm below surface, with an average depth of 164 cm below surface. This is similar to the mean depth (141 cm) of subsurface archaeological sites found within the San Ramon Valley in western Contra Costa County northwest of the study area (Meyer 1996:69). The presence of prehistoric archaeological deposits buried beneath sterile alluvium has also been noted within the Walnut Creek floodplain and in the Livermore Valley, and several sites within the interior Alameda and Contra Costa counties revealed cultural materials in association with paleosols (Meyer and Rosenthal 1997:II.4). Meyer's predictions for the subsurface archaeological potential that apply to the current study area are summarized in Table 1 (refer to Figure 3).

Table 1. Archaeological Potential of Los Vaqueros 100 TAF Reservoir Project (adapted from Meyer 1996:Table 4)

Landscape Segment	Early Holocene	Middle Holocene	Late Holocene
Upper Kellogg Creek			
Upstream section	Low	Moderate	High
Midstream section	None	None	None
Downstream section	Moderate	Moderate	Low
Middle Kellogg Creek	Moderate	Moderate	Low
Camino Diablo Hillfront	None	None	None
Lower Kellogg Creek	Moderate	Moderate	Low

The subsurface archaeological testing was invaluable for the 100 TAF Los Vaqueros Reservoir Project cultural resources compliance with Section 106, as the method, study, and approach established by Meyer using geology to predict potentials for buried, intact archaeological deposits, removed much of the guesswork from cultural resources mitigation. The predictive model that resulted from his study also applies to large portions of the expansion project and is considered throughout this assessment report.

2.3 Cultural Setting

This section provides background information pertinent to the evaluation of the cultural resources within the study area. The following summary is necessarily brief. The archaeological and archival research and recording of oral histories, conducted on behalf of CCWD for the 100 TAF Los Vaqueros Reservoir project has resulted in a comprehensive historical framework for the Los Vaqueros area. Researchers investigated Native American as well as immigrant and first generation American ties with the area. The prehistory of the region has been extended thousands of years deeper into the past through geoarchaeological testing, construction monitoring, and related archaeological data recovery that accessed previously unknown deeply buried sites in the valley floor. The following cultural setting integrates the results of the SSUAF studies for the 100 TAF Reservoir project.

<u>Prehistory</u>

Evidence gathered from recent archaeological investigations conducted under the auspices of CCWD in the Upper Los Vaqueros Watershed has revealed nearly 10,000 years of occupation, one of the longest sequences of human presence yet documented in a single locality in the broader San Francisco Bay Area (Meyer and Rosenthal 1997; Milliken et al. 2007). The most recently updated prehistory of the San Francisco Bay Area, as presented by Milliken et al. (2007), incorporates the findings of archaeological research conducted in the Los Vaqueros area. The prehistory presented in Meyer and Rosenthal (1997), is summarized below to provide a context within which to evaluate cultural resources and develop potential research questions to guide recommendations for mitigation. The interested reader is referred to Milliken et al. (2007) for an updated prehistory of the broader San Francisco Bay Area.

Meyer and Rosenthal (1997:V.13) have organized the prehistory of the Los Vaqueros region into five periods including:

- Lower Archaic period 10,000 to 6,000 B.P (8050 to 4050 B.C.)[3]
- Middle Archaic period 6,000 to 2,500 B.P. (4050 to 50 B.C.)
- Upper Archaic period 2,500 to 1,500 B.P. (50 B.C. to A.D. 450)
- Upper Archaic/Emergent period transition 1,500 to 700 B.P. (A.D. 450 to 1250)
- Emergent period 1,000 to 200 B.P. (A.D. 1250 to ca. 1750)

Two different chrono-cultural frameworks are commonly used to organize the archaeological record in the San Francisco Bay Area. One system comprises the Early-Middle-Late period divisions established by Beardsley (1954), commonly referred to as the Central California Taxonomic System (CCTS) (Gerow with Force 1968). The other system is based on the Archaic-Emergent period chronology established by Fredrickson (1973, 1994). The CCTS

[3] When dates are presented in B.P., the corresponding B.C./A.D. dates are provided in parentheses as a conceptual aid.

system divisions are primarily based on changes in material culture, including stylistic changes in artifacts such as shell beads, and the presence or absence of various artifact types or classes. Some temporal subdivisions have been refined to 200-300-year intervals on the basis of shell bead horizons that have recently been recalibrated using the radiocarbon dating technique (e.g., Groza 2002). The Archaic-Emergent period chronology represents changes in subsistence and settlement patterns, economic strategies, as well as stylistic elements of the material culture. Choice of chrono-cultural framework depends upon the research questions and the nature of the archaeological record being studied. It is interesting to note that Milliken et al. (2007) use a hybrid system for their recent reevaluation of the prehistory of the San Francisco Bay Area, applying a combination of the temporal sequence of the CCTS, and the cultural sequence of the Archaic-Emergent framework (ibid.:101).

As Meyer and Rosenthal (1997:II.12) point out, the Los Vaqueros study area had not been widely studied prior to the Los Vaqueros Reservoir Project studies, which began in the 1980s, and the archaeological record was not well-known compared to those of the neighboring San Francisco Bay and the Delta regions. The CCTS had been developed in ignorance of the true time depth of the Los Vaqueros occupation; with the earliest period beginning after people had been living in the Los Vaqueros area for thousands of years. Due to both the relative lack of archaeological studies, and a general scarcity of temporally diagnostic artifact types, such as shell beads, from those sites that had been investigated, the divisions of the CCTS, based largely on changes in temporally diagnostic artifact types, were not as effective for linking discrete deposits from the Los Vaqueros area to time-specific subperiods of the CCTS. For these reasons, Meyer and Rosenthal frame their analysis with the Archaic-Emergent scheme, which allows for greater time depth. This framework also places the interpretive focus on behavioral changes, such as shifts in economic strategies and mobility patterns, though these are identified in part by temporally diagnostic artifacts, such as millingslabs or mortars. Nonetheless, with the accumulation of evidence in the 1990s from the archaeological excavations undertaken as part of the mitigation for the Los Vaqueros Reservoir, Meyer created a chrono-cultural sequence, depicted in Figure 4, largely based on artifact types for the Los Vaqueros area (adapted from Meyer, depicted in Milliken et al. 2007:122-123). This sequence presents the updated Los Vaqueros scheme in relation to both the Archaic-Emergent scheme (e.g., Fredrickson 1974) and the Early-Middle-Late scheme (e.g., Bennyhoff and Hughes 1987).

Meyer's chart summarizes notable developments and refinements of the chrono-cultural framework for the Los Vaqueros area, directly resulting from the cultural resources mitigation measures stemming from compliance with both CEQA and NEPA, including:

- Extending the Lower Archaic 2000 years deeper in time to at least 10,000 B.P. (8050 B.C.), formerly the province of the Paleoindian period according to Fredrickson (1974); and a time not covered by the CCTS (e.g., Bennyhoff and Hughes 1987).

Figure 4: Chrono-cultural Sequence for the Los Vaqueros Region

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- Extending the beginning of the Middle Archaic 1000 years back in time to around 6000 B.P. (4050 B.C.), whereas the Fredrickson Middle Archaic originates around 5000 B.P. (3050 B.C.) (1974).
- Dividing the Upper Archaic to include an Upper Archaic/Emergent transition period.
- Dividing the Emergent period into a Lower and an Upper Emergent period.

Prehistoric components from sites investigated in the project area include one from the Lower Archaic, four from the Middle Archaic, six from the Upper Archaic, seven from the Upper Archaic/Emergent transition, and six from the Emergent.

Lower Archaic Period

The earliest occupation of the study area, during the Lower Archaic period is characterized by high residential mobility evidenced by short-term occupation of sites. Milliken et al. (2007:114) refer to this as a generalized mobile forager pattern. Artifacts characteristic of this period include millingslabs and handstones for processing plant resources such as seeds and nuts, and wide-stemmed projectile points. The radiocarbon date of 7920 cal B.C. represents the earliest date for cultural deposits from this period in the Kellogg Creek valley, obtained from a discrete charcoal concentration beneath an inverted millingslab at CA-CCO-696. The deposit lies at a depth of between 390 and 415 cm.

Other characteristics of the Lower Archaic period include the importation of obsidian from the North Coast Ranges and the preference for a tightly flexed burial position. CA-CCO-696 yielded a tightly flexed burial at a depth of 325 cm, radiocarbon-dated to 5490 cal B.C. A few hundred meters from CA-CCO-696, the oldest documented grave in the Kellogg Creek valley was recovered from CA-CCO-637, radiocarbon-dated to 6570 cal B.C. (Meyer and Rosenthal 1998).

Middle Archaic Period

During the Middle Archaic period residential mobility had decreased and base camps were established in the Kellogg Creek valley. Groundstone mortars and pestles replaced handstones and millingslabs by 4000 cal B.C. (Milliken et al. 2007:115). A wooden mortar was recovered with a groundstone pestle at CA-CCO-637, radiocarbon-dated to 3800 cal B.C. (Meyer and Rosenthal 1997). A groundstone mortar was recovered in association with deposits containing the remains of acorns and wild cucumber, dating to at least 5,700 years ago, at CA-CCO-696 (Rosenthal and Meyer 2004:34-35; Wohlgemuth 2004:143). In addition to acorns, Kellogg Creek occupants ground manzanita seeds and grey pine nuts. Despite the shift in plant resource processing tools, there is no documented change in associated floral assemblages throughout the Archaic period (Meyer and Rosenthal 1997:V.14). During the Middle Archaic period burial position became more variable, ranging from flexed to extended positions. The first cut shell beads are found in mortuary contexts. Valley occupants continued to obtain obsidian from distant sources.

Upper Archaic Period

During the Upper Archaic period residential mobility decreased and fixed villages were established. Plant resources from both the uplands and grassland-savanna were gathered, with an increased use of small seeds, but a continued preference for acorns. Bedrock milling stations, characterized by mortar cups ground into boulders and bedrock outcrops, first appeared between 1600 and 1300 B.P. (A.D. 350 to 650), based on stratigraphic evidence (Meyer and Rosenthal 1997:V.14). Bedrock milling stations are difficult to date because the mortars in the bedrock outcrops are only rarely found in stratigraphic association with intact midden containing datable evidence.

The Upper Archaic period burial customs once again show a preference for flexed burials. A difference in social status has been inferred from the differential distribution of uniformly made shell beads and ornaments in mortuary contexts. The shell also indicates the continuing importance of trade and exchange.

Upper Archaic/Emergent Period Transition

During the Upper Archaic/Emergent period transition there was a shift in burial practices and land-use patterns. Bedrock milling stations offer tangible evidence that more locations in the valley were utilized, but in contrast to the preceding period, occupations were brief and were probably associated with resource acquisition and processing. Occupation of the valley was more varied, including shorter-term use of both the lowland and the upland, where bedrock milling stations were often located. Burial customs shifted once again, to a preference for extended positions (Meyer and Rosenthal 1997:V.15). Obsidian use increased from earlier periods, but other exchange items were absent.

Emergent Period

By the Emergent period fixed villages were once again established in the lowlands and bedrock milling stations continued to be used for bulk processing of grassland-savanna small seed resources and upland nut and berry crops. Obsidian use increased, inferred by the importation of obsidian cobbles and minimally modified flake blanks, exclusively from Napa Valley sources (Meyer and Rosenthal 1997:V.15). Milliken et al. (2007:116) note the introduction of the bow and arrow at the beginning of this period. The people, traditions and culture of the Emergent Period in the Kellogg Creek valley and vicinity were most likely those encountered by the earliest European visitors to the area in the second half of the 18^{th} century.

Native American History

SSUAF produced a volume entitled *Native American History Studies for the Los Vaqueros Project: A Synthesis* (Fredrickson et al. 1997) in which several authors discuss the history of Native American occupation and use of the study area, and establish the nature and extent of Native American ties to the study area today. The following discussion briefly summarizes their findings.

Milliken has conducted extensive research on the likely proto-historic Native American occupants and their territories within the Los Vaqueros study area. Evidence for the physical connections of various family and tribal groups to the study area are tenuous. Attempts to reconstruct them have involved careful reading and analysis of mission records and linguistic analyses that include interpretations of historical relationship based on linguistic similarity and difference. Prior to missionization, the first records of Native Americans were written by Spaniards traveling through Native American lands. During the mission period the Spanish padres kept records of births, deaths, and marriages of Native Americans who were assimilated into the mission system. Based on extensive analyses of these records, Milliken has concluded that while a general picture of tribelet territories can be inferred, precise tribelet boundaries cannot be determined (Milliken 1997a:8). His examination of historical documents indicates that the Kellogg Creek drainage was near the boundary of two neighboring political groups, the Volvons (speakers of the Bay Miwok language) and the Ssaoams (speakers of the Costanoan/Ohlonean language), at the time of Spanish settlement in California.

The Volvon territory may have included the peak of Mt. Diablo and the adjoining rugged lands to the east. Volvon villages were located along the Marsh Creek drainage, possibly also at Clayton to the north of Mt. Diablo, or to the southeast in the Kellogg Creek drainage. The Ssaoams lived in the hill and valley country surrounding Brushy Peak and Altamont Pass, which separated the Livermore Valley from the San Joaquin Valley. Their territory may also have encompassed the high lands south and east of Kellogg Creek, including the Vasco Caves, and possibly the valley of Kellogg Creek itself. Portions of the pipeline corridors extend into what was Tamcan territory, to the east of the Volvon and Ssaoam territories. The Tamcans lived along the Old River branch of the San Joaquin River, east of the current town of Byron, and spoke Far Northern Valley Yokuts (Milliken 1995:255, 256, 259; 1997a:8-10, 24, 26, 28). Due to their location within a semi-arid environment, the Volvon and Ssaoam tribelets may have been less sedentary than their neighbors living in better watered locales. However, a benefit of their situation may have lain in their strategic trading position, between the Livermore and San Joaquin valleys (Milliken 1997b:37). Trade items that passed between the San Joaquin River Delta and areas closer to the San Francisco Bay included baskets and basketry materials, arrow shafts, finished arrows and pieces of obsidian, bows, shell beads, tobacco, preserved foods, bird feathers and minerals for paint (Milliken 1997b:42).

The arrival of the Spanish explorers in 1775 threatened the cultural and political organization of these native groups. The Franciscan priests were intent upon changing the native people of California into Catholic agriculturists, which led to a rapid and major reduction in native Californian populations. The native peoples living in the Mount Diablo region (including the present-day Los Vaqueros area) suffered a complete Spanish takeover of their lands by the end of the eighteenth century. The Spaniards founded Mission San Francisco de Asis (now called Mission Dolores) in 1776, Mission Santa Clara the following year, and Mission San Jose in 1797. While some natives were drawn to the mission life by their interest in Spanish technology and religion, others were opposed to the Spanish settlement and most were eventually forced to join the missions, retreat into the hinterlands, or were killed (Milliken 1997c:88).

Under Spanish missionization of the San Francisco Bay Area, the native populations continued to decrease in numbers. Seven missions were eventually established in what was once Ohlone territory and those natives who were living and working under the authority of the missions were baptized as Catholics (Levy 1978). Between 1803 and 1807, 108 Volvons were baptized, with half of the baptisms occurring at Mission San Jose and the other half at Mission San Francisco. One hundred and eight Ssaoam people, the entirety of the surviving Ssaoam population, were also converted at Mission San Jose during this same period. One hundred and thirty-seven Tamcan people were baptized at Mission San Jose between 1806 and 1824, with the majority of baptisms taking place in 1911. (Milliken 1995:256, 259; 1997a:24, 26, 28; 1997c:88). By the autumn of 1806, all members of the Ssaoam and Volvon tribelets had been removed to the missions or had passed away. Higher mortality rates from introduced diseases, social strain from disrupted trading networks, and environmental pressures resulting from encroachment of livestock on what were formally Native American lands served to largely eradicate aboriginal life ways (Milliken 1997c:88). The abandonment by the Ssaoam and Volvon people gave the Tamcans the opportunity to expand westward outside of their Delta territory (Milliken 1997c:105-106) until they too were subsumed under the mission system.

By 1832, the population had decreased to less than one-fifth of its number at the time of initial contact with the Spanish (Levy 1978). Only nine of the original Ssaoam neophytes and 11 Ssaoam descendents were living at Mission San Jose at the close of 1836. Likewise, only six original Volvons and five Volvon descendents survived at Mission San Jose (Milliken 1997d:137). Many of the surviving "converted" natives worked as vaqueros for the missions and spent much time grazing cattle. At that time, the Los Vaqueros area remained unclaimed and was one of the areas used by missions for cattle ranching.

Beginning in the mid-1830s, the missions became secularized resulting in more than 800 patents of land that comprised more than 12 million acres that were issued to individuals by the Mexican government in what is now California (Ziesing 1997a). After missionization, Native Americans dispersed and were most often lost to historical record keeping. Native Americans had few choices, and limited or no legal rights, once the mission system broke down. Under Spanish, and later Mexican, law, mission lands and stock were to be allocated to the mission Indians following disbandment of the mission. This almost never happened and much of the mission lands, including those areas previously used for cattle-grazing, were quickly divided up among elite Mexican families leaving the remaining Indian population with nothing. As a result, many native peoples migrated back to their homelands and began working as vaqueros or servants for the new owners of the land. Others did not join the system and lived apart from the ranchers, occasionally stealing livestock, especially horses (Milliken 1997d:137, 138).

Demand for Indian vaqueros to work on the large cattle ranches was so strong that raids on Native American villages were conducted to obtain Indian workers (Davis, Stewart and Hitchcock 1997:146). When Francisco Alviso, Antonio Higuera and Manuel Miranda were granted Cañada de los Vaqueros in 1844, they hired Native Americans to develop and maintain the rancho while they themselves resided elsewhere. Milliken was unable to determine how long this arrangement continued, but by 1860 no listings of Native American families at Los Vaqueros were included in the U.S. Census. The mid-1850s through the 1860s mark the first time that non-Native American land owners lived at Los Vaqueros (Davis, Stewart and Hitchcock 1997:145, 149; Milliken 1997d:142-143).

By at least the late-1880s, there is again evidence that Native Americans were living at Los Vaqueros. Site CA-CCO-450/H (the Upper Vasco Ranch Adobe Dwelling Site), has been identified, on the basis of historical records, as a ranch headquarters that may have accommodated Native Americans living slightly apart from the ranch complex who may have served as cowboys and household servants. Talking about the adobe ranch structure inhabited by the then landowners, Juan and Lorenzo Suñol, informants recalled that, at least by the late 1880s, an Indian rancheria was located approximately 1,000 ft. west of the adobe structure (Davis, Stewart and Hitchcock 1997:150). An archaeological study of the various components of this complex site could potentially reveal details of the nature of Native American-Immigrant rancher interaction and cultural exchange during the mid-1800s.

Milliken notes that the extensive research on the path of Ssaoam and Volvon (and by extension, Tamcan) descendents into the late 19th and 20th centuries has not yet been conducted. Due to large gaps in record keeping, this is likely to be a very difficult process (Milliken 1997d:144). Beginning in the early 1900s, academic interest in the fast-disappearing cultures of the Californian Native Americans resulted in a number of ethnographic and linguistic studies, primarily by staff and students of the Anthropology

Department at the University of California, Berkeley. However, their research focused on the reconstruction of pre-contact lifeways, rather than on what was happening contemporaneously (Davis, Hitchcock and Mertz 1997:156-157).

A group of Native Americans who had ties to the Los Vaqueros Reservoir area prior to missionization moved to an area in the foothills of the Sierra Nevada mountain range near the town of Ione. Lobo (1997) conducted interviews with Native American Ione residents who had ties to the Los Vaqueros area. The Ione area shares many physical characteristics of the Kellogg Creek landscape, although certain resources such as the reeds used in basketry, are not available in the Sierra foothills. Ione has long been a place of refuge for Native Americans who inhabited the Los Vaqueros region. In pre-contact times, people would migrate to the Sierra foothills during times of flooding (Lobo 1997).

Native Americans living in Ione have made visits to the Los Vaqueros area at various times throughout their lives, to which they express having strong emotional and spiritual ties. In the past, they traveled with relatives to visit other relatives and friends, many of whom are now deceased. Oral histories recorded by Lee Davis in 1993 revealed that the mother of Henry Alvarez, an Ohlone elder informant, used to take him to collect medicinal plants along Kellogg Creek and Vasco Road (Davis, Hitchcock and Mertz 1997:158). The Vasco Caves (which are outside of the study area) are notable landscape elements. The grinding stones (bedrock milling stations) at Los Vaqueros are another familiar and central element of the cultural landscape. Those at Los Vaqueros are very similar to those located in the Ione area (Davis, Hitchcock and Mertz 1997:161; Lobo 1997). Significant places such as Mount Diablo, the Upper Kellogg Creek valley, or Ione, are conceptualized as focal points by today’s Ione Miwok people. Lobo (1997:171) defines a focal point as "culturally significant gathering points or hubs within a region". The focal point contrasts with the boundary concept most commonly used by archaeologists. She argues that this concept allows a more realistic understanding of a people’s relationship to the natural environment and their social world. For more detailed information on the importance of the Ione and Mount Diablo regions to Native Americans refer to Lobo (1997) and Ortiz (1997).

Historical Background

The report details the historical background because the project area encompasses a Historic District and the project has the potential to adversely impact individual historic properties as well as the District. There would potentially be cumulative adverse effects to individual properties and the Historic District from the 100 TAF Reservoir and the proposed project. The detailed historical background provides a context within which to evaluate the resources and the project effects and to proposed research questions and future mitigation measures.

The founding of Mission San Jose in 1797 by Spain marked the start of European influence in the East Bay (Praetzellis et al. 1997:15). Settlements were established inland and reached nearly to the Los Vaqueros watershed, for maintenance of the Mission system's expanding grazing lands. At that time, the control of the Missions was focused around the more accessible San Francisco Bay. It was not until after Mexico's secession from Spain in 1821 that land was granted to private citizens, a practice that increased significantly after the 1833 act of the Mexican legislature that established the secularization of the missions.

During the 1820s the Los Vaqueros study area, then known as Poso de los Vaqueros (Spring of the Cowboys), was not yet settled although nearby surrounding areas were occupied by "mission outstations" (Praetzellis et al. 1997:15). The study area was, however, used for the Mission's yearly rodeo or cattle round-up (Praetzellis et al. 1997:15-17) which involved the separation and gelding of the free ranging Mission cattle.

Between 1835 and 1836 the Mexican government began offering grants of Mission grazing land primarily to *Californios* (both Spanish speaking descendants of European settlers, and Mestizo and Europeanized Natives) and Mexican colonists. By 1839, the areas surrounding the Los Vaqueros watershed had all been claimed (Praetzellis et al. 1997:17). At that time, the Los Vaqueros study area was still communal grazing land used for annual rodeos by the surrounding ranches in the same fashion as it had been under the Mission system (Praetzellis et al. 1997:17).

In 1836, Mission San Jose shut down, freeing the Indian neophytes to return to their villages, or take up work on the newly granted ranches. The secularization of the Missions was intended to be the final step of the process to make the Indians Spanish (Rawls and Bean 1998:26-27), after which the neophytes living in the communities surrounding Mission San Jose were to be granted half of the Mission land (Rawls and Bean 1998:59). However, this policy was never properly implemented and many neophytes were reduced to raiding horses from the local ranches, which resulted in violence and Mexican reprisals against them, as well as a general opposition to settling near the San Joaquin Valley (Stewart 1994:57-59).

It was not until February of 1844 that the Los Vaqueros study area was granted as a rancho (Ziesing 1997a:27). Three brothers-in-law, Francisco Alviso, Antonino Higuera, and Manuel Miranda first requested the Cañada de Los Vaqueros (Valley of the Cowboys) in May of 1841, when Alviso had built a corral for livestock he had begun grazing on the land, but the grant was not formally awarded until 1844. The Rancho consisted of an area of 4 leagues (17,754 acres), and was bounded by property owned by John Marsh to the north (Los Meganos), Antonio Maria Pico to the east (Cañada de Buenos Ayres), Robert Livermore and Jose Noriega to the south (Las Positas), and Jose Dolores Pacheco to the east (Rancho Santa Rita).

Alviso and his family did little to improve the land other than erecting tents and temporary shelters for the *Californios* and Native Americans they employed as ranch hands (Praetzellis et al. 1997:19). The land grant was intended to be a place for the owners to graze their herds while they resided further to the west in more populated regions (Ziesing 1997a:27).

In 1847 Francisco Alviso and his wife sold what was claimed to be the entire Los Vaqueros land grant to Jose Noriega and Robert Livermore, the owners of Rancho Las Positas located to the south. It was alleged that the other original grantees of the rancho, Manuel Miranda, Antonino Higuera, and their wives had transferred their interest to Alviso in 1846 (Praetzellis et al. 1997:24). At the time it was contested whether the deeds from Manuel Miranda and Antonino Higuera granting their thirds of the land were legitimate. If not, Francisco Alviso legally could only transfer the one-third of the grant to which he held title.

Robert Livermore, originally a merchant marine by trade, was known amongst the landed families of the area with whom he had associated since his arrival in Monterey in 1829 (Praetzellis et al. 1997:25). He had married into the Higuera family, and was the godfather to the first child of Manuel Miranda and his wife Maria. This connection may have been part of the reason for the family's inclination to acquire Los Vaqueros, just north of Livermore's Las Positas rancho. Livermore had known Jose Noriega since his early days in the area; the two had met at Mission San Jose in 1830. In 1835, they agreed to establish their own rancho, and in 1839 received the land grant for what would become Las Positas (Praetzellis et al. 1997:25).

Livermore and Noriega filed their claim to Los Vaqueros in February of 1852, and in September of 1855 the Board of Land Commissioners confirmed this (Praetzellis et al. 1997:24-25). In 1853, however, while waiting for the confirmation of the combined Los Vaqueros/Las Positas land grant, Noriega purchased full ownership of Los Vaqueros from Livermore to whom he in turn granted his share of Las Positas as part of the bargain (Praetzellis et al. 1997:25), thus separating the two grants.

Livermore however had already transferred his interest in the Los Vaqueros to his wife and children in 1852, a fact which he neglected to reveal to his partner. The deception was uncovered that same year and Livermore was forced to compensate Noriega (Ziesing 1997a:38) who retained rights to the property.

Jose Noriega, then believing he owned the entire Los Vaqueros land grant, sold half in April 1853 to Dr. Benjamin Cory, who in turn sold it to William Akenhead. Akenhead then lost his interest due to an unpaid debt and it was purchased by Juan Suñol in 1856 at a "sheriff's sale" (Praetzellis et al. 1997:25). Meanwhile, in 1855, Noriega had transferred the remaining half of Los Vaqueros to Massimo Fernandez, his brother-in-law (Praetzellis et al. 1997:25).

On November 14, 1857, Lorenzo Suñol (Juan's brother) purchased Fernandez's interest, while a group of Basque or *Basco* settlers purchased Juan Suñol's share from Etiene Garat (who received this portion of Los Vaqueros from Suñol in March of 1857) (Ziesing 1997a:38). When Lorenzo Suñol died intestate in 1866, Juan claimed his interest in the property (Praetzellis et al.1997:57).

It is possible that the *Bascos*' and Suñols' purchase of two halves of the Los Vaqueros land grant was orchestrated as a partnership (Praetzellis et al. 1997:28). The families operated on the Los Vaqueros land grant together for approximately 10 years, but despite any agreement they may have had going into the purchase of the land, they feuded constantly over grazing rights (Praetzellis et al. 1997:30). The Suñols and *Bascos* used the land in a fashion similar to that of the first grantees – primarily for grazing. During this period the rancho owners built living structures for themselves and their hands (Ziesing 1997a:28), but they only improved a very small portion of the land, amounting to approximately five acres (Ziesing 1997a:32).

In 1860, Simon Blum, a merchant originally from France but who had operated in northern California since the early 1850s, purchased the one third interest of Manuel Miranda as well as smaller interests from the heirs of Antonino Higuera, whose shares were alleged to have been sold by Francisco Alviso years prior to Livermore and Noriega. In 1862, Blum attempted to make a legal claim for his right to half of the Los Vaqueros rancho - he filed a suit against the Suñol and *Basco* families which would carry on for years before any resolution could be reached (Ziesing 1997a:38).

In 1864, Louis Peres, another Frenchman, and Pedro Altube, a Basque, were partners in the wholesale cattle-butchering business (Ziesing 1997a:65). The two acquired the *Basco* share of the Los Vaqueros grant, which they believed to be half of the total property (Ziesing 1997a:29). Peres would be one of the first ranchers in the area to fence his property, a decade before county law required such protections, although this improvement may have been an attempt to prevent encroaching land claims such as those of Simon Blum (Praetzellis et al. 1997:31).

By 1871 Pedro Altube had sold most of his interest in Los Vaqueros to Peres so that he could focus on investments in Nevada. It was during this period, in the late 1870s, that Peres began subdividing Los Vaqueros into smaller leased properties that paid a portion of their crops as rent. Under Peres' management as much as two-thirds of the property was improved for agriculture by 1880 (Ziesing 1997a:32). Family farms began replacing the large scale ranches that had existed in the area before, and, as a result, the local population expanded and communities began to develop.

Beginning in the 1870s, wheat became an important crop in the California agricultural economy. Shortages in the labor necessary for its harvesting led to increased mechanical specialization which resulted in California becoming one of the United States' leading agricultural producers at the time (Ziesing 1997a:87). During the 19th century California saw a number of such specialized 'booms' that increased due to technological improvements, such as improved transportation (Ziesing 1997a:87), and more rapid communication, both of which allowed for a more flexible and potentially variable market economy. Most farmers in the Los Vaqueros area however practiced mixed-agriculture at that time, combining hay and grain farming with the raising of sheep, cattle, and horses. As a result, such rapid changes in demand were felt, but not to the same degree as elsewhere in the state (Ziesing 1997a:87).

During the latter half of the 19th century, Los Vaqueros was the subject of a number of court cases due to the numerous illegitimate or contested claims to the land grant. Two of the most important of these lawsuits, *Louis Peres et al. v. Juan Suñol* and *Simon Blum v. Suñol* focused on the legality of Juan Suñol's claim to half of the property (Ziesing 1997a:38).

In 1870, the court decided that in *Louis Peres et al. v. Juan Suñol,* the Suñol land claim was invalid, giving Louis Peres legal right to one-sixth of the Los Vaqueros property (Praetzellis et al 1997:57). In the case of *Simon Blum v. Suñol* that went on until 1883, the case was decided for both plaintiff and defendant after appeals, and in the face of another appeal, Blum eventually settled for $8,500, obtaining the rights to the Suñol portion of the property, which amounted to two-thirds of the total land grant (Ziesing 1997a:38-40).

At the same time, Blum also persuaded Pierre Dupuy, who held half of the original estate granted to Cory by Noriega (one-sixth of the total Los Vaqueros land grant), to foreclose on Peres with whom he had a large mortgage (Ziesing 1997a:39-40). Peres received money from 'Railroad Baron' Charles McLaughlin in order to pay this debt. McLaughlin claimed that Peres sold him the property for the money he used to pay off his mortgage, while Peres claimed that he only borrowed from McLaughlin and used the Los Vaqueros property as surety (Ziesing 1997a:38). By 1890, Charles McLaughlin's estate gained ownership of the majority (five-sixths) of the Los Vaqueros landholding (Dupuy still held a one-sixth interest), although McLaughlin himself was killed in 1883 by the plaintiff in another lawsuit against him (Ziesing 1997a:101). Between 1881 and 1890, McLaughlin and his family made a number of improvements to the Los Vaqueros land grant, including petitioning the county to form the Vasco Grant School District and build a schoolhouse for the children of tenants. During this period, 4,000 to 5,000 acres of the grant were leased for a share of the tenants' crop, and 10,000 to 12,000 acres were leased for cash as cattle grazing land (Praetzellis et al. 1997:82). For more detail on the complex and somewhat confused exchanges of title and litigation regarding the Los Vaqueros land grant during the second half of the 19th century, see Ziesing (1997a:25-73) and Praetzellis et al. (1997:50-76).

Kate McLaughlin, Charles wife, died shortly after her husband was killed in 1883. The McLaughlin Estate was left to adopted daughter Mary Crocker, and niece Kate Dillon (who married into the Winship family) and became known as the Crocker/Winship Estate, although it was most commonly associated with Crocker.

In June 1929 Mary Crocker, then owner of the Los Vaqueros land grant, was killed in an automobile accident (Praetzellis et al. 1997:91), and shortly thereafter the Wall Street stock market crash of 1929 took place. The crash caused crop prices to fall so dramatically that tenants could no longer afford the rent on the land of the Crocker estate that they farmed (Praetzellis et al. 1997:94). The Crocker/Winship Estate owned the Los Vaqueros land grant until 1935 when it was divided and sold off in portions (Ziesing 1997a:148).

In the Vasco (a popular name for the Los Vaqueros land grant) falling crop prices were felt by tenants before owners, and by 1930 tenancy rates were dropping. Tenants were further affected as the Crocker estate began dividing and selling the original Los Vaqueros land grant. In 1936, Charles and Sue Nissen purchased 2,394 acres, and by 1940 they owned approximately 3,500 acres, farming some of the land and leasing the rest to many of the Crocker's former tenants (Ziesing 1997a:148-149). Oscar Starr, whose father-in-law and brother established the Caterpillar Tractor Company in the 1920s (Praetzellis et al. 1997:95), purchased 7,883 acres in 1935. Starr used the land as a sheep and cattle ranch, grew grain and hay, and built shops where he experimented with farm machinery, and in particular, developed the diesel version of the Caterpillar Tractor (Ziesing 1997a:152-153).

The Nissen portion of the land (in the south and east of the grant) was sold to the Jackson family in the 1950s. In the north, the Grueninger family, who had farmed the land for a number of years, at first as tenants, had acquired 640 acres by 1940 and by the late 1960s or early 1970s had sold their portion of the property to the Kaiser Construction Company. Other smaller landholders (especially in the Black Hills region) held onto their property into the 1960s (Ziesing 1997a:148-149).

Meanwhile, to the north of the Los Vaqueros land grant, another large land holding, Rancho de Los Meganos had been going through its own series of changes (a section of the Transfer Station-Los Vaqueros Pipeline Corridor traverses the eastern portion of Los Meganos). In 1836, near the end of the Mexican period, John Marsh arrived in Los Angeles, Alta California. While riding north in search of a place to settle down, he met Jose Noriega. Noriega agreed to accept all of Marsh's money, $500, in exchange for Noriega's Rancho de Los Meganos. Marsh thus became the first Anglo-American to settle in Contra Costa County (Emanuels 1993:204).

From 1838 until he built what became known as the "Stone House" in 1856, Marsh lived on the rancho in a small adobe structure. This adobe was apparently located very close to a group of Indians, likely to have been Bay Miwok. When twin brothers William and Joseph Smith moved their families from Massachusetts to California in 1849, John Marsh was there to greet them. Accounts vary somewhat, but it seems clear that shortly after their arrival the brothers were met by Marsh and quickly acquired land, either from Marsh's vast holdings or from an unknown party (Kyle 1990:64; Munro-Fraser 2000:671). The brothers were both carpenters and ordained ministers and they quickly found jobs in 'New York of the Pacific,' today known as Pittsburgh, constructing housing for the flood of migrants coming to California in search of gold. Joseph died of malaria that first winter.

The following summer, William received news that a ship docking in San Francisco was carrying passengers from Maine wanting to settle permanently in California (Kyle 1990:64). He immediately went to greet them and offered each family a lot at Smith's Landing on which to build a home. Approximately half of the families accepted his offer, and the settlement they created was named Antioch at their 1851 Fourth of July picnic (Munro-Fraser 2000:672-3).

On June 24, 1851, Marsh, who was then in his 50s, married Abbie Tuck. She was a devout Baptist living with missionaries near San Jose. He took her to live in his four-room, earthen-floor adobe house. In 1854 he hired artisans to build a more permanent and stately structure, later to be known as the Stone House. The cost of the building was about $20,000 (Historic Record Company 1926:381). Abbie Marsh died in August 1855 before the house was finished, leaving behind John Marsh and their young daughter, Alice (Emanuels 1993:204).

On September 24, 1856, Marsh was stabbed to death on the road just outside Martinez by Jose Olivas, Juan Garcia, and Felipe Moreno, three disgruntled employees who felt he had cheated them out of their wages. They overtook his buggy on mustangs while he was traveling to Martinez. They lassoed him, pulled him off his buggy, and then stabbed him to death. His driverless horse and buggy continued on to Martinez, where it was spotted by some citizens, who went back and found his body (Historic Record Company 1926:382).

After a series of events, Marsh's rancho was finally acquired by James T. Sanford. According to Emanuels (1993:199) the only noteworthy aspect of Sanford was his sale of a few acres to the San Pablo and Tulare Railroad, thereby defining the land for the village of Brentwood. Sanford, together with John F. Williams, owned all of the Brentwood Coal Company, which also held partial title to the Marsh land. In 1878, Sanford missed his mortgage payments on the Marsh property, and the Savings and Loan Society wasted no time in acquiring it (Emanuels 1993:200).

The Savings and Loan Society of San Francisco kept most of the rancho land for 22 years, renting it out to dry-land farmers. Rent was paid in the form of wheat or barley at a rate between one-quarter to one-third of their crop (Emanuels 1993:200). On October 23, 1900, a group of Scottish investors, Balfour-Guthrie Investment Company, bought Rancho de Los Meganos from the Savings and Loan Society for $200,799.43. Even though Balfour-Guthrie purchased the land in 1900, it took until 1913 for the firm to obtain a portion of the ranch still owned by the estate of James T. Sanford (a little more than 5.25 percent of the land), which they offered $50,000 for the parcel. At the same time, the company acquired another 500 acres from Peter G. King (Hohlmayer 1991a).

On September 16, 1912, a permit was issued by the chief of the U.S. Army Corps of Engineers and authorized by the Secretary of War to divert 200 cubic ft. per second of water from Indian Slough, a branch of Old River (which, in turn, was a branch of the San Joaquin River) in Contra Costa County (Hohlmayer 1991a). Balfour-Guthrie spent $500,000 that same year building an irrigation system to spread water over more than 22,000 acres, including lands near the cities of Brentwood and Knightsen, Discovery Bay to the east, and the town of Oakley to the north.

The development of this irrigation system changed the land use in the area from cattle, grain, and alfalfa production to dairy farms, orchards (walnuts, cherries, almonds, apricots, peaches, and plums), and vineyards (Hohlmayer 1991b). Planting of other crops, such as tomatoes, strawberries, and beans began in the 1950s.

Further to the east, the Delta lands, through which the Delta-Transfer Station Pipeline Corridor runs and upon which the Old River Pump Station is situated, were in the process of being reclaimed. Development of the Delta began in 1850 with the Swamp and Overflow Land Act, which transferred ownership of all swamp and overflow lands, including the Delta marshes, from the Federal government to the State government. This transfer was on condition that the State allocate revenue from land sales towards swamp reclamation, including the construction of levees and drains. Land in the Delta was available for private purchase and state laws enacted in 1855 and 1858 set the acreage limit and price per acre to prevent monopolies and speculation. Reclamation was at the whim of the land holder and so was undertaken in a piecemeal and uncoordinated manner (Hittell 1872:604; Mitchell 1994:411-412; State of California, Department of Water Resources 2007:2-3).

In 1861, the Board of Swamp-Land Commissioners was developed to manage reclamation projects. The Board failed to implement large-scale reclamation projects or flood-control plans which left it open to political criticism. Five years after its formation, the Board was disbanded and its authority reassigned to county boards of supervisors (Hittell 1872:598; Mitchell 1994:412-413; State of California, Department of Water Resources 2007:3). In 1868, a new law was adopted that authorized reclamation districts and allowed tax assessments to be supervised at the county level. County boards of supervisors could form reclamation districts, controlled by trustees who were elected by land holders. Acreage limitations were removed allowing large-scale investment in swampland reclamation. By 1871, nearly all delta swampland was in large private holdings (Mitchell 1994:414).

The first levees within the Delta were hand-built using some horse power. Most of the laborers were Chinese. The costs of maintaining the levees within the unstable Delta soils became prohibitive. In the late 1870s, steam-powered dredges were introduced to move alluvial soils from the channels for large levee construction at around half the cost of hand-powered labor. By the end of World War I, nearly all of the Delta marshland had been reclaimed, and the number of operating dredges markedly decreased. The transformation of the Delta into the series of channels and levied islands as it appears today was almost complete (State of California, Department of Water Resources 2007:3).

In 1936, the Contra Costa Water District (CCWD) was formed by a popular vote for the purpose of "contracting, purchasing, and distributing the water provided by the U.S. Bureau of Reclamation" (Ziesing 1997a:149). The construction of the Contra Costa Canal in 1948 greatly facilitated this, but by 1960 customer demand began to force the development of a new intake and a backup reservoir (Ziesing 1997a:149). The Kellogg Creek valley became the prime target for this new development due to the generally underdeveloped farming and grazing land along the creek, and steep terrain ideal for damming (Ziesing 1997a:149-150).

The process of planning and negotiating the Los Vaqueros Reservoir progressed slowly through the 1970s, and it was not until 1985, under the threat of impending development, that the CCWD was finally forced into action. By 1988, funding was obtained for the project and over the next decade the necessary land was purchased (Ziesing 1997a:150).

The Kellogg Creek Historic District

The Upper Kellogg Creek Watershed was designated a Historic District in 1992. Most recorded sites within the Watershed comprise the Kellogg Creek Historic District. The National Register of Historic Places defines a 'district' as:

> [A] geographically definable area, urban or rural, possessing a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united by past events or aesthetically by plan or physical development. A district may also comprise individual elements separated geographically but linked by association or history (NPS NRHP 2004).

The District encompasses both archaeological and architectural properties from the prehistoric and historic periods. SSUAF, author of the ′Evaluation, Request for Determination of Eligibility, and Effect′ for the original Los Vaqueros Project, stated that "While the determination of continuous occupation awaits further investigation, these resources appear to be linked because they illustrate settlement and subsistence patterns through time within an intermediate zone situated between the Delta/Sacramento Valley, San Francisco Bay Area, and the Coast Ranges" (SSUAF 1992:65). As well as occupational continuum, SSUAF based their assessment on physiographic features, historic land-holding boundaries, and establishment of a district as a management tool (SSUAF 1992:78). They recommended the inclusion of 68 historic properties comprising 69 cultural components within the District. The prehistoric period is represented by 12 open sites, 16 milling stations, 8 rock shelters and a rock art site. A ranch site represents what SSUAF refers to as the "ethnohistoric" period (historic period occupation by Native Americans), and the historic period includes an ancillary farm or ranch complex, a water management feature, five stone fences and corrals, 23 farm or ranch headquarters, and a site of unknown characteristics (SSUAF 1992:80). In addition to these, two prehistoric milling stations and five water management features recorded by Ziesing in 2000 are considered eligible for NRHP district status, bringing the total of historic properties within the District to 75. The Los Vaqueros Expansion study area encompasses a portion of the historic district and a subset of these properties. Although the Expansion study area does not coincide with the historic district boundaries, the historic district will continue to be treated as a historically coherent and significant unit and all historic properties that have been evaluated and found eligible for listing on the NRHP as contributing elements to the historic district will maintain that status.

EXPECTED PROPERTY TYPES

Property types were defined by SSUAF to aid in the process of evaluation and protection of cultural resources (SSUAF 1992:37-40). SSUAF developed a site taxonomy based on a combination of visible traits (e.g., rockshelter, midden) and inferred site function (e.g., base camp). Property types share some attributes but the type distinctions emphasize the major attributes. Prehistoric property types typically found in the Kellogg Creek Historic District and in the lands to the east (west of the Old River) include but are not limited to the following classification, largely based on the SSUAF property type taxonomy:

Open Sites exhibit prehistoric deposits that may or may not be visible on the surface. These sites have an open setting, often with an overview of valley lands. They may include features such as burials and/or bedrock milling stations. The deposits include materials associated with domestic activities such as concentrations of debitage, fire-affected rock, burned and unburned animal bone, and/or shell, which are common components of midden. For this reason some open sites have been interpreted as occupation sites. Open sites with less diverse materials may represent special-purpose stations. Examples of open sites within the study area include CA-CCO-447/H and -458/H.

Large Occupation Sites or Small Villages are similar to open sites, or base camps, but are larger in size and have a higher degree of diversity of materials. None of the sites identified during the original Los Vaqueros cultural resource studies has been classified as a large occupation/small village. The nearest example is CA-CCO-320 in Round Valley, just north of the study area.

Milling Stations are identified by the presence of bedrock mortars (bedrock milling stations). Such sites may also contain prehistoric cultural deposits such as concentrations of debitage, fire-affected rock, burned and unburned animal bone, and/or shell, or other rock features, but these deposits are often sparse, if present. There are many milling stations within the study area. Examples include CA-CCO-462 and -463.

Rockshelters are often found in large rock outcrops and may contain associated features such as midden (prehistoric cultural deposits with concentrations of debitage, fire-affected rock, burned and unburned animal bone, and/or shell), bedrock milling stations, or rock art. None of the known historic properties in the study area have been classified as rockshelters.

Lithic Scatters are concentrations of flaked stone materials such as obsidian or chert that represent the remains of stone tool production. These typically lack other cultural materials or features. Although SSUAF did not include this property type in their original classification, lithic scatters are often the initial identifier of buried prehistoric sites. The property type is included here because surface surveys may identify a lithic scatter that may later be redefined on the basis of subsurface testing and data recovery. Thus, it is a useful category for classifying initial finds before mitigation has been undertaken.

Rock Art Sites include the painting, pecking, or engraving on rock faces, which can occur in isolation or in association with bedrock milling stations, midden, rockshelters, and/or subsurface deposits. The rock faces may be found on isolated or grouped boulders or rock shelter interiors. Painting on rock surfaces in Central California is both a rare occurrence and highly susceptible to, and easily degraded by, vandalism. The petroglyph boulder CA-CCO-597 is the sole example of a rock art site within the study area.

Ranch Sites date to the Post-Mission period, represent Native American ranch laborer occupations in proximity to ranch headquarters, and are characterized by Native American materials (e.g., flaked stone artifacts and debitage) located near historic-period ranch structures. Such sites are relatively recent and show little evidence of significant soil modification. SSUAF believes that CA-CCO-450/H is a representative of this property type, an interpretation partially based on historic accounts.

In summary, the prehistoric and ethnohistoric period property types found within the study area include a ranch site, rock art site, milling stations, and open sites. Property types found within the vicinity but not within the study area include large occupation sites or small villages, and rock shelters.

Historic property types commonly encountered in the Kellogg Creek Historic District but also found in the lands to the east (west of Old River) include but are not limited to the following:

Ranch or Farm Headquarters include ranching or farming structures as well as domestic features. These may include: living quarters, structural remains such as building platforms, terracing, footings, cellar holes, chimney bases, hand-dug wells, privies, cisterns, barns, corrals, or non-native vegetation, roads, and fences. These properties are either the historically documented headquarters of farming or ranching operations or contain archaeological features that indicate such use. The Perata/Bonfante tenant ranch, CA-CCO-427H, is an example of a ranch headquarters.

Ancillary Farm/Ranch Complex represents a temporary domestic occupation associated with some animal management feature, such as a corral. Site CCO-454H, the Los Vaqueros sheep camp, is an ancillary ranch complex.

Isolated Refuse Dump can be identified by the presence of historic-period refuse without any of the other features listed under farm/ranch headquarters. The historic component of CA-CCO-458/H was classed as a refuse dump and recommended as not eligible for listing on the NRHP in 1992.

Water Management Feature defines individual or associated features used for the storage or manipulation of water. They include: dams, reservoirs, stockponds, water tanks, spring improvements, creek improvements, wind pumps/troughs, and ditches. Associated water management features comprise the historic component of CA-CCO-467/H.

Livestock Features are built elements used for the maintenance of livestock. They include stone and wood corrals and fences. The three-sided stone structure at CA-CCO-726/H has been interpreted as a livestock feature.

Historic Artifact Scatters are defined by debris and refuse concentrations and caches from the historic period characterized by materials such as glass (e.g., fragments of window pane, bottles), ceramics (e.g., table ware, storage containers), metal (e.g., wire, nails, farm equipment), brick, and/or wood. They are represented by such deposits and are also defined by the absence of structural remains, standing or collapsed.

In accordance with federal guidelines, deflated or collapsed buildings are treated as archaeological phenomena, while standing structures are considered architectural properties.

3.0 Literature and Records Search

The cultural resources of the Los Vaqueros Watershed have been studied extensively by CCWD starting in the mid-1980s. The EIS/EIR for the original Los Vaqueros Project was certified in the early 1990s and the reservoir was filled with water in 1998. Since that time, the cultural resources of the Watershed have been managed and monitored by CCWD staff. In 2001 the Los Vaqueros Study Team began to thoroughly review all the documentation regarding cultural resources in the study area and to verify the locations of selected sites in areas that would be directly affected by reservoir expansion. This cultural assessment effort was concentrated within the Los Vaqueros Watershed, although data were also collected for the potential conveyance corridor alternatives in the lands that lie between the reservoir to the west and the Delta to the east. The staff of the Northwest Information Center (NWIC) of the California Historical Resources Information System conducted records searches October 22, 2001 (NWIC File No. 01-970), October 30, 2003 (NWIC File No. 03-249), January 8, 2004 (NWIC File No. 03-458), and March 20, 2007 (NWIC File No. 06-1316). An additional records search was conducted by Heidi Koenig of ESA on April 16, 2008 (NWIC File No. 07-1482). Staff reported locations of known cultural resources and previous cultural resources studies within the study area and adjoining ¼-mile area on USGS 7.5-Minute Topographic Maps of Brentwood (1978), Byron Hot Springs (1953, photorevised 1968), Clifton Court Forebay (1978), Tassajara (1991), and Woodward Island (1978).

The NWIC staff also searched the Office of Historic Preservation Historic Properties Directory with archaeological determinations of eligibility (September 18, 2006); the California Inventory of Historical Resources (March 1976); the Historic Resources Inventory of Contra Costa County (1989); and the following Historic maps: 1861 Rancho Cañada de los Baqueros Plat Map; 1861 Rancho Los Meganos Plat Map; 1862 GLO Plat Maps T1N R2E, T1N R3E, T1S R2E, and T1S R3E; 1871 GLO Plat Map T2S R2E; 1879 Smith & Elliott (publishers) Map of Contra Costa County and Part of Alameda County; 1898 (reprinted 1947) USGS Mt. Diablo Quadrangle; and the 1916 (reprinted 1948) USGS Byron Quadrangle. Results are presented by project component below.

3.1 Previous Studies

A total of 59 previous studies have been conducted in portions of the study area. Table 2 lists these studies in chronological order by author and report number (NWIC filing system), year, type of study, and the project component(s) of the Los Vaqueros Expansion that they overlap. Full bibliographic references for these studies are presented in the References section.

Table 2. Previous Cultural Resources Studies

Author/ Report No.	Year	Survey/Study Type	Comments	Project Component(s)
Brown, Kyle, Adam Marlow, Thomas Young, James Allan and William Self S-029590	2004	mixed survey strategy, pedestrian & windshield	includes P-01-010702, Brushy Creek Ranch	LV-SBA Pipeline
Chavez, David and Jan M. Hupman S-026870	2003	intensive pedestrian survey	no significant cultural materials observed	Transfer-Bethany Pipeline
Giliberti, Joseph S-027445	2002	mixed survey strategy, pedestrian and windshield	no significant cultural materials observed	Delta-Transfer Pipeline
Stoyka, Michael and Michael Meyer S-023758	2001	intensive pedestrian survey	includes CCO-427H & CCO-459	275 TAF Reservoir
Hattersley-Drayton, Karana S-022707	2000	Site-specific investigations	relates to CCO-450/H	275 TAF Reservoir; western Access Road
SSUAF S-022918	2000	intensive pedestrian survey	includes CCO-427H & CCO-459	275 TAF Reservoir
Meyer, Jack and Michael D. Meyer S-022919	2000	archaeological monitoring & data recovery	includes CCO-447/H, -450/H, -725, -726/H & P-07-000791	275 TAF Reservoir
Meyer, Michael D. and Jack Meyer S-023208	2000	Site-specific investigations: site recording, monitoring	Includes CCO-453/H and 534H	160 TAF Borrow Pit
Meyer, Jack, Lori Hager, Thomas Martin and Annita Waghorn S-023280	2000	site specific investigations	relates to CCO-397	Transfer-LV Pipeline
Hattersley-Drayton, Karana and Mary Praetzellis S-023523	2000	site specific investigations	relates to CCO-450/H	275 TAF Reservoir; western Access Road
Praetzellis, Mary, Jack Meyer and Suzanne Stewart S-021899	1999	Historic Property Treatment Plan	includes CCO-9, -397, -446, -447/H, -452, -459, -463, -535H, -725, -726/H & P-07-00791	275 TAF Reservoir; Transfer-LV & Inlet-Outlet Pipelines; Marina Facility; western Access Road
Meyer, Jack and Jeffrey S. Rosenthal S-020396	1998	archaeological monitoring	Site-specific, relates to CCO-637	New Dam
Meyer, Jack S-020398	1998	site specific investigations	relates to CCO-450/H	275 TAF Reservoir; western Access Road
Meyer, Michael D. and Suzanne B. Stewart S-021113	1998	site specific investigations	relates to CCO-535H	Transfer-LV Pipeline

Table 2. Previous Cultural Resources Studies (continued)

Author/ Report No.	Year	Survey/Study Type	Comments	Project Component(s)
Praetzellis, Mary, Suzanne B. Stewart, and Grace H. Ziesing S-019318	1997	research	includes site histories of CCO-427/H, -445H, -446H, -447/H, -450/H, -467/H, -470H & -535H	275 TAF Reservoir; Transfer-LV & Inlet-Outlet Pipelines
Ziesing, Grace H. S-019319	1997b	site specific investigations	relates to CCO-470H	275 TAF Reservoir
Meyer, Jack and Jeffrey S. Rosenthal S-020072	1997	site specific investigations	relates to CCO-447/H, -458/H, -459, -468, -469, -636, -637 & -696	275 TAF Reservoir; New Dam
Meyer, Jack and David A. Fredrickson S-018187	1996	subsurface testing	includes CCO-447/H & -637	Transfer-LV & Inlet-Outlet Pipelines
Solari, Elaine-Maryse and Dell Upton S-018202	1996	site specific investigations	relates to CCO-470H	275 TAF Reservoir
Brady and Associates, Inc. and Sonoma State University Anthropological Studies S-018558	1996	regional overview & management plan	includes CCO-9, -397, -446H, -447/H, -450/H, -452, -462, -463, -467/H & -535H	275 TAF Reservoir, Transfer-LV & Inlet-Outlet Pipelines
Meyer, Jack S-018641	1996	subsurface testing	includes CCO-637 & -696	New Dam; Expanded Old River Intake & Pump Station; Transfer Station; Transfer-LV & Inlet-Outlet Pipelines
Ziesing, Grace H. S-018933	1996	subsurface investigations	Site-specific project, relates to CCO-427H, -445H & -447/H	275 TAF Reservoir; Inlet-Outlet Pipelines
Meyer, Jack S-017546	1995	mixed survey strategy, pedestrian	no significant cultural materials observed	275 TAF Reservoir; LV-SBA Pipeline
Meyer, Jack S-016654	1994	intensive pedestrian survey	no significant cultural materials observed	New Delta Intake and Pump Station
Sonoma State University Academic Foundation S-018252	1994	Historic Property Treatment Plan	includes CCO-427/H, -445H, -447/H, -458/H, -459, -468, -469, -470H, -636 & -637	275 TAF Reservoir; New Dam
Praetzellis, Adrian, Grace H. Ziesing and Mary Praetzellis S-019524	1994	historic study	includes CCO-427, -450/H & -470	275 TAF Reservoir

Table 2. Previous Cultural Resources Studies (continued)

Author/ Report No.	Year	Survey/Study Type	Comments	Project Component(s)
Moratto, Michael J. (ed) S-023674	1995	survey	no significant cultural materials observed	Delta-Transfer, Transfer-LV & Transfer-Bethany Pipelines
Holman, Miley Paul S-013839	1992	mixed survey strategy, pedestrian	no significant cultural materials observed	Transfer-Bethany Pipeline
Bramlette, Allan G., Mary Praetzellis, Adrian Praetzellis, Katherine M. Dowdall, Patrick Brunmeier and David A. Fredrickson S-013256	1991	mixed survey strategy, pedestrian	no significant cultural materials observed	Delta-Transfer Pipeline; Expanded Old River Intake and Pump Station; Transfer-LV, LV-SBA, & Transfer-Bethany Pipelines; Expanded Transfer Facility
Fong, Michael R. and Donna M. Garaventa, Stuart A. Guedon, Steven J. Rossa and David G. Brittin S-014597	1991	intensive pedestrian survey	no significant cultural materials observed	Transfer-Bethany Pipeline
Romano, Melinda S-012275	1990	intensive pedestrian survey	no significant cultural materials observed	Delta-Transfer Pipeline
Jackson, Thomas L., Michael J. Moratto, Richard M. Pettigrew, C. Kristina Roper and Randall F. Schalk (eds) S-012300	1990	intensive pedestrian survey	no significant cultural materials observed	Delta-Transfer & Transfer-Bethany Pipelines
Bramlette, Allan, Mary Praetzellis, Adrian Praetzellis, Margaret Purser and David A. Fredrickson S-012800	1990	mixed survey strategy, pedestrian	CCO-447/H, -458/H, -467/H, -636, -637 & -726/H	275 TAF Reservoir; Transfer-LV, LV-SBA, Transfer-Bethany, & Inlet-Outlet Pipelines; New Access Road
Bramlette, Allan, Mary Praetzellis, Adrian Praetzellis and David A. Fredrickson S-010040	1988	mixed survey strategy, pedestrian	includes CCO-9, -397, -427H, -445H, -446H, -447/H, -450/H, -452, -458/H, -459, -462, -463, -464, -467/H, -468, -469, -470H & -535H	275 TAF Reservoir; New Dam; Borrow Area; Dam Stockpile; Transfer-LV, LV-SBA & Inlet-Outlet Pipelines; Marina Facility; Interpretive Center Options; Fishing Access; Day-Use Facilities; User Parking, western Access Road

Table 2. Previous Cultural Resources Studies (continued)

Author/ Report No.	Year	Survey/Study Type	Comments	Project Component(s)
Holman, Miley Paul S-010461	1988	mixed survey strategy, pedestrian	P-01-010702 is within the survey area but not recorded	LV-SBA Pipeline
Bramlette, Allan G. S-008969	1987	mixed survey strategy, pedestrian	no significant cultural materials observed	LV-SBA Pipeline
Bramlette, Allan and Albert J. Villemaire S-009385	1987	archaeological monitoring	encountered CCO-696	275 TAF Reservoir; Inlet-Outlet Pipelines
Keswick, Janet A., Allan G. Bramlette and David A. Fredrickson S-009400	1987	mixed survey strategy, pedestrian	no significant cultural materials observed	LV-SBA Pipeline
Orlins, Robert I. S-009466	1987	record search only	no significant cultural materials on record at NWIC	LV-SBA Pipeline
Eidsness, Janet P. and Randall A. Milliken S-008108	1986	mixed survey strategy, pedestrian	CCO-397 & -535H	Stockpile Area; Transfer-LV Pipeline; Interpretive Center North Option
Frederickson, David A. S-008757	1986	review of previous studies	no significant cultural materials	275 TAF Reservoir
Holman, Miley Paul S-008912	1986a	mixed survey strategy, pedestrian	CCO-597 within survey area but not recorded	Transfer-Bethany Pipeline
Holman, Miley Paul S-008913	1986b	mixed survey strategy, pedestrian	no significant cultural materials observed	Transfer-Bethany Pipeline
Jensen & Associates S-010509	1986	intensive pedestrian survey	CCO-397	Transfer-Los Vaqueros Pipeline; LV-SBA Pipeline; Transfer-Bethany Pipeline
Holman, Miley Paul S-007679	1985	mixed survey strategy, pedestrian	no significant cultural materials observed	LV-SBA & Transfer-Bethany Pipelines
Holman, Miley Paul S-006699	1984a	mixed survey strategy, pedestrian	no significant cultural materials observed	LV-SBA Pipeline
Wiberg, Randy S. S-006701	1984	mixed survey strategy, pedestrian	no significant cultural materials observed	LV-SBA Pipeline
Holman, Miley Paul S-006710	1984b	mixed survey strategy, pedestrian	no significant cultural materials observed within APE	LV-SBA Pipeline
Holman, Miley Paul S-007090	1984c	mixed survey strategy, pedestrian	no significant cultural materials observed	LV-SBA Pipeline
Clark, Matthew R. S-005869	1983	intensive pedestrian survey	no significant cultural materials observed	Transfer-Bethany Pipeline

Table 2. Previous Cultural Resources Studies (continued)

Author/ Report No.	Year	Survey/Study Type	Comments	Project Component(s)
Frederickson, David A. S-006007	1983	intensive pedestrian survey	no significant cultural materials observed	Transfer-Bethany Pipeline
Holman, Miley Paul S-006123	1983	mixed survey strategy, pedestrian	no significant cultural materials observed	275 TAF Reservoir
Clark, Matthew R. S-006489	1984	mixed survey strategy, pedestrian	no significant cultural materials observed	Transfer-Bethany Pipeline
Fredrickson, David A. (ed.) S-005763	1982	intensive pedestrian survey	CCO-9, -427/H, -445H, -446H, -447/H, -450/H, -452, -458/H, -459, -462, -463, -464, -467/H, -468, -470H, -636, -637, -696, -725, -726/H, P-07-000532 & P-07-000791	275 TAF Reservoir; New Dam; Borrow Area; Transfer-LV, LV-SBA, & Inlet-Outlet Pipelines; Marina Facility; Interpretive Center; Fishing Access, Day-Use Facilities; User Parking; western Access Road
West, G. James S-010508	1982	mixed survey strategy, pedestrian	no significant cultural materials observed	Delta-Transfer Pipeline
Porter, Cris D., Jennie Goodrich and Michael Baldrica S-002310	1980	mixed survey strategy, pedestrian	CCO-9 & CCO-427H	275 TAF Reservoir
Albee, A. D. S-002621	1979	intensive pedestrian survey	no significant cultural materials observed within APE	Transfer-LV Pipeline
Coles, George R. S-002329	1966	surveyed	possibly included CCO-397, -447/H & -726/H	Transfer-LV, LV-SBA & Inlet-Outlet Pipelines; Interpretive Center North Option; Stockpile Area
Treganza, Adan E. S-002330	1964	surveyed	CCO-397 recorded; CCO-446H, -447/H, -535H, -637 & -726/H	Stockpile Area; Transfer-LV, LV-SBA & Inlet-Outlet Pipelines; SBA Pump Station; Interpretive Center Options

Figure 5 depicts the portion of these studies that overlap with the project study area. Those areas not covered by previous surveys, or for which the surveys were more than 10 years old, were surveyed for the Los Vaqueros Reservoir Expansion project.

Figure 5 Areas Previously Surveyed

CONFIDENTIAL; NOT AVAILABLE FOR PUBLIC REVIEW

3.2 Recorded Cultural Resources

The records and literature search yielded 42 previously recorded cultural resources within the study area and one sensitive site, the Reburial Site. The confidential locations of these resources are depicted on Figure 6. It is important to note that only 35 of these are within the project APE. Most of these have been recommended as eligible for listing on the NRHP as contributing elements to the Kellogg Creek Historic District, and/or as individual properties. Table 3 summarizes the previously recorded cultural resources and lists their status with regard to eligibility for listing on the NRHP as recommended in the 1992 Evaluation (SSUAF 1992). Many of the recorded cultural resources within the Los Vaqueros Expansion study area were included in the original Los Vaqueros Reservoir studies. The study area and APE for the 100 TAF Los Vaqueros Reservoir project encompassed the entire Upper Kellogg Creek watershed.

The study area and proposed APE for the Expansion project does not include the entire watershed, and extends beyond the watershed to cover facilities and pipelines. In addition, NRHP status changed for two of these resources as a direct result of archaeological testing and data recovery findings during mitigation for the Los Vaqueros Reservoir project in the 1990s. Section 7.3 presents an updated NRHP status for each cultural resource, based on published reports of archaeological investigations and other mitigative actions in the 1990s and early 2000s, as well as field surveys conducted by WSA in 2007.

3.3 Previous Prehistoric Period Research within the Study Area

The records search revealed 29 sites with prehistoric period components within the Los Vaqueros Reservoir Expansion Project study area (refer to Figure 6). These include CA-CCO-9, -143, -144, -310, -397, -417, -447/H, -450/H, -452, -455, -456, -458/H, -459, -462, -463, -464, -467/H, -468, -469, -597, -621/H, -636, -637, -653, -696, -725, -726/H, -755, and P-07-002640. Of these, thirteen were subjected to some level of mitigation under the 100 TAF Los Vaqueros Reservoir Project (CA-CCO-447/H, -450/H, -458/H, -459, -468, -469, -621/H, -636, -637, -653, -696, -725, and -726/H). This mitigation has been reported in various documents produced by SSUAF under the auspices of CCWD and is summarized below. A single site, CCO-621/H was determined not eligible for listing. The historic component of CCO-458/H was found ineligible for listing on the NRHP.

Figure 6 Cultural Resources Locations

CONFIDENTIAL; NOT AVAILABLE FOR PUBLIC REVIEW

Table 3. Previously Recorded Cultural Resources within the Study Area

Resource	Property Type	Previous Mitigation	NRHP Status as of 1992	Within APE
CA-CCO-9	Milling Station	Avoided	Eligible, individual and district	Yes
CA-CCO-143	Lithic Scatter	No Known Mitigation	Not evaluated	No
CA-CCO-144	Lithic Scatter	No Known Mitigation	Not evaluated	No
CA-CCO-310	Rock Shelter	Avoided	Eligible, individual and district	Yes
CA-CCO-397	Open Site, Milling Station	Avoided	Eligible, individual and district	Yes
CA-CCO-417	Rock Shelter	Avoided	Eligible, individual and district	Yes
CA-CCO-427H	Ranch Headquarters	Phased Data Recovery	Eligible, district only	Yes
CA-CCO-445H	Ranch Headquarters	Phased Data Recovery	Eligible, district only	Yes
CA-CCO-446H	Ranch Headquarters	Avoided; screened from view	Eligible, district only	Yes
CA-CCO-447/H	Livestock Management Feature; Open Site (burials)	Phased Data Recovery; screened from view	Eligible, district only	Yes
CA-CCO-448H	Ranch Headquarters	No Known Mitigation	Ineligible	Yes
CA-CCO-450/H	Ranch Headquarters; Open Site, Milling Station	Phased data recovery; Avoid adobe and structures	Eligible, individual and district	Yes
CA-CCO-452	Milling Station	Avoided	Eligible, district only	Yes
CA-CCO-454H	Ancillary Farm/Ranch Complex	Phased Data Recovery	Eligible, individual and district	Yes
CA-CCO-455	Rock Shelter	Avoided	Eligible, individual and district	Yes
CA-CCO-456	Rock Shelter	Avoided	Eligible, district only	Yes
CA-CCO-458/H	Historic Artifact Scatter; Prehistoric Open Site (burials)	Phased Data Recovery	Historic: ineligible. Prehistoric: eligible, individual and district	Yes
CA-CCO-459	Open Site with Milling Station (burials)	Phased Data Recovery	Eligible, district only	Yes
CA-CCO-462	Milling Station	Avoided	Eligible, district only	Yes
CA-CCO-463	Open Site with Milling Station	Avoided	Eligible, individual and district	Yes
CA-CCO-464	Milling Station	Avoided	Eligible, district only	Yes
CA-CCO-467/H	Water Management Features, Milling Station	Avoided	Eligible, individual and district	Yes
CA-CCO-468	Open Site with Milling Station	Phased Data Recovery	Eligible, individual and district	Yes
CA-CCO-469	Milling Station	Phased Data Recovery	Eligible, district only	Yes

Table 3. Previously Recorded Cultural Resources within the Study Area (continued)

Resource	Property Type	Previous Mitigation	NRHP Status as of 1992	Within APE
CA-CCO-470H	Ranch Headquarters	Phased Data Recovery	Eligible, individual and district	Yes
CA-CCO-533H	Ranch Headquarters	Avoided	Eligible, district only	No
CA_CCO-534H	Ranch Headquarters	Avoided	Eligible, district only	No
CA-CCO-535H	Ranch Headquarters	Phased Data Recovery; demolish buildings; avoid subsurface deposits	Eligible, district only	Yes
CA-CCO-596H	Ranch Headquarters	Avoided	Not included in 1992 Evaluation	Yes
CA-CCO-597	Rock Art Site	Avoided	Not included in 1992 Evaluation	Yes
CA-CCO-621/H	Ranch Headquarters; Lithic Scatter	Phased Data Recovery	Not included in 1992 Evaluation; Determined ineligible after testing	Yes
CA-CCO-636	Milling Station	Phased Data Recovery	Eligible, individual and district	Yes
CA-CCO-637	Surface Lithic Scatter; Open Site (burials)	Phased Data Recovery	Eligible, individual and district	Yes
CA-CCO-650H	Historic Artifact Scatter	15 Uncontrolled Shovel Probes	Ineligible after testing	Yes
CA-CCO-653	Open Site with single human burial	Phase 1 inventory	Not included in 1992 study or Evaluation	No
CA-CCO-696	Deeply buried Open Site (burials)	Data Recovery; construction monitoring	Discovered after 1992 Evaluation; treated as eligible	Yes
CA-CCO-725	Open Site	Level 2 Data Recovery	Discovered after 1992 Evaluation; treated as eligible	Yes
CA-CCO-726/H	Historic Artifact Scatter; Open Site	Construction monitoring	Discovered after 1992 Evaluation; treated as eligible	Yes
CA-CCO-755	Buried Open Site	Construction monitoring	Discovered after 1992 Evaluation	Yes
P-07-002640	Isolated pestle	Construction monitoring	Discovered after 1992; treated as ineligible	No
P-07-000791	Water Management Feature	Not relocated (suspected covered by silt)	Discovered after 1992; treated as eligible	Yes
P-01-010702	Ranch Headquarters	Not in original study area	Not included in 1992 study or Evaluation	No

Mitigation is designed and implemented for specific project impacts on specific historic properties or historical resources (those cultural resources that have been listed or are eligible for listing on the NRHP and/or on the CRHR). It is possible that new projects could have potential adverse effects on sites that have been the subject of previous mitigation, therefore requiring further mitigation. Each resource is described in some detail in the following sections in support of the evaluations and mitigation measures recommended in section 6.0.

Prehistoric Sites Mitigated for the 100 TAF Reservoir Project

CA-CCO-447/H - Open Site (burials)

This site is located in the Middle Kellogg Creek Valley in close proximity to the creek. It was originally recorded as historic-era, but was reassigned as multi-component following the discovery of subsurface prehistoric archaeological material (two pieces of flaked stone in association with a layer of freshwater shells at 145 cm below surface) in a geotechnical test pit. During Level 1 archaeological testing of the historic foundation feature in 1994, three stone flakes were excavated. None of the flakes were in their primary context (Ziesing 1996:59).

In 1997, CA-CCO-447/H was tested as part of the mitigation for the Los Vaqueros 100 TAF Reservoir Project. The site area was re-surveyed, and backhoe trenching and feature excavation was undertaken. Survey transects spaced a maximum of 1 m apart were walked within a 50-m radius of the previously recorded site boundary. A few pieces of debitage were located during this surface examination (Meyer and Rosenthal 1997:III.3). Three test trenches were excavated in the area of the original geotechnical test pit. The geotechnical pit was relocated and re-excavated. The deposit that had been recorded as a prehistoric site was found to be material that had been redeposited in conjunction with channel sediments (Meyer and Rosenthal 1997:III.5) and the site was determined to lack any significant intact prehistoric component (Meyer and Rosenthal 1997:iii, I.2). During this test trenching phase, a buried paleosol was identified at over 225 cm below surface, though the upper portion of the paleosol had been eroded.

A single rock feature was also found at 20 to 30 cm below surface. Meyer and Rosenthal (1997:III.5) described the feature as "a small concentration of angular sandstone cobbles that appeared to have been heat-affected." A small number of chert flakes along with some fragments of bone were found in association, though no formal tools were encountered. Meyer and Rosenthal (1997:III.5) suggest that the rock feature may be associated with the historic component of CA-CCO-447/H.

In 1998, excavation of a waterline trench through CA-CCO-447/H exposed human bone. The trench averaged 120 cm in depth and human skeletal material was found in two locations within the trench alignment. The burials were excavated and a number of artifacts and heat-affected rock were also recovered. Burial 1, located 60 cm below surface, was identified as a young adult. Burial 2 was found at around the same depth of Burial 1, and was determined to be an adult male. The body had been placed in a semi-extended position. A radiocarbon date of 4555 cal B.P. (2605 B.C.) was obtained for this individual. A rim fragment of an andesite groundstone bowl mortar was recovered approximately 70 to 75 cm below surface. A cooking feature was found at a depth of 30 to 40 cm and a rock line indicative of a relatively intact remains of a living surface was found 30 to 50 cm below surface (Meyer and Meyer 2000:42, 44, 46, 47).

The prehistoric component of this site has been interpreted as a food processing location and an occupation camp used at least intermittently (Meyer and Meyer 2000:47). This would fall under the historic property type of open site with human burials associated with the Middle Archaic period.

CA-CCO-450/H – Open Site with Milling Station and possible Ranch Site

In 1996, prehistoric artifacts were found eroding out of a cutbank near the projected high-water mark following the proposed inundation of the Los Vaqueros Reservoir (referred to as the High Water Site and included as part of CA-CCO-450/H). It was thought that this site would potentially be disturbed and/or destroyed by erosion and wave action, and hence further archaeological investigations to determine the nature of the prehistoric deposit were initiated. An intensive surface survey was undertaken and 21 test trenches were excavated over a 7,000 square meter area. A few isolated artifacts were found over a wide area though no concentrations of cultural materials were identified. Three of the artifacts were found on the ground surface while the other three were excavated from over 60 cm below surface. The cut bank was re-inspected. Archaeological materials, including flaked stone debitage and heat-affected rock, were found in association with a buried paleosol at this location. Artifact analyses date the occupation of this portion of the site to within the last 1,500 years and the Upper Archaic through Emergent periods (Meyer 1998:8-12).

During archaeological monitoring of the demolition of a portion of a stone fence (historic-era component) for construction of Road 3A through the edge of the site, a handstone fragment was found within the backdirt removed from the western side of the roadbed, at the location where it intersected the stone fence (Meyer and Meyer 2000:33). The handstone fragment, made of greywacke, shows polishing and smoothing on one face, pecking along three sides, and some smoothing along the fragmented end. Meyer and Meyer (2000:33) suggest that the handstone may have historically been included in the rubble fill that supported the upper portions of the stone fence, and therefore, was discovered in secondary context. Nonetheless the presence of this artifact type associated with the Lower Archaic period and the earliest occupation of the area, suggests that there may be intact evidence, albeit deeply buried, somewhere nearby and in the vicinity of CA-CCO-450/H.

The site CA-CCO-450/H may yield evidence of Native American lifeways in the historic period as well. The site has many remnants associated with Native American archaeological sites, including bedrock milling stations, a rich midden, and possible housepits that have yet to be investigated or dated. Historic accounts mention a Native American settlement in the vicinity of the ranch headquarters at CA-CCO-450/H though the exact location of this settlement has not been determined. There are two bedrock milling station complexes, CA-CCO-467/H and CA-CCO-461, a short hike north of the site center of CA-CCO-450/H, and the High Water Site at the eastern boundary of the extensive site area. The relationship between these locations is not yet understood, but it is likely that the location has been used repeatedly for at least the last 1,500 years, and possibly much longer, if the handstone found in the historic period stone fence came from nearby intact deposits.

CA-CCO-458/H – Open Site (burials)

The prehistoric component of CA-CCO-458/H is a midden deposit, composed of flaking debris, and burnt bone, shell, baked clay, groundstone and heat-altered rock (Meyer and Rosenthal 1997:III.7). This site lies under the 100 TAF Reservoir pool adjacent to Kellogg Creek. Prior to inundation the site was subject to Level I and II archaeological investigations. Testing (Level I) included surface survey, mechanical trenching, surface grid unit excavation, site mapping and cutbank examination. Data recovery (Level II) included vertical unit excavation and areal exposure (Meyer and Rosenthal 1997:III.7). Ten features and three human burials were discovered. The features included a prepared clay floor, a hearth, refuse-filled pits, and an ash layer. A portable mortar and refuse scatters were also observed. The artifact assemblage consisted of flaked stone (debitage, modified flakes, bifaces, cores, bipolar cores, core tools, cobble tools, and projectile points), groundstone (block mortar, bowl mortar fragment, pestles and pestle fragments), soapstone and shell beads and ornaments, baked clay, faunal bone and shell (Meyer and Rosenthal 1997:III.12-III.15).

The archaeological remains were widely distributed at or near the surface of the site, but primarily concentrated in two loci. The East Locus yielded a sparse assemblage of flaked stone artifacts, fauna, and lumps of baked clay but no features or temporally diagnostic pieces. Obsidian hydration evidence suggests that the East Locus was used from the Upper Archaic period to the first part of the Lower Emergent period. The West Locus yielded a rich and diverse assemblage including thousands of pieces of flaked stone debris, three diagnostic points, floral and faunal remains, and fire-cracked rock. All ten features and the three burials were found with this assemblage. Obsidian hydration evidence, a radiocarbon date and temporally diagnostic artifacts indicate that the West Locus was used during the Emergent period (Meyer and Rosenthal 1997:iv, III.7). Meyer and Rosenthal (1997) and Wohlgemuth

(1997) have interpreted CA-CCO-458/H as a small residential site with very short term occupations in the earlier East Locus, and with an intensive use of acorns and small seeds during the Emergent period in the West Locus.

CA-CCO-459 – Open Site with Milling Station (burial)

This site was originally recorded as comprising five bedrock mortar cups situated on two sandstone outcrops. Archaeological investigations were undertaken at this site between 1994 and 1997 including surface survey, site mapping, and backhoe trenching. This was followed by vertical unit excavation and areal exposure, mortar recording and flotation sampling (Meyer and Rosenthal 1997:III.19). Previously unrecorded bedrock mortar cups were located during the surface survey. Four features associated with a buried paleosol located between 78 and 92 cm below surface were encountered during test excavations, including a pit, refuse scatter, a pit with a refuse scatter, and a rock hearth. Flotation samples were taken from these features revealing an intensive use of both acorns and small seeds (Meyer and Rosenthal 1997:III.21-III.23; Wohlgemuth 1997:H-2). In addition, the remains of a single human infant were recovered (Meyer and Rosenthal 1997:III.22). The locale has been interpreted as a site for processing plant resources either in the spring or fall (Meyer and Rosenthal 1997; Taite 1997:I-5; Wohlgemuth 1997:H-33).

The artifact assemblage consisted of flaked stone (debitage, modified flake, cores and a cobble tool), groundstone (portable mortars, a pestle fragment), modified bone fragments, a baked-clay tube fragment and a baked-clay artifact that had been shaped. Faunal bone and a few grams of freshwater shellfish were also recovered (Meyer and Rosenthal 1997:III.23). Based on the results of radiocarbon and obsidian-hydration dating, the site appears to represent an Upper Archaic/Emergent period component (Meyer and Rosenthal 1997:III.24).

In 1999, an intensive pedestrian survey was conducted around the reservoir inspecting the area between the high-water line and the water’s edge, as recommended in the Cultural Resources Management Plan for the Los Vaqueros Resource Management Plan. An isolated bedrock mortar was located in close proximity to the known and mapped bedrock mortars and the boundary of CA-CCO-459 was extended (SSUAF 2000:6). Also in 1999, a temporary exclusion zone was staked out at this site, as recommended in the ′Historic Property Treatment Plan for the Phase I Recreation Program and for Late Discoveries′ (Praetzellis 2000:2), while work was conducted nearby.

CA-CCO-468 – Open Site with Milling Station

This site is currently located at the edge of and partially inundated by the 100 TAF reservoir pool adjacent to a tributary of Kellogg Creek. It consists of a number of milling stations with bedrock mortar cups, two portable hopper mortars and a rock alignment. Archaeological investigations were undertaken at this site between 1994 and 1997, including surface survey, site mapping, mortar recording, backhoe trenching, shovel test units, vertical and areal exposure unit excavation and flotation sampling (Meyer and Rosenthal 1997:III.19). A total of six bedrock mortars were located and measured, and a concentration of fire-affected sandstone was uncovered just below surface level, possibly representing a cooking hearth. The artifact assemblage, found at or near the surface, consisted of flaked stone, including four Stockton series projectile points, two block mortars, faunal bone, and a piece of marine shell. Based on radiocarbon dating, obsidian-hydration analyses and temporally diagnostic artifacts, site usage was dated to the Upper Emergent period (Meyer and Rosenthal 1997:III.26-III.27).

CA-CCO-469 – Milling Station

This site, inundated by the 100 TAF reservoir pool, is characterized by several bedrock mortars found adjacent to a tributary of Kellogg Creek in relatively flat topography. Level 1 archaeological investigations, including surface survey, mortar recording, and backhoe trenching yielded sparse archaeological material, no temporally diagnostic artifacts and no materials for either radiocarbon or obsidian hydration testing, and so this site has not yet been associated with a particular prehistoric period (Meyer and Rosenthal 1997:iii, III.30).

CA-CCO-621/H – Non-Site (formerly Lithic Scatter)

Located outside of the Kellogg Creek Watershed, this cultural resource lies in the lowland delta just west of the Old River, adjacent to one of the oldest drainage ditches in the study area. A level 1 investigation with testing failed to locate intact prehistoric deposits at this site. The site is no longer considered to have a prehistoric component. The original report of lithic debitage on the site surface has been interpreted as materials that were in secondary context having most likely arrived at the site as fill (Meyer and Rosenthal 1997: iii, I.2, III.3).

CA-CCO-636 – Open Site

This site, currently inundated by the 100 TAF Reservoir pool, lies adjacent to Kellogg Creek at the foot of a hillslope. It was originally recorded as a sparse lithic scatter with hopper mortar slabs. Archaeological investigations undertaken at this site between 1994 and 1997 included surface survey, backhoe trenching, shovel test units, and vertical unit excavation and areal exposure (Meyer and Rosenthal 1997:III.33). The only identified feature was a historic-era cobblestone pavement, inferred to be a rock-lined floor which would have supported a superstructure. The sparse artifact assemblage consisted of flaked stone (including a Stockton series projectile point and a biface tip), and groundstone (including a pestle fragment and block mortars). Equally sparse faunal bone and shell from freshwater mussel was associated with the artifact assemblage and concentrated in two main loci (Meyer and Rosenthal 1997:III.34-III.35). Use of the site has been dated to the Upper Archaic and Emergent periods, based on temporally diagnostic artifacts, a radiocarbon date, and obsidian hydration evidence.

CA-CCO-637 – Open Site (burials)

Site CA-CCO-637 lies deeply buried at the narrowest part of the Upper Kellogg Creek Valley under the footprint of the dam. This site was originally recorded as a sparse lithic and shell scatter visible on the surface, covering an area of roughly 90-x-180 m. Archaeological investigations were undertaken at this site between 1994 and 1997, including surface survey, site mapping, backhoe trenching, shovel test units, vertical unit excavation and areal exposure. Archaeological monitoring of construction activities at CA-CCO-637 was also undertaken (Meyer and Rosenthal 1997:III.37, III.39).

Archaeological testing yielded a single human burial, two baked clay hearths, one rock hearth, and four refuse scatters. The artifact assemblage included flaked stone (projectile points, bifaces, modified flakes, debitage, cores, core tools, and cobble tools), groundstone (pestles and mortars), marine shell beads and ornaments (primarily *Olivella* End-Ground, Spire-Lopped and Thick Rectangular beads found in association with a burial, and a fragment of a possible *Haliotis* shell ornament found in association with another burial), baked clay, faunal bone (mammal, bird and fish), and faunal shell (Meyer and Rosenthal 1997:III.41-III.44). Subsequent construction unearthed the remains of 24 individuals, some associated with extensive bead assemblages. These burials are among the oldest in central California (Meyer and Rosenthal 1997:iv). Meyer and Rosenthal (1998:ii) report a radiocarbon date of 8530 B.P. from one of the deepest burials.

Most of the cultural remains were found associated with a buried paleosol between 70 and 130 cm below surface (Meyer and Rosenthal 1997:III.40). Primary use of this temporary campsite was during the Middle Archaic period, based on radiocarbon dates, obsidian hydration evidence, and temporally diagnostic artifacts. An analysis of seasonality based on faunal remains suggests that the site was primarily in use during the spring to mid-summer (Taite 1997:I-5). By contrast, a seasonality assessment based on floral remains suggests summer and fall residence (Wohlgemuth 1997:H-33). There is some indication that the site may have been used sporadically through the Emergent period (Meyer and Rosenthal 1997:iv).

CA-CCO-653 – Open Site (single burial)

Site CA-CCO-653 is located in open agricultural land, approximately 850 m west of Italian Slough. This site was recorded as a sparse surface distribution of flaked and ground stone, faunal debris, and a single human burial located in the southern portion of the site. Surface artifacts found at this site include one obsidian serrated projectile point tip, two obsidian biface fragments, eight pieces of debitage, one mano, one pestle fragment, and one shaped baked clay fragment. Two large obsidian concave base points were found associated with the burial. No obvious midden soils were apparent. The site measures 200 m north-south; the east-west dimensions are unknown, due to the fact that surface observations were limited to the pipeline ROW because of an access dispute with the landowner. The burial was discovered during excavation of a "mud-mixing hole", at a depth of 1.5m below the surface. As of September 27, 1992, the burial is unexcavated and its integrity is unknown. Mitigation was limited to a Phase 1 inventory level. (P. Bouey et al. 1992).

CA-CCO-696 – Open Site (burials)

Discovered in a backhoe trench during archaeological subsurface testing, this site is composed of two components at different depths with evidence for human use of the site from the Lower Archaic through the Emergent periods. Component 696 Deep dates to the early Holocene and has been interpreted as a temporary camp. Component 696 West has been dated to the Upper Archaic and Emergent periods and appears to represent a residential community, or village site. The site is located between CA-CCO-458/H and -637 adjacent to the former pathway of Kellogg Creek and underneath the upstream footprint of the dam. The site was first discovered during geoarchaeological testing in 1994. Archaeological investigations were undertaken at the site between 1994 and 1997, including backhoe trenching, test units, vertical unit excavation and areal exposure, burial removal, and feature recordation. Archaeological monitoring of construction activities was also undertaken (Meyer and Rosenthal 1997:III.47).

The upper component of the site (696 West) is an extensive and diverse deposit including at least 169 human burials, shell beads and ornaments, flaked stone tools, points, and debris, groundstone tools, floral and faunal remains, and residential features. This component is associated with a paleosol formed in the Vaqueros deposit. Features found within 696 West include baked clay hearths, rock hearths, refuse scatters, storage pits, daub concentrations, concentrations of milling equipment, an antler cache/work area, post holes, and a possible outline of a house (Meyer and Rosenthal 1997:iv, III.56). The floral assemblage shows a prevalence of buckeye, a resource requiring a great amount of processing. An increase in small seeds was also noted. The seeds indicate that the upper west component was occupied during a fuller range of seasons than the deep component (Wohlgemuth 1997:H-33). Freshwater mussel shell was found throughout the west deposit as part of the midden, in and around the burials.

The lower component, associated with a paleosol in the Kellogg deposit, includes a temporally diagnostic wide-stemmed projectile point, handstones, millingslabs, flaked stone core tools and some floral and faunal remains. The floral remains of the deep component include acorn, wild cucumber, and manzanita, with very few small seeds. These resources could have been found in the immediate vicinity of the site, indicating a highly mobile, short-term occupation during summer and fall (Wohlgemuth 1997:H-33).

Radiocarbon dates from the deep component indicate an age of more than 9000 B.P. (7050 B.C.). This is the oldest archaeological deposit dated in the greater San Francisco Bay Area (Meyer and Rosenthal 1997:iv). This site also yielded one of the oldest central Californian radiocarbon-dated human burials at 7400 B.P. (5450 B.C.).

CA-CCO-725 – Open Site

Located on the hillslope above the floodplain of a major tributary of Kellogg Creek, this site is represented by a large fire-affected rock feature, interpreted as a hearth or cooking feature that was discovered during the construction of Road 3A following the western shore of the reservoir. The feature was exposed, sampled and documented, then paved over. The feature was described as "a concentration of angular to sub-angular cobbles that exhibited extensive fracturing and reddish discoloration typically associated with intense and/or repeated exposure to high temperatures" (Meyer and Meyer 2000:24). It was found to measure roughly 3.8 m in length, 1.8 m in width and 0.2 m in thickness. Material excavated from the feature matrix was screened with ¼-inch mesh, as was a portion of the backdirt that had been graded from above the feature. Several fragments of heat-affected rock and an obsidian flake were retrieved from the screen. A charcoal sample was also collected, which yielded a date of 1185 cal B.P. (A.D. 765), placing the feature within the Upper Archaic/Emergent transition period. In addition, soil samples were collected and subjected to a flotation analysis. Wood charcoal and a small number of seeds, representing species of herb, bean and grass, were recovered. It was thought that this site would have been used intermittently or for a short period as a camp or food processing station (Meyer and Meyer 2000:21, 24, 26, 28).

CA-CCO-726/H – Open Site

The prehistoric component of CA-CCO-726/H, also known as the Powerline Site, was located during archaeological monitoring of a waterline trench excavation in 1998 (Meyer and Meyer 2000:50). The feature consisted of a concentration of angular to sub-angular cobbles that showed signs of heat-alteration at a depth of approximately 80 to 100 cm below surface. The feature was exposed using hand tools and sampled. Excavated material was screened through ¼-in. mesh along with a large portion of the backdirt removed from around and outside of the feature. No artifacts were retrieved though heat-affected rock and a large amount of wood charcoal were found. A charcoal sample produced a radiocarbon date of 790 cal B.P. (A.D. 1160), placing the feature within the Upper Archaic/Emergent Transition period. Flotation analyses of soil removed from the feature matrix revealed numerous pieces of charcoal and some seeds, primarily grass species. The feature was interpreted as the remains of a cooking pit (Meyer and Meyer 2000:50, 54).

Archaeological monitoring of the construction of two detention ponds revealed a greywacke cobble-core tool. One end of the tool has been bifacially flaked to produce a rough working edge and battering or use-wear was observed along a portion of the margin (Meyer and Meyer 2000:55).

<u>Prehistoric Sites with No Previous Mitigation</u>

CA-CCO-9, -452, -463, and -464 Milling Stations

A cluster of four milling stations including CA-CCO-9, -452, -463, and -464 lines the southern approach to the Los Vaqueros Reservoir. They are situated on either side of Kellogg Creek and Vasco Road above the current level of inundation. They will be inundated, or in the case of -464 at water's edge, with the expansion of the reservoir pool to 275 TAF. CA-CCO-9 and -452 are on the gently sloping east side of the creek and road, while -463 and -464 are in markedly steeper terrain on the west side of the creek and road. In addition to bedrock mortars, a cupule rock and a grooved petroglyph have been observed at CA-CCO-9 (SSUAF 1992).

No mitigation has been undertaken at these four bedrock milling stations. The two sites east of Kellogg Creek in gentler terrain (-9 and -452) both appear to be much more extensive and complex than the two smaller and higher western sites in steeper terrain (-463 and -464). No dates have been obtained for the prehistoric use of these sites. Their temporal and functional relationship to the deeply buried, complex and rich sites with burials in the valley bottom remains to be explored.

CA-CCO-143, -144 Lithic Scatters

These two lithic scatter sites are located in open, flat agricultural land, approximately 1 km west of the Italian Slough. Both sites were first recorded in 1948 as separated by a few yards, but since then they are considered to have been combined as a result of decades of agricultural disturbance. Site CA-CCO-143 consists of a scatter of broken rocks, a spire-ground Olivella bead, two obsidian flakes and at least one artifact (a possible quartzite chopper). The site has been leveled, plowed, and planted in barley. The depth of the site is unknown, although investigation of a nearby irrigation ditch yielded no evidence of subsurface deposits. Site CA-CCO-144 could not be relocated as of 1990.

CA-CCO-397 Open Site with Milling Station

This site is located on a low bench and sloped area in a cluster of bedrock outcrops amid grassland with scattered oaks at the edge of the valley floor of Kellogg Creek. The site consists of a midden deposit and lithic scatter with nine bedrock mortars. Both chert and obsidian debitage were observed on the site surface, along with a sandstone milling slab and fire-cracked rocks. The site is part of the Kellogg Creek Historic District. In 1982 a barbed wire fence was mapped cutting through the site separating one bedrock mortar from the rest of the site (Baldrica and Davis 1982). A list of measurements and profile sketches of 7 mortars (DPR Archaeological Site Record by Eidsness et al. 1986; Updated DPR Site Record by Stoyka and Gassner 2000) accompany an updated sketch map showing the relationship of the site to Kellogg Creek and a new road alignment that cuts through the site (Stoyka and Gassner 2000) as part of the most recent site record update on file at the NWIC. This updated site record was prepared when the road passing through CA-CCO-397 became integrated into the Los Vaqueros trail system. No artifacts or features were observed during a field reconnaissance conducted at this time (Praetzellis 2000:2). The site was disturbed by cattle grazing and a metal water trough in addition to the roadway and wire fence. No archaeological testing or data recovery has been conducted at this site.

CA-CCO-462 Open Site with Milling Station and CA-CCO-467/H Milling Station

These two milling stations lie on fairly steep upland terrain adjacent to small tributaries of Kellogg Creek. Neither of these sites has been mitigated. Portions of both of these sites will be inundated by the expansion of the reservoir.

CA-CCO-310, -417, -455, -456 Rockshelters

These four sites include a cluster of 20 possible rockshelters, 7 caves, 23 BRMs, and areas of midden soil, spread out over an area of 1 ¼ by ¼ mile. These resources are situated along the slopes of an east-west trending ridgeline (310, 455, and 456) and down into a NE-SW trending valley (417), through which flows a seasonal creek. Another seasonal drainage, running E-W, is located to the south of the ridgeline upon which the sites are located. Cultural constituents include obsidian flakes, dietary and artifactual mammal bones, charcoal flecks, possible groundstone and stone tools. These sites are in good to excellent condition, as of 1996. Site CA-CCO-417 was originally recorded as Locus 11 within site CA-CCO-434 (Vasco Caves); site 434 lies outside of the APE, therefore it will not be affected by the construction of the eastern hiking trail. Site CA-CCO-310 was combined with the historic site CA-CCO-454H as of 1995, due to the presence of historic period artifacts within site 310. These sites are all part of the Kellogg Creek Historic District.

CA-CCO-597 Rock Art Site

This petroglyph boulder lies outside of the Kellogg Creek Watershed in gently hilly terrain west of the flat reclaimed agricultural lands of Old River. The temporal and functional relationship of this isolated petroglyph boulder to the prehistory of the Kellogg Creek Watershed remains to be established. The site lies in the pathway of the proposed Transfer-Bethany Pipeline, and has not previously been studied or evaluated.

CA-CCO-755 – Buried Open Site

CA-CCO-755, the Gas Line Site, was located in 2002 during a spot check as part of archaeological monitoring of construction activities. The Gas Line Site is situated on a terrace at the mouth of Mariposa Canyon, above an ephemeral stream near its junction with Kellogg Creek. A concrete valve box and parallel-running gas pipelines have disturbed the site. The artifactual material, consisting of four bone fragments (unidentified to species), two obsidian flakes and a heat-affected rock that may be a fragment of a milling slab, were found in the builder's trench fill of the valve box. No artifacts were observed on the surface of the surrounding area, leading the recorders to surmise that the cultural deposit is buried (Meyer and Meyer 2002).

P-007-002640 Isolate

This isolated pestle was uncovered during trenching for the installation of a buried waterline in 2003. It is located between a pvc blow-off valve and a wood bridge which crosses Kellogg Creek, on a peninsula bordered by an unnamed tributary and Kellogg Creek. The pestle is a flattened elongated cylinder, measuring 51.7 mm to 57.8 mm in diameter by 145.6 mm in length. No other cultural materials were noted. There has not been any testing for subsurface deposits (Meyer 2003).

<u>Discussion and Significance of Previous Prehistoric-Era Research</u>

Archaeological investigations undertaken on behalf of CCWD for the Los Vaqueros Reservoir cultural resources mitigation in the 1990s have expanded the prehistory of the study area. Evidence of human occupation 5,000 years older than previously thought was found at depths of up to 4 m below surface in the Upper Kellogg Creek valley in proximity to the present-day dam. Studies that have helped refine the prehistory of the Los Vaqueros area include analysis of floral flotation samples from five prehistoric components at four sites (Wohlgemuth 1997), faunal analysis of samples from 10 components at seven sites (Taite 1997), shellfish identifications from six sites (Huddleson 1997), and archaeological interpretation of deposits, including radiocarbon dating from eight sites (Meyer and Rosenthal 1997, 1998). Assemblages representing all periods of prehistory, from the Lower

Archaic through the Upper Emergent, have been investigated. Following a presentation of previous historical research within the study area, the contributions from the prehistoric studies are discussed with relation to the research questions guiding those studies (e.g., SSUAF 1992) and evaluated in order to present a modified set of research questions for the purposes of this assessment report and recommendations for future mitigation.

3.4 Previous Historical Research within the Study Area

The records search yielded 16 sites with historic period components within the study area. These include CA-CCO-427H, 445H, 446H, 447/H, 448H, 450/H, 454H, 467/H, 470H, 533H, 534H, 535H, 650H, 726/H, the Spring Box Site (P-07-000791) and Brushy Creek Ranch (P-01-010702). Twelve of these were subject to some level of mitigation under the 100 TAF Los Vaqueros Reservoir Project (CA-CCO-427H, 445H, 446H, 447/H, 450/H, 467/H, 470H, 533H, 534H, 535H, 650H, and 726/H). Much of the historical records research and oral history research for the majority of the historic period properties was undertaken by Hattersly-Drayton (1993) and summarized in Praetzellis et al. (1997). Mitigation conducted as part of the 100 TAF Los Vaqueros Reservoir Project has been reported in various documents produced by SSUAF under the auspices of CCWD and is summarized below.

CA-CCO-427H, the Perata/Bonfante Place, Ranch Headquarters

The site was the center of a 300-acre tenant ranch complex in the Cañada de los Vaqueros land grant. This property has been partially inundated by the Los Vaqueros Reservoir since 1998. The site consisted of a foundation of dry-laid sandstone slabs, a hand-dug well, the remains of a wooden water tank, and a scatter of historic debris. The original structure shown on the 1916 USGS Byron quadrangle was thought by Fredrickson to have burned down, and was then built over with existing modern structures including a small wooden barn and a complex of corrals (Fredrickson 1982). A brief summary of the tenancy and land use follows.

1885-1908	Leased from Mary Crocker and occupied by the Perata family, Italian immigrants and general farmers.
1908-1927	Leased from Mary Crocker and occupied by the Bonfante family, Italian immigrants and relatives of the Peratas. The Bonfantes grew hay and grain.
1927	Almeida family leased and occupied for a short period of time.
1927-1929	Cardoza brothers leased and occupied primarily for dairying.
1935	No longer occupied as a domestic site; sold to Oscar Star as part of the 7,883-acre Mary Crocker estate parcel.
1947	Sold to the Bankheads

Descendents of the Bonfantes interviewed by SSUAF provided a sketch of the layout of the ranch during the occupation by the Bonfante family. A simple redwood dwelling with two bedrooms, a living room, and a kitchen wing served as the house. The ranch also included a barn that accommodated up to 20 horses, a blacksmith shop, pig sty, granary, chicken house, bunkhouse, and two-hole outhouse (Hattersly-Drayton 1993).

The site was subject to data recovery excavation in 1995 (Ziesing 1996). An area of more than 12,000 square ft. was cleared of vegetation and topsoil and four 3-ft.-wide trenches varying in length from 6 to 21 ft. were excavated. Five structures were identified and an additional three buried features were excavated. Excavated material was not screened. An oral historian interviewed two Bonfante sisters who had lived at the site when they were young.

The first area of activity, referred to as the ‘domestic complex’, revealed a cellar hole that corresponded to a wine cellar. A living surface covered with artifactual material, several stone footings, a portion of stone paving, a well, and a linear concentration of artifacts was also located within the domestic complex area. Within the cellar hole were items related to domestic and personal use, food and beverage consumption and storage, medicinal artifacts, agricultural activities and structural items. The occupation surface artifact assemblage consisted of primarily personal items including clothing, and grooming and medicinal artifacts. Games and toys, agricultural items, horse and wagon materials, coins, tablewares, serving wares, storage items, furnishings, some structural materials and sheep bone with no evidence of butchery were also represented. The linear artifact debris feature consisted almost entirely of materials relating to food processing, consumption and storage. The material from this area dated to the early 20th century with a mid-20th century component representing the Bonfante post-abandonment period (Ziesing 1996:121-139).

The second area identified by Ziesing was the barn area. A concentration of stones was thought to represent disturbed foundation wall from the barn, while a stone platform in one portion of the barn location was inferred to have functioned as either an entryway or a special-use platform. Sandstone slabs and stacked fieldstones along one edge were described by Ziesing (1996:141) as forming a combined foundation, floor surface and terrace wall. Two test trenches were excavated within this area. No cultural material was found beneath the level of the stones, though horseshoes and a butchered cow bone were found within the barn area. The barn is thought to have been built in the late 1800s (Ziesing 1996:139-145).

The third area comprised a blacksmith shop. An area measuring 30-x-33 ft. was cleared mechanically and further excavated by hand. The blacksmith shop itself was represented by wooden posts and planking. Two 3-ft.-long lines of fieldstones were thought to have formed the base of a forge. Artifact concentrations included blacksmithing tools and worked iron, a coal concentration, a slag deposit, and a cache of at least 55 alcohol bottles. A large number of blacksmithing tools and artifacts were found in association with milled boards and was thought to be the remains of a wall that collapsed outward (Ziesing 1996:145-176). Based on the range of artifacts found in association with the blacksmith shop, Ziesing (1996:173) suggested that the site was more likely to have been a multi-use workshop, used for repair work and manufacturing of a variety of household and farming or ranching items.

The fourth activity area was referred to as stream improvements and consisted of stacked rock along both sides of a nearby seasonal drainage, inferred to represent the remains of a bridge. No artifacts were found in association with this feature (Ziesing 1996:176-179).

A stone-lined cellar hole cut was the fifth activity area defined by Ziesing. The feature was surface-cleared, and then excavated by hand. A 3-x-14 ft. trench, dug to a depth of 4½ ft., was excavated through a portion of the feature. At the time the Bonfante sisters lived at that location, the cellar was used by their father to store animal feed. No artifacts were found dating to the construction period of the cellar (likely the late 1800s), however a wide variety of artifacts were found from the early 1900s representing the following categories: food preparation, consumption and storage, furnishings, grooming and health, heating and lighting, clothing, footwear, sewing, ironing, hunting, games, indulgences (alcohol), hardware, transportation, and agricultural machinery (Ziesing 1996:179-198).

In 1999, an intensive pedestrian survey was conducted around the reservoir inspecting the area between the high-water line and the water's edge, as recommended in the Cultural Resources Management Plan. At this time, it was found that the stone foundations of the barn and a bridge had been exposed by erosion (SSUAF 2000:9).

In summary, features at CCO-427H include an occupation surface, a trash scatter, a cellar hole near the house, a well, remains of a barn, a storage cellar, stone revetments on the creek bank, and the remains of a blacksmith shop. Based on oral history the structures were probably built in the 1800s, but most of the artifactual material probably dates to the Bonfante family occupation from 1908 to 1927 (Ziesing 1996:iv). Praetzellis et al. (1997) predict that there remain as yet unidentified buried features.

CA-CCO-445H, the Weymouth/Antone Rose Place, Ranch Headquarters

The site was the center of a 300-acre tenant ranch complex in the Cañada de los Vaqueros land grant. This property is a historic ranch complex that has been inundated by the 100 TAF Reservoir since 1998. Prior to inundation the site consisted of features located in two areas separated by a tributary of Kellogg Creek. In the area on the south side of the creek, historic evidence included a three-sided stone foundation with two wooden beams lying in the center, a well, a wooden tripod with gears and wind pump blades. Portions of the creek bank were lined with stone, and historic debris was eroding out of the bank. An earthen dam was installed south of the stone foundation. Sandstone slabs were clustered on the north side of the creek forming a flat surface presumed to be a house foundation. Additional finds included cast-iron plow fragments and turn-of-the-century historic debris. A brief summary of the tenancy and land use follows.

1880-1884	Weymouth leased from Peres and grew hay and grain. In 1881, Peres transferred ownership along with Weymouth's lease, to McLaughlin.
1884-1894	Estrada, a French immigrant, leased and farmed the property.
1895-mid-1920s	The Rose brothers, Portuguese immigrants, leased and farmed the land but reportedly had little livestock.
Mid-1920s	Cabral took over the lease to raise livestock. By 1929 Cabral was leasing several neighboring properties and the property was vacant and fell into disrepair. A 1929 inventory listed several standing buildings including an eight-room house, two sheds, two barns, a granary, a well, and a windmill.
1941	Sold to Oscar Starr by the Mary Crocker estate.

The site was subject to data recovery excavation in 1995 (Ziesing 1996). Within the first stage of data recovery the surface area of the site was cleared by hand and by backhoe, and seven 2-to-3½-ft.-wide test trenches varying in length from 8 to 75 ft. were excavated. As a result, seven structures were exposed and recorded, and six subsurface features were excavated. Excavated material was not screened and for the most part artifacts were recorded and cataloged in the field. Ziesing divided the site into three distinct areas including the barn complex, the house area and the stream area (Ziesing 1996:69-70).

The barn complex portion of the site comprised the three-sided stone foundation, the remains of a sandstone surface and/or foundation (now disturbed), and a line of fieldstones. A 3-x-75-ft. trench was excavated through the three-sided foundation, and a second trench of a similar size was excavated to a depth of 8 inches through the space between the three-sided foundation and the sandstone surface. The fieldstone alignment was encountered within this trench. Another two trenches were excavated through two sides of the larger, more intact structural remains measuring roughly 50-x-50 ft. This structure was identified as having been a barn. Artifacts retrieved from this area included wire and cut nails, horseshoes, bailing wire, metal hardware, glass fragments, a porcelain button, long carriage bolts, an adjustable pipe wrench, and horse-harness grommets and buckles. Artifacts excavated from the area of the smaller barn included a wire nail, a fragment of a canning jar, an iron ring that may have been a pipe fitting, horseshoes and a harness buckle. However, the artifacts were found in association with post-occupation slopewash deposits, and were, therefore, in secondary context (Ziesing 1996:72-77).

A 2-x-25-ft. trench was excavated through the house area. Following this, surface clearing, exposing an area measuring roughly 70-x-100 ft., and removal of the upper 1 to 8 inches of topsoil was undertaken. At this time an extensive artifact scatter (covering approximately 50-x-60 ft.) was located and only minimal structural features, including three redwood posts and a terrace or border wall constructed of fieldstones. The artifact scatter, which had been disturbed by plowing or discing, consisted primarily of domestic or personal refuse such as bottle and glass fragments, canning jar fragments, tin food cans, ceramic sherds, glass tableware, silverplate flatware, butchered animal bone, a whetstone, stove parts, lamp parts, glass beads, a hair curler, fragments of a watch, a marble, a Christian medallion, and metal, bone, porcelain and shell buttons. The structural and tool assemblages were represented by a door knob, door hardware, a door hinge, bolts, iron spikes, cut and wire nails, a copper-alloy drain guard, a red brick fragment, furniture hardware, an ax head, nail pulling pliers and a claw hammer head. In addition, iron machinery or pump parts, harness buckles and horseshoes, mower pieces, and a shotgun shell and a .22 caliber bullet casing were also excavated (Ziesing 1996:78-85).

Removal of a further 8 inches of soil revealed three historic trash pits, each containing one episode of fill with two of the refuse pits having been burned in place. Artifacts excavated from the unburned pit included food cans, bottles and jars, a milk can, fragments of earthenware vessels, a furniture spring, shoe fragments, minimal structural material, and cow and sheep bones. One of the burned pits contained cut and wire nails, earthenware and glass fragments, wire, and cow and sheep bones. The other burned pit contained cut and wire nails, window glass, egg shell, a light bulb fragment, an earthenware vessel, canning jar lid liners, and cow, sheep, pig and chicken bones (Ziesing 1996:78-83). The artifact scatter and pit features were thought to relate to 20th century occupation of the area by the Rose household (Ziesing 1996:86).

Within the stream area, the third area defined by Ziesing, six discrete features were investigated and two test trenches were excavated. Features included a well, a stacked-stone bridge footing along the creek bank (previously described as stone terracing), a small rectangular stone footing, the remains of a stone-lined cellar, a stone retaining wall along the creek bank, and a buried artifact concentration and historic ground surface located roughly one ft. beneath the latest alluvial deposit.

Portions of a windmill and pump surrounded the redwood plank-lined well. Artifacts found in association with the well included earthenware sherds, bottle finishes, a canning jar lid liner, iron hardware, and a silver-plated watch surround. Cultural material found with the stone lined cellar included canning jar fragments, earthenware vessels, a glass tumbler, ceramic sherds, glass fragments, porcelain dolls, buttons, a leather shoe, cut nails and other structural fasteners, a box wrench, various pieces of agricultural machinery, and cow, sheep and pig bones. Artifacts associated with the stone footing included decomposed cloth or leather, clothing/tack rivets, sundry iron fittings, nails, coal, and sheep bones. Ziesing (1996:92) considered that it may have been a footing for a water tank. The presence of wagon bolts, a toggle, a whiffletree hook, and various items from at least one harness set up indicated to Ziesing (1996:97) that this feature may also have been used to store wagon gear. The buried artifact concentration contained a wide variety of artifact types including kitchenware, ceramics and glassware, medicinal items, clothing and footwear, toys, furnishings, lighting, structural hardware, wagon hardware, and faunal material. The windmill and the cellar were dated to the late 1800s. The creek bank stone features dated to post-1906 (Ziesing 1996:87-113). Praetzellis et al. (1997) do not offer comments on the potential for additional in situ deposits.

CA-CCO-446H, the Raffett Place, the French Frank Place, Ranch Headquarters

This tenant ranch complex lies at the extreme northern edge of the Cañada de Los Vaqueros land grant, in the alluvial valley north of the Los Vaqueros Reservoir dam. Site features include two cellar holes, a chimney base, three stone-lined building platforms each with stone terracing, additional stone terracing and a possible hand-dug, stone-lined well, and a sheet deposit of historic artifacts. A mound may be the remains of an adobe referred to by Minnie Bordes in a letter dated 1878 (Praetzellis et al. 1997:132). A brief summary of the tenancy and land use follows.

1870s	Bordes family, French immigrants, leased the property and produced grain.
1880	Frank Raffett (French Frank), French immigrant, joined the Bordes family; he took over the lease from the Bordes when they moved. He maintained a bocce ball court.
By 1908	The lease was taken over by Cabral to raise livestock; Raffett left to grow hay on 160 acres he purchased nearby.
1929	Appraisal lists unoccupied three-room house, barn, and shed.
1941	Property sold to Oscar Starr by Mary Crocker estate; property leased by Starr to Souza and Pimental who eventually purchase the land.

The site was recorded but never subject to data recovery as the site was located outside the area of direct effects of the 100 TAF Reservoir project. However, since increased access was anticipated as a result of the nearby recreation area, the site was enclosed by metal fence stakes and nylon tape. Praetzellis et al. (1997) report good to excellent site integrity. Some features appear to be untouched, but depressions may be the result of pot hunting. Alternatively, the depressions have been interpreted as cow wallows.

CA-CCO-447/H, Livestock Management Feature

This site is located in a narrow canyon in the Kellogg Creek valley north of the Los Vaqueros Reservoir dam. The historic component of this site consists of a square, three-sided, dry-laid, sandstone foundation, dating to the early 19th century and associated with livestock management, and two circular depressions (Meyer and Meyer 2000:39; Ziesing 1996:45). No historical information is provided by Praetzellis et al. (1997) regarding the property ownership, tenancy, or land use, and minimal information is included within Ziesing (1996). A brief summary of the ownership, tenancy and land use follows.

post-1888	Mary Crocker leased the ranch, possibly to Frank Raffett (refer to CA-CCO-446H)

A Level 1 testing program was undertaken in 1994, involving excavations within the area of the stone foundation. Two parallel trenches were excavated across the foundation. Excavation of another trench bisecting one of the circular depressions was recommended but following surface exposure the depression was determined to be natural and no data recovery was undertaken (Ziesing 1996:47). An area measuring 25-x-25 ft. around the foundation was surface-cleared allowing recordation of the feature. A 3-x-25 ft. trench was excavated within the structure, running diagonally. A second 6½-ft.-wide trench began outside of the structure, crossed the northwest wall and connected to the first excavated trench (Ziesing 1996:49-53).

The foundation was laid in a U-shape within an excavated ditch. The walls were up to 18 inches thick. The southwest wall measured 12½ ft. long, the northwest wall was 10 ft. long, and the northeast wall measured 6½ ft. in length (Ziesing 1996:49). A builders' trench ran along the outside of the northwest wall, and four possible postholes were found within 3 inches of the trench. While no floor was observed, some wood plank fragments were found below the surface within the foundations (Ziesing 1996:49, 51, 54). The structure was determined to be a livestock shelter or holding pen, and may have been associated with a nearby ranch (site CA-CCO-446H) (Meyer and Meyer 2000:41).

The cutbank of a nearby creek was inspected during this phase of data recovery. A cultural layer of fine-grained silty clay containing charcoal and glass fragments was observed at this location. The cultural layer was observed within a 28-ft.-long portion of the creek bank, and was not observed on the opposite bank (Ziesing 1996:57).

Artifactual material retrieved from excavations surrounding the structure was highly fragmented, and included pieces of bottle glass, porcelain, cast iron, sheet metal, cut and wire nails, a lead seal, a copper alloy rivet, a brick fragment, bits of asphalt, concrete, asbestos, a piece of window glass, a trouser rivet, buttons, tobacco pipe fragments, .22 caliber rim fire bullet casings, and bone (primarily rodent) (Ziesing 1996:57-59). There were few chronologically diagnostic artifacts within the assemblage. Based on the evidence, Ziesing assumes a late-19th to early-20th century date for the materials (Ziesing 1996:59).

The historic component of this site lies just outside of the area of direct impact for the 100 TAF Reservoir project. Once exposure and excavation of the foundation was complete, the excavation was backfilled and the site was designated an Environmentally Sensitive Area and monitored during the installation of the water conveyance pipeline. Praetzellis et al. (1997) do not offer predictions regarding the potential for additional historic era features or deposits in the vicinity.

CA-CCO-448H, Fragulia Tenant Ranch

This ranch headquarters site is located in the hills east of Vasco Road, near the head of a northwest trending seasonal tributary of Kellogg Creek. Elements of the site include a stone foundation, fruit trees and structural remains. Sometime after 1982, the construction of two roads disturbed the site. Because of this destruction, 448H was considered to be ineligible to the National Register in the 1992 Evaluation. Oral history interviews from 1993 indicate that features may exist at the Fragulia Place (cellar, privy) that are deep enough to have survived the destruction. Therefore, this site still has the potential to contain important information and should be considered potentially eligible to the Kellogg Creek Historic District (Praetzellis et al., 1997). A brief summary of the ownership, tenancy, and land-use follows.

ca. 1886	Andrew Fragulia settles in the Vasco
1887	Andrew Fragulia and his wife, Maria Volponi had their first child, Jane on the ranch.
1893-1925	The Fragulias reside on the property, raising crops and selling them in town. They had one of the few substantial truck gardens in the Vasco.
1924	Andrew and Maria retire, and sell their personal property to their two oldest sons, Louis and Andrew.
1929	Significant improvements were made to the Fragulia Place; the property now consisted of a six-room house, a large barn, an old barn, a well and windmill, a bunkhouse, blacksmith shop, chicken houses, a separator house, and a two-seater privy out back.
1933	Maria Fragulia dies of a heart attack. Andrew Fragulia dies two years later.
1935	James Fragulia takes over the ranch, but could not afford to buy it for $16,000 when it was offered for sale.
Late 1930s	The Fragulias move to Livermore
1941	The Fragulia Place was within the parcel sold to Oscar Starr by the Crocker estate.

CA-CCO-450/H, the Suñol Adobe/Dario Place, Ranch Headquarters

This rancho site is located at the confluence of two seasonal creeks at the base of a northeast-facing slope. Marshy land bordering the 100 TAF Reservoir lies nearby but the reservoir does not reach the site. Historic features include an adobe mound, built around 1852 and reportedly the remnants of the first permanent dwelling on the Cañada de Los Vaqueros land grant, and rock walls sometimes referred to as stone alignments or fences (Praetzellis et al. 1997:138-39). The more modern ranch complex built on the same site by Ordway around 1950, consists of a log cabin residence called the Cowboy House, a large barn, and associated corrals, sheds, and wooden and wire fencing. The barn and corrals appear to be in use as of June 2007. The Cowboy House has been surrounded by a high cyclone fence to discourage entry and windows have been boarded over with plywood. A brief summary of the ownership, tenancy and land use follows.

ca. 1852	Adobe built by Lorenzo Suñol, Spanish immigrant, who was a squatter on the property.
1856-1866	The Suñol brothers occupied the adobe and raised livestock and grain, as part of an extensive ranching network that was documented in the 1860 census.
1856-1871	Feuding over ownership of Cañada de Los Vaqueros land grant between Suñol and Peres; lawsuit settled in favor of Peres.
1870	The Suñol Adobe was owned by Peres and Altube, Spanish immigrants.
1880	The property is occupied by the Frank Viala household, French immigrants, who raised hay and grain.
1886	The Darios, French immigrants, occupied the property, raised hay and grain.
1927	The Almeida family leased the property; a four-room house, lean-to, and two barns are documented.
1930	Nunez leased the property and raised hay and grain
1935	The property was sold to Oscar Starr as part of Mary Crocker estate. Starr had others raise hay and grain, but he did not occupy the property.
1948	Starr sold the property to Ordway who occupied and built the half-log cabin and barn that stand there today.

The historic component of this site lies outside of the area of direct impact for the 100 TAF Reservoir Project and very little data recovery associated with mitigation has been performed to date. An approximately 40-ft. portion of a roughly 800-ft.-long rock wall, or stone fence, in the southern portion of the site has been exposed and mapped (Meyer and Meyer 2000). This portion of the fence was demolished as part of Road 3A construction. Excavation was undertaken by shovels, hoes, trowels and brooms. The soil removed from the first 10 ft. of the wall, as well as a sample of soil from the remaining section of the excavated fence, was screened through a ¼-inch mesh. Following its exposure, a series of overhead photographs were taken of the fence, and a 2-ft. cross-section was excavated through the fence. Following recordation, the fence was reburied (Meyer and Meyer 2000:33). Excavations revealed that the fence had been constructed of dry-stacked local stone in two parallel rows, spaced approximately 3 ft. apart, with rubble placed in between. The fence was generally one course high and Meyer and Meyer (2000:33, 37) inferred that the upper portion of the fence had at some time been removed. Artifacts found in and around the fence included a mower tooth, part of a plow blade, three fragments of ferrous metal strap, two .22 caliber shell casings, two 12-gauge shell casings, and several pieces of two-strand, two-point, barbed wire. The artifacts were reburied along the fence that runs adjacent to Road 3A. Meyer and Meyer (2000:37) suggest that the stone fence, along with another roughly parallel fence to the north, may have been constructed during the 1850s or 1860s during the period that the land title was being disputed.

In 1999, following discing of recreation trails within the watershed, CA-CCO-450/H was re-inspected. At this time, Praetzellis (2000:1) noted that "no significant damage to the archaeological deposits was observed."

The Cowboy House and barn were formally described and evaluated as part of a Historic Architectural Survey Report (Hattersly-Drayton 2000). Barriers, in the form of boulders, were placed to prevent damage to the adobe mound and other sensitive areas. The adobe remains and any associated buried features are significant as they may represent the earliest permanent residential structure in the watershed. The split log cabin lies above a lined cellar that may be a remnant of an older building (Hattersly-Drayton 2000). The cabin itself has historical significance and may require further documentation prior to demolition and inundation.

CA-CCO-467/H, Melies Cash Entry, Water Management Features and Possible Domestic Complex

The historic component of this site consists of: two spring boxes; a rock-lined well; a water tank; a square, three-sided, stone structure; and historic debris. These historic features are presumably associated with a domestic complex that now lies beneath an adjacent reservoir. A brief summary of the ownership, tenancy and land use follows.

1876 On behalf of Peres, Melies purchased 160 acres from the government including this site.

1878 Ownership transferred to Peres.

1881 Sold as part of 880 acres to McLaughlin.

The historic features and debris were left by a tenant rancher during the McLaughlin ownership, but the property is not specifically mentioned in lease agreements; the historic features and debris may be related to occupation of the Dario Place (CA-CCO-450/H) located nearby to the east (Praetzellis et al. 1997:149).

The site was not directly impacted by the Los Vaqueros Reservoir and there has been no mitigation or data recovery to date. A relatively new, small reservoir has been built in the immediate vicinity. The stone structure is within the reservoir and is occasionally covered by water. Praetzellis et al. (1997) anticipate the potential for buried historic features within the reservoir. Historic research has failed to reveal a link between the historic features and debris, and a known and documented household or tenant and so the potential of this site to yield historically important information may be limited by comparison with other historic sites in this study area.

CA-CCO-454H, Los Vaqueros sheep camp

This site is a seasonally occupied sheep camp dating to the late 19th and early 20th century. A Level 1 data-recovery excavation was implemented in July 1993 during the pre-construction phase for the installation of a natural gas pipeline, which passes between sites 310 and 454H. Forty Surface Transect Units (STU) and two Vertical Units (VU) were excavated, yielding a small collection of both historic- and prehistoric-period artifacts. No testing was done within the site boundaries; the Area of Direct Impact (ADI) for the pipeline did not extend into the sites. This site has been combined with site CA-CCO-310, a prehistoric rockshelter site, due to the close proximity of the two sites and the presence of historic-period artifacts at 310. No information is available as to ownership or tenancy of this site.

CA-CCO-470H, Vasco Adobe/Starr Ranch, Ranch Headquarters

This site was the center of a ranching complex from the 1850s through 1995 and now lies submerged beneath the 100 TAF Reservoir pool. Basque ranchers built the Vasco Adobe and associated outbuildings in the mid-1850s. After purchasing the property in 1935, Oscar Starr built three residences, a barn, workshop, shed, and silo. A brief summary of the ownership, tenancy, and land use follows:

ca. 1844 From this time the property was used for communal grazing by neighboring ranchers.

1857 Basque immigrants (e.g., Altube and Arrambide) settled at the adobe and grazed cattle in the area.

1871 Most Basques moved to Nevada to continue cattle ranching.

1873	Peres listed on map at the location of 470H as the head of a large household.
1880	Peres had accumulated title to most, if not all, of the 17,752-acre rancho.
1881	Peres turned the property over to McLaughlin to secure a loan; Peres remained as tenant.
1882	Leased by Silva family, Portuguese immigrants who occupied and farmed. The family lived in the adobe house. After 1890 they lived in a brown wood-framed house with gabled roof.
By 1897	Peres had lost all court cases to regain his land.
1915	Cabral leased the property on behalf of his cousin, Domingo, an immigrant from Azores; occupied and farmed.
1929	An inventory listed a 6-room house, bunkhouse, blacksmith shop, shed, two chicken houses, large barn, granary, well, and windmill.
1935	Property was sold to Oscar Starr as part of the Mary Crocker estate; Starr had others raise livestock on the ranch while he lived elsewhere; the complex fell into ruins.
1948	Property was sold to Ordway who made additions to the main residence, offset the road, installed a pool in the front, and added an adobe wall.

The entire site has been inundated by the Los Vaqueros Reservoir since 1998. Data recovery was undertaken at the Vasco Adobe in 1994 (Ziesing 1997b). As part of the investigations, interviews were conducted with local people who may have been able to identify the location of structures at the site. A surface survey of the area was undertaken to determine areas requiring further examination. A mound of sandstone rocks which may have been the remains of the stairway leading into the adobe was identified as warranting subsurface investigation. A 40-x-75-ft. area was cleared around this feature revealing two activity areas. A 3-ft.-wide, 44-ft.-long trench was excavated through the first activity area, the site of the originally identified sandstone mound. Exposed features included a flagstone surface, a dry-laid sandstone wall, and a feature described as a "7½ -ft squarish configuration of sandstone blocks…with fired adobe-style brick fragments in the center of it" (Ziesing 1997b:45). The bricks had been crudely fired as opposed to having been sun-dried. Nineteenth-century artifacts were found in the soil deposits overlying this feature. Further testing within the adobe structure identified a kitchen area with a bread oven and fireplace, and the main room to the east of the kitchen. Few artifacts were found associated with occupation of the adobe, but those that did remain included: glass bottles; cans; serving dishes and tableware; a lead pencil; lamp glass; a handle; cut and wire nails; wire; various metal items such as strap metal, gear, nut and bolt; a clay pipe; buttons; fabric; brick and mortar; window glass; and a bullet casing (Ziesing 1997b:95-100). The post-occupation cultural deposits included a wide range of artifacts encompassing the following categories: food; food preparation; consumption and storage; furnishings; heating and lighting; clothing and footwear; accoutrements; grooming and health; entertainment; indulgences-alcohol and tobacco; structural hardware and material; farming; hunting; ranching; tools; transportation; and writing (Ziesing 1997b:G-1-G-15).

The second activity area comprised rocks and scattered bricks adjacent to a metal well casing. A 25-x-30-ft. area was cleared and a brick surface surrounded by a low trough was revealed. These bricks were standard sized construction-grade bricks (Ziesing 1997b:45, 26). A cast-iron water pipe suggests that the brick surface or platform was used for some kind of water-related function, and the trough may have been caused by walking on wet ground. This feature may not have been associated with the adobe, but rather the subsequent ranch occupation (Ziesing 1997b:175).

A survey using a metal detector was conducted to try to locate a blacksmith shop that had been recorded in a historic document. Various artifacts were found scattered throughout the site area by this method. The remains of two dry-laid stone bridge abutments, as well as possible wooden bridge remnants, were found along Kellogg Creek during the survey (Ziesing 1997b:46, 49). The exposed areas were further cleared to reveal an area with maximum dimensions of 120-x-75 ft. A remote sensing survey using a magnetometer was undertaken to locate stone walls, floors or similar features. Areas described by Ziesing as being of high and very low magnetic resistivity were excavated though only one additional feature was revealed. This feature was a historic trash pit (Ziesing 1997b:49, 52).

Another stone surface was also identified. A number of cobbles and artifacts such as cut nails had been observed on the surface in this location, and the area was cleared to expose this feature. Artifacts retrieved from the overlying alluvial soil were predominately structural materials, but also included a piece of farming equipment, bullet casings, clothing related items, and fragments of white earthenware. The purpose of the surface was not determined, though it may have been related to 19th-century grain farming (Ziesing 1997b:178-181).

The 1999 CRMP noted the potential for additional buried deposits associated with the adobe and the later wood-frame dwelling. An architectural study of the National Register-eligible buildings standing at the Starr Ranch was prepared in 1996 (Solari and Upton 1996). These include the hot-riveted buildings constructed by Starr, who developed the diesel Caterpillar tractor. This report includes a historical background, measured drawings, and high definition photographs.

CA-CCO-533H – Everson Farmstead

This property was a ranch headquarters located on public land within the valley of Kellogg Creek. The site consists of sandstone rock alignments and aggregations that suggest structural footings and the remains of a windmill. The sandstone rock alignment due east of a recent wooden enclosure may be the corner of a structural footing. A linear sandstone alignment may also represent a footing, while dispersed sandstone rocks may be disturbed footing materials. Domestic refuse deposits were not noted on the surface, but may be buried under alluvium. The physical integrity of the site appears good. The integrity of potentially buried deposits remains unknown (Praetzellis, 1997: 155). A brief summary of the ownership, tenancy, and land use follows:

1870	Louis Everson filed a Cash Entry on the 160-acre parcel containing the site. He lived and farmed here with his wife and three infant children.
1875	The Eversons sold the property to Henry McCabe, son of Thomas and Maria McCabe. It is unknown whether Henry McCabe and his family lived on this site; they are not shown on the census.
1891	Henry McCabe sold the property to Myrtil Blum, son of Los Vaqueros land speculator Simon Blum; Myrtil quickly transferred it to William Brown.
1906	William Brown sold the property to John Brown
1910	Widow Catherine Brown lived in this location with her two adult sons; they were general farmers.
1924	The John Brown estate auctions off the property to the highest bidder, Edward Grueninger for $5,426.

This site has not undergone any mitigation measures as of 1996, because there have not been any plans to develop the area in which it is located. As a result, it is not as well understood as other sites in the Los Vaqueros watershed. If impacts to the site cannot be avoided, an HPTP outlining a phased data recovery program should be developed and implemented.

CA-CCO-534H – Andrews/Barkley/Bakers Farmstead

This site is a ranch headquarters located in the valley of Kellogg Creek at the base of a hill to the west of Vasco Road. The site consists of the structural remains of a collapsed barn and possible outbuilding, consisting of stone alignment and raised platform; a possible dwelling footing; associated water-management features; and a sheet-refuse deposit consisting of wire and cut nails, toy wagon and tricycle, white improved and black-transfer-printed earthenware, and salt-glazed stoneware bottle sherds. Exotic vegetation includes a fruit tree, two pepperwood trees, and a walnut tree. An earthen levee measuring approximately 3 ft. wide by 1.5 ft. high by 1,000 ft. long originates at the base of a hill and terminates immediately north of a standing windmill frame. In addition, the site contains a concrete cistern filled with recent debris. The physical integrity of the site appears good to excellent

(Praetzellis 1997: 156). The integrity of potentially buried deposits remains unknown. A brief summary of the ownership, tenancy, and land use follows:

1870 According to a U.S. Census of 1870, James and Anna Andrews and their seven children had been living and farming at site CA-CCO-534H.

1872 James Andrews purchased the 160-acre parcel containing the site from the General Land Office (GLO) with Agricultural College Scrip In December.

1875 Andrews filed a Homestead Entry on a neighboring 80-acre parcel; the time period on this entry expired and the GLO canceled it in 1885.

1889 Andrews purchases the 80 acres with a Cash Entry patent in April.

1902 The Savings and Loan sold the 160-acre parcel to Frank Baker.

1910 According to the U.S. Census, the Barkley family continued to rent the property, until they moved a short distance up the creek, taking their house with them; the house was moved three times, eventually ending up in Brentwood.

1920 Frank Baker built a new house on the property and retired there. After his death a few years later, the parcel, along with the neighboring 80-acres passed to his widow, Mary Baker.

1925 Chris Christenson and his bride, Vivian Morchio moved into the Baker place.

1940 Edward Grueninger purchased the 240-acre parcel after Mary Baker's death for $6,375. The Baker house was sold to Dell Hansen, who moved it to the yacht harbor, where it eventually burnt down.

This site is located within the Los Vaqueros Reservoir watershed that may be impacted by increased access. It may be affected by vandalism or by other as yet unidentified impacts. Site preservation is preferred to data recovery; plans should be developed to avoid damage to the site. If impacts cannot be avoided, a phased data recovery program should be developed and implemented. The location of the Barkley child's grave should be determined by interviews with members of the Barkley family.

CA-CCO-535H, Easton/Morchio/Grueninger Farmstead, Ranch Headquarters

This property was a ranch headquarters in the broadest part of Kellogg Creek Valley. In 1986 the site consisted of numerous standing barns and outbuildings, exotic vegetation, and a dispersed scatter of domestic refuse and farm machinery. In 1998 the barns were removed, and two maps of the complex and a brief historical sketch were prepared. The ranch buildings included a house, tankhouse, well, windmill, pump house, horse barn (probably built in the 1870s), a sheep barn (1945), fuel and tool shed, turkey shed, tractor equipment and harvester shed, bunkhouse, granary/garage, blacksmith shop, and smokehouse (SSUAF 1999:28). A brief summary of land ownership and land use follows.

1872	Eastons, Scottish immigrants, patented a quarter section including this property.
1880	Easton son, George, occupied and ran the farm with his family. He raised livestock (horses, hogs, and chickens) and conducted hay farming.
1900	Morchio family, Italian immigrants, leased, occupied, and raised grain on the property.
ca. 1910	Documents list the substantial Easton house (two bedrooms upstairs, 5 bedrooms downstairs), two barns, granary/garage, chicken houses, bunkhouse, tankhouse, blacksmith shop and smokehouse (Hattersly-Drayton 1993:20).
1919	Grueninger (parents were German immigrants in the 1880s) bought parcel from Easton and conducted dry farming.
1927	Replaced Easton house with Craftsman-style bungalow; discarded many old possessions into Kellogg Creek.
1935	Grueninger gradually built his operation into a large ranch by purchasing neighboring properties to make a full section (640 acres). He deeded the property to his nephew, Pyron Crosslin.
No date	Crosslin sold to Kaiser Construction Company, but remained on the property as a resident with a life estate.
1971	Craftsman style house burned and the Crosslins moved, giving up life estate.

In the 1990s, prior to initiation of the Los Vaqueros 100 TAF Reservoir construction and mitigation, there were three extant barns (granary, shed and garage, shelter for harvester) and a horse arena, which was probably the oldest extant structure on the Vasco (Praetzellis et al. 1997:160).

In 1998, data recovery investigations were undertaken at CA-CCO-535H as part of the mitigation measures developed for the demolition and clean-up activities being undertaken at the site (Meyer and Stewart 1998). The site was photographed, mapped and recorded in detail. In addition, a steel probe was used to determine if stone paving existed buried beneath the barn floors (Meyer and Stewart 1998:5-7). The proposed mitigation involved the demolition and removal of all above-ground debris and structures (SSUAF 1998:3). However, the building that had been previously identified as the ranch bunkhouse was later discovered to have originally served as one of the county's earliest Tax Assessor's offices. The building, which had already been relocated once, was relocated off-site to allow site clearance to continue (Meyer and Stewart 1998:7). The building was considered ineligible for the NRHP and no further consideration was required (Meyer and Stewart 1998:8).

CA-CCO-650H, Historic Artifact Scatter

This site is an historic artifacts scatter, which mostly originates from within the fill dirt used to build up the levee road forming the western bank of a small irrigation canal. No structural debris was noted. Fifteen uncontrolled shovel probes were dug, but only one yielded any subsurface deposits. Due to the extremely disturbed condition and poor integrity of this site, no further management is recommended. There is no available information on the history of owners or tenants for this site.

CA-CCO-726/H, Powerline Site, Historic Artifact Scatter

The historic component of the Powerline Site consists of an extensive artifact scatter (Meyer and Meyer 2000:50). Archaeological monitoring of this site was undertaken in 1998 during the excavation of a waterline trench. No subsurface historic materials were located at this time. Monitoring of the construction of two detection points was also undertaken. Historic artifactual material within this area was found to cover a 120-x-60-ft. area at 6 to 8 inches below surface. These artifacts were related to household domestic use, and included ceramic ware, glass bottles and other drinking ware, canning jars, a portion of a griddle or stove burner, cow, sheep and deer bone (some saw-cut), sheet metal, a chain and hook, and nails. Diagnostic artifacts ranged in date from 1875 to 1920, with most artifacts falling into the 1880 to 1910 date bracket. Meyer and Meyer (2000:56) suggested that the artifact scatter may have been associated with a household site, and that the lack of any features or patterning to the historic material indicates that the site has likely been disturbed by cultivation (Meyer and Meyer 2000:50, 55-56). Based on the pattern of household trash disposal from the same occupation period at other sites in the vicinity, it is likely that there was a household nearby, however any such household escaped detection during the extensive archival research conducted by SSUAF for the Los Vaqueros Reservoir project (e.g., Praetzellis et al. 1995).

Discussion and Significance of Previous Historic-Era Research

The archaeological investigations summarized above were complemented by equally intensive collection of oral testimonies and archival research. As a result, the occupations of most of the ranch headquarters have been associated with specific individuals through time. This has allowed for the historical and interpretive connection of material culture remains with individuals of different ethnicities, genders, ages, life histories, and social affiliations. The historic-period occupation of the study area has yielded archaeological evidence primarily from the later 1800s when tenant ranchers of different ethnicities dry-farmed the land. Of the two remaining adobe ruins from the earliest occupations of the area, the Suñol Adobe has been carefully excavated. A more detailed consideration of the results of Historic-period research is presented within the research framework in section 5.1 Previous Research Questions.

3.5 Native American Consultation

The Native American Heritage Commission (NAHC) was contacted by letter on July 10, 2008, requesting information on sacred lands and a contact list of local tribal representatives and most likely descendents (MLD). A response was received from the NAHC on August 1, 2008, noting, "A record search of the sacred land file has failed to indicate the presence of Native American cultural resources in the immediate project area." The letter also provided a list of Native American contacts in Contra Costa and Alameda counties.

4.0 Survey

4.1 Survey Method

The majority of the study area has been previously surveyed for cultural resources (Figure 5). Additional surveys were conducted for the Los Vaqueros Expansion Area Studies. Consultants conducted a mixed strategy pedestrian survey of the reservoir expansion area and portions of the proposed pipeline corridors as well as the proposed eastside hiking trail. In the reservoir expansion area, surveyors targeted known historic properties between the existing 100 TAF reservoir and the proposed 275 TAF expansion area with an additional search area, or buffer, extending 200 ft. beyond the anticipated 275 TAF high water mark (560 ft. amsl). All previously recorded and evaluated sites were relocated and examined for new evidence of disturbance that might have affected their NRHP-eligibility status. Any new cultural resources were mapped and recorded.

Segments of each of the proposed pipeline corridors (Delta-Transfer, Transfer-LV, and Transfer-Bethany), the powerlines (Options 1 and 2), and associated facilities including the Transfer Facility Expansion area, power substation, and the Staging Area north of the dam, that had not been previously surveyed, or that had been surveyed more than 10 years ago, were examined on foot using 4-m transect intervals. Archaeologists searched for evidence of past cultural activities older than 45 years such as concentrations of flaked stone, groundstone, charcoal, fire-affected rock, locally dark soil, shell and/or bone fragments, shards of ceramic or glass, brick, nails, wire, foundations, fencerows, corrals, and irrigation ditches.

4.2 Survey Results

Cultural resource surveys were undertaken in April 2004, May, June, and November 2007, and February and April 2008. The April 2004 survey was undertaken by WSA as part of an earlier phase for the planning of this project. Table 4 presents a summary of the cultural resources within the study area and proposed APE. Sixteen historic properties were relocated and assessed for evidence of recent damage and these are discussed below. Nine historic properties were not accessible due to inundation or their removal as part of the mitigation for the 100 TAF Los Vaqueros Reservoir (CA-CCO-445H, 458/H, 469, 470H, 636, 637, 696, 725, 726/H, and 755). Nine cultural resources were recorded and have been assumed eligible for listing on the NRHP and the CRHR for the purposes of this assessment report.

CA-CCO-9, Milling Station

This site was revisited on June 11, 2007. BRMs were relocated in two main clusters. The 1953 site map depicts the northern cluster, while the southern cluster is depicted on the 1980 site map, across a newly built wooden footbridge. Site appears undisturbed with lichen and leaf litter covering most boulders.

Mitigation recommendation: thorough recordation with focus on mapping (combining the 1953 and 1980 site maps to form a complete site map of both clusters.)

CA-CCO-143 and 144, Lithic Scatters

On April 22, 2008, WSA staff revisited these site locations. There was no evidence of the site on the surface. Visibility was very poor (less than 5%), and the area has been heavily disturbed by agricultural activity over the decades.

CA-CCO-397, Milling Station

On February 29, 2008, WSA staff revisited this site. The condition of the site appears to be unchanged since it was last recorded, except for a few things. A barbed-wire fence has been erected which bisects the western 1/3 of the site, just to the west of the 1986 datum. There were no previously recorded BRMs on any boulders to the west of this fence, although this was not verified during the 2008 revisit. The land is currently being used for cattle grazing; there were cattle on the western side of the fence at the time of the revisit and evidence of cattle tramping within the site boundaries. A total of seven BRMs were relocated, corresponding to the locations on the 1999 sketch map, which was based on the 1986 sketch map. The condition of the site seems to be good, with some loss of integrity due to erosional activity and grazing.

Table 4. Summary of Results of Cultural Resources Survey

Resource	Site Type	Last Assessed	Condition	Previous Mitigation
CA-CCO-9	Milling Station	June 2007; No obvious disturbance	Excellent; subsurface unknown	Avoided; long term monitoring
CA-CCO-143	Lithic Scatter	April 2008; could not relocate	Unknown	No known mitigation
CA-CCO-144	Lithic Scatter	April 2008; could not relocate	Unknown	No known mitigation
CA-CCO-397	Open Site	November 2007; Disturbance from active animal burrows and cattle trail	Poor to good; subsurface unknown	No mitigation
CA-CCO-427H	Ranch Headquarters	June 2007; No obvious disturbance; unrecorded grooved boulders in creek bed	Subsurface excellent in locations not previously excavated	Level 2 Data Recovery; Partial Inundation
CA-CCO-445H*	Ranch Headquarters	No access; inundated	Unknown	Level 1 and 2 Data Recovery; Inundation
CA-CCO-446H	Ranch Headquarters	November 2007; No obvious new disturbance	No remaining structures; subsurface unknown	Avoided; Screened
CA-CCO-447/H	Livestock Feature; Open Site with burials	November 2007; No obvious new disturbance	Good; subsurface good in locations not previously excavated	Historic: Level 1 Data Recovery; Screened; construction monitoring Prehistoric: Level 1 Data Recovery; construction monitoring
CA-CCO-450/H	Ranch Headquarters; Open Site (includes "High Water Site")	June 2007; Corrals and barn in use; no obvious new disturbance of prehistoric	Structures good; subsurface unknown	Stone Fence recorded; Historic Architectural Survey Report (2000); Partial screening of cabin; Barrier placement
CA-CCO-452	Milling Station	June 2007; Some surface disturbance	Excellent; subsurface unknown	Avoided
CA-CCO-458/H*	Historic Artifact Scatter; Open Site with burials	No access; inundated	Unknown	Level 2 Data Recovery; Inundation
CA-CCO-459	Milling Station with human remains	April 2004, June 2007; Partial exposure and erosion due to fluctuating water level; additional bedrock mortars observed	Good to Excellent; previous testing	Level 2 Data Recovery; Partial inundation; Long term monitoring
CA-CCO-462	Milling Station	June 2007; No obvious disturbance	Excellent; subsurface unknown	Avoided

Table 4. Summary of Results of Cultural Resources Survey(continued)

Resource	Site Type	Last Assessed	Condition	Previous Mitigation
CA-CCO-463	Open Site with Milling Station	June 2007; No obvious disturbance	Excellent; subsurface unknown	Avoided; long term monitoring
CA-CCO-464	Milling Station	June 2007; No obvious disturbance; site larger and more complex than recorded	Excellent; subsurface unknown	Avoided
CA-CCO-467/H	Water Management Feature; Milling Station	April 2004; No obvious disturbance	Good; subsurface unknown	Avoided
CA-CCO-468	Milling Station and Open Site	June 2007; No obvious new disturbance; broken mortar scattered on surface	Fair to good	Level 1 Test; Partial Inundation
CA-CCO-469*	Milling Station	No access; inundated	Unknown	Level 1 Test; Inundation
CA-CCO-470H*	Ranch Complex	No access; inundated	Unknown	Level 2 Data Recovery; Inundation
CA-CCO-533H	Ranch Headquarters	April 2008	Poor to fair; subsurface unknown	Avoided
CA-CCO-534H	Ranch Headquarters	April 2008	Poor to fair; subsurface unknown	Avoided
CA-CCO-535H	Ranch Headquarters	April 2008; No surface elements of the site remain	Poor to fair; subsurface unknown	Buildings demolished; Care taken to maintain subsurface integrity
CA-CCO-596H	Ranch Headquarters	April 2008	Fair to Good Subsurface unknown	No known mitigation; not in 100 TAF reservoir APE
CA-CCO-597	Petroglyph Boulder	April 2008; Petroglyph not visible	Poor to Fair; subsurface unknown	Graffiti noted; not in 100 TAF reservoir APE
CA-CCO-621/H	Ranch Headquarters; Lithic Scatter	April 2008	Poor	Phased Data Recovery
CA-CCO-636*	Milling Station	No access; inundated	Unknown	Level 1 Test; Inundation
CA-CCO-637*	Lithic Scatter (surface); Open Site with burials (buried)	No access; under dam	Unknown	Level 2 Data Recovery; Covered by Dam
CA-CCO-650H	Historic Artifact Scatter	April 2008; could not relocate	Unknown	15 uncontrolled shovel probes; no further management recommended

Table 4. Summary of Results of Cultural Resources Survey(continued)

Resource	Site Type	Last Assessed	Condition	Previous Mitigation
CA-CCO-653	Open site with single burial	April 2008; could not relocate	Unknown	Phase 1 inventory
CA-CCO-696*	Open Site with burials (deeply buried)	No access; under dam, inundated	Unknown	Construction Monitoring; Level 2 Data Recovery; Inundation
CA-CCO-725*	Open Site	No access; paved under road	Unknown	Level 2 Data Recovery; Paved over
CA-CCO-726/H	Historic Artifact Scatter; Open Site	November 2007 No obvious new disturbance	Good to Excellent	Construction monitoring
CA-CCO-755*	Buried Open Site	April 2008; no surface evidence	Unknown	Construction monitoring
P-07-000791	Water Management Feature	April 2004; could not relocate	Good	Covered by silt
P-07-002640	Isolated pestle	February 2008; could not relocate	Poor	No known mitigation
Kellogg Creek Dam	Water Management Feature	June, November 2007 Parts of original dam dismantled, some removed	Fair	Original function of structure destroyed; No known previous mitigation
Kellogg Creek Irrigation Ditch	Water Management Feature	First recorded Nov 2007	Good	No known mitigation
Irrigation Ditch 1	Water Management Feature	First recorded Nov 2007	Good	Avoided by original installation of Delta-Transfer pipeline 1998
Irrigation Ditch 2	Water Management Feature	First recorded Nov 2007	Good	Avoided by original installation of Delta-Transfer pipeline 1998
Irrigation Ditch 3	Water Management Feature	First recorded Nov 2007	Good	Avoided by original installation of Delta-Transfer pipeline 1998
Byron-Bethany Irrigation Canal	Water Management Feature	First recorded Nov 2007	Good	Avoided by original installation of Delta-Transfer pipeline 1998
Concrete Culvert	Water Management Feature	First recorded Nov 2007	Excellent	Avoided by original installation of Delta-Transfer pipeline 1998
SPRR grade	Linear Feature	First recorded Nov 2007	Good	Avoided by original installation of Delta-Transfer pipeline 1998
Transmission Line	Linear Feature	First recorded Nov 2007	Good	Avoided by original installation of Delta-Transfer pipeline 1998

* Resources were not accessible at the time of the survey.

CA-CCO-427H, Perata/Bonfante Site, Ranch Headquarters

This site was revisited on June 11, 2007, by WSA staff. The site is a Ranch Headquarters, and has been previously mitigated with data recovery including excavation of at least 5 different features. The site no longer has standing structures. Most fences have been removed. We discovered two grooved boulders in the creek adjacent to the historic site. The site is partially inundated.

CA-CCO-446H, Ranch Headquarters

This site was revisited in 2007. The site may be adversely affected by construction of inlet and outlet pipelines for the Los Vaqueros Reservoir Expansion Project.

CA-CCO-447/H, Livestock Feature; Open Site with Burials

This site was revisited in 2007. The site may be adversely affected by construction of inlet and outlet pipelines for the Los Vaqueros Reservoir Expansion Project.

CA-CCO-450/H, Ranch Headquarters

The site was visited by WSA on June 12, 2007. Marshy land bordering the 100 TAF Reservoir lies nearby but the reservoir does not currently cover the site. The Cowboy House has been surrounded by a high cyclone fence to discourage entry and windows have been boarded over with plywood. There appears to be continued animal usage of the pens located adjacent to the cabin. The barn also appears to be used for storage of large machinery. The site appears to be in a good stable condition.

CA-CCO-452, Milling Station

This is another BRM site located east of Los Vaqueros Rd along Kellogg Creek below the reservoir. The ground is gently sloping and overgrown. There is some disturbance that has churned up the dirt around the boulders. We relocated some of the boulders with BRMs mapped in 1982, including the datum on split boulder, located other possible BRMS, but did not relocate the boulder with 2 BRMs on the 1982 map.

CA-CCO-459, Milling Station with Human Remains

The site was revisited on June 12, 2007. More BRMs were located than were previously recorded. The lone BRM, on the shore of the reservoir, is now visible; wave erosion has damaged it. No artifacts were noted.

CA-CCO-462, Milling Station

Site was relocated and appeared to be in a good, stable undisturbed condition. Lichen and leaf litter concealed many of the BRMs. The site is located further north west up the seasonal drainage, and is heavily overgrown by poison oak in the drainage where the BRMs are mapped, and by leaf litter and grass above on the terrace where the barbed wire fence is. Cattle have heavily disturbed the steep slope above the stream bed, primarily affecting the prehistoric portion of the site. They do not appear to have disturbed the terrace.

CA-CCO-463, Open Site with Milling Station

This site was visited by WSA on June 11, 2007. It appeared that the site has been undisturbed, except for some surface disturbance from cattle. Lichen and dried grasses obscure many of the BRMs on this site. CCO-463 is located west of Los Vaqueros Rd. across from CCO-9. The site is on a steeper slope setting higher above a tributary creek than CCO-9 which is on a very gentle slope down near Kellogg Creek. We did not relocate all BRMs mapped in 1982, namely those near and along the seasonal creek.

CA-CCO-464, Milling Station

Site CA-CCO-464 was visited by WSA on June 11, 2007. There was no obvious disturbance and the site appears larger and more complex than previously recorded. BRMs are located above a seasonal drainage on the west side of Los Vaqueros rd across from CCO-452. These BRMs are on a fairly steep slope. We were unable to relocate the exact configuration of boulders and BRMs recorded on the 1982 map, but located other examples. The site is overgrown with brush in some areas, and covered by leaf litter in others, but otherwise appears to be undisturbed.

CA-CCO-467/H, Milling Station, Water Management Features

This site was revisited in 2004. The site is located among trees lining a narrow seasonal stream and the bedrock mortars are thickly covered with leaf fall and other debris. No obvious disturbance was observed. A portion of this site will be inundated by the expansion of the reservoir.

CA-CCO-468, Milling Station and Open Site

The site was visited by WSA in June 2007. This site is currently located at the edge of and partially inundated by the 100 TAF reservoir pool adjacent to a tributary of Kellogg Creek.

The elements of the site include 5 previously recorded BRMs, a small earthen dam, and possible rock shelters upstream. The rock shelters are on the south sloped side of the seasonal creek and are formed by very large sandstone boulders with a very low gap. The shelter is heavily used by small animals and the dirt is churned up and covered with leaf litter. The soil is light brown silty loam. No obvious new disturbance was noted. At the time of inspection, the water level of the creek was low, allowing for documentation of the effects of draw down, such as increased visibility of the site and possible erosion. As a result of the draw-down, another grouping of BRMs was found in the creek bed. A partial portable mortar was found, but not collected.

CA-CCO-533H, Ranch Headquarters

In February of 2008, WSA staff revisited this site. The site appears much the same as described by the 1986 site record, except for a few minor modifications. The area is currently being used for cattle grazing, so there is some disturbance from that activity. Feature 1, a possible fieldstone building foundation corner seemed to have been disturbed, as some of the rocks were loose. Another circular metal trough had been placed close to the SW portion of the site boundary, near Feature 3. Thick-gauge wire and fan blades were also found near Feature 1 and the wood enclosure. The heavy metal pipe was relocated. The artifact concentration discovered by Meyer in 2003 could not be relocated.

CA-CCO-534H, Ranch Headquarters

In February of 2008, WSA staff revisited this site. The site has changed significantly since it was last recorded in 1999; all standing structures have been removed leaving only the wooden remains of a windmill. Two cement troughs were situated at the base of a hill, near the windmill remnants. The (levee) arroyo still remains, but no exotic trees remain. To the south, the previously recorded resources appear to have been removed.

CA-CCO-535H, Ranch Headquarters

An inspection of the site on November 21, 2007 revealed several indications of a former ranch and domestic occupation of the small knoll. These include a cement foundation and walkway, a cluster of pepper trees, a broken cement bird bath, various rusted metal pipes, fittings, and a tank, and shaped sandstone paving stones and wood posts eroding out of a roughly rectangular mound of dirt, stone, and debris. Domestic refuse was found scattered over the surface of the northeastern slope of the knoll. The above-ground, architectural elements of the resource were determined to be ineligible for listing on the NRHP and have been demolished and removed. There does not appear to have been significant ground disturbance subsequent to the demolition in 1998.

CA-CCO-596H, Farm Headquarters

On February 13, 2008, WSA staff revisited this site. The site has remained much the same as it appeared when it was recorded in 1986. All ten of the features were relocated, and appeared as described on the 1986 site record, with the exception of an unrecorded rock wall originating at the house and running parallel to the recorded wall for approximately 25 ft. WSA staff updated the site record sketch map.

CA-CCO-597, Petroglyph Boulder

In April of 2008, WSA staff revisited this site. A single boulder was located in an open field matching the description and location of site CA-CCO-597. However WSA staff could not make out the previously reported petroglyphs. There was modern graffiti, as well as recent and older scrapes from heavy machinery, indicating that there have been attempts to move the boulder.

CA-CCO-621/H, Secondary Lithic Scatter and Farm Headquarters

This site was originally recorded in 1990 as containing both prehistoric and historic elements. However testing revealed that the prehistoric component consisting of several obsidian flakes and bifaces, was in secondary context. The historic component consists of a sheet scatter of historic and modern ceramic shards, brick, and concrete. The buildings were torn down in 1990. Two large palm trees and several fruit trees were also recorded. Only one palm tree remains and the fruit trees have been removed as of February 2008. Brick, glass, and other domestic debris were observed. A fenced-in area was found at the south edge of the site. No prehistoric artifacts were found.

CA-CCO-650H, Historic Artifact Scatter

In April of 2008, WSA was unable to relocate any evidence of the reported historic debris in the levee roads and the levee banks

CA-CCO-653, Open Site with Burial

In April of 2008, WSA staff revisited this site but were unable to relocate any evidence of the site, due to poor visibility (less than 5 percent) and evidence of heavy agricultural disturbance including plowing and harvesting.

CA-CCO-726/H

The site location was revisited in November 2007. There is no obvious evidence of the site, and no evidence of significant disturbance subsequent to installation of the 100 TAF dam.

CA-CCO-755, Open Site

In April of 2008, WSA staff revisited the site location and noted the absence of any obvious site disturbance subsequent to the utility work in 2002 that uncovered prehistoric debris. No evidence was expected as it was reported as buried.

P-07-00791, Water Management Feature

The Spring Box Site has been silted over and two successive surveys by WSA staff in 2004 and 2007 have been unable to relocate the small wooden feature.

Kellogg Creek Dam

This newly-recorded feature is a board-form concrete irrigation structure with associated floodgates and irrigation drain-pipes used to redirect water to associated agricultural fields, located at the point where the flow of Kellogg Creek shifts from east to northwest. It is crossed northeast-southwest by a bridge on Kellogg Creek Road, and blocked by a gate 15’ northwest of the bridge. The structure appears to be the remains of a stoplog (or handstop) dam, which raises the water level in a culvert beneath the Kellogg Creek Road Bridge and allows it to be redirected for purposes of irrigation. The dam itself is no longer intact and the creek flow is now uninterrupted. At the northwest corner of the bridge, bolted to the concrete retaining wall there is vertical wood planking which was likely used to attach the wood structure of the dam itself. A number of fragments of broken wood planking are visible beneath the bridge and just downstream (northeast) from the bridge. Broken concrete and drain-pipe fragments are also located along the creek bed downstream. The bridge itself uses modern bolts that have little corrosion and what appears to be pressure treated wood.

Kellogg Creek Irrigation Ditch

This segment of an irrigation ditch, now referred to as Kellogg Creek, is located within Contra Costa County. An associated dam feature has been recorded separately. This segment of the irrigation ditch is partially overgrown and suffering from erosion.

Irrigation Ditch 1

This 200-ft. segment of an unnamed irrigation ditch is located within Contra Costa County. The irrigation ditch is depicted on the 1916 USGS Byron Quadrangle Topographic Map (surveyed in 1911). It emanated from a pumping plant at Indian Slough and extended south to its intersection with another irrigation ditch that emanated from Italian Slough. The alignment of the ditch has not been changed. This segment of the ditch is unlined. A concrete culvert (recorded separately), which is marked with the date 1940, allows flow of water beneath SR4.

Irrigation Ditch 2

This 200-ft. segment of an unnamed irrigation ditch is located within Contra Costa County. The irrigation ditch is depicted on the 1943 War Department Byron Quadrangle Topographic Map. It extended north and south of SR4. A portion of the irrigation ditch north of SR4 has been altered and the southern portion has been extended (USGS 1978 Woodward Island topographic map). This segment is unlined and is heavily overgrown with vegetation.

Irrigation Ditch 3

This 200-ft. segment of an unnamed irrigation ditch is located within Contra Costa County. The irrigation ditch is depicted on the 1916 USGS Byron Quadrangle Topographic Map (surveyed in 1911). It emanated from Indian Slough, extended southwesterly, turned to the southeast and then continued due south. It is depicted on the 1943 War Department Byron Quadrangle Topographic Map as maintaining the same alignment but having been extended further to the south to connect with another irrigation ditch emanating from Italian Slough. By the time the 1978 USGS Woodward Island Quadrangle Topographic Map was produced, the southern portion of the irrigation ditch, south of Camino Diablo, had been realigned. The northern portion of the irrigation ditch has been reconfigured to conform to the Discovery Bay residential development along SR4. The southern portion of the irrigation ditch appears to maintain the same alignment as in 1978.

Byron-Bethany Irrigation Canal

This 200-ft. segment of the Byron-Bethany Irrigation Canal is located within Contra Costa County. The Byron-Bethany Irrigation Canal connects to Kellogg Creek in the north, continues in a north-south direction past Camino Diablo, then extends in a jagged alignment in a roughly southeast direction, intersecting with the California Aqueduct to the south. The canal was constructed pre-1943, as it first appears on the War Department Byron Quadrangle Topographic Map for that year, though at that time it extended only as far as approximately one-third of the way between the township of Byron and Byron Hot Springs. By the time the

1978 USGS Brentwood Quadrangle Topographic Map was produced, the alignment had been extended to meet the California Aqueduct. Based on Google Earth (2007), an approximately 0.65 mile section of the canal approximately 0.7 miles northwest of its intersection with the California Aqueduct has been removed or possibly relocated underground.

Concrete Culvert

The culvert is located within Contra Costa County. The box culvert is constructed of board-form concrete and stamped with the date 1940. The culvert allows water to flow beneath SR4 along an unnamed irrigation ditch (recorded separately as Irrigation Ditch 1). The base level of the culvert is higher than the irrigation ditch into which the water flows. Therefore, this culvert may also have been designed to function as a drop, which is used to slow the flow of water (see Etcheverry 1916:278; Davis and Wilson 1919:282).

Southern Pacific Railroad Grade

This 200-ft. segment of the Southern Pacific Railroad (SPRR) is located within Contra Costa County. A segment of the same railway line further to the southeast has been recorded by PAR Environmental Services in 2001 with the trinomials CA-CCO-744H/CA-ALA-601H (P-07-02553/P-01-010452). PAR observed that the railroad track had remained essentially unchanged since its construction, retaining the original grade, alignment and rail gauge width. The replacement of tracks and ties with similar materials was noted as part of regular maintenance and operation. Likewise, this segment of the railroad appears to also retain its original grade, alignment and rail gauge width. Pieces of the track have been replaced as per regular maintenance requires. The most easily dateable replacement is that of the tie plates which likely occurred in the 1940s. The replacement tie plates are stamped with the date 1944 and a C within a diamond. The railroad is currently in use.

Transmission Line

This 200-ft. segment of the transmission line is located within Contra Costa County. The transmission line parallels the Southern Pacific Railroad (SPRR) on the western side at this segment. Two more modern transmission lines also follow the same alignment in this area, with one located on either side of the railroad. The poles and crossbars are constructed of wood. Aqua and clear glass insulators were observed on the wooden crossbars. No insulators or fragments of insulators were located on the ground surrounding the line. However, based on viewing from below, the aqua glass insulators, which appear to have an inner skirt, sharp drip points and are internally threaded, appear to be of the Hemingray 42 type (see Tibbits 1972:76). These were produced between the 1920s and 1950s (Willis 2007). Production of Hemingray's glass insulators ceased in 1967 (Whitten n.d.).

5.0 Research Questions

The Evaluation prepared by SSUAF (1992) as part of the cultural resources compliance for the Los Vaqueros Reservoir project established a set of research questions to guide cultural resources investigations for prehistoric, ethnohistoric, and historic-era site components within the project area. These research questions are presented below. They have been used to guide the evaluation of cultural resources as part of this report. The questions are followed by an assessment of how the research, conducted as part of the mitigation during the 1990s, has succeeded in addressing the questions. Section 5.2 presents suggestions for updating the research questions to guide future mitigation programs undertaken as part of Section 106 and CEQA compliance for the Los Vaqueros Reservoir Expansion. A more complete research design will be developed in the Cultural Resources Management Plan that will be prepared after the Programmatic Agreement is signed, and prior to preparing any Historic Property Treatment Plans.

5.1 Previous Research Questions and Findings

The lists of research questions and potentially contributing data sets developed by SSUAF (1992) for the Los Vaqueros Project have been reproduced below. Research questions have been underlined. The research questions are organized by Prehistoric, Ethnohistoric, and Historic periods.

<u>Prehistoric Archaeology</u>

Prehistoric archaeology includes the archaeology of Native Americans prior to the time of contact. Three major research topics were investigated by SSUAF and further divided into the following series of subtopics.

REGIONAL CHRONOLOGY

Does the project area conform to Fredrickson's chronology? SSUAF was able to refine the Fredrickson chronology based on their findings in the Los Vaqueros project area, as discussed previously in section 2.3, and depicted in Figure 4.

Do sites in the project area date to before 1,500 B.P.? Yes. The oldest intact deposits date to at least 9000 B.P. from the site CCO-696 (Meyer and Rosenthal 1997).

Are older sites present in the project area that have been buried by alluvial deposits? Yes, Meyer and Rosenthal (1997) identified a series of buried paleosols within the Kellogg Creek valley, the oldest dating to the Pleistocene. Cultural deposits were found in association with the paleosols buried beneath alluvial deposits, some as deep as 4 m below the surface.

If multi-component sites are present in the project area, do settlement patterns change over time? Two prehistoric sites investigated during previous mitigation had more than one temporally and spatially discrete component. Components from CA-CCO-458/H include the East Locus (Upper Archaic through first part of the Lower Emergent periods), and the West Locus (Emergent period). Overall the site has been interpreted as a small residential site with very short-term occupations. The East Locus was occupied earlier leaving behind a sparse assemblage with no features. The West Locus was occupied subsequently and exhibits 10 features, 3 burials, and a richer and more diverse assemblage. This difference may simply reflect a longer period of time over which the intermittent short-term use continued, or it may represent a shift in site use to more extended stays, possibly by larger groups of people.

CA-CCO-696 yielded a component older than 9,000 B.P. and associated with the Lower Archaic that has been interpreted as a short-term camp by Meyer and Rosenthal (1997). The second, more recent component associated with the Upper Archaic through the Lower Emergent periods, represents a shift to long-term occupation, as evidenced in part by the over 169 burials.

Based on only these two sites, settlement pattern change in the Los Vaqueros study area may have involved a shift towards a more intensive and extended use of lowland sites over time, resulting in a large number of burials and other features and an enrichment of the associated assemblages both in artifact variety and density. However, settlement pattern analysis does require a much broader scope than can be gained from the study of two sites, both in terms of sampling from different environmental zones, but also in terms of the number of sites for decoding changing patterns of settlement.

SUBSISTENCE-SETTLEMENT

Was the project area occupied seasonally, year round, or only for short-term, resource-specific procurement? Recent archaeological research has shown that these questions can be addressed by some of the well-preserved and datable deposits in the Los Vaqueros lowlands. The question can be more fully addressed once additional research has included sites from uplands to complement existing research from sites in the lowlands. Floral and faunal analyses indicate some seasonal use of various sites, and a preponderance of short-term use (e.g., Meyer and Rosenthal 1997). Investigating a fuller range of zones including the uplands to update the comprehensive prehistory should be a goal of future research.

Is there variability in site types within the project area over time that would indicate shifting adaptive strategies? Variability in site types over time is very generally expressed as the appearance of multiple bedrock milling stations in both the uplands and the lowlands, with the transition from the Archaic to the Emergent period. There is no evidence to date that the uplands were occupied prior to the appearance of bedrock milling stations. Within the lowland archaeological sites of the study area, archaeological research has shown variation in preferences in game animals, and in plant resources over time. Implements have changed from millingslabs to mortars and bedrock milling stations. Larger spear and dart points were replaced by the bow and arrow. These changes in material culture and food preferences indicate changes in adaptive strategies.

Will archaeological sites contain low diversity of materials and tool types reflective primarily of the procurement and processing of plant materials and secondarily of activities, such as tool maintenance, related to hunting? Some sites have been interpreted as primarily processing sites (e.g., 459). To date, no statistically meaningful measures of diversity have been employed by SSUAF archaeologists to interpret their findings.

Will Archaic Period sites (if found) be task specific with low constituent diversity? Archaeological sites investigated to date have revealed occupations from the Lower Archaic (CCO-696), from the Middle Archaic (447/H, 637) and from the Upper Archaic (450/H, 636, 459, 458/H, 696, and 725). Most of these occupations appear to be focused on food processing (e.g., 459), while others show intriguing evidence for diversity of activities including more substantial evidence for residence and burials (e.g., 696, 637). The Upper Archaic shows an increased range of exploited habitats, and occupation over a wider range of seasons. CCO-696 yielded 160 burials from this period and evidence for house construction, suggesting the site was residential and subject to long-term use.

Will upland Archaic Period sites occur less frequently than Emergent Period sites (lowland areas are excluded from the test because it is believed that lowland Archaic Period sites will be underrepresented because of soil deposition processes)? Upland sites were mitigated by avoidance and were therefore not investigated. Bedrock milling stations, located in both the lowlands and uplands, were first used towards the very end of this period. Contrary to expectations, lowland Archaic period sites were recovered at great depths and in good to excellent condition. They occur with similar frequency as those of the Emergent period.

Will Lower Emergent Period sites be predominantly task specific with low artifact diversity and fewer small, possibly seasonal campsites? Many sites showed occupation during the Upper Archaic/Lower Emergent period transition (450/H, 458/H, 637, 696, 725, 726/H), although the evidence at each site was sparse. They appear to represent short-term, periodic use over a relatively long time span. No clear evidence of a residential base has been identified.

Is there more intensive use of the Los Vaqueros area during the Upper Emergent Period? The sites represent a wide range of site types, from extensive residential occupations to bedrock milling stations with very sparse deposits. CCO-458/H appears to have been a major central habitation site with burials and a house floor, while bedrock milling stations appear more focused on food-processing activities. A wider variety of species, including fish, were utilized.

For any given period, how does subsistence and settlement in the project area compare with the San Ramon Creek and Alamo Creek watersheds? In the summary mitigation report, Meyer and Rosenthal (1997:V.10) conclude that the data recovered during the Los Vaqueros Project parallels the patterns observed in other nearby valleys including the Walnut Creek, San Ramon, and Livermore drainages. With the exception that the Lower Archaic deposits in the Los Vaqueros area are older than any evidence of occupation in the interior Diablo Range, they argue that the Middle and Upper Archaic assemblages are quite similar to other nearby watersheds. Sites are located in riparian habitats and often contain human burials and residential features. Mortars and pestles are found in Middle Archaic through Emergent-period deposits. Throughout the Archaic, small, medium, and large species of mammals were exploited, and tool stone from local sources (e.g., cherts) predominate. Obsidian occurs in low frequencies, and was obtained from both Eastern Sierra and North Coast Ranges sources. With the Emergent period, there is an increase in exchange items such as obsidian from the North Coast Ranges. There is an intensified use of floral resources and an increase in marine fish and shellfish. Changes in subsistence and settlement patterns are not linear and do not show an increase in sedentism and intensified land use over time. The picture is more variable and complex.

INTERACTION AND EXCHANGE

In central California, changes in prehistoric interaction and exchange are marked by variation in obsidian use. SSUAF sought to test the hypothesis for a shift to a regularized exchange system with the Lower Emergent period by looking for changes in the exploitation of obsidian in the archaeological record over time (Meyer and Rosenthal 1997:V.10).

What is the temporal, geographic and source variability of obsidian in the Los Vaqueros area? Subsets of this question include the following: Is obsidian rare to absent in Archaic Period sites? If obsidian occurs in the Archaic Period, will it be limited to formal artifacts, broken artifacts, and flakes indicative of maintenance and repair? Given sufficient sample size, will the obsidian in Archaic Period sites have relatively high source variability?

The earliest occupations yielded non-local obsidian, indicating that forays for collection and/or networks for exchange may have been far-reaching. The low frequency of flaking debris to tools indicates that obsidian was acquired in the form of finished tools throughout the Archaic period. Obsidian use increased with the Upper Archaic/Emergent transition, and by the Emergent period, obsidian was imported exclusively from the Napa Valley source, in the form of cobbles and minimally modified flake blanks (Meyer and Rosenthal 1997:V.11).

How does obsidian use in the project area compare with obsidian use in the San Ramon Creek and Alamo Creek watersheds? Is obsidian use in the Los Vaqueros Project area indicative of regularized exchange during the Emergent Period and ad hoc exchange during the Archaic Period, as observed elsewhere in Contra Costa County? Meyer and Rosenthal (1997:V.12) report that the patterns of exchange of obsidian generally agree with patterns observed in other nearby valleys. Increased frequencies of obsidian during the Emergent period is interpreted to represent the development and elaboration of a regional exchange system, which may have been associated with the acquisition of food items such as marine fish and shellfish.

What is the temporal, geographic and source variability of other exotic materials in the Los Vaqueros area? Other items of exchange include marine-shell beads and ornaments. The oldest evidence dates to 4770 B.P. at CCO-637 and a burial containing more than 1,000 *Olivella* shell beads. Frequency of shell beads peaked during the Upper Archaic. By the Upper Emergent period, Los Vaqueros appears to have participated in the clam-shell disk bead system of currency.

The lack of synchronicity between the changing frequencies of obsidian and marine-shell beads suggests that more than one exchange system was operating.

<u>Ethnohistoric Archaeology</u>

As discussed above, Ethnohistoric archaeology addresses the history of Native Americans from around the time of contact onwards. SSUAF developed a series of research questions organized under three major research topics for Ethnohistoric archaeology.

SETTLEMENT AND SUBSISTENCE IN THE MISSION AND POST-MISSION PERIODS

Did Native Americans use the mountainous portion of the project area as a refuge during the Mission Period? This question has not been successfully addressed by archaeological work conducted for the Los Vaqueros Reservoir studies because the focus of research has been on the lowland sites. Upland sites have not been dated. Oral testimonies and archival research reveal an oral tradition of moving to the foothills to escape periodic floods, and some speculate that foothills were also seen as a refuge from severe epidemics associated with the coming of the Whites (Lobo 1997:180). However, the foothills referred to by informants are located in the Ione area east of the central valley, rather than in the project area, on the west side of the central valley.

Praetzellis et al. (1997:14-15) point out that by 1805, all the inhabitants of the Los Vaqueros area had been moved to the missions (Milliken 1994:44), and the Los Vaqueros watershed remained unoccupied until the 1840s when Francisco Alviso, Antonino Higuera and Manuel Miranda were granted the Los Vaqueros rancho as tenants-in-common.

Did Native Americans work on ranchos during the Mexican and early American periods? Archival research has suggested that Native Americans worked on ranchos. To date, the only Ranch Headquarters with the potential to verify this, CCO-450/H, remains to be systematically investigated.

Did Native Americans use traditional resources while working on the ranchos? This question has not yet been adequately addressed. The lower adobe, 470H, yielded details on the Basque inhabitants but no evidence of associated Native Americans (Ziesing 1997b). Neither interviews nor archival research have yielded any information on the rancheria complex at 450/H. Future archaeological work may be the only means by which information can be gathered on 19th-century Indian lifeways at Los Vaqueros (Davis et al. 1997:150).

Tribelet Group Boundaries and Relations

Were the boundaries between the Julpun to the north, the Volvon to the west, and the Ssaoam to the south fluid? Did tribelet boundaries change during the ethnohistoric period? This question has not been addressed by archaeological or other studies to date.

Can individuals who belonged to specific tribelets be identified as workers on ranchos in the project area? The identity of the rancheria residents at CCO-450/H may never be learned (Davis et al. 1997:150). Documentary evidence suggests the possibility that two part-Ssoam men referred to only by first names, worked in the Livermore Valley area and may have worked for one of the landholders in the Los Vaqueros area (Milliken 1997d:143). This argument has not been substantiated with archaeological investigation.

Where did Native Americans go when they ceased working on the ranchos in the project area? This is another question that was not answered by archaeological mitigation work. Ethnographic research has yielded stories of relatives of present-day informants working their way from one job to another, from the Livermore and Pleasanton areas east towards Ione, where the informants now live (e.g., Lobo 1997). The 1860 U.S. Census shows only a few Native American individuals and families in the Livermore Valley area and none in the Los Vaqueros (Davis et al. 1997:149). The descendants of the Miwok with ties to the Los Vaqueros area now inhabit Ione in the Sierra foothills (Lobo 1997).

Acculturation

How did subsistence and settlement practices change during the ethnohistoric period? To what extent were traditional lifeways and cultural practices retained (or abandoned) during the ethnohistoric period? The volume 'Native American History Studies for the Los

Vaqueros Project: A Synthesis′ edited by Fredrickson, Stewart, and Ziesing (1997) resulting from mitigation for the 100 TAF Reservoir, provides detailed answers to these questions. However these questions have not yet been addressed by archaeological studies. The Ranch Headquarters CCO-450/H offers the potential to investigate this topic. There appears to be a substantial and complex history of Native American occupation at the site. An investigation of change through time using controlled archaeological excavation could begin to answer this question.

Historical Archaeology

Historical Archaeology addresses the archaeology from the time of contact through the recent past. SSUAF was able to address three major research topics with their archaeological investigations in the Los Vaqueros area (e.g., Ziesing 1996). They also made use of oral histories and archival research, as reported in ′The Los Vaqueros Watershed: A Working History′ (Praetzellis et al. 1997). The research topics and individual questions that guided the SSUAF research for mitigation of the 100 TAF Reservoir are presented first, followed by a summary of some of the results based primarily on archaeological work.

RANCHING ADAPTATIONS RELATIVE TO ENVIRONMENTAL CONDITIONS

How did area ranchers adapt to their changing economic and environmental milieu? Subsets of this question include the following: What were the effects on ranching operations of the change from the hide-and-tallow trade to the new demand for beef cattle? How did the droughts of the 1860s, 1890s, and 1930s affect the local adaptations? How was this related to the greater water requirements of beef cattle? To what degree did subsistence agriculture increase during periods of economic decline for cattle ranchers? To what extent were patterns of land use, development, and tenure associated with family developmental cycles? What was the effect on the natural environment of the managed ecosystem created by the ranchers? How did the economic strategies of owners differ from tenants? Which of the two groups fared better?

SOCIAL RELATIONS

How were social relations managed within and between ranching units? Subsets of this question include the following: What evidence exists for competition for resources in the study area? To what degree was this based on ethnicity versus other factors? How were physical and social boundaries given material form?

APPLICATION OF THE MODERNIZATION MODEL IN THE LOS VAQUEROS UPLANDS

To what degree is the modernization model of social and cultural change relevant to the Los Vaqueros uplands? Subsets of this question include the following: What evidence is there for continuity/change in Native American culture during the Mexican/American period? To *what degree was the opening up of trade in Alta California following the Gold Rush reflected on a household level? Is there evidence that elements of traditional culture operated simultaneously with modern Victorian values? Successful, urban Californios tended to embrace Americanization. Was this also true of less successful rural people? Did the decline of the fortunes of the Mexican rancheros influence the intensity of their participation in Victorian values? To what degree did Victorian values come to dominate in the Los Vaqueros uplands, and among what groups? How did rural patterns of ethnicity vary from urban patterns? How did this vary between households of differing economic, social, ethnic, and geographic characteristics?*

Historic Period Research Results

Six phases of historic land use were identified as a result of extensive archival research conducted for the Los Vaqueros area (Ziesing 1996:204-205). These phases include:

1820-1862	Los Vaqueros land grant considered public; open range for cattle
1863-1871	Peres fences grant so that only landowners can graze cattle
1872-1881	gradual transition from grazing to dry-land farming
1882-1910	grant split into tenant holdings; wheat cultivation dominant
1911-1935	tenant holdings continue; wheat cultivation transitions to sheepraising
1935-1990	sharp decline in tenant farming; Crocker estate subdivides and sells to individual landowners

The archaeological evidence at Vasco Adobe, CCO-470H, is associated primarily with the first three phases of land use in the Vasco (Ziesing 1997b:203). Occupation continued into the fourth phase but toward the end of the period the Adobe was abandoned when a wood-frame farmhouse was constructed nearby. Although the Vasco Adobe was built in the middle of the 1850s by Basque cattle ranchers, archaeological evidence from the architecture, site patterning, and deposits of household refuse reflect use of the site in the late 1860s and early 1870s (Ziesing1997b:iii). Most of the other excavated historic-era sites, including 427H, 445H, and 447/H, fall within the fourth phase, Tenants/Dominant Wheat, 1881 to ca. 1910 (Ziesing 1996:205).

The main research issues addressed by SSUAF for historic period sites include ranching adaptations and the environment, modernization, and social relations involving tenancy and ethnicity. Ziesing tackled the first two issues with archaeological findings at 427H, 445H, 447/H, and 470H. Social relations are more fully explored using historical research and oral history (e.g., Hattersly-Drayton 1993; Praetzellis et al. 1995).

RANCHING ADAPTATIONS AND THE ENVIRONMENT

Water management is a fundamental adaptation to the semi-arid environment of the Vasco. The residential sites had hand-dug or bored wells. A few sites had windmills. Many sites show modifications of creek banks and ditches dug to provide water to livestock. The Vasco was never irrigated, which restricted tenants to dry-land mixed farming even when neighboring areas turned towards the more profitable use of land-intensive cultivation of specialty crops, once irrigation was made available (Ziesing 1996:207).

Construction techniques Common to all excavated sites was the extensive use of local materials, especially sandstone, in construction. The stone was minimally shaped, if at all, and was either dry-laid or held together by a mud-based mortar. The stonework incorporated both the foundations and flooring of structures in many cases. Stone-lined cellars were usually situated away from the house and used for cool storage. In one case the cellar was located directly beneath the house. Although not much remained of house structures in the 1990s, historic photographs and oral testimony show that they were constructed of wood rather than stone, as might be expected given the prevalence of this building material.

In the Vasco, the land was rarely owned by the family that farmed it. This may have had a large influence on the relative lack of investment in buildings, both houses and barns. Historical analysts of barns in the Vasco have little comparative material to draw from as barns in California have not been systematically studied. Ziesing makes some attempt at tracing the origins of the barn styles in the Vasco (e.g., New England vs. Midwest). There are no significant conclusions from this analysis of the two barns CCO-427H and CCO-445, except that they are generally larger than similar barns in other regions, and that they were most likely provided by the landowner and for this reason may not have reflected any of the ethnicity-specific construction styles of the tenants.

The Vasco Adobe served as a bunkhouse for vaqueros with an industrial-sized kitchen. It also housed landowners and their families on occasion (Ziesing 1996:206). The design of the adobe appears to adapt the traditional Spanish adobe to the local environment. Local materials, such as sandstone and clay, were used in the construction. The kitchen was attached and there was an interior fireplace. The Vascos (*Bascos*) originated from Basque country in Spain. Basque cultural traditions and design differ from those of Spain, though they share some similarities. The Basques spent some time in Argentina on their way to California and were familiar with Spanish architectural style. The Spanish style adobe contrasts with the subsequent wood-frame structures in the Vasco.

MODERNIZATION

The material culture associated with the occupation of the Vasco Adobe during the 1860s and 1870s reflects participation in a mass market, cosmopolitan trade network. Ziesing notes a remarkable similarity in artifact types among contemporary sites, regardless of their economic, ethnic, geographic, or functional association (Ziesing 1997b:209). Ziesing proposes a mix of tradition and modernization, with the architecture, butchery techniques and meat preparation reflecting traditional Basque elements, while the ceramics, bottled condiments, canned foods, all reflected participation in the modern economy of California. Subsequent occupants (e.g., Peres) focused on modernizing the building, removing many of the more unique elements of the adobe, such as the bread oven and the open hearth in the kitchen.

The five sites excavated and reported in Ziesing (1996) were occupied from ca. 1880 to ca. 1930, a time of modernization. Modernization has been measured by Victorianization, or the adoption of Victorian values. Immigrant families arrived in the Vasco steeped in their own particular ethnic culture and values. Victorianism describes a set of cultural values, practices and aesthetics that came to predominate among the Euroamerican cultural and political establishment of the 19th-century America acting as a homogenizing force that smoothed over ethnic differences (Hardesty 1980). Identification of a trend toward Victorianism has been particularly successful in interpretations of early urban California (e.g., the archaeological studies conducted for replacement of the Cypress Structure in West Oakland).

Built Environment Building construction and site layout was remarkably similar from site to site, leading Ziesing to postulate that the land owners may have been largely responsible for providing and maintaining the built environment for their tenants (Ziesing 1996:212). Small differences between CCO-427H and CCO-445H, both 300-acre tenant farms, suggest that one tenant may have been more demanding of the landowner to provide more (e.g., a second barn, or a state-of-the-art windmill), a demand supported by a more productive tenancy, for example.

Refuse Disposal Patterns Residential yards were littered with extensive debris scatters regardless of the ethnic origin of the tenant families. Small filled pits suggest that refuse was sometimes placed in pits and burned, but the majority of trash appears to have been informally distributed about the residence (Ziesing 1996:214). Trash deposits were also found in streambeds or gullies. This pattern appears to be independent of ethnic preferences or traditions, and may have more to do with poor rural tenant farmer practicality or aesthetic.

Technological Innovation Over the course of the period of tenant occupation and farming, ca. 1880 to ca. 1930 on the Vasco, tenant farmers continued to use horse-drawn machinery and to farm wheat, even when other California farmers were making the transition to mechanized equipment, agribusiness, and specialty-crop cultivation (Ziesing 1996:215-216). The majority of land on the Vasco was hilly, and the tractors could not perform as well as horses. Irrigation districts did not reach into the Kellogg Creek watershed and as a result specialty-crop cultivation was not practicable. For these reasons tenant farmers remained conservative and did not take advantage of technological innovations, for the most part.

Mass Consumption The Vasco tenants on a whole were relatively poor and prided themselves at being self-sufficient (Ziesing 1996:220). Deposits from different sub-periods within the period of ca. 1880 to ca. 1930 show an increase in presence, and variation, in decorated ceramics through time. This is interpreted as an increase in participation in the world market. In order to better gauge the extent to which residents of the Vasco kept up with fashions in material culture, future excavations of contemporary rural and urban sites are needed for comparison. At the very least, the presence and gradual increase of more fashionable ceramics, and increase in food cans, suggest the increased influence and "the pervasiveness of a poverty-defying mass market in household goods" over time (Ziesing 1996:221).

SOCIAL RELATIONS: TENANCY AND ETHNICITY

Early occupation of the Vasco is represented by the Vasco Adobe, originally built and occupied by a family of Basque origins. The material culture they left behind conveys adaptation and incorporation of elements from different ethnicities. The adobe building was styled after Spanish adobes, but with unique elements, such as an interior kitchen and fireplace, that may have been related to Basque building traditions (Ziesing 1997b:208). Ceramic tablewares were English and typically found in most Anglo-American middle class households of the time. Ziesing proposes that imported foodstuffs, such as olive oil, wine, and spices reflect Basque preferences, as do the butchery patterns and practices, although she does not provide evidence to support her claims. A preference for olive oil and wine was not unique to Basques, but rather included most Mediterranean cultures at the time.

During the years in which the historic-era sites were occupied, ca. 1880 to ca. 1930, there were two distinct land-use periods as defined by Praetzellis et al. (1995). Recent European immigrants lived in small family groups and farmed or ranched as tenants. Even though at least four different ethnic groups were present, including Portuguese, French, Italian and Irish, there was an overall shared conservatism in most aspects of farm and family life, including consumption patterns, building construction, technological innovation, and refuse disposal (Ziesing 1996:221). These recent immigrants did not succumb to the Victorianism prevalent in other contexts at the time, and yet they followed a seemingly common and conservative way of doing things. For example, they used horse-drawn machinery, used wells and windmills for water, disposed of garbage in their front yards or in nearby creeks, and used plain or mismatched kitchen and dining wares. Farm or ranch complexes were laid out in very similar plans with similar architecture and construction materials and techniques.

Ziesing suggests that the relative homogeneity of the architecture and physical layout of the ranch complexes was due to the fact that land owners, of which there were very few, were responsible for providing and maintaining these structural aspects of ranch life, while tenants probably felt little desire to invest their own resources and energy in something that they did not own, as tenancy was considered to be a temporary condition. Most tenants expected to be able to buy their own land eventually, and those that did not eventually moved into town.

Despite the relative homogeneity of the material culture and archaeological evidence, oral testimonies reveal that the tenant residents of the Vasco maintained social networks largely defined by ethnic ties (Hattersly-Drayton 1993; Ziesing 1996).

5.2 Modified Research Questions

The research questions developed for the 100 TAF Los Vaqueros Reservoir (SSUAF 1992) are sufficient for updating the cultural resources identification, assessment of integrity, and evaluations, in the study area for the 275 TAF reservoir expansion. This set of research questions will be revised in the Cultural Resources Management Plan (CRMP) that will be modified once the PA has been updated, and prior to the development and implementation of any HPTPs. Some suggestions for future research are presented here.

<u>Suggestions for Future Prehistoric-Period Research</u>

Future prehistoric-period research questions should focus on two main goals: compiling and improving what is known about the lowland occupations of the Kellogg Creek Watershed, and learning more about the upland occupations, and how they complement lowland occupations through time. The 275 TAF reservoir expansion will have a cumulative adverse effect on the Kellogg Creek Historic District when combined with the previous effects of the 100 TAF reservoir. The prehistoric research that resulted from the 100 TAF mitigation has never been compiled in a scholarly study or in a document prepared for the public. These results should be combined with results from any mitigation resulting from the 275 TAF reservoir and combined in a scholarly study of the Historic District, as well as in a document accessible to members of the interested public.

To this end, future HPTPs that address known or potential prehistoric archaeological sites should revise the prehistoric research design to reflect findings to date. Work should focus on sites in upland contexts. All of these are milling stations. Did prehistoric exploitation of the uplands predate the bedrock milling stations? How does the variability in size and location reveal the nature of the bedrock milling sites? Were they simply resource-procurement and short-term processing sites or were some associated with a fuller range of activities? Findings should be integrated with the results of the intensive lowland studies and synthesized to present a more complete story of the prehistoric occupation of the Los Vaqueros area.

Suggestions for Future Historic-Period Research

As mentioned above for prehistoric research questions, the 275 TAF reservoir will have a cumulative adverse effect on the Historic District unless it is mitigated. A great deal of historic era research was conducted as part of the mitigation for the 100 TAF reservoir. This should be complemented by two main avenues of research including an investigation into the known location of the earliest documented historic-era residence, and a comprehensive analysis of water management within the Historic District.

Historical research in the Vasco focused on five sites that represent the Tenant/Dominant Wheat land-use phase at Los Vaqueros (Praetzellis et al. 1995). Ziesing concludes that her results are preliminary and require further support from additional excavations at sites with occupants of known ethnicity. She suggests that the work at the Suñol Adobe, CCO-450/H, should provide information from an earlier time period that can be the basis of a diachronic comparative study (Ziesing 1996:223).

The Suñol Adobe represents an "ingenious and sensitive adaptation of experience and tradition to a new environment and economy" (Ziesing 1997b:211). Excavation of the Suñol Adobe at CCO-450/H would provide a comparative study to test whether this mix of tradition and innovation was common to early Vasco inhabitants. Ziesing (1997b:214) suggests that a comparative study might be able to address:

- The role of women on Los Vaqueros ranches in the 1850s and 1860s;
- The impact of the climatic disasters of the early 1860s on the lifestyle of the Vasco inhabitants;
- Evaluation of the structural uniqueness of the Vasco adobe compared to the Suñol adobe; the changing relationship between the Bascos and the Suñols by looking at whether or not they shared building technology;
- The role of Native American labor in the 1850s Vasco (since the village site is there);
- Early ranch diet, butchering techniques, and consumer goods for comparison with Vasco Adobe. The study would be more effective when compared with contemporary collections outside the Los Vaqueros area, and when compared with Basque food habits.

Water management is a crucial feature of the history of land use and occupation of the Historic District. Tenant ranchers functioned in the semi-arid environment with no irrigation; by contrast, there were major modifications for water management, such as irrigation, in adjacent delta area, resulting in a very different history of land use. The various water management features that have been identified in the Los Vaqueros area through archaeological research should be presented in a comprehensive study that details the range of variation in construction methods and materials, locations, and functions of these features and how they relate to the success of the tenant farmers throughout their occupation of the Vasco.

6.0 Impacts and Mitigation

6.1 Impact Evaluation Criteria

Assessment of potential impacts on historic properties from a Los Vaqueros Reservoir expansion requires determining how the undertaking could affect those attributes of cultural resources that make them NRHP eligible. Only properties within the APE must be considered. Most of the properties that have been determined eligible within the APE are contained within a National Register Historic District, and as such are interrelated insofar as eligibility is concerned.

The National Register of Historic Places (NRHP), created under the NHPA, is the federal list of cultural resources worthy of preservation. An historic property is a cultural resource that has been listed in or is determined eligible for listing in the NRHP. Resources listed in the NRHP include districts, sites, buildings, structures, and objects that are significant in American history, prehistory, architecture, archaeology, engineering, and culture. The NRHP is maintained and expanded by the National Park Service on behalf of the Secretary of the Interior. The Office of Historic Preservation in Sacramento, California, administers the local NRHP program under the direction of the State Historic Preservation Officer (SHPO). To guide the selection of properties included in the NRHP, the National Park Service has developed the NRHP Criteria for Evaluation. The criteria are standards by which every property that is nominated to the NRHP is judged. The quality of significance in American history, architecture, archaeology, and culture is possible in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, material, workmanship, feeling, and association, and meet one of the following criteria:

> Criterion A: a property is associated with events that have made significant contributions to the broad patterns of the history of the United States; or
>
> Criterion B: a property is associated with the lives of people significant in United States history; or
>
> Criterion C: a property embodies the distinctive characteristics of a type, period, or method of construction; represents the work of a master; possesses high artistic value; or represents a significant and distinguishable entity whose components may lack individual distinction; or

Criterion D: a property has yielded, or may be likely to yield, information important in prehistory or history (36 CFR Part 60.4).

The CEQA defines significant historical resources as "resources listed or eligible for listing in the California Register of Historical Resources (CRHR)" (Public Resources Code Section 5024.1). A resource may be considered historically significant if it meets the following criteria for listing on the CRHR:

A. It is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage; or

B. It is associated with the lives of persons important to California's past; or

C. It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

D. It has yielded or is likely to yield information important in prehistory or history (Public Resources Code Section 5024.1).

In order to meet one or more of the four specific criteria listed above, a cultural resource must possess integrity to qualify for listing in either the CRHR or the NRHP. Integrity is generally evaluated with reference to qualities including location, design, materials, workmanship, setting, feeling, and association. A potentially eligible site must retain the integrity of the values that would make it significant. Typically, integrity is indicated by evidence of the preservation of the contextual association of artifacts, ecofacts, and features within the archaeological matrix (Criterion D) or the retention of the features that maintain contextual association with historical developments or personages that render them significant (Criteria A, B, or C). Evidence of the preservation of this context is typically determined by stratigraphic analysis and analysis of diagnostic artifacts and other temporal data (e.g., obsidian hydration, radiocarbon assay) to ascertain depositional integrity or by the level of preservation of historic and architectural features that associate a property with significant events, personages, or styles.

Integrity refers both to the authenticity of a property's historic identity, as shown by the survival of physical characteristics that existed during its historic period and to the ability of the property to convey its significance. This is often not an all-or-nothing scenario (determinations can be subjective); however, the final judgment must be based on the relationship between a property's features and its significance.

In cases such as the Los Vaqueros Reservoir Expansion Project where both the CRHR and NRHP evaluation criteria apply, federal standards prevail. Historic properties assessed as

NRHP-eligible are also considered "important", and procedures for managing these properties under 36 CFR 800 satisfy the State CEQA Guidelines as well.

Once a project has been defined and recognized as a federal undertaking, an Evaluation and Request for Determination of Eligibility and Effect will be submitted by the Reclamation archaeologist to the SHPO, and one of three possible Findings of Effect can be made: No Effect, No Adverse Effect, or Adverse Effect. Advisory Council regulations (36 CFR 800.9) define an undertaking as having an effect on a historic property when the undertaking may alter the characteristics of the property that qualify the property for inclusion in the NRHP, including alteration of the property's location, setting, or use.

An undertaking may have an *adverse effect* when the effect on an historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include, but are not limited to:

- Physical destruction or alteration of all or part of the property;
- Isolation of the property from or alteration of the property's setting when that character contributes to the property's qualification for the NRHP;
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting;
- Neglect of a property resulting in its deterioration or destruction; and
- Transfer, lease, or sale of the property.

Section 15064.5 of the CEQA Guidelines indicate a project may have a significant environmental effect if it causes "substantial adverse change" in the significance of an "historical resource" or a "unique archaeological resource" as defined or referenced in CEQA Guidelines Section 15064.5[b, c] (revised October 26, 1998). Such changes include "physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired" (CEQA Guidelines 1998 Section 15064.5 [b]).

6.2 Site Evaluation

Forty-four cultural resources and one sensitive location are located within the APE. Of these, 41 are listed or eligible for listing, on the NRHP and are referred to as historic properties. For each of the historic properties, all site records are presented with summaries of any previous evaluations in Appendix A (bound separately). Updates to these evaluations are suggested based on recent site visits; however there was no archaeological testing in the assessment phase of this project. These evaluations are summarized in Table 5. Those resources that have not been evaluated will be treated as potentially eligible for listing on the NRHP for the purposes of this report.

Table 5. Summary of Evaluations of Cultural Resources in the APE

Resource	Integrity/Previous Mitigation	Last Assessed	1992 NRHP Status	Update
CA-CCO-9 Milling Station	Excellent/ Avoided; long term monitoring	June 2007 No obvious disturbance	Eligible	Eligible
CA-CCO-310 Rock Shelter	Excellent/ Level 1 Data Recovery (Stewart 1995)	April 1996 No apparent recent disturbances	Eligible	Eligible
CA-CCO-397 Open Site	Good/ No mitigation	November 2007 Disturbance from numerous animal burrows and cattle trail along barbed wire fence	Eligible	Eligible
CA-CCO-417 Rock Shelter	Excellent/ Avoided	October 1995 No new disturbance	Eligible	Eligible
CA-CCO-427H Ranch Headquarters	Excellent/ Level 2 Data Recovery; Partial Inundation	June 2007 No obvious disturbance; unrecorded grooved boulders in creek bed	Eligible	Eligible
CA-CCO-445H Ranch Headquarters	Excellent/ Level 1 and 2 Data Recovery; Inundation	No access: inundated	Eligible	Eligible
CA-CCO-446H Ranch Headquarters	Good/ Avoided; Screened	November 2007 No obvious new disturbance	Eligible	Eligible
CA-CCO-447/H Livestock Feature; Open Site with burials	Historic: Good Prehistoric: Excellent/ Historic: Level 1 Data Recovery; Prehistoric: Level 1 Data Recovery;	November 2007 No obvious new disturbance	Eligible	Eligible
CA-CCO-448H Ranch Headquarters	Lacking/ 1997 Investigations reveal presence of excavated features (Praetzellis 1997). Avoidance is recommended.	March 1997 No new disturbance since post-1982 destruction.	Ineligible	Treat as Eligible
CA-CCO-450/H Ranch Headquarters; Open Site	Historic: Good to Excellent Prehistoric: Fair/ Stone Fence recorded; Historic Architectural Survey Report (2000); Partial screening of cabin; Barrier placement	June 2007 Cabin fenced; corrals and barn in use; no obvious new disturbance of prehistoric	Eligible; buildings, structures not eligible)	Eligible; Buildings, structures not eligible)

Table 5. Summary of Evaluations of Cultural Resources in the APE (continued)

Resource	Integrity/Previous Mitigation	Last Assessed	1992 NRHP Status	Update
CA-CCO-452 Milling Station	Excellent/ Avoided	June 2007 Some surface disturbance	Eligible	Eligible
CA-CCO-454H Ranch Headquarters	Good to Excellent/ Level 1 Data Recovery conducted (Stewart (1995)	April 1996 No obvious new disturbance	Eligible	Eligible
CA-CCO-455 Rock Shelter	Excellent/ Avoided	April 1996 No new disturbance	Eligible	Eligible
CA-CCO-456 Rock Shelter	Excellent/ Avoided	April 1996 No new disturbance	Eligible	Eligible
CA-CCO-458/H Open Site with burials	Excellent/ Level 2 Data Recovery; Inundation	No access: inundated	Eligible	Eligible
CA-CCO-459 Milling Station with human remains	Good to Excellent/ Level 2 Data Recovery; Partial inundation	April 2004, June 2007 Partial exposure and erosion due to fluctuating water level; additional bedrock mortars observed	Eligible	Eligible
CA-CCO-462 Milling Station	Excellent/ Avoided	June 2007 No obvious disturbance	Eligible	Eligible
CA-CCO-463 Open Site with Milling Station	Excellent/ Avoided	June 2007 No obvious disturbance	Eligible	Eligible
CA-CCO-464 Milling Station	Excellent/ Avoided	June 2007 No obvious disturbance; site appears larger and more complex than recorded	Eligible	Eligible
CA-CCO-467/H Water Management Artifact Scatter; Milling Station	Historic: Fair to Good; Prehistoric: Excellent/ Avoided	April 2004 No obvious disturbance	Eligible	Eligible
CA-CCO-468 Milling Station and Open Site	Fair to Good/ Level 1 Test; Partial Inundation	June 2007 No obvious new disturbance; broken mortar scattered on surface	Eligible	Eligible
CA-CCO-469 Milling Station	Fair to Good/ Level 1 Test; Inundation	No access: inundated	Eligible	Eligible
CA-CCO-470H Ranch Complex	Excellent/ Level 2 Data Recovery; Inundation	No access; inundated	Eligible	Eligible
CA-CCO-535H Ranch Headquarters	Excellent (subsurface)/ Care taken to maintain subsurface integrity	November 2007 No obvious new disturbance	Eligible	Eligible
CA-CCO-596H Ranch Headquarters	Fair to good	April 2008 No obvious new disturbance	Not in 1992 APE	Treat as eligible

Table 5. Summary of Evaluations of Cultural Resources in the APE (continued)

Resource	Integrity/Previous Mitigation	Last Assessed	1992 NRHP Status	Update
CA-CCO-597 Petroglyph Boulder	Poor to fair/ Graffiti noted	April 2008 heavy machinery damage	Not in 1992 APE	Treat as eligible
CA-CCO-621/H Ranch Headquarters; Lithic Scatter	Poor/ Phased Data Recovery	April 2008; one of two palm trees has been removed	Not in 1992 APE	Ineligible
CA-CCO-636 Milling Station	Good/ Level 1 Test; Inundation	No access: inundated	Eligible	Eligible
CA-CCO-637 Open Site with burials	Excellent (subsurface)/ Level 2 Data Recovery; Covered by Dam	No access; under dam	Eligible	Eligible
CA-CCO-650H Historic Artifact Scatter	Poor/ Phase 1 Shovel Probe	April 2008; Could not relocate	Not in 1992 APE	Ineligible
CA-CCO-696 Open Site with burials	Excellent/ Level 2 Data Recovery; Inundation	No access; under dam, inundated	Treated as eligible when discovered	Treat as eligible
CA-CCO-725 Hearth Feature	Good/ Level 2 Data Recovery; Paved over	No access; paved under road	Treated as eligible when discovered	Treat as eligible
CA-CCO-726/H Historic Artifact Scatter; Hearth Feature	Good to Excellent/ Construction monitoring	November 2007 No obvious new disturbance	Treated as eligible when discovered	Treat as eligible
CA-CCO-755 Buried Open Site	Poor/Construction monitoring	April 2008; could not relocate	Not in 1992 APE	Treat as eligible
P-07-000532 Reburial Site (Sensitive Site)	Excellent/ No previous mitigation; Inundation	No access: inundated	Not part of 1992 study	Treat as eligible
P-07-000791 Water Management Feature	Good/ covered by silt	April 2004; could not relocate	Treated as eligible when discovered	Treat as eligible
Kellogg Creek Dam Water Management Feature	Fair/ function of structure destroyed; no known mitigation	June, November 2007 Parts of original dam dismantled, some removed	Not discovered in 1992 study	Treat as eligible
Kellogg Creek Irrigation Ditch Water Management Feature	Good/ no known mitigation	First recorded Nov 2007	Not discovered in 1992 study	Treat as eligible

Table 5. Summary of Evaluations of Cultural Resources in the APE (continued)

Resource	Integrity/Previous Mitigation	Last Assessed	1992 NRHP Status	Update
Irrigation Ditch 1 Water Management Feature	Good/ avoided by original installation of Delta-Transfer pipeline 1998	First recorded Nov 2007	Not discovered in 1992 study	Treat as eligible
Irrigation Ditch 2 Water Management Feature	Good/ avoided by original installation of Delta-Transfer pipeline 1998	First recorded Nov 2007	Not discovered in 1992 study	Treat as eligible
Irrigation Ditch 3 Water Management Feature	Good/ avoided by original installation of Delta-Transfer pipeline 1998	First recorded Nov 2007	Not discovered in 1992 study	Treat as eligible
Byron-Bethany Irrigation Canal Water Management Feature	Good/ avoided by original installation of Delta-Transfer pipeline 1998	First recorded Nov 2007	Not discovered in 1992 study	Treat as eligible
Concrete Culvert Water Management Feature	Excellent/ avoided by original installation of Delta-Transfer pipeline 1998	First recorded Nov 2007	Not discovered in 1992 study	Treat as eligible
SPRR Grade Linear Feature	Good/ avoided by original installation of Delta-Transfer pipeline 1998	First recorded Nov 2007	Not discovered in 1992 study	Treat as eligible
Transmission Line Linear Feature	Good/ avoided by original installation of Delta-Transfer pipeline 1998	First recorded Nov 2007	Not discovered in 1992 study	Treat as eligible

6.3 Potential Project Impacts

The following analysis considers only the potential impacts on the 41 historic properties (NEPA) and the Reburial Site within the APE (all of the resources listed in Table 5 except for CA-CCO-448H, CA-CCO-621/H, and CA-CCO-650H). These can all be considered historical resources as well, as they are all also listed, or eligible for listing on the CRHR (CEQA). There are no unique archaeological resources (CEQA). There is no further need to consider the effects of the project on those resources that not eligible for listing on the NRHP (NEPA) or the CRHR (CEQA).

The construction and management of project components could impact historic properties either directly or indirectly. Direct impacts may occur when impacts on historic properties cannot be avoided through project redesign or other methods. Demolition or inundation of historic buildings and excavating an archaeological site are examples of direct impacts.

Historic properties could also be affected indirectly as a result of increased access to the project area that leads to vandalism and unauthorized excavation and collection. Potential project impacts are presented by project component and the historic properties that would be impacted.

Los Vaqueros Reservoir Expansion

Eighteen known historic properties and the Reburial site (a sensitive site) would be affected by expansion of the Los Vaqueros Reservoir to 275 TAF. The potential impacts on each of these resources are summarized in Table 6. The construction schedule includes drawdown of the existing 100 TAF reservoir, a two-year period in which it would be empty (during dam construction), and inundation to the 275 TAF level. After the reservoir has been filled, the reservoir would be subject to periodic water level fluctuations. The impacts associated with this construction schedule include the following:

- During construction period drawdown, exposure of currently inundated sites to increased erosion and access could lead to vandalism and illegal collecting.
- During periods when the water levels are highest, some sites could be inundated. Inundation is typically considered by SHPO to be an adverse effect.
- As a result of periodic water level fluctuations during normal operation of the reservoir, sites within the fluctuation zone would be exposed to increased erosion.
- During operation of the reservoir, increased access to sites in both the fluctuation zone and just beyond the water's edge could lead to an increased potential for vandalism and illegal collecting.

The drawdown for construction would expose ten currently partially or fully inundated sites (CA-CCO-427H, 445/H, 450/H, 458/H, 459, 469, 470H, 636, 696, and the reburial site) to erosion and the effects of increased access, which could include vandalism and illegal collecting. Inundation of the expanded reservoir to the new 275 TAF level would subject nine sites (CA-CCO-9, 452, 462, 463, 464, 467/H, 468, 725, and P-07-000791) to inundation for the first time and re-submerge or more fully submerge those ten sites that are currently inundated (CA-CCO-427H, 445H, 450/H, 458/H, 459, 469, 470H, 636, 696, and the reburial site P-07-000532). The buildings at CCO-450/H would be demolished prior to inundation.

Twelve of the known historic properties listed in Table 6 would be within the area exposed by periodic lowering of the reservoir level due to seasonal variation in the availability of water (CA-CCO-9, 427H, 450/H, 452, 459, 462, 463, 464, 467/H, 468, and 725, P-07-000791). The 275 TAF Reservoir could periodically be drawn down as low as the level of the high water level of the original 100 TAF reservoir pool. During drawdown, the area between the 100 TAF and the 275 TAF high water marks would be subjected to increased erosion and increased access, which could lead to vandalism and illegal collecting of historic properties.

Table 6. Potential Impacts to Historic Properties from the Reservoir Expansion

Site Number Property Type	Construction	Operation and Maintenance		
	Drawdown	Inundation	Water Level Fluctuation	Access
CA-CCO-9 Milling Station		x	x	x
CA-CCO-427H Ranch Headquarters	x	x	x	x
CA-CCO-445H Ranch Headquarters	x	x		
CA-CCO-450/H Ranch Headquarters Occupation Site	x	x	x	x
CA-CCO-452 Milling Station		x	x	x
CA-CCO-458/H Occupation Site	x	x		
CA-CCO-459 Milling Station; Burial	x	x	x	x
CA-CCO-462 Milling Station		x	x	x
CA-CCO-463 Occupation Site		x	x	x
CA-CCO-464 Milling Station		x	x	x
CA-CCO-467/H Milling Station; Tenant Ranch		x	x	x
CA-CCO-468 Milling Station; Occupation Site		x	x	x
CA-CCO-469 Milling Station	x	x		
CA-CCO-470H Ranch Headquarters	x	x		
CA-CCO-636 Occupation Site	x	x		
CA-CCO-696 Buried Site	x	x		
CA-CCO-725[a] Rock Feature		x	x	x
P-07-000532 Reburial Site	x	x		
P-07-000791 "Spring Box Site" Water Management Feature		x	x	x

[a] The rock feature (CA-CCO-725) was removed and the area was paved over to construct Road 3A during installation of the 100 TAF reservoir. The feature itself no longer exists; however, there is a high potential for additional features and deposits historically associated with the feature in the immediate vicinity.

Mitigation Measures that would reduce the impacts on historic properties to a less-than-significant level are discussed in section 7.4.

Los Vaqueros Dam

Construction of a new dam could potentially impact three known historic properties within or close to the proposed footprint of the main structure (Table 7). Although these sites (CA-CCO-458/H, -637, and -696) have already been subject to mitigation, there is a high potential that previously undisturbed, significant archaeological deposits remain at each site and in the vicinity, which has been identified as an area of high potential for buried cultural deposits (Meyer and Rosenthal 1997). Expansion of the dam footprint upstream would require an extended period of drawdown and the mass excavation for a new foundation to a depth of more than 50 ft. The extended drawdown would expose any near-surface remains to erosion, vandalism, and illegal collecting. The mass excavation would remove and destroy any cultural deposits or human remains. The movement of heavy equipment and materials could crush, mix, and expose any intact deposits remaining at site CCO-458/H upstream of the existing dam structure, and -637 downstream of the existing dam structure, that are not directly removed by mass excavation.

TABLE 7. Potential Impacts of the New Dam on Historic Properties

Site Number Property Type	Construction			Operation and Maintenance		
	Drawdown	Excavation	Crushing	Inundation	Water Level Fluctuation	Access
CA-CCO-696 Buried Site; Burials	x	x	x	x		
CA-CCO-458/H Occupation Site; Burials	x	x	x	x		
CA-CCO-637 Buried Site; Burials		x				

Borrow Area

The preferred borrow area for a dam construction material is located west of the existing dam. No known historic properties fall within the borrow area; however, heavy vehicle traffic between the borrow area and the dam could potentially impact two historic properties, CA-CCO-696 and -458/H. Heavy equipment access and transportation of borrow materials would affect the site by crushing, mixing, and exposing any sub-surface deposits.

Old River Intake and Pump Station

There are no historic properties within the proposed APE for this facility. As such, no adverse effects to recorded historic properties are expected.

Reservoir Inlet and Outlet Pipelines

The approximately 1,000-ft.-wide reservoir inlet and outlet pipelines study area contains four historic properties (CA-CCO-446H, -447/H, -726/H, and -755). The potential impacts on resources are summarized in Table 8. The alignment of the inlet and outlet pipelines has not yet been chosen within the 1,000-ft.-wide study corridor, and it could be possible to avoid excavation impacts on these resources through choice of alignment.

Table 8. Potential Impacts from the Inlet/Outlet Pipelines on Historic Properties

	Pipeline Construction		Operation and Maintenance
Site Number Property Type	Excavation	Staging and Access	Access
CA-CCO-446H Ranch Headquarters	x	x	x
CA-CCO-447/H Occupation; Livestock Shelter; Burials	x	x	
CA-CCO-726/H Rock Feature; Historic Artifact Scatter	x	x	x
CA-CCO-755 Buried Open Site	x	x	x

The proposed recreational facilities include a new marina facility, interpretive center, fishing access, day-use facilities, user parking, and hiking trails. The only proposed recreational facility that has the potential to impact historic properties is the hiking trail/access road that would follow the western edge of the Expanded Los Vaqueros Reservoir.

Western Hiking Trail/Access Road

A combined new hiking trail and service road following the western perimeter of the expanded reservoir could affect a series of five historic properties (summarized in Table 9**)** that are at or within 200 ft. of the proposed maximum water line. Each of these historic properties could also be impacted by road building and maintenance as well as increased access resulting from the new trail and road.

Table 9. Potential Impacts of the Western Hiking Trail/Access Road on Historic Properties

Site Number Property Type	Road Construction		Road Operation and Maintenance
	Excavation	Staging and Access	Access
CA-CCO-450/H Ranch Headquarters; Occupation Site	x	x	x
CA-CCO-462 Milling Station	x	x	x
CA-CCO-463 Occupation Site	x	x	x
CA-CCO-464 Milling Station	x	x	x
CA-CCO-467/H Milling Station; Tenant Ranch	x	x	x

Eastside Hiking Trail

A new hiking trail that would link existing service roads following the eastern perimeter of the expanded reservoir could affect two historic properties (summarized in Table 10**)** that are visible and accessible from the proposed trail. Each of these historic properties could also be impacted by increased access resulting from the new trail.

Table 10. Potential Impacts of the Eastside Hiking Trail on Historic Properties

Site Number Property Type	Road Construction		Road Operation and Maintenance
	Excavation	Staging and Access	Access
CA-CCO-455 Rockshelter			x
CA-CCO-456 Rockshelter			x

Delta-Transfer Pipeline

The APE for the conveyance pipeline from the supply source at Old River to the Transfer Facility has been proposed as a 200-ft.-wide corridor centered on the existing pipeline. Pipeline installation taking place along this corridor will include a combination of open trenching and jack-and-bore technique. The jack and bore is used to avoid by going beneath existing features such as railroad grades, road crossings, and irrigation canal or flood control channels. The nine newly recorded historic properties include a railroad grade, transmission line, irrigation canals and associated flood-control facilities. There are low potential impacts to these historic properties.

<u>Expanded Transfer Facility</u>

There are no known historic properties within the proposed APE for expansion of the Transfer Facility; therefore, impacts to historic properties are expected to be low.

<u>Transfer-LV Pipeline</u>

The APE for the conveyance pipeline from the Transfer Facility to the Los Vaqueros Reservoir has been proposed as a 200-ft.-wide corridor centered on the existing pipeline. This corridor meets the 1,000-ft.-wide corridor study area of the reservoir inlet and outlet pipelines, considered separately below. There are two historic properties within the Transfer-LV Pipeline APE (CA-CCO-397 and -535H). These resources are highly visible and accessible within the 200-ft. corridor and will be vulnerable to every potential impact from the project, including trenching construction methods, use of the area for staging and travel during construction and access to the pipeline once it is installed.

<u>Transfer-Bethany Pipeline</u>

The APE for the conveyance pipeline from the Expanded Transfer Facility to the Bethany Reservoir has been proposed as a 300-ft.-wide corridor. Pipeline trenching, staging, and heavy equipment access along this corridor could potentially impact two historic properties, CA-CCO-596H and 597. There are no known historical resources along either of the conveyance options (tunnel, or trench and tunnel). There is a low potential for undiscovered resources.

<u>New Transmission Lines and Substations</u>

Impacts from the transmission line from the Old River Pump Station and the Delta Pump Station to the Expanded Transfer Facility have been analyzed under the Delta-Transfer Pipeline (see above) as the two facilities would be co-aligned. There are nine cultural resources that have been assumed to be eligible for listing on the NRHP and the CRHR for the purposes of this analysis. They are discussed below under *Delta-Transfer Pipeline* because these facilities would be located within the same alignment.

There are no historical resources within the APE for the remaining elements of the electrical power options, including transmission and distribution lines and substations, therefore, no significant impacts to recorded historical resources are expected.

6.4 Mitigation Measures

As details of the plans for the project components are refined, and their potential impacts on historic properties are more clearly understood, each historic property will be assessed to determine the appropriate method of mitigation. Site-specific mitigation measures will be spelled out in HPTPs that follow from the PA. The preferred approach to mitigation is site avoidance. If avoidance is not prudent or feasible or could not ensure the adequate protection of sensitive historic properties, then evaluation, testing, and data recovery, if appropriate, could be necessary. Involvement of appropriate Native American groups will be solicited during the mitigation decision-making process.

The mitigation measures presented below describe in general terms the types of mitigation appropriate for the Los Vaqueros Reservoir Expansion.

The proposed Mitigation Measures fall into five categories:

- Site avoidance;
- Site preservation and protection;
- Preconstruction testing in areas of high potential for buried resources and human remains;
- Construction monitoring in areas of moderate potential for buried resources and human remains;
- Site evaluation and data recovery;
- Un-surveyed lands
- Unanticipated discoveries
- Scholarly and non-technical syntheses of mitigation results from data recovery in order to offset the cumulative effects on the Historic District and individual historic properties

Although specific mitigation measures will be detailed in HPTPs stemming from the renegotiated PA, and these will occur once the project design has been finalized, it is possible that some mitigation measures can be undertaken prior to initiation of the construction phase of the project.

Mitigation Measure 1: Avoid Cultural Resource Sites

The preferred method of avoiding impacts is to relocate construction-related activities to avoid historic properties. Fencing and monitoring to ensure that sites are protected might also be necessary and these are discussed in Mitigation Measure 2. Adequate avoidance requires that the qualities that might make properties eligible for the NRHP be considered. For example, prehistoric or historic archaeological sites can be avoided by restricting ground-disturbing activities in the vicinity of the site. In the process of project planning, project components have been designed to avoid, where possible, known historic properties. The historic properties that fall within pipeline APEs may be avoided by minor changes in the alignment in the immediate vicinity of each historic property. For example, if feasible from an engineering perspective, the final location of the trench to install the Transfer-Bethany pipeline could be adjusted within the 200-ft.-wide APE corridor to avoid damage to the petroglyph boulder, CA-CCO-597. As another example, the proposed Delta-Transfer Pipeline will parallel the existing Delta-Transfer Pipeline. Historic properties that could be avoided by judicial placement of the construction trenching, staging areas, and access roads within the APE corridor include CA-CCO-726/H, -446H, -447/H, -397, and -535H. If the engineers are successful in placing the construction trenching, staging and access areas away from these resources, they must also be protected by Mitigation Measure 1b, with temporary fences set up during pipeline installation.

Once the locations of access points, staging areas, and other construction-related activities are determined, specific measures to protect sites in the vicinity of each activity will be established and implemented through HPTPs, prior to construction.

Mitigation Measure 2: Prevent Access to Historic Properties

To prevent construction-related adverse impacts to historic properties within the APE, fencing or other barriers will be placed around sites that could be impacted. A cultural resource construction monitoring plan will be prepared and implemented to ensure that monitoring and/or physical barriers adequately protect sites from incidental construction activities. As an example, the petroglyph boulder, CA-CCO-597 falls within the APE for the Transfer-Bethany Pipeline and will be fenced during construction allowing for a 20-ft buffer to ensure that heavy equipment traffic and staging- and storage-related activities do not cause inadvertent damage to the property.

Mitigation Measure 3: Conduct Construction Crew Training

All construction crews that work on the project should undergo a training session to inform them of the presence and nature of NRHP-eligible cultural resources and human remains within the project area; of the laws protecting these resources and associated penalties; and of the procedures to follow should they discover cultural resources during project-related work.

Mitigation Measure 4: Preconstruction Testing and Data Recovery for NRHP-Eligible Properties

The significant impacts posed by the original project were mitigated for many resources to what was then a less-than-significant level. The proposed project may pose additional significant impacts to NRHP-eligible properties that would need to be mitigated to a less-than-significant level. Portions of sites that had not been previously exposed or studied may be damaged by new construction activities, and new sites may be discovered. Both CA-CCO-458/H and 696 are located just upstream of the 100 TAF dam and both yielded buried prehistoric cultural deposits and human remains and have a high potential to contain additional deposits and human remains that have not yet been disturbed (Meyer and Rosenthal 1997). The intensive geoarchaeological studies conducted in association with the 100 TAF Reservoir project concluded that there are areas of high potential to contain buried cultural deposits and human remains in the immediate vicinity of the dam (Meyer and Rosenthal 1997). Mass excavation for the new dam foundation will damage and remove any remaining deposits, including human remains. In this case, previous mitigation does not preclude the need for further mitigation with the initiation of a new project.

A Memorandum of Understanding (MOU) was developed between CCWD and interested Native Americans that outlined the process for the respectful treatment of Native American graves and human remains discovered during preconstruction and construction of the Los Vaqueros Project. This MOU should be reviewed and renewed for the current project. The updated MOU should outline the process for the respectful treatment of Native American graves and human remains when it is known ahead of time that construction has a high potential for damaging Native American graves and human remains. One approach that has been used in Contra Costa County is the controlled, monitored preconstruction excavation of the location suspected to have buried human remains that allows for the careful and respectful removal of Native American graves and human remains as they are uncovered (Price et al. 2005; 2006). A similar approach was used for the 100 TAF Reservoir construction (e.g., Meyer and Rosenthal 1997:III.52-53). This preconstruction controlled excavation is conducted at a much slower pace, with modified equipment (e.g., scraper with rubber tires rather than metal treads, or a backhoe with straight-edged rather than toothed bucket) and in smaller increments (e.g., 3-inch lifts) with both archaeologists and Native American monitors present. If human remains are observed, the mechanical excavation is halted in the area to allow archaeologists to carefully remove the remains and any associated grave goods in the presence of a Native American monitor. Once the maximum depth of cultural deposits has been reached, preconstruction excavation is complete, and the remaining mass excavation can proceed without the limitations imposed by the mitigation for cultural resources and human remains. The details of mitigation measures for specific sites and impacts will be worked out and presented in HPTPs once the Evaluation, PA and MOU are in place. A preliminary assessment of the sites that cannot be avoided and may be directly impacted by the project either by ground disturbance associated with construction and/or inundation, include CA-CCO-9, 450/H, 452, 462, 463, 464, 468, 637, 696, and 725. Sites that may be exposed during the drawdown and may require additional data recovery include CA-CCO-427H, 445H, 458/H, 459, 469, 470H, and 636. If sites within the pipeline corridors cannot be avoided and protected by temporary fencing (Mitigation Measures 1a and 1b) then the adverse effects on these sites should be mitigated through testing and data recovery. These sites include CA-CCO-726/H, 446H, 447/H, 397, 597, and 535H.

Mitigation Measure 5: Monitor Areas with Moderate and High Potential for Buried Resources and Human Burials during Ground-Disturbing Activities

Where the undertaking must disturb areas with either high or moderate potential for buried cultural deposits and human remains, the minimal mitigation recommended is to have a qualified archaeologist present during any ground-disturbing activities. A Cultural Resources Construction Monitoring Plan (CRCMP) should be prepared outlining the areas along Kellogg Creek and water conveyance alignments that should be monitored during construction. If buried sites are found, they will need to be evaluated for eligibility to the NRHP, and appropriate treatment will need to be developed in accordance with the Section 106 consultation process as outlined in the PA and the CRCMP.

Mitigation Measure 6: Design Project Facilities to be Unobtrusive

Where preserved historic properties are within the proposed APE of an aboveground facility, the facility should be designed to be architecturally compatible with historic properties and should be designed to blend visually with the surrounding area. Where appropriate, landscaping should be used to screen facilities from historic properties and to avoid or reduce visual impacts. The design of such facilities and landscaping should be undertaken in consultation with the SHPO.

Mitigation Measure 7: Review, Update, and Implement Existing Cultural Resources Management Plan for the Kellogg Creek Watershed

Impacts on some sites from increased access and vandalism can be prevented by implementing the existing Cultural Resources Management Plan. The plan was developed for the original Los Vaqueros Project; it remains relevant for the current project, but should be reviewed and updated, with specific attention to the Research Questions. In some cases, preserving historic properties in place may be possible. To ensure the long-term protection of these sites, the plan provides guidelines to prevent impacts on historic properties, such as restrictions for use in areas of sensitivity, and a long-term monitoring program to ensure that NRHP-eligible properties are protected in the future.

Mitigation Measure 8: Conduct Surveys for Unsurveyed Portions of the Project Area

Any new land bought as compensatory mitigation for replacement of listed species habitat lost due to project expansion under the Endangered Species Act and any other compensatory mitigation required by USEPA and USFWS under the Fish and Wildlife Coordination Act must be surveyed. Any cultural resources discovered as a result of this survey must be inventoried and evaluated for eligibility for listing in the NRHP and for any project effects. Any modifications to the project, such as pipeline reroutes, no matter how minor, must also be surveyed, and any discovered cultural resources inventoried and evaluated for eligibility for listing in the NRHP in accordance with the Section 106 compliance process.

Mitigation Measure 9: Prepare an Inadvertent Discovery Plan

A plan should be prepared to deal with unanticipated discovery of cultural resources and human remains. An Inadvertent Discovery Plan shall be prepared to detail the procedure to follow when cultural resources are discovered during construction. Inadvertent Discovery Plans describe the laws, procedures and contact information needed for handling situations when a project inadvertently discovers archaeological resources.

Mitigation Measure 10: Prepare a Comprehensive Prehistory of Kellogg Creek Historic District

Results from the recordation, testing, and data recovery of the prehistoric-era resources shall be synthesized into a comprehensive scholarly study of the prehistory of the Kellogg Creek Historic District guided by the research questions presented within the Cultural Resources Technical Report with particular attention paid to the change in use through time of the lower elevations of the Kellogg Creek Watershed and resources therein within the context of the greater watershed.

Mitigation Measure 11: Prepare a Public-Access Prehistory of Kellogg Creek Historic District

Results from the recordation, testing, and data recovery of the prehistoric-era resources within the Kellogg Creek Historic District shall be synthesized into a document that can be easily accessed and understood by members of the public including children of grade-school age.

Mitigation Measure 12: Prepare a Synthesis of the History of the Kellogg Creek Historic District

Results from the recordation, testing and data recovery of the historic-era resources within the Kellogg Creek Historic District shall be synthesized with existing analysis and reporting generated as a result of the installation of the 100 TAF reservoir and shall be presented in a new scholarly report with particular emphasis placed on analysis of the use of watershed lands with regard to elevation, resources, setting, and changing needs over time.

Compliance with these mitigation measures will mean that the project will have no adverse effects (or less than significant impact) on significant cultural resources or on the Historic District.

Table 11 presents in summary form the historic properties within the APE, the potential impacts posed by the project, and recommended mitigation measures to reduce these impacts to less than significant level. Mitigation measures 3 and 6 though 12 apply to all historic properties within the APE and are not included in the summary in Table 11.

Table 11. Summary of Management Recommendations for Cultural Resources within the APE

Resource	Status	Potential Effects	Management Recommendations
CA-CCO-9 Milling Station	Eligible, I and D	I, E, A	4
CA-CCO-310 Rockshelter	Eligible, I and D	A	2, 5
CA-CCO-397 Open Site	Eligible, I and D	EX, SA	1, 2, 4, 5
CA-CCO-417 Rockshelter	Eligible, I and D	A	2, 5
CA-CCO-427H Ranch Headquarters	Eligible, D	DD, I, E, A	4
CA-CCO-445H Ranch Headquarters	Eligible, D	DD, I	4
CA-CCO-446H Ranch Headquarters	Eligible, D	EX, SA, A	1, 2, 4, 5
CA-CCO-447/H Livestock Feature; Open Site with burials	Eligible, D	EX, SA	1, 2, 4, 5
CA-CCO-448H Ranch Headquarters	Treat as eligible, D	None	No further consideration
CA-CCO-450/H Ranch Headquarters; Open Site	Eligible, I and D	DD, I, E, A, EX, SA	4
CA-CCO-452 Milling Station	Eligible, D	I, E, A	4
CA-CCO-454H Ancillary Ranch Complex	Eligible, D	A, possibly EX	1, 2, 5
CA-CCO-455 Rockshelter	Eligible, I and D	A	2, 5
CA-CCO-456 Rockshelter	Eligible, D	A	2, 5
CA-CCO-458 Open Site with burials	Eligible, I and D	DD, I, EX, CR, CA	4
CA-CCO-459 Milling Station with human remains	Eligible, D	DD, I, E, A, EX, SA	4
CA-CCO-462 Milling Station	Eligible, D	I, E, A, EX, SA	4
CA-CCO-463 Open Site with Milling Station	Eligible, I and D	I, E, A, EX, SA	4
CA-CCO-464 Milling Station	Eligible, D	I, E, A, EX, SA	4

Table 11. Summary of Management Recommendations for Cultural Resources within the APE (continued)

Resource	Status	Potential Effects	Management Recommendations
CA-CCO-467/H Water Management Artifact Scatter; Milling Station	Eligible, I and D	I, E, A, EX, SA	2, 4, 5
CA-CCO-468 Milling Station and Open Site	Eligible, D	I, E, A, EX, SA	4
CA-CCO-469 Milling Station	Eligible, D	DD, I	4
CA-CCO-470H Ranch Complex	Eligible, I and D	DD, I	4
CA-CCO-535H Ranch Headquarters	Eligible, D	EX, SA	1, 2, 4, 5
CA-CCO-596H Ranch Headquarters	Treat as Eligible, I	EX, SA	1, 2, 4, 5
CA-CCO-597 Petroglyph Boulder	Treat as Eligible, I	EX, SA	1, 2
CA-CCO-621/H Ranch Headquarters; Lithic Scatter	Ineligible after testing	EX, SA	No further consideration
CA-CCO-636 Milling Station	Eligible, I and D	DD, I	4
CA-CCO-637 Open Site with burials	Eligible, I and D	EX	4
CA-CCO-650H Historic Artifact Scatter	Ineligible after testing	EX, SA	No further consideration
CA-CCO-696 Open Site with burials	Treat as Eligible, I and D	DD, I, EX, CR, CA	4
CA-CCO-725 Hearth Feature	Treat as Eligible, D	I, E, A, EX, SA	4
CA-CCO-726/H Historic Artifact Scatter; Hearth Feature	Treat as Eligible, D	EX, SA, A	4
CA-CCO-755 Buried Open Site (possible burial)	Treat as Eligible, D	EX, SA, A	4
P-07-000532 Reburial - Sensitive Site	Treat as eligible	DD, I	1, 2
P-07-000791 Water Management Feature	Treat as eligible	I, E, A	4
Kellogg Creek Dam Water Management Feature	Treat as eligible	EX, SA, A	1, 2
Kellogg Creek Irrigation Ditch Water Management Feature	Treat as eligible	EX, SA	1, 2
Irrigation Ditch 1 Water Management Feature	Treat as eligible	EX, SA	1, 2
Irrigation Ditch 2 Water Management Feature	Treat as eligible	EX, SA	1, 2
Irrigation Ditch 3 Water Management Feature	Treat as eligible	EX, SA	1, 2

Table 11. Summary of Management Recommendations for Cultural Resources within the APE (continued)

Resource	Status	Potential Effects	Management Recommendations
Byron-Bethany Irrigation Canal Water Management Feature	Treat as eligible	EX, SA	1, 2
Concrete Culvert Water Management Feature	Treat as eligible	EX, SA	1, 2
SPRR Grade Linear Feature	Treat as eligible	EX, SA	1
Transmission Line Linear Feature	Treat as eligible	EX, SA	1

STATUS KEY:
I: eligible as an individual property
D: eligible as a contributor to the Historic District
I and D: eligible as both an individual property and as a contributor to the Historic District

POTENTIAL EFFECTS KEY:
DD: Drawdown
A: Access
I: Inundation
E: Erosion
R: Recreation
EX: Excavation
CR: Crushing
CA: Construction Access
SA: Staging and Access

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APPENDIX H

Traffic and Air Quality Analysis Information

H-1 Traffic Analysis Information

Table H-1 summarizes the project construction traffic estimated for each proposed facility and for each of the four alternatives.

TABLE H-1
LOS VAQUEROS CONSTRUCTION TRAFFIC ASSUMPTIONS

			Construction Worker Commute Trips[1]		Equipment and Materials Haul Trucks			Total
	LV Project Facility	**Crew Size**	Round Trips / Day	One-way Trips / Day*	Round Trips / Day	One-way Trips / Day	One-way Trips / Hour (10-Hr Day)	One-way Trips / Day
	Alternatives 1 and 2[2]							
1	LV Reservoir Expansion	75	94	188	130	260	26	448
2	Transfer Facility	50	63	125	235	470	47	595
3	New Delta Intake	50	63	125	170	340	34	465
	Pipelines		0				0	0
4	Delta-Transfer	50	63	125	180	360	36	485
5	Transfer-LV	50	63	125	165	330	33	455
6	Transfer-Bethany	50	63	125	180	360	36	485
7	Power Option 1 or 2	25	31	63	25	50	5	113
8	LV Recreation Facilities	50	63	125	60	120	12	245
	Total (rounded up)	**400**	**500**	**1000**	**1150**	**2300**	**230**	**3300**
	Alternative 3[3]	**263**	**375**	**750**	**619**	**1,590**	**159**	**2,340**
	Alternative 4[4]	**60**	**75**	**150**	**136**	**272**	**27**	**425**

1 Work crew trips include daily commute to / from project site + 25% additional trips, assuming 1/4 of workers leave/return during day (e.g. lunch)
2 Alts 1 and 2 - Construction traffic totals include all facilities including Recreation Facilities traffic in peak project total even though these facilities would be built after most everything else and would not likely occur at the same time as other construction activities.
3 Alternative 3 - Project construction traffic estimate totals include facilities shown under alternative 1 with the following adjustments: no construction of the new Delta Intake and Pump Station (3); truck trips for Old River Pump Station Expansion so minor not included; and (6) Transfer-Bethany Pipeline not included.
4 Alternative 4 - Project construction traffic estimate totals assume 50% of the traffic level estimated for the reservoir expansion (1) under Alternative 1, 25% of the traffic associated with the Transfer Facility Expansion (2) to reflect an upgrade only; and only 20% of the traffic associated with the Recreation Facilities (8), since the Marina would not be move to the north end of the reservoir and there would be no second Interpretive Center constructed.

H-2 Air Quality Models and Results

Introduction

Several air quality models were used to quantify criteria pollutant emissions during construction activities associated with the Project. The California Air Resources Board (CARB) OFFROAD2007 model calculates emissions of ROG, NOx, CO, CO_2 and PM10 from off-road construction equipment based on the type, horsepower, activity, load factor, and equipment deterioration. Offroad equipment assumptions and results of OFFROAD2007 modeling are presented in **Section 1** for the project specific equipment provided by the applicant. In **Section 2**, CARB's EMFAC2007 emission factors are presented for on-road vehicles in Contra Costa County for the year 2015 and are used to calculate the emissions generated by worker and haul truck trips during construction. Fugitive dust emissions are also calculated based on the URBEMIS2007 default average of 10 pounds per acre-day and the assumption that 15 acres will all be disturbed at any one time during construction of all Project Alternative components. Finally, in **Section 3**, electricity usage and associated indirect electricity generation greenhouse gas emissions are presented.

Section 1 – Offroad Equipment Emissions

Estimated Construction Schedule - Reservoir Expansion

		Year 1											
Description	Duration	January	February	March	April	May	June	July	August	September	October	November	December
Notice to Proceed		◆											
Mobilization													
Roads and Temporary Construction	6 wk												
Site Preparation	**10 wk**												
Pump Dead Pool	4 wk												
Demo Upper Spillway	7 wk												
Groundwater Cutoff and Cofferdam	4 wk												
Foundation	**19 wk**												
Excavate Dam Foundation	19 wk												
Grout Upper Left Abutment	8 wk												
Grout Upper Right Abutment	5 wk												
Embankment	**79 wk**												
Strip Riprap From Excavated Dam	9 wk												
Construct Haul Roads Over Excavated Dam	9 wk												
Place Embankment Fill Year 1	13 wk												
Place Embankment Fill Year 2	34 wk												
Import Filter, Drain, Raprip and Bedding	30 wk												
Instrumentation	2 wk												
RCC Abutment	**30 wk**												
Import and Stockpile RCC Aggregate	30 wk												
Construct RCC Buttress	19 wk												
Hydraulic Structures	**76 wk**												
Construct Outlet Retaining Wall	11 wk												
Extend Excavation (Outlet) Intake Structure	26 wk												
Install Mech/Elec at (Outlet) Intake Structure	26 wk												
Install Mech/Elec at (Outlet) Outlet Structure	7 wk												
Connect Spillway to Existing Chute	19 wk												
Install New Inlet Conduit	13 wk												
Install Mech/Elec Inlet Conduit	9 wk												
Maintenance Access Roads	**81 wk**												
Excavate and Stabilize Intake Access Road	13 wk												
Pave Access Roads	5 wk												
Substantial Completion													

Estimated Labor and Equipment

		Year 1											
Description		January	February	March	April	May	June	July	August	September	October	November	December
Project Management													
Administration		176	176	176	346	346	346	346	346	346	346	346	346
Management		433	433	433	433	433	433	433	433	433	433	433	433
Engineering		433	433	433	433	433	433	433	433	433	433	433	433
Safety		217	217	217	217	217	217	217	217	217	217	217	217
Subtotal		**1,259**	**1,259**	**1,259**	**1,429**	**1,429**	**1,429**	**1,429**	**1,429**	**1,429**	**1,429**	**1,429**	**1,429**
Quality Assurance and Control													
Observation		217	217	217	217	217	217	217	217	217	217	217	173
Inspection		651	651	651	651	651	651	651	651	651	651	651	173
Testing		868	868	868	868	868	868	868	868	868	868	868	173
Subtotal		**1,736**	**1,736**	**1,736**	**1,736**	**1,736**	**1,736**	**1,736**	**1,736**	**1,736**	**1,736**	**1,736**	**519**
Construction Labor													
Operator		1085	1085	1085	9382	11467	11467	11467	9382	9382	1085	1,085	217
Driver					5212	5212	5212	5212	5212	2606	2606		
Carpenter				1302	1302	1302	1736	1736	1736	2604	2604	2,604	1736
Electricial													
Laborer					1668	1668	2085	2085	2085	2085	2085	2085	2085
Subtotal		**1,085**	**1,085**	**2,387**	**17,564**	**19,649**	**20,500**	**20,500**	**18,415**	**16,677**	**8,380**	**5,774**	**4,038**
Total Labor Hours		**4,080**	**4,080**	**5,382**	**20,729**	**22,814**	**23,665**	**23,665**	**21,580**	**19,842**	**11,545**	**8,939**	**5,986**
	Crew#	**24**	**24**	**31**	**120**	**132**	**137**	**137**	**125**	**115**	**67**	**52**	**35**
Equipment Hours													
Wheel and Track Loader				173	692	692	692	692	692				
Hydraulic Excavator				173	1040	1040	1040	1040	1040				
Track Type Tractor w/ Dozer		173	90		692	692	1126	1126	1126	868	868	868	
Scraper		346	173				1038	1038	1038	2076	2076	2076	
Motor Grader		173	90		346	346	346	346	346				
Compactor										692	692	692	
Water Wagon		173	90							434	434	434	
Off Highway Truck					1730	1730	1730	1730	1730				
Highway Truck				1586	1586	1586	1586	1586	1586	1586	1586		
Water Truck				173	173	217	217	217	217	217	217	217	
Crane 100 Ton			217	217	217	217	217	217	217	217	217	217	217
RCC Batch and Placement							434	434	434	434	434		
Service and Support Equipment		173	173	173	346	346	346	346	346	346	346	346	173
Subtotal		**1,038**	**833**	**2,495**	**6,822**	**6,866**	**8,772**	**8,772**	**8,772**	**6,870**	**6,870**	**4,850**	**390**
Total Equipment Hours		**1,038**	**833**	**2,495**	**6,822**	**6,866**	**8,772**	**8,772**	**8,772**	**6,870**	**6,870**	**4,850**	**390**
	Year 1 total	**63,350**		**9**									

Worse Case Year - Year 2015

Month	Equipment Type	Representative Equipment Model	Fuel	MaxHP	Total Equip Hours Per Month	Qty of Equip	State Average HP	Equipment Usage Days/Year	Activity from OFFROAD2007 (hr/day)	Emissions from OFFROAD 2007 Model (tons/day)					Emission Factor (lbs/hp-hr)					Equipment Emissions (lbs/month)					Equipment Emissions (tons/month)				
										ROG	CO	NOX	CO2	PM	ROG	CO	NOX	CO2	PM	ROG	CO	NOX	CO2	PM	ROG	CO	NOX	CO2	PM
JANUARY	Wheel and Track Loader	Wheel loader - CAT 966	d	259	0	0	500	22	109.15	0.01	0.04	0.09	18.80	0.00	0	0	0	0.6891	0.00011	0	0	0	0	0	0	0	0	0	0
	Hydraulic Excavator	Excavator - CAT 320	d	138	0	0	157	22	1335.22	0.07	0.44	0.49	74.85	0.03	0	0	0	0.7141	0.00026	0	0	0	0	0	0	0	0	0	0
	Track Type Tractor w/ Dozer	Track type tractor - CAT D6N	d	145	173	1	147	22	209.09	0.01	0.06	0.07	10.59	0.00	0	0	0	0.6891	0.00023	14.5492	99.78	107.9	17285.76	5.7040187	0	0	0	8	0
	Scraper	Scraper - CAT 631	d	462	346	2	356	22	136.99	0.02	0.07	0.16	22.00	0.01	0	0	0.01	0.9021	0.00026	129.334	479.7	1081	144199	41.708062	0	0	1	65	0
	Motor Grader	Grader - CAT 140	d	222	173	1	225	22	242.28	0.02	0.05	0.14	20.83	0.00	0	0	0.01	0.7643	0.00018	22.6074	69.01	197.6	29352.19	6.8153321	0	0	0	13	0
	Compactor	Compactor - CS 323	d	83	0	0	104	22	12.82	0.00	0.00	0.00	0.52	0.00	0	0	0.01	0.7768	0.00042	0	0	0	0	0	0	0	0	0	0
	Water Wagon	Water Wagon 8,000 Gal - CAT 631	d	417	173	1	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	37.0676	112.6	267.8	51519.14	9.5505003	0	0	0	23	0
	Off Highway Truck	Articulated Truck 18 CY - CAT 735	d	408	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	0	0	0	0	0	0	0	0	0	0
	Water Truck	Water Truck 3000 Gal and Pump	d	417	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	0	0	0	0	0	0	0	0	0	0
	Crane 100 Ton	Grove Crane GMK4100B	d	390	0	0	334	22	43.70	0.00	0.01	0.03	3.93	0.00	0	0	0	0.5387	0.00013	0	0	0	0	0	0	0	0	0	0
	RCC Batch and Placement	Pumps	d	190	0	0	206	22	41.09	0.00	0.01	0.02	5.22	0.00	0	0	0.01	1.2331	0.00019	0	0	0	0	0	0	0	0	0	0
	Service and Support Equipment	Generator sets, compressors	d	303	173	1	327	22	41.09	0.00	0.01	0.02	5.22	0.00	0	0	0	0.7768	0.00012	20.9674	79.49	190	40718.54	6.3043669	0	0	0	18	0
FEBRUARY	Wheel and Track Loader	Wheel loader - CAT 966	d	259	0	0	500	22	109.15	0.01	0.04	0.09	18.80	0.00	0	0	0	0.6891	0.00011	0	0	0	0	0	0	0	0	0	0
	Hydraulic Excavator	Excavator - CAT 320	d	138	0	0	157	22	1335.22	0.07	0.44	0.49	74.85	0.03	0	0	0	0.7141	0.00026	0	0	0	0	0	0	0	0	0	0
	Track Type Tractor w/ Dozer	Track type tractor - CAT D6N	d	145	90	0.5202	147	22	209.09	0.01	0.06	0.07	10.59	0.00	0	0	0	0.6891	0.00023	7.56894	51.91	56.11	8992.59	2.9674086	0	0	0	4	0
	Scraper	Scraper - CAT 631	d	462	173	1	356	22	136.99	0.02	0.07	0.16	22.00	0.01	0	0	0.01	0.9021	0.00026	64.6671	239.9	540.6	72099.51	20.854031	0	0	0	33	0
	Motor Grader	Grader - CAT 140	d	222	90	0.5202	225	22	242.28	0.02	0.05	0.14	20.83	0.00	0	0	0.01	0.7643	0.00018	11.7611	35.9	102.8	15269.93	3.5455485	0	0	0	7	0
	Compactor	Compactor - CS 323	d	83	0	0	104	22	12.82	0.00	0.00	0.00	0.52	0.00	0	0	0.01	0.7768	0.00042	0	0	0	0	0	0	0	0	0	0
	Water Wagon	Water Wagon 8,000 Gal - CAT 631	d	417	90	0.5202	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	19.2837	58.55	139.3	26801.86	4.9684684	0	0	0	12	0
	Off Highway Truck	Articulated Truck 18 CY - CAT 735	d	408	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	0	0	0	0	0	0	0	0	0	0
	Water Truck	Water Truck 3000 Gal and Pump	d	417	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	0	0	0	0	0	0	0	0	0	0
	Crane 100 Ton	Grove Crane GMK4100B	d	390	217	1.2543	334	22	43.70	0.00	0.01	0.03	3.93	0.00	0	0	0	0.5387	0.00013	35.2561	118.1	298.9	45593.67	10.792598	0	0	0	21	0
	RCC Batch and Placement	Pumps	d	190	0	0	206	22	41.09	0.00	0.01	0.02	5.22	0.00	0	0	0.01	1.2331	0.00019	0	0	0	0	0	0	0	0	0	0
	Service and Support Equipment	Generator sets, compressors	d	303	173	1	327	22	41.09	0.00	0.01	0.02	5.22	0.00	0	0	0	0.7768	0.00012	20.9674	79.49	190	40718.54	6.3043669	0	0	0	18	0
MARCH	Wheel and Track Loader	Wheel loader - CAT 966	d	259	173	1	500	22	109.15	0.01	0.04	0.09	18.80	0.00	0	0	0	0.6891	0.00011	18.6629	63.47	143.8	30875.94	5.0021929	0	0	0	14	0
	Hydraulic Excavator	Excavator - CAT 320	d	138	173	1	157	22	1335.22	0.07	0.44	0.49	74.85	0.03	0	0	0	0.7141	0.00026	15.9654	101.1	112.5	17049.51	6.1429783	0	0	0	8	0
	Track Type Tractor w/ Dozer	Track type tractor - CAT D6N	d	145	0	0	147	22	209.09	0.01	0.06	0.07	10.59	0.00	0	0	0	0.6891	0.00023	0	0	0	0	0	0	0	0	0	0
	Scraper	Scraper - CAT 631	d	462	0	0	356	22	136.99	0.02	0.07	0.16	22.00	0.01	0	0	0.01	0.9021	0.00026	0	0	0	0	0	0	0	0	0	0
	Motor Grader	Grader - CAT 140	d	222	0	0	225	22	242.28	0.02	0.05	0.14	20.83	0.00	0	0	0.01	0.7643	0.00018	0	0	0	0	0	0	0	0	0	0
	Compactor	Compactor - CS 323	d	83	0	0	104	22	12.82	0.00	0.00	0.00	0.52	0.00	0	0	0.01	0.7768	0.00042	0	0	0	0	0	0	0	0	0	0
	Water Wagon	Water Wagon 8,000 Gal - CAT 631	d	417	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	0	0	0	0	0	0	0	0	0	0
	Off Highway Truck	Articulated Truck 18 CY - CAT 735	d	408	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	0	0	0	0	0	0	0	0	0	0
	Water Truck	Water Truck 3000 Gal and Pump	d	417	173	1	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	37.0676	112.6	267.8	51519.14	9.5505003	0	0	0	23	0
	Crane 100 Ton	Grove Crane GMK4100B	d	390	217	1.2543	334	22	43.70	0.00	0.01	0.03	3.93	0.00	0	0	0	0.5387	0.00013	35.2561	118.1	298.9	45593.67	10.792598	0	0	0	21	0
	RCC Batch and Placement	Pumps	d	190	0	0	206	22	41.09	0.00	0.01	0.02	5.22	0.00	0	0	0.01	1.2331	0.00019	0	0	0	0	0	0	0	0	0	0
	Service and Support Equipment	Generator sets, compressors	d	303	173	1	327	22	41.09	0.00	0.01	0.02	5.22	0.00	0	0	0	0.7768	0.00012	20.9674	79.49	190	40718.54	6.3043669	0	0	0	18	0
APRIL	Wheel and Track Loader	Wheel loader - CAT 966	d	259	692	4	500	22	109.15	0.01	0.04	0.09	18.80	0.00	0	0	0	0.6891	0.00011	74.6517	253.9	575.2	123503.8	20.008772	0	0	0	56	0
	Hydraulic Excavator	Excavator - CAT 320	d	138	1040	6.0116	157	22	1335.22	0.07	0.44	0.49	74.85	0.03	0	0	0	0.7141	0.00026	95.9772	607.7	676.1	102494.1	36.928887	0	0	0	46	0
	Track Type Tractor w/ Dozer	Track type tractor - CAT D6N	d	145	692	4	147	22	209.09	0.01	0.06	0.07	10.59	0.00	0	0	0	0.6891	0.00023	58.1967	399.1	431.5	69143.03	22.816075	0	0	0	31	0
	Scraper	Scraper - CAT 631	d	462	0	0	356	22	136.99	0.02	0.07	0.16	22.00	0.01	0	0	0.01	0.9021	0.00026	0	0	0	0	0	0	0	0	0	0
	Motor Grader	Grader - CAT 140	d	222	346	2	225	22	242.28	0.02	0.05	0.14	20.83	0.00	0	0	0.01	0.7643	0.00018	45.2148	138	395.2	58704.39	13.630664	0	0	0	27	0
	Compactor	Compactor - CS 323	d	83	0	0	104	22	12.82	0.00	0.00	0.00	0.52	0.00	0	0	0.01	0.7768	0.00042	0	0	0	0	0	0	0	0	0	0
	Water Wagon	Water Wagon 8,000 Gal - CAT 631	d	417	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	0	0	0	0	0	0	0	0	0	0
	Off Highway Truck	Articulated Truck 18 CY - CAT 735	d	408	1730	10	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	362.676	1101	2621	504072.1	93.443744	0	1	1	229	0
	Water Truck	Water Truck 3000 Gal and Pump	d	417	173	1	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	37.0676	112.6	267.8	51519.14	9.5505003	0	0	0	23	0
	Crane 100 Ton	Grove Crane GMK4100B	d	390	217	1.2543	334	22	43.70	0.00	0.01	0.03	3.93	0.00	0	0	0	0.5387	0.00013	35.2561	118.1	298.9	45593.67	10.792598	0	0	0	21	0
	RCC Batch and Placement	Pumps	d	190	0	0	206	22	41.09	0.00	0.01	0.02	5.22	0.00	0	0	0.01	1.2331	0.00019	0	0	0	0	0	0	0	0	0	0
	Service and Support Equipment	Generator sets, compressors	d	303	346	2	327	22	41.09	0.00	0.01	0.02	5.22	0.00	0	0	0	0.7768	0.00012	41.9347	159	379.9	81437.08	12.608734	0	0	0	37	0
MAY	Wheel and Track Loader	Wheel loader - CAT 966	d	259	692	4	500	22	109.15	0.01	0.04	0.09	18.80	0.00	0	0	0	0.6891	0.00011	74.6517	253.9	575.2	123503.8	20.008772	0	0	0	56	0
	Hydraulic Excavator	Excavator - CAT 320	d	138	1040	6.0116	157	22	1335.22	0.07	0.44	0.49	74.85	0.03	0	0	0	0.7141	0.00026	95.9772	607.7	676.1	102494.1	36.928887	0	0	0	46	0
	Track Type Tractor w/ Dozer	Track type tractor - CAT D6N	d	145	692	4	147	22	209.09	0.01	0.06	0.07	10.59	0.00	0	0	0	0.6891	0.00023	58.1967	399.1	431.5	69143.03	22.816075	0	0	0	31	0
	Scraper	Scraper - CAT 631	d	462	0	0	356	22	136.99	0.02	0.07	0.16	22.00	0.01	0	0	0.01	0.9021	0.00026	0	0	0	0	0	0	0	0	0	0
	Motor Grader	Grader - CAT 140	d	222	346	2	225	22	242.28	0.02	0.05	0.14	20.83	0.00	0	0	0.01	0.7643	0.00018	45.2148	138	395.2	58704.39	13.630664	0	0	0	27	0
	Compactor	Compactor - CS 323	d	83	0	0	104	22	12.82	0.00	0.00	0.00	0.52	0.00	0	0	0.01	0.7768	0.00042	0	0	0	0	0	0	0	0	0	0
	Water Wagon	Water Wagon 8,000 Gal - CAT 631	d	417	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	0	0	0	0	0	0	0	0	0	0
	Off Highway Truck	Articulated Truck 18 CY - CAT 735	d	408	1730	10	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	362.676	1101	2621	504072.1	93.443744	0	1	1	229	0
	Water Truck	Water Truck 3000 Gal and Pump	d	417	217	1.2543	381	22	172.98	0.02	0.05	0.12	23.53	0.00	0	0	0	0.7141	0.00013	46.4952	141.2	336	64622.27	11.979529	0	0	0	29	0
	Crane 100 Ton	Grove Crane GMK4100B	d	390	217	1.2543	334	22	43.70	0.00	0.01	0.03	3.93	0.00	0	0	0	0.5387	0.00013	35.2561	118.1	298.9	45593.67	10.792598	0	0	0	21	0
	RCC Batch and Placement	Pumps	d	190	0	0	206	22	41.09	0.00	0.01	0.02	5.22	0.00	0	0	0.01	1.2331	0.00019	0	0	0	0	0	0	0	0	0	0
	Service and Support Equipment	Generator sets, compressors	d	303	346	2	327	22	41.09	0.00	0.01	0.02	5.22	0.00	0	0	0	0.7768	0.00012	41.9347	159	379.9	81437.08	12.608734	0	0	0	37	0

	Equipment Type	Representative Equipment Model	Fuel	MaxHP	Total Equip Hours Per Month	Qty of Equip	State Average HP	Equipment Usage Days/Year	Activity from OFFROAD2007 (hr/day)	Emissions from OFFROAD 2007 Model (tons/day) ROG	CO	NOX	CO2	PM	Emission Factor (lbs/hp-hr) ROG	CO	NOX	CO2	PM	Equipment Emissions (lbs/month) ROG	CO	NOX	CO2	PM	Equipment Emissions (tons/month) ROG	CO	NOX	CO2	PM
JUNE	Wheel and Track Loader	Wheel loader - CAT 966	d	259	692	4	500	22	109.15	0.01	0.04	0.09	18.80	0.00	4E-04	0	0	0.6891	0.0001	74.652	253.9	575.201	123504	20.009	0	0	0	56	0
	Hydraulic Excavator	Excavator - CAT 320	d	138	1040	6.012	157	22	1335.22	0.07	0.44	0.49	74.85	0.03	7E-04	0	0	0.7141	0.0003	95.977	607.7	676.147	102494	36.929	0	0	0	46	0
	Track Type Tractor w/ Dozer	Track type tractor - CAT D6N	d	145	1126	6.509	147	22	209.09	0.01	0.06	0.07	10.59	0.00	6E-04	0	0	0.6891	0.0002	94.696	649.4	702.06	112507	37.126	0	0	0	51	0
	Scraper	Scraper - CAT 631	d	462	1038	6	356	22	136.99	0.02	0.07	0.16	22.00	0.01	8E-04	0	0	0.9021	0.0003	388	1439	3243.4	432597	125.12	0	1	2	196	0
	Motor Grader	Grader - CAT 140	d	222	346	2	225	22	242.28	0.02	0.05	0.14	20.83	0.00	6E-04	0	0	0.7643	0.0002	45.215	138	395.22	58704	13.631	0	0	0	27	0
	Compactor	Compactor - CS 323	d	83	0	0	104	22	12.82	0.00	0.00	0.00	0.52	0.00	8E-04	0	0	0.7768	0.0004	0	0	0	0	0	0	0	0	0	0
	Water Wagon	Water Wagon 8,000 Gal - CAT 631	d	417	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	0	0	0	0	0	0	0	0	0	0
	Off Highway Truck	Articulated Truck 18 CY - CAT 735	d	408	1730	10	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	362.68	1101	2620.53	504072	93.444	0	1	1	229	0
	Water Truck	Water Truck 3000 Gal and Pump	d	417	217	1.254	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	46.495	141.2	335.954	64622	11.98	0	0	0	29	0
	Crane 100 Ton	Grove Crane GMK4100B	d	390	217	1.254	334	22	43.70	0.00	0.01	0.03	3.93	0.00	4E-04	0	0	0.5387	0.0001	35.256	118.1	298.938	45594	10.793	0	0	0	21	0
	RCC Batch and Placement	Pumps	d	190	434	2.509	206	22	41.09	0.00	0.01	0.02	5.22	0.00	6E-04	0	0	1.2331	0.0002	52.358	198.5	474.351	101678	15.743	0	0	0	46	0
	Service and Support Equipment	Generator sets, compressors	d	303	346	2	327	22	41.09	0.00	0.01	0.02	5.22	0.00	4E-04	0	0	0.7768	0.0001	41.935	159	379.922	81437	12.609	0	0	0	37	0
JULY	Wheel and Track Loader	Wheel loader - CAT 966	d	259	692	4	500	22	109.15	0.01	0.04	0.09	18.80	0.00	4E-04	0	0	0.6891	0.0001	74.652	253.9	575.201	123504	20.009	0	0	0	56	0
	Hydraulic Excavator	Excavator - CAT 320	d	138	1040	6.012	157	22	1335.22	0.07	0.44	0.49	74.85	0.03	7E-04	0	0	0.7141	0.0003	95.977	607.7	676.147	102494	36.929	0	0	0	46	0
	Track Type Tractor w/ Dozer	Track type tractor - CAT D6N	d	145	1126	6.509	147	22	209.09	0.01	0.06	0.07	10.59	0.00	6E-04	0	0	0.6891	0.0002	94.696	649.4	702.06	112507	37.126	0	0	0	51	0
	Scraper	Scraper - CAT 631	d	462	1038	6	356	22	136.99	0.02	0.07	0.16	22.00	0.01	8E-04	0	0	0.9021	0.0003	388	1439	3243.4	432597	125.12	0	1	2	196	0
	Motor Grader	Grader - CAT 140	d	222	346	2	225	22	242.28	0.02	0.05	0.14	20.83	0.00	6E-04	0	0	0.7643	0.0002	45.215	138	395.22	58704	13.631	0	0	0	27	0
	Compactor	Compactor - CS 323	d	83	0	0	104	22	12.82	0.00	0.00	0.00	0.52	0.00	8E-04	0	0	0.7768	0.0004	0	0	0	0	0	0	0	0	0	0
	Water Wagon	Water Wagon 8,000 Gal - CAT 631	d	417	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	0	0	0	0	0	0	0	0	0	0
	Off Highway Truck	Articulated Truck 18 CY - CAT 735	d	408	1730	10	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	362.68	1101	2620.53	504072	93.444	0	1	1	229	0
	Water Truck	Water Truck 3000 Gal and Pump	d	417	217	1.254	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	46.495	141.2	335.954	64622	11.98	0	0	0	29	0
	Crane 100 Ton	Grove Crane GMK4100B	d	390	217	1.254	334	22	43.70	0.00	0.01	0.03	3.93	0.00	4E-04	0	0	0.5387	0.0001	35.256	118.1	298.938	45594	10.793	0	0	0	21	0
	RCC Batch and Placement	Pumps	d	190	434	2.509	206	22	41.09	0.00	0.01	0.02	5.22	0.00	6E-04	0	0	1.2331	0.0002	52.358	198.5	474.351	101678	15.743	0	0	0	46	0
	Service and Support Equipment	Generator sets, compressors	d	303	346	2	327	22	41.09	0.00	0.01	0.02	5.22	0.00	4E-04	0	0	0.7768	0.0001	41.935	159	379.922	81437	12.609	0	0	0	37	0
AUGUST	Wheel and Track Loader	Wheel loader - CAT 966	d	259	692	4	500	22	109.15	0.01	0.04	0.09	18.80	0.00	4E-04	0	0	0.6891	0.0001	74.652	253.9	575.201	123504	20.009	0	0	0	56	0
	Hydraulic Excavator	Excavator - CAT 320	d	138	1040	6.012	157	22	1335.22	0.07	0.44	0.49	74.85	0.03	7E-04	0	0	0.7141	0.0003	95.977	607.7	676.147	102494	36.929	0	0	0	46	0
	Track Type Tractor w/ Dozer	Track type tractor - CAT D6N	d	145	1126	6.509	147	22	209.09	0.01	0.06	0.07	10.59	0.00	6E-04	0	0	0.6891	0.0002	94.696	649.4	702.06	112507	37.126	0	0	0	51	0
	Scraper	Scraper - CAT 631	d	462	1038	6	356	22	136.99	0.02	0.07	0.16	22.00	0.01	8E-04	0	0	0.9021	0.0003	388	1439	3243.4	432597	125.12	0	1	2	196	0
	Motor Grader	Grader - CAT 140	d	222	346	2	225	22	242.28	0.02	0.05	0.14	20.83	0.00	6E-04	0	0	0.7643	0.0002	45.215	138	395.22	58704	13.631	0	0	0	27	0
	Compactor	Compactor - CS 323	d	83	0	0	104	22	12.82	0.00	0.00	0.00	0.52	0.00	8E-04	0	0	0.7768	0.0004	0	0	0	0	0	0	0	0	0	0
	Water Wagon	Water Wagon 8,000 Gal - CAT 631	d	417	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	0	0	0	0	0	0	0	0	0	0
	Off Highway Truck	Articulated Truck 18 CY - CAT 735	d	408	1730	10	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	362.68	1101	2620.53	504072	93.444	0	1	1	229	0
	Water Truck	Water Truck 3000 Gal and Pump	d	417	217	1.254	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	46.495	141.2	335.954	64622	11.98	0	0	0	29	0
	Crane 100 Ton	Grove Crane GMK4100B	d	390	217	1.254	334	22	43.70	0.00	0.01	0.03	3.93	0.00	4E-04	0	0	0.5387	0.0001	35.256	118.1	298.938	45594	10.793	0	0	0	21	0
	RCC Batch and Placement	Pumps	d	190	434	2.509	206	22	41.09	0.00	0.01	0.02	5.22	0.00	6E-04	0	0	1.2331	0.0002	52.358	198.5	474.351	101678	15.743	0	0	0	46	0
	Service and Support Equipment	Generator sets, compressors	d	303	346	2	327	22	41.09	0.00	0.01	0.02	5.22	0.00	4E-04	0	0	0.7768	0.0001	41.935	159	379.922	81437	12.609	0	0	0	37	0
SEPTEMBER	Wheel and Track Loader	Wheel loader - CAT 966	d	259	0	0	500	22	109.15	0.01	0.04	0.09	18.80	0.00	4E-04	0	0	0.6891	0.0001	0	0	0	0	0	0	0	0	0	0
	Hydraulic Excavator	Excavator - CAT 320	d	138	0	0	157	22	1335.22	0.07	0.44	0.49	74.85	0.03	7E-04	0	0	0.7141	0.0003	0	0	0	0	0	0	0	0	0	0
	Track Type Tractor w/ Dozer	Track type tractor - CAT D6N	d	145	868	5.017	147	22	209.09	0.01	0.06	0.07	10.59	0.00	6E-04	0	0	0.6891	0.0002	72.998	500.6	541.197	86729	28.619	0	0	0	39	0
	Scraper	Scraper - CAT 631	d	462	2076	12	356	22	136.99	0.02	0.07	0.16	22.00	0.01	8E-04	0	0	0.9021	0.0003	776.01	2878	6486.81	865194	250.25	0	1	3	392	0
	Motor Grader	Grader - CAT 140	d	222	0	0	225	22	242.28	0.02	0.05	0.14	20.83	0.00	6E-04	0	0	0.7643	0.0002	0	0	0	0	0	0	0	0	0	0
	Compactor	Compactor - CS 323	d	83	692	4	104	22	12.82	0.00	0.00	0.00	0.52	0.00	8E-04	0	0	0.7768	0.0004	45.604	287	331.592	44616	24.332	0	0	0	20	0
	Water Wagon	Water Wagon 8,000 Gal - CAT 631	d	417	434	2.509	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	92.99	282.4	671.907	129245	23.959	0	0	0	59	0
	Off Highway Truck	Articulated Truck 18 CY - CAT 735	d	408	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	0	0	0	0	0	0	0	0	0	0
	Water Truck	Water Truck 3000 Gal and Pump	d	417	217	1.254	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	46.495	141.2	335.954	64622	11.98	0	0	0	29	0
	Crane 100 Ton	Grove Crane GMK4100B	d	390	217	1.254	334	22	43.70	0.00	0.01	0.03	3.93	0.00	4E-04	0	0	0.5387	0.0001	35.256	118.1	298.938	45594	10.793	0	0	0	21	0
	RCC Batch and Placement	Pumps	d	190	434	2.509	206	22	41.09	0.00	0.01	0.02	5.22	0.00	6E-04	0	0	1.2331	0.0002	52.358	198.5	474.351	101678	15.743	0	0	0	46	0
	Service and Support Equipment	Generator sets, compressors	d	303	346	2	327	22	41.09	0.00	0.01	0.02	5.22	0.00	4E-04	0	0	0.7768	0.0001	41.935	159	379.922	81437	12.609	0	0	0	37	0
OCTOBER	Wheel and Track Loader	Wheel loader - CAT 966	d	259	0	0	500	22	109.15	0.01	0.04	0.09	18.80	0.00	4E-04	0	0	0.6891	0.0001	0	0	0	0	0	0	0	0	0	0
	Hydraulic Excavator	Excavator - CAT 320	d	138	0	0	157	22	1335.22	0.07	0.44	0.49	74.85	0.03	7E-04	0	0	0.7141	0.0003	0	0	0	0	0	0	0	0	0	0
	Track Type Tractor w/ Dozer	Track type tractor - CAT D6N	d	145	868	5.017	147	22	209.09	0.01	0.06	0.07	10.59	0.00	6E-04	0	0	0.6891	0.0002	72.998	500.6	541.197	86729	28.619	0	0	0	39	0
	Scraper	Scraper - CAT 631	d	462	2076	12	356	22	136.99	0.02	0.07	0.16	22.00	0.01	8E-04	0	0	0.9021	0.0003	776.01	2878	6486.81	865194	250.25	0	1	3	392	0
	Motor Grader	Grader - CAT 140	d	222	0	0	225	22	242.28	0.02	0.05	0.14	20.83	0.00	6E-04	0	0	0.7643	0.0002	0	0	0	0	0	0	0	0	0	0
	Compactor	Compactor - CS 323	d	83	692	4	104	22	12.82	0.00	0.00	0.00	0.52	0.00	8E-04	0	0	0.7768	0.0004	45.604	287	331.592	44616	24.332	0	0	0	20	0
	Water Wagon	Water Wagon 8,000 Gal - CAT 631	d	417	434	2.509	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	92.99	282.4	671.907	129245	23.959	0	0	0	59	0
	Off Highway Truck	Articulated Truck 18 CY - CAT 735	d	408	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	0	0	0	0	0	0	0	0	0	0
	Water Truck	Water Truck 3000 Gal and Pump	d	417	217	1.254	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	46.495	141.2	335.954	64622	11.98	0	0	0	29	0
	Crane 100 Ton	Grove Crane GMK4100B	d	390	217	1.254	334	22	43.70	0.00	0.01	0.03	3.93	0.00	4E-04	0	0	0.5387	0.0001	35.256	118.1	298.938	45594	10.793	0	0	0	21	0
	RCC Batch and Placement	Pumps	d	190	434	2.509	206	22	41.09	0.00	0.01	0.02	5.22	0.00	6E-04	0	0	1.2331	0.0002	52.358	198.5	474.351	101678	15.743	0	0	0	46	0
	Service and Support Equipment	Generator sets, compressors	d	303	346	2	327	22	41.09	0.00	0.01	0.02	5.22	0.00	4E-04	0	0	0.7768	0.0001	41.935	159	379.922	81437	12.609	0	0	0	37	0
NOVEMBER	Wheel and Track Loader	Wheel loader - CAT 966	d	259	0	0	500	22	109.15	0.01	0.04	0.09	18.80	0.00	4E-04	0	0	0.6891	0.0001	0	0	0	0	0	0	0	0	0	0
	Hydraulic Excavator	Excavator - CAT 320	d	138	0	0	157	22	1335.22	0.07	0.44	0.49	74.85	0.03	7E-04	0	0	0.7141	0.0003	0	0	0	0	0	0	0	0	0	0
	Track Type Tractor w/ Dozer	Track type tractor - CAT D6N	d	145	868	5.017	147	22	209.09	0.01	0.06	0.07	10.59	0.00	6E-04	0	0	0.6891	0.0002	72.998	500.6	541.197	86729	28.619	0	0	0	39	0
	Scraper	Scraper - CAT 631	d	462	2076	12	356	22	136.99	0.02	0.07	0.16	22.00	0.01	8E-04	0	0	0.9021	0.0003	776.01	2878	6486.81	865194	250.25	0	1	3	392	0
	Motor Grader	Grader - CAT 140	d	222	0	0	225	22	242.28	0.02	0.05	0.14	20.83	0.00	6E-04	0	0	0.7643	0.0002	0	0	0	0	0	0	0	0	0	0
	Compactor	Compactor - CS 323	d	83	692	4	104	22	12.82	0.00	0.00	0.00	0.52	0.00	8E-04	0	0	0.7768	0.0004	45.604	287	331.592	44616	24.332	0	0	0	20	0
	Water Wagon	Water Wagon 8,000 Gal - CAT 631	d	417	434	2.509	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	92.99	282.4	671.907	129245	23.959	0	0	0	59	0
	Off Highway Truck	Articulated Truck 18 CY - CAT 735	d	408	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	0	0	0	0	0	0	0	0	0	0
	Water Truck	Water Truck 3000 Gal and Pump	d	417	217	1.254	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0	0	0.7141	0.0001	46.495	141.2	335.954	64622	11.98	0	0	0	29	0
	Crane 100 Ton	Grove Crane GMK4100B	d	390	217	1.254	334	22	43.70	0.00	0.01	0.03	3.93	0.00	4E-04	0	0	0.5387	0.0001	35.256	118.1	298.938	45594	10.793	0	0	0	21	0
	RCC Batch and Placement	Pumps	d	190	0	0	206	22	41.09	0.00	0.01	0.02	5.22	0.00	6E-04	0	0	1.2331	0.0002	0	0	0	0	0	0	0	0	0	0
	Service and Support Equipment	Generator sets, compressors	d	303	346	2	327	22	41.09	0.00	0.01	0.02	5.22	0.00	4E-04	0	0	0.7768	0.0001	41.935	159	379.922	81437	12.609	0	0	0	37	0

	Equipment Type	Representative Equipment Model	Fuel	MaxHP	Total Equip Hours Per Month	Qty of Equip	State Average HP	Equipment Usage	Activity from OFFROAD2007 (hr/day)	Emissions from OFFROAD 2007 Model (tons/day)					Emission Factor (lbs/hp-hr)					Equipment Emissions (lbs/month)					Equipment Emissions (tons/month)				
								Days/Year		ROG	CO	NOX	CO2	PM	ROG	CO	NOX	CO2	PM	ROG	CO	NOX	CO2	PM	ROG	CO	NOX	CO2	PM
DECEMBER	Wheel and Track Loader	Wheel loader - CAT 966	d	259	0	0	500	22	109.15	0.01	0.04	0.09	18.80	0.00	4E-04	0.0014	0.003	0.69	0.000112	0	0	0	0	0	0	0	0	0	0
	Hydraulic Excavator	Excavator - CAT 320	d	138	0	0	157	22	1335.22	0.07	0.44	0.49	74.85	0.03	7E-04	0.0042	0.005	0.71	0.000257	0	0	0	0	0	0	0	0	0	0
	Track Type Tractor w/ Dozer	Track type tractor - CAT D6N	d	145	0	0	147	22	209.09	0.01	0.06	0.07	10.59	0.00	6E-04	0.004	0.004	0.69	0.000227	0	0	0	0	0	0	0	0	0	0
	Scraper	Scraper - CAT 631	d	462	0	0	356	22	136.99	0.02	0.07	0.16	22.00	0.01	8E-04	0.003	0.007	0.9	0.000261	0	0	0	0	0	0	0	0	0	0
	Motor Grader	Grader - CAT 140	d	222	0	0	225	22	242.28	0.02	0.05	0.14	20.83	0.00	6E-04	0.0018	0.005	0.76	0.000177	0	0	0	0	0	0	0	0	0	0
	Compactor	Compactor - CS 323	d	83	0	0	104	22	12.82	0.00	0.00	0.00	0.52	0.00	8E-04	0.005	0.006	0.78	0.000424	0	0	0	0	0	0	0	0	0	0
	Water Wagon	Water Wagon 8,000 Gal - CAT 631	d	417	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0.0016	0.004	0.71	0.000132	0	0	0	0	0	0	0	0	0	0
	Off Highway Truck	Articulated Truck 18 CY - CAT 735	d	408	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0.0016	0.004	0.71	0.000132	0	0	0	0	0	0	0	0	0	0
	Water Truck	Water Truck 3000 Gal and Pump	d	417	0	0	381	22	172.98	0.02	0.05	0.12	23.53	0.00	5E-04	0.0016	0.004	0.71	0.000132	0	0	0	0	0	0	0	0	0	0
	Crane 100 Ton	Grove Crane GMK4100B	d	390	217	1.254335	334	22	43.70	0.00	0.01	0.03	3.93	0.00	4E-04	0.0014	0.004	0.54	0.000128	35.3	118	298.9	45594	10.7926	0	0	0	21	0
	RCC Batch and Placement	Pumps	d	190	0	0	206	22	41.09	0.00	0.01	0.02	5.22	0.00	6E-04	0.0024	0.006	1.23	0.000191	0	0	0	0	0	0	0	0	0	0
	Service and Support Equipment	Generator sets, compressors	d	303	173	1	327	22	41.09	0.00	0.01	0.02	5.22	0.00	4E-04	0.0015	0.004	0.78	0.00012	21	79.5	190	40719	6.30437	0	0	0	18	0

Dam Construction Emissions:

Totals:		ROG	CO	NOX	CO2	PM
	January	225	841	1844	283075	70
	February	160	584	1328	209476	49
	March	128	475	1013	185757	38
	April	751	2890	5645	1036467	220
	May	760	2918	5713	1049570	222
	June	1237	4806	9702	1627210	377
	July	1237	4806	9702	1627210	377
	August	1237	4806	9702	1627210	377
	Septemb	1164	4565	9521	1419114	378
	October	1164	4565	9521	1419114	378
	Novembe	1111	4367	9046	1317436	363
	Decembe	56	198	489	86312	17

	ROG	CO	NOX	CO2	PM
Total (tons per year)	5	18	37	5392	1

Worse-Case Day: (June, July, or August)

ROG	CO	NOX	CO2	PM
56	218	441	73964	17

Pipeline and PumpStation Construction Emissions:

Year 2015

	Equipment Type	Representative Equipment Model or OFFROAD Category	Fuel	MaxHP	Qty of Equip	State Average HP	Hours per Day	Equipment Usage	Activity from OFFROAD2007 (hr/day)	Emissions from OFFROAD 2007 Model (tons/day)					Emission Factor (lbs/hp-hr)					Equipment Emissions (lbs/day)					Equipment Emissions (tons/year)				
								Days/Year		ROG	CO	NOX	CO2	PM	ROG	CO	NOX	CO2	PM	ROG	CO	NOX	CO2	PM	ROG	CO	NOX	CO2	PM
Pipeline	Wheel loader	Wheel loader - CAT 966	d	259	2	500	8	260	109.15	0.01	0.04	0.09	18.80	0.00	0.00	0.00	0.00	0.69	0.00	1.73	5.87	13.3	2855.58	0.463	0.224	0.8	1.729	336.8	0.06
	Compactor	Compactor - CS 323	d	83	2	104	8	260	12.82	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.01	0.78	0.00	1.05	6.636	7.667	1031.58	0.563	0.137	0.9	0.997	121.7	0.07
	Mass Excavator	Excavator - CAT 325l	d	188	4	222	8	260	543.02	0.03	0.09	0.24	43.04	0.01	0.00	0.00	0.00	0.71	0.00	3.02	9.289	24.17	4296.3	0.804	0.393	1.2	3.143	506.7	0.1
	Grove Crane (30 ton)	RT530	d	152	2	149	8	260	61.51	0.00	0.01	0.02	2.47	0.00	0.00	0.00	0.00	0.54	0.00	1.5	7.817	10.89	1310.22	0.617	0.195	1	1.416	154.5	0.08
	Water truck	Water Truck 3000 Gal and Pump	d	417	2	381	8	260	172.98	0.02	0.05	0.12	23.53	0.00	0.00	0.00	0.00	0.71	0.00	3.43	10.41	24.77	4764.78	0.883	0.446	1.4	3.22	561.9	0.11
Pump Station - Phase	Wheel loader	Wheel loader - CAT 966	d	259	1	500	8	50	109.15	0.01	0.04	0.09	18.80	0.00	0.00	0.00	0.00	0.69	0.00	0.86	2.935	6.65	1427.79	0.231	0.022	0.1	0.166	32.38	0.01
	Grader	Grader - CAT 140	d	222	1	225	8	50	242.28	0.02	0.05	0.14	20.83	0.00	0.00	0.00	0.01	0.76	0.00	1.05	3.191	9.138	1357.33	0.315	0.026	0.1	0.228	30.78	0.01
	Backhoe	CAT 430	d	98	1	75	8	50	2801.73	0.08	0.49	0.54	72.40	0.04	0.00	0.00	0.01	0.69	0.00	0.6	3.634	4.04	540.245	0.306	0.015	0.1	0.101	12.25	0.01
Pump Station - Phase	Excavator	Excavator - CAT 320	d	138	2	157	8	100	1335.22	0.07	0.44	0.49	74.85	0.03	0.00	0.00	0.00	0.71	0.00	1.48	9.348	10.4	1576.83	0.568	0.074	0.5	0.52	71.52	0.03
	Backhoe	CAT 430	d	98	3	75	8	100	2801.73	0.08	0.49	0.54	72.40	0.04	0.00	0.00	0.01	0.69	0.00	1.81	10.9	12.12	1620.73	0.918	0.09	0.5	0.606	73.52	0.05
	Trencher	Trencher	d	82	1	69	8	100	330.41	0.02	0.08	0.12	10.71	0.01	0.00	0.01	0.01	0.94	0.00	1.09	4.368	6.704	616.42	0.56	0.054	0.2	0.335	27.96	0.03
Pump Station - Phase 3	Excavator	Excavator - CAT 320	d	138	1	157	8	110	1335.22	0.07	0.44	0.49	74.85	0.03	0.00	0.00	0.00	0.71	0.00	0.74	4.674	5.201	788.417	0.284	0.041	0.3	0.286	39.34	0.02
	Backhoe	CAT 430	d	98	2	75	8	110	2801.73	0.08	0.49	0.54	72.40	0.04	0.00	0.00	0.01	0.69	0.00	1.2	7.268	8.08	1080.49	0.612	0.066	0.4	0.444	53.91	0.03
	Concrete pump truck	Offhighway Truck	d	417	1	381	8	110	172.98	0.02	0.05	0.12	23.53	0.00	0.00	0.00	0.00	0.71	0.00	1.71	5.205	12.39	2382.39	0.442	0.094	0.3	0.681	118.9	0.02
	Forklift	Rough Terrain Forklift	d	94	2	83	8	110	774.91	0.03	0.16	0.20	24.17	0.02	0.00	0.01	0.01	0.75	0.00	1.45	7.711	9.344	1130.6	0.76	0.08	0.4	0.514	56.41	0.04

Worse-Case Daily Emissions: Pipeline plus Phase 3 of Pump Station

ROG	CO	NOX	CO2	PM
16	65	116	19640	5

Total Annual Emissions

ROG	CO	NOX	CO2	PM
2	8	14	2199	1

Section 2 – On-Road Vehicle Emfac2007 Emission Factors for Contra Costa County and On-Road Vehicle Emissions

Air Quality Analysis for Mobile Emissions
Los Vaqueros
grams/mile

	ROG	CO	NOx	CO2	PM10
LDA - 2015 45 mph	0.031	1.337	0.083	354.656	0.028
LDT - 2015 45 mph	0.052	2.13	0.167	438.669	0.036
MDT - 2015 35 mph	0.06	1.941	0.305	613.458	0.042
HDT - 2015 35 mph	0.371	2.863	4.736	1496.25	0.233

Paved Road
lbs/VMT
Entrained
PM10
0.0014798

Unpaved Road
lbs/VMT
Entrained
PM10
0.0443627

Assumed average speed to be 35 mph to and from the project site for haul trucks.
Assumed average speed to be 45 mph to and from the project site for workers.

EMISSIONS CALCULATION FOR ON-ROAD VEHICLES DURING CONSTRUCTION

Emissions = Vehicle Type x Emission Factor x Miles/Trip x Trips/Day

Note: Trip length takes into account round trips
Mobile Emissions Associated with Worker and Haul Truck trips in 2015

Emission Factors

				ROG	CO	Nox	CO2	PM10
LDV	2015 emissions (grams/mile)			0.0415	1.7335	0.125	396.6625	0.032
	2015 emissions (pounds/mile)			9.15E-05	3.82E-03	2.76E-04	8.74E-01	1.55E-03
	Miles/Trip	Trips/day	Miles/day	Mobile Source Emissions (pounds per roundtrip)				
	60	1	60	0.01	0.23	0.02	52.47	0.09

				ROG	CO	Nox	CO2	PM10
HDT	2015 emissions (grams/mile)			0.371	2.863	4.736	1496.253	0.233
	2015 emissions (pounds/mile)			8.18E-04	6.31E-03	1.04E-02	3.30E+00	1.99E-03
	Miles/Trip	Trips/day	Miles/day	Mobile Source Emissions (pounds per roundtrip)				
	30	1	30	0.02	0.19	0.31	98.96	0.06

DAM CONSTRUCTION: **ALTERNATIVES A THROUGH C and E**

Round Trips per year		Pollutant Emissions (pounds per year)				
Crew #	Haul Trucks	ROG	CO	NOx	CO2	PM10
250000	183960	5886.23	92158.5	61755.3	31321763	34256.138
		Pollutant Emissions (tons per year)				
		ROG	CO	NOx	CO2	PM10
		2.94	46.08	30.88	14207.46	17.13

PIPELINE AND PUMPSTATIONCONSTRUCTION: **ALTERNATIVES A THROUGH E**

					ROG	CO	Nox	CO2	PM10
HDT	2015 emissions (grams/mile)				0.371	2.863	4.736	1496.253	0.233
	2015 emissions (pounds/mile)				8.18E-04	6.31E-03	1.04E-02	3.30E+00	1.99E-03
	Miles/Trip		Trips/day	Miles/day	Mobile Source Emissions (pounds per day)				
From LA	700		1	700	0.57	4.42	7.31	2309.05	1.40
From Tracy	60		1	60	0.05	0.38	0.63	197.92	0.12

	Round Trips per day		Pollutant Emissions (pounds per day)				
	Haul Trucks	Days	ROG	CO	NOx	CO2	PM10
Pipeline	4	260	1.11759	8.6244	14.2666	4507.261	2.7238371
			Pollutant Emissions (tons per year)				
			ROG	CO	NOx	CO2	PM10
			0.15	1.12	1.85	531.56	0.35

Section 3 – Electricity Usage and Indirect GHG Emissions from Electricity Generation

Estimated Electrical Demand Loads with the Proposed Project:

Location	Future Without Project (MWh/yr)	Alternative 1 (MWh/yr)	Alternative 2 (MWh)	Alternative 3 (MWh)	Alternative 4 (MWh)
AIP	0	34,269	70,581	72,163	35,119
Delta Intake and Pump Station	0	0	28,715	0	0
Old River Intake and Pump Station	0	21,629	40,680	42,795	26,960
Rock Slough Pumping Plant	10,452	19,658	20,680	11,807	10,676
Transfer Pump Station	0	9,026	33,230	32,949	24,326
Export Pumping for SBA and SCVWD CVI	0	68,171	11,754	13,223	68,171
Additional Export Pumping for Level 4 Ref	0	0	0	68,171	0
Total	**10,452**	**152,753**	**205,640**	**241,107**	**165,253**

SOURCE: URS, 2008. Dan Drew, P.E., Pumping and Emission Data. August 19, 2008.

Notes:

1. Demands assume a conservative level of pumping based on the operations modeling for the 2030 Level of Demand and Severe Fishery Restrictions. For more information on the operations modeling see Appendix C.
2. "Export pumping for SBA and SCVWD CVP" refers to the pumping at Banks or Jones Pumping Plants required to deliver water to these agencies.
3. "Additional export pumping for Level 4 Refuge" refers to increased exports at Banks or Jones Pumping Plants that only occurs in Alternative 3.
4. Power usage associated with pumping at Banks Pumping Plant is assumed for the export pumping described in notes 2 and 3 above.

Rounded Values for report:

Location	Future Without Project (MWh/yr)	Alternative 1 (MWh/yr)	Alternative 2 (MWh)	Alternative 3 (MWh)	Alternative 4 (MWh)
AIP	34,300	70,600	72,200	35,200	32,800
Delta Intake and Pump Station	0	28,700	30,200	0	0
Old River Intake and Pump Station	21,600	40,700	42,800	27,000	22,100
Rock Slough Pumping Plant	4,700	7,100	7,600	3,500	5,000
Transfer Pump Station	9,000	33,200	33,000	24,300	12,100
Export Pumping for SBA and SCVWD CVI	68,200	11,800	13,200	68,200	68,200
Additional Export Pumping for Level 4 Ref	0	0	0	2,500	0
Total	**137,800**	**192,100**	**199,000**	**160,700**	**140,200**

SOURCE: URS, 2008. Dan Drew, P.E., Pumping and Emission Data. August 19, 2008.

Pumping Rates:

Location	Future Without Project TAF/yr	Alternative 1 TAF/yr	Alternative 2 TAF/yr	Alternative 3 TAF/yr	Alternative 4 TAF/yr
AIP	71	147	150	73	68
Delta Intake and Pump Station	0	80	84	0	0
Old River Intake and Pump Station	63	119	125	72	65
Rock Slough Pumping Plant	28	43	46	21	30
Transfer Pump Station	28	71	77	55	32
Export Pumping for SBA and SCVWD CVP	232	40	45	232	232
Additional Export Pumping for Level 4 Refuge	0	0	0	8	0

SOURCE: URS, 2008. Dan Drew, P.E., Pumping and Emission Data. August 19, 2008.

Notes:

1. All values are long-term average (1922-2003) annual pumping, from CalSim II model studies performed for each project alternative.

Estimated Carbon Emissions with Proposed Project:

Scenario	Diversion Data				Pump Data									Estimated Electrical Demand			Estimated Carbon Emissions			
	Volume	Pumping Time		Avg. Flow	No.	Motor Size		Flow per Pump		Head	Efficiency	Brake Horsepower					Source	Emission Factor	Carbon Emission	
	(AF/YR)	(DAY/YR)	(HR/YR)	(CFS)	(#)	(HP)	(KW)	(CFS)	(GPM)	(FT)	(%)	(HP)	(KW)	(KW-HR/YR)	(MW-HR/YR)	(KW-HR/AF)		(LB CO2/ MW-HR)	(LB/YR)	(METRIC TON/YR)
AIP Pump Station																				
Future Without Project	71,178	143.542	3,445	250.0	5	3,000	2,238	50.0	22,442	400	85%	2,667	1,989	34,268,708	34,269	481.5	CVP/MID	406.00	13,913,096	6,310
Alternative 1	146,601	295.645	7,095	250.0	5	3,000	2,238	50.0	22,442	400	85%	2,667	1,989	70,581,176	70,581	481.5	CVP/MID	406.00	28,655,957	12,996
Alternative 2	149,887	302.272	7,255	250.0	5	3,000	2,238	50.0	22,442	400	85%	2,667	1,989	72,163,223	72,163	481.5	CVP/MID	406.00	29,298,269	13,287
Alternative 3	72,944	147.104	3,530	250.0	5	3,000	2,238	50.0	22,441	400	85%	2,667	1,989	35,118,951	35,119	481.5	CVP/MID	406.00	14,258,294	6,466
Alternative 4	68,162	137.460	3,299	250.0	5	3,000	2,238	50.0	22,442	400	85%	2,667	1,989	32,816,653	32,817	481.5	CVP/MID	406.00	13,323,561	6,042
Delta Pump Station																				
Future Without Project	0	0.000	0	0.0	0	0	0	0.0	0	0	0%	0	0	0	0	0.0	PG&E	455.81	0	0
Alternative 1	79,524	235.843	5,660	170.0	*4*	*2,000*	*1,492*	42.5	19,075	*300*	85%	1,700	1,268	28,715,173	28,715	361.1	PG&E	455.81	13,088,663	5,936
Alternative 2	83,658	248.103	5,954	170.0	*4*	*2,000*	*1,492*	42.5	19,075	*300*	85%	1,700	1,268	30,207,911	30,208	361.1	PG&E	455.81	13,769,068	6,244
Alternative 3	0	0.000	0	0.0	0	0	0	0.0	0	0	0%	0	0	0	0	0.0	PG&E	455.81	0	0
Alternative 4	0	0.000	0	0.0	0	0	0	0.0	0	0	0%	0	0	0	0	0.0	PG&E	455.81	0	0
Old River Pump Station																				
Future Without Project	63,424	127.900	3,070	250.0	5	2,100	1,567	50.0	22,442	290	87%	1,889	1,409	21,629,340	21,629	341.0	CVP/MID	267.96	5,795,798	2,628
Alternative 1	119,286	240.560	5,773	250.0	5	2,100	1,567	50.0	22,442	290	87%	1,889	1,409	40,679,828	40,680	341.0	CVP/MID	267.96	10,900,567	4,944
Alternative 2	125,487	253.065	6,074	250.0	5	2,100	1,567	50.0	22,442	290	87%	1,889	1,409	42,794,541	42,795	341.0	CVP/MID	267.96	11,467,225	5,201
Alternative 3	71,645	112.878	2,709	320.0	5	3,000	2,238	64.0	28,725	*320*	87%	2,668	1,990	26,960,473	26,960	376.3	CVP/MID	267.96	7,224,328	3,276
Alternative 4	64,783	130.646	3,135	250.0	5	2,100	1,567	50.0	22,442	290	87%	1,889	1,409	22,092,796	22,093	341.0	CVP/MID	267.96	5,919,986	2,685
Rock Slough Pump Station																				
Future Without Project	28,281				4									4,660,709	4,661	164.8	CVP/MID	162.00	755,035	342
Alternative 1	43,174				4									7,115,075	7,115	164.8	CVP/MID	162.00	1,152,642	523
Alternative 2	46,010				4									7,582,448	7,582	164.8	CVP/MID	162.00	1,228,357	557
Alternative 3	21,216				4									3,496,397	3,496	164.8	CVP/MID	162.00	566,416	257
Alternative 4	30,084				4									4,957,843	4,958	164.8	CVP/MID	162.00	803,171	364
Transfer Station Pumping Plant																				
Future Without Project	27,708	77.600	1,862	180.0	4	2,100	1,567	45.0	20,199	**277**	87%	1,624	1,212	9,025,610	9,026	325.7	PG&E	455.81	4,113,963	1,866
Alternative 1	70,999	53.425	1,282	670.0	8	4,500	3,357	83.8	37,590	**398**	87%	4,343	3,240	33,229,740	33,230	468.0	PG&E	455.81	15,146,448	6,869
Alternative 2	76,763	57.760	1,386	670.0	8	4,500	3,357	83.8	37,592	**365**	87%	3,983	2,971	32,948,560	32,949	429.2	PG&E	455.81	15,018,283	6,811
Alternative 3	54,726	48.405	1,162	570.0	8	4,500	3,357	71.3	31,979	**378**	87%	3,509	2,617	24,326,361	24,326	444.5	PG&E	455.81	11,088,198	5,029
Alternative 4	32,334	81.500	1,956	200.0	4	2,500	1,865	50.0	22,444	**312**	85%	2,080	1,552	12,142,441	12,142	375.5	PG&E	455.81	5,534,646	2,510
Totals - CCWD Pumping Plants																				
Future Without Project	190,591														69,584					11,146
Alternative 1	459,584														180,321					31,267
Alternative 2	481,805														185,697					32,100
Alternative 3	220,531														89,902					15,028
Alternative 4	195,363														72,010					11,602
Harvey O. Banks Pumping Plant																				
Future Without Project	232,000	113.248	2,718	1,032.8	?	?	?	*1,032.8*	463,569	247	86%	33,622	25,082	*68,170,641*	68,171	293.8	SWP	478.90	32,646,920	14,806
Alternative 1	40,000	19.025	457	1,060.0	?	?	?	*1,060.0*	475,760	247	86%	34,506	25,741	*11,753,559*	11,754	293.8	SWP	478.90	5,628,779	2,553
Alternative 2	45,000	21.403	514	1,060.0	?	?	?	*1,060.0*	475,760	247	86%	34,506	25,741	*13,222,754*	13,223	293.8	SWP	478.90	6,332,377	2,872
Alternative 3	232,000	110.346	2,648	1,060.0	?	?	?	*1,060.0*	475,760	247	86%	34,506	25,741	*68,170,641*	68,171	293.8	SWP	478.90	32,646,920	14,806
Alternative 4	232,000	110.346	2,648	1,060.0	?	?	?	*1,060.0*	475,760	247	86%	34,506	25,741	*68,170,641*	68,171	293.8	SWP	478.90	32,646,920	14,806
Level 4 Refuge (Alt 3 on	8,458	4.023	97	1,060.0	?	?	?	*1,060.0*	475,760	247	86%	34,506	25,741	*2,485,290*	2,485	293.8	SWP	478.90	1,190,205	540
Total																				
Future Without Project																				25,952
Alternative 1																				33,820
Alternative 2																				34,972
Alternative 3																				30,374
Alternative 4																				26,407

Transfer Facility Pumping Plant - Total Dynamic Head

	Avg. Flow (CFS)	Transfer Res. (FT)	LV Reservoir Storage (TAF)	LV Reservoir WSEL (FT)	Static Lift (FT)	Head Losses (FT)	TDH (FT)
Future Without Project	180	213.00	78.000	453	240	37	277
Alternative 1	670	213.00	207.000	560	347	51	398
Alternative 2	670	213.00	199.000	527	314	51	365
Alternative 3	570	213.00	222.000	536	323	55	378
Alternative 4	200	213.00	115.000	480	267	45	312

Alternative 1, 2, 3, or 4 Indirect GHG Emissions from Project Electricity Use (Metric Tons/ Year):

Operational Emissions	Total Metric Tons/Year CO2E	Increase in Metric Tons/Year CO2E
Future Without Project	25,952	n/a
Alternative 1	33,820	7,868
Alternative 2	34,972	9,020
Alternative 3	30,374	4,422
Alternative 4	26,407	455

SOURCE: URS, 2008. Dan Drew, P.E., Pumping and Emission Data. August 19, 2008.

Notes:
1. Metric tons/year of CO2E were calculated using the California Climate Action Registry General Reporting Protocol emission factors and methodology. See Appendix G for more details.
2. "Future Without Project" includes power required for pumping at Banks and Jones Pumping Plants needed to deliver water to the SBA, SCVWD's CVP supplies, and power required at CCWD pumping facilities.
3. "Increase in Metric Tons/Year" shows the increas in the total emissions for each alternative compared to the emissions for "Future Without Project".

Rounded Values for report:

Operational Emissions	Total Metric Tons/Year CO2E	Increase in Metric Tons/Year CO2E
Future Without Project	26,000	n/a
Alternative 1	33,800	7,900
Alternative 2	34,900	9,000
Alternative 3	30,400	4,400
Alternative 4	26,400	500

APPENDIX I

Projects Considered for Cumulative Analysis of Land-side Resources and Issue Areas

TABLE I-1
POTENTIAL PROJECTS FOR CUMULATIVE EFFECTS EVALUATION

Project Name	Location	Description	Status/Schedule	Relationship to Proposed Project[a]	Potential for Cumulative Effect
Development Projects					
Brentwood	City of Brentwood	A total of 4,844 residential units and 1,373,275 square feet of commercial development are currently planned for construction by 2018. Of this total, 484 units are under construction, 3889 units are approved, but no permit has been issued and 471 units are proposed but are not yet approved.	Some units are under construction with project approval up until 2018	4.5 miles north of the Delta-Transfer Pipeline	Yes. Despite relative distance from project, there is a potential for construction periods to overlap with project; therefore, consider potential for cumulative construction effects such as traffic and air quality. Consider potential for cumulative project siting effects on habitat and farmland loss.
Cecchini Ranch	Discovery Bay	About 1,110 acres planned for 4,000 or less new residences, new marina, commercial and light industrial uses, new parks, new schools, and new trail system, open space, and delta interpretive center.	Development Plan/ General Plan Amendment Study in Progress (2008). EIR to follow. Possible construction start sometime between 2014 and 2018	0.1-miles from Delta-Transfer Pipeline along SR4; 0.1-miles from Old River Pump Station	Yes. Potential for construction periods overlap with project; therefore, consider potential for cumulative construction effects such as noise, traffic and air quality. Consider potential for cumulative project siting effects on habitat and farmland loss.
Bixler Road Business Park	Discovery Bay	Change in land use designation from Office (OF) to Business Park (BP) to establish a 62,500 sq. ft. business park.	Applications submitted 12/11/2006 and are under review. Applicant is trying to address issue with driveway entrance encroaching onto irrigation canal	0.5 miles north of the Delta-Transfer Pipeline	Yes. Potential for construction periods overlap with project; therefore, consider potential for cumulative construction effects such as noise, traffic and air quality. Consider potential for cumulative project siting effects on habitat and farmland loss.
Pantages Bay at Discovery Bay	Discovery Bay	Change in the land use designation from Agricultural Lands (AL) to Single Family Residential-High Density (SH) to allow for an approximately 290 unit water-oriented residential project. Approximately 172 acres in size.	EIR to be released soon and ground work is estimated to begin in 2010	2 miles north of Old River Intake	Yes. Potential for construction periods overlap with project; therefore, consider potential for cumulative construction effects such as noise, traffic and air quality. Consider potential for cumulative project siting effects on habitat and farmland loss.
Bixler Road Commercial Project	Discovery Bay	GPA study to re-designate 46 acre parcel from Agricultural Lands (AL) to a mix of commercial, office, and light industrial uses.	GPA study authorized, but no applications submitted to date.	1 mile north of Delta-Transfer Pipeline	Yes. Potential for construction periods overlap with project; therefore, consider potential for cumulative construction effects such as noise, traffic and air quality. Consider potential for cumulative project siting effects on habitat and farmland loss.

TABLE I-1 (Continued)
POTENTIAL PROJECTS FOR CUMULATIVE EFFECTS EVALUATION

Project Name	Location	Description	Status/Schedule	Relationship to Proposed Project[a]	Potential for Cumulative Effect
Development Projects (cont.)					
Bixler Road Residential Project	Discovery Bay	GPA study to re-designate Agricultural Lands (AL) to combination of Single Family Residential – High Density (SH), Open Space (OS), and Parks and Recreation (PR) in order to subdivide and develop 20-acre sire into 68 single family lots.	GPA authorized, but no applications submitted to date.	1.5 miles north of Delta-Transfer Pipeline	Yes. Potential for construction periods overlap with project; therefore, consider potential for cumulative construction effects such as noise, traffic and air quality. Consider potential for cumulative project siting effects on habitat and farmland loss.
Clifton Court Road Land Re-designation	Discovery Bay	GPA study to re-designate 24.7 acre site from Delta Recreation and Resources (DR) to Agricultural Land (AL) in support of a minor subdivision.	GPA study authorized, but no applications submitted to date.	2.5 miles east of Transfer-Bethany Pipeline	No. These types of projects are too small to generate a cumulatively considerable contribution to cumulative effects in the project area. Not considered.
Cell Tower	Discovery Bay	135 foot cell tower to be constructed on the southern edge of CCWD's Old River Pump Station.	Ground breaking within the next 3-6 months.	On the southern edge of Old River Pump Station.	No. These types of projects are too small to generate a cumulatively considerable contribution to cumulative effects in the project area. Not considered.
Byron – various small development projects	Byron	Potential projects include a 4-lot subdivision	unknown	Various distances from Transfer-Bethany Pipeline	No. These types of projects are too small to generate a cumulatively considerable contribution to cumulative effects in the project area. Not considered.
Mountain House Specific Plan I, II, and III	Northwestern San Joaquin County	Future phases of multi-year build out of new community on 4,784 acres including 2,500 acres for residential, 700 acres commercial, and 750 acres open space and parks. Total ultimate population projected to be 44,000. First phase – 14 neighborhoods have been completed.	2004 – 2024/2044	3 miles east of Bethany Reservoir and terminus of Transfer-Bethany Pipeline.	Yes. No construction period overlap with proposed LV project; therefore, no potential for cumulative construction impacts. Consider potential cumulative project siting effects on habitat and farmland loss.
Public Infrastructure Projects					
City of Brentwood Solid Waste Transfer Facility Expansion	City of Brentwood	Expansion of the existing Brentwood solid waste transfer facility into an adjacent area, installation of a transfer facility building, and related improvements including installation of vehicle weigh scales, a scale house, and on-site roadways. Estimated to be 4.8 acres in size.	Approved in 2005, but on hold due to financing considerations. 2 year extension approved by planning commission on December 18, 2007.	5 miles north of the point where the Expanded Transfer Facility, Delta-Transfer Pipeline and Transfer-LV Pipeline all meet.	Yes. Potential for construction periods overlap with project; therefore, consider potential for cumulative construction effects such as noise, traffic and air quality. Consider potential for cumulative project siting effects on habitat and farmland loss.

TABLE I-1 (Continued)
POTENTIAL PROJECTS FOR CUMULATIVE EFFECTS EVALUATION

Project Name	Location	Description	Status/Schedule	Relationship to Proposed Project[a]	Potential for Cumulative Effect
Public Infrastructure Projects (cont.)					
Sellers Avenue Sewer Lift Station Expansion and Upgrade	City of Brentwood	The work includes rehabilitation of an existing sewage lift station including repair and lining of the wet well; replacement of pumps, valves and control equipment; construction of valve vault, manholes, force main and gravity sewer pipe; connection to existing interceptor sewer; and site paving and fencing. Approximately 2,000 sq. ft. in size.	Under construction from March 2008 to May 2008	2 miles north of the point where the Expanded Transfer Facility, Delta-Transfer Pipeline and Transfer-LV Pipeline all meet.	No because no overlap with construction periods associated with project.
Surface Water Treatment Facility Phase II	City of Brentwood	Construction of a water treatment plant adjacent to the Randall Bold Treatment Plant. Approximately 10 acres in size.	Under construction from September 2006 to October 2008.	7 miles northwest of the point where the Expanded Transfer Facility, Delta-Transfer Pipeline and Transfer-LV Pipeline all meet.	No because no overlap with construction periods associated with project
Wastewater Treatment Plant Upgrade	Discovery Bay	Install four to six greenhouse structures to dry biosolids and install new 14-inch diameter pipeline to new outfall 100 feet into channel at Old River.	Most of the upgrades have been completed except for 100 foot by 200 foot car-port, 50-70 foot antenna and a 30 foot pipeline. To be completed by mid 2009.	0.5 miles west of Old River Intake	Yes. Already constructed, so no potential for cumulative construction effects. Consider potential for cumulative siting effects on Old River shoreline / aquatic habitat.
Water well	Discovery Bay	400 foot deep water well to be drilled in the middle of Discovery Bay.	Test hole to be drilled before end of November 2008. Production well to be drilled by mid 2009.	2 miles northwest of Old River Intake	No. These types of projects are too small to generate a cumulatively considerable contribution to cumulative effects in the project area. Not considered.
Byron Bethany Irrigation District (BBID) Corporate Offices	Byron	BBID proposes construction of its headquarters, which includes a single-story steel office building, a warehouse/garage building and a water retention pond in the northeast corner of the site. Located in the eastern part of the County at 7995 Bruns Road in the Byron area.	Mitigated negative declaration prepared.	2.5 miles east of Transfer-Bethany Pipeline	Yes. No construction period overlap with proposed LV project; therefore, no potential for cumulative construction impacts. Consider potential cumulative project siting effects on habitat and farmland loss.

TABLE I-1 (Continued)
POTENTIAL PROJECTS FOR CUMULATIVE EFFECTS EVALUATION

Project Name	Location	Description	Status/Schedule	Relationship to Proposed Project[a]	Potential for Cumulative Effect
Public Infrastructure Projects (cont.)					
Green Waste Recycling Facility	Byron	Project consists of establishing a green waste, concrete and asphalt recycling operation. The facility will occupy the front (west) fourth of the lot, the remaining portion of the parcel will remain undeveloped. The only structure proposed is a 60 square foot restroom. Located on Hope Way, between Armstrong Way and Byron Highway, in the Byron area.	Construction to begin soon – paving the site and putting in a septic system.	1 mile east of Transfer-Bethany Pipeline	Yes. No construction period overlap with proposed LV project; therefore, no potential for cumulative construction impacts. Footprint impacts too minor to make a cumulatively considerable contribution to loss of habitat or farmland. Consider potential cumulative project siting effects on habitat and farmland loss.
CCWD Alternative Intake Project	Victoria Island	Additional Delta water intake facility and pump station. CCWD will use, not to increase total water diversion, but to maximize water quality of the water it diverts from the Delta.	Construction began in May 2008 and is expected to take 2 years to be completed.	2.5 miles southeast of Old River Intake and Pump Station and proposed new Delta Intake and Pump Station.	Yes. No construction period overlap with proposed project; therefore, no potential for cumulative construction impacts. Consider potential for cumulative project siting effects on local Delta channel shoreline / aquatic habitat.
DWR South Bay Aqueduct (SBA) Enlargement	Northeastern Alameda County	Capacity enlargement of SBA canal system from Bethany Reservoir west and through Alameda County. System serves Zone 7, Alameda County Water Agency and Santa Clara Valley Water District	Construction in progress; to be completed in 2009.	Proposed Transfer-Bethany Pipeline connects to SBA system at Bethany Reservoir under Project Alternatives 1 and 2.	Yes. No construction period overlap with proposed LV project; therefore, no potential for cumulative construction impacts. Consider potential cumulative project siting effects on habitat and farmland loss.
Altamont Water Treatment Plant	Northeastern Alameda County	23-50-acre, 42 mgd drinking water treatment plant, raw water conveyance, and raw water intake and pump.	In design review, with project timing to be based upon agency water-supply needs and funding availability. Could be completed as early as 2010.	4 miles southeast of Bethany Reservoir where the Transfer-Bethany pipeline connects to the SBA system under Alternatives 1 and 2	Yes. No construction period overlap with proposed LV project; therefore, no potential for cumulative construction impacts. Consider potential cumulative project siting effects on habitat and farmland loss.
Altamont Pipeline Project	Northeastern Alameda County	11-mile buried potable water pipeline that would convey potable water to portions of Alameda County by connecting the future Altamont Water Treatment Plant to Zone 7 Water Agency's existing Cross Valley Pipeline.	A 5-mile segment of pipeline within the City of Livermore, from Kitty Hawk Road to the vicinity of Vasco Road. Construction of this initial segment is set to begin in summer	4 miles southwest of Bethany Reservoir where the Transfer-Bethany pipeline connects to the SBA system under Alternatives 1 and 2	No. No construction period overlap with proposed LV project; therefore, no potential for cumulative construction impacts. Because Altamont pipeline is buried with grassland habitat restored it would not contribute to potential cumulative habitat or farmland loss.

TABLE I-1 (Continued)
POTENTIAL PROJECTS FOR CUMULATIVE EFFECTS EVALUATION

Project Name	Location	Description	Status/Schedule	Relationship to Proposed Project[a]	Potential for Cumulative Effect
Public Infrastructure Projects (cont.)					
Altamont Pipeline Project (cont.)			2008 and take about a year to complete. Zone 7 is currently evaluating the timing of treatment plant itself and the remaining 6-mile stretch of pipeline through unincorporated Alameda County west to Livermore.		
Vasco Road Landfill	Northeastern Alameda County	Application to extend the term of the Conditional Use Permit for this facility from 2008 to 2022 and formalize permission to continue to conduct waste diversion and materials recycling operations. Located at 4001 North Vasco Road about 1 mile north of Dalton Road in the unincorporated Livermore area.	This project has been approved and is in progress.	6 miles southwest of the terminus of Transfer-Bethany Pipeline.	No. There are no construction activities associated with this project and no change of operations. Given distance from project facilities, no potential for cumulative operational effects (such as noise).
Buena Vista Wind Energy Project	Northeastern Alameda County	Removal and replacement of existing wind turbines. Restoration of former turbine sites and maintenance roads.	Turbines have been removed and replaced but they are not operating yet.	6-miles east of Los Vaqueros Reservoir	No. No construction period overlap with proposed project; therefore, no potential for cumulative construction impacts.
Public Roadway Projects					
Balfour Road	Contra Costa County	Widen shoulders and roadway along both sides of Balfour Road, and install traffic signal.	Estimated construction completion 2010/2011	3 miles north of the Delta-Transfer Pipeline	No. Possible construction period overlap but this project is too small and distant from reservoir expansion project to generate a cumulatively considerable contribution to cumulative effects in the project area. Not considered.
Sellers Avenue	Contra Costa County	Install Traffic Signal and turn lanes at the Balfour Road intersection.	Awaiting fund allocation	3.5 miles northwest of Delta-Transfer Pipeline	No. Possible construction period overlap but this project is too small and distant from reservoir expansion project to generate a cumulatively considerable contribution to cumulative effects in the project area. Not considered.

TABLE I-1 (Continued)
POTENTIAL PROJECTS FOR CUMULATIVE EFFECTS EVALUATION

Project Name	Location	Description	Status/Schedule	Relationship to Proposed Project[a]	Potential for Cumulative Effect
Public Roadway Projects (cont.)					
Deer Valley Road	Contra Costa County	Realign curve and widen shoulders; Provide shoulder widening for recovery area and bike lanes.	Estimated construction completion 2010/2011	4 miles northwest of Los Vaqueros Reservoir	No. Possible construction period overlap but this project is too small and distant from reservoir expansion project to generate a cumulatively considerable contribution to cumulative effects in the project area. Not considered.
Point of Timber Road	Contra Costa County	Install traffic signal at Byron Highway intersection.	Awaiting fund allocation	2 miles north of Delta-Transfer Pipeline	No. Possible construction period overlap but this project is too small and distant from reservoir expansion project to generate a cumulatively considerable contribution to cumulative effects in the project area. Not considered.
State Route 4	Contra Costa County, intersection of Byron Highway and SR 4 (Byron)	Construction of approximately 4 miles of new two-lane expressway between Balfour Road, in Brentwood, and Walnut Blvd and widening of approximately 4.5 miles of Marsh Creek Road between SR4 Bypass and SR4/Byron Highway; Install left turn lane and intersection improvements at Byron Highway intersection.	Construction of some projects complete, while others are funding.	Ranges from 1.25 miles to 3.5 miles from Delta-Transfer Pipeline	Yes. Construction period overlap uncertain because schedule is not set. If there is construction schedule overlap then potential for cumulative construction effects, particularly traffic and air quality. Also consider potential for project siting effects on habitat and farmland loss.
Walnut Boulevard Widening - Phase II (Street)		Construction of AC pavement structural section, curbs, gutters, sidewalk, traffic signal, signing, striping, median, and landscaping.	This project is expected to be completed by the end of 2007.		Yes. No construction period overlap with proposed project; therefore, no potential for cumulative construction impacts. Consider potential for cumulative project siting effects on habitat and farmland loss.
Marsh Creek Road	Contra Costa County	Widen roadway and shoulders, install guardrail, eliminate roadway obstacles, and install roadway signs and pavement markers.	Estimated construction completion 2010/2011	2.5 miles northwest of Los Vaqueros Reservoir at the closest point of construction	No – construction will not overlap
Vasco Road	Contra Costa County	Various construction projects at various points along the road such as realignment, widening, lane reconfiguration, restriping and providing median barriers. Also includes the construction of a new connector road between Vasco Road and Byron Highway.	Construction is currently under way and will continue until at least 2011. Some projects are on hold until funds become available.	Various distances from southern terminus of Transfer-Bethany Pipeline.	Yes. No construction period overlap with proposed LV project; therefore, no potential for cumulative construction impacts. Consider potential for cumulative project siting effects on habitat and farmland loss.

TABLE I-1 (Continued)
POTENTIAL PROJECTS FOR CUMULATIVE EFFECTS EVALUATION

Project Name	Location	Description	Status/Schedule	Relationship to Proposed Project[a]	Potential for Cumulative Effect
Public Roadway Projects (cont.)					
Byron Highway	Contra Costa County	Install asphalt concrete overlay on existing pavement surface; Construct a 6' wide paved shoulders and 2' shoulder backing along Byron Highway; Widen the road near Byron Elementary School; Install traffic signal and left turn lane at the Camino Diablo intersection.	Some construction will be completed by 2008 and other projects will be implemented as funds allow.	Kay access road to and through project area	No. No construction period overlap with proposed project; therefore, no potential for cumulative construction impacts. No widening so no project siting / footprint impacts.
Recreation trails					
EBRPD Delta Trail Extension and SPRR Trail	Eastern Contra Costa County	Two trails proposed in District's Parks Master Plan Map. (1) Delta Trail Extension, along Old River south to Clifton Court Forebay; and (2) SPRR Trail, along railroad ROW in northeastern Alameda County.	Delta Trail Extension - funding is pending, construction could occur in 3- to 5-year range. SPRR Trail to be constructed in 5 to 10-year range	Delta Trail Extension along Old River, adjacent to Old River PS and proposed new Delta Intake and Pump Station	No. Construction activity of Delta Trail Extension might overlap with proposed project but limited construction activity expected for trail development (e.g., limited grading, fencing and sign installation) with no cumulatively considerable contribution. For SPRR Trail construction periods not expected to overlap. Not considered.
Round Valley to Big Break Trail	Eastern Contra Costa County	A seven mile trail that connects the Morgan Territory to Brushy Peak Trail to the Marsh Creek Trail.	Awaiting final General Plan	1 mile northwest of Los Vaqueros Reservoir at its closest point.	No. Construction activity of Delta Trail Extension might overlap with proposed project but limited construction activity expected for trail development (e.g., limited grading, fencing and sign installation) with no cumulatively considerable contribution.
Vasco Caves to Brushy Peak Trail	Eastern Contra Costa County	A 3.5 mile trail extending from the Vasco Caves park area to the Brushy Peak park area.	Currently in the planning process; land is yet to be acquired.	2 miles southeast of Los Vaqueros Reservoir	No. Construction activity of Delta Trail Extension might overlap with proposed project but limited construction activity expected for trail development (e.g., limited grading, fencing and sign installation) with no cumulatively considerable contribution.
Brushy Peak to Bethany Reservoir Trail	Eastern Contra Costa County	About a 5.5 mile trail connecting Bethany Reservoir and the Morgan Territory to Brushy Peak Trail.	Awaiting funds	Within immediate vicinity of Bethany Tunnel Option and southern most tunnel boring pit	No. Construction activity of Delta Trail Extension might overlap with proposed project but limited construction activity expected for trail development (e.g., limited grading, fencing and sign installation) with no cumulatively considerable contribution.

TABLE I-1 (Continued)
POTENTIAL PROJECTS FOR CUMULATIVE EFFECTS EVALUATION

NOTES:

a Relationship to proposed project is generally described as distance to nearest proposed project facility.

SOURCES:

1 Catherine Kutsuris, Advance Planning Deputy Director, Contra Costa County, September 30, 2008

2 Brewer, Boni. 2008. Personal communication via email with Boni Brewer, Public Information Specialist with Zone & Water Agency. October 9, 2008.

3 Eldridge, Paul. 2008. Personal communication via email with Paul Eldridge, Assistant Public Works Director with the City of Brentwood. October 7 and 8, 2008.

4 Eldridge, Paul. Personal communication via telephone with Paul Eldridge, Assistant Public Works Director with the City of Brentwood. October 15, 2008.

5 Huerta, Adelina. 2008. Personal communication via email with Adelina Huerta, Associate Civil Engineer with Contra Costa County Public Works Department- provided spreadsheet with project information. October 23, 2008.

6 Jensen, Bruce. 2008. Personal communication via email with Bruce Jensen, Senior Planner with Alameda County Planning Department. October 7, 2008.

7 Koehne, Virgil. 2008. Personal communication via email with Virgil Koehne, General Manager with Discovery Bay. October 8 and 13, 2008.

8 Kersevan, Steve. 2008. Personal communication via telephone with Steve Kersevan, Professional Engineer with the City of Brentwood. October 20, 2008.

9 Roche, Patrick. 2008. Personal communication via email with Patrick Roche, Principal Planner with Contra Costa County. October 7, 9 and 28, 2008.

10 Townsend, Jim. 2008. Personal communication via telephone with Jim Townsend, Trails Development Program Manager with the East Bay Regional Park District. October 21, 2008.

11 EBRPD. 2007. Existing and Potential Parklands and Trails.

12 CCWD. 2006. Alternative Intake Project Fact Sheet. December, 2006.

13 Zone 7. 2006. CEQA Addendum Altamont Pipeline Project. February, 2006.

14 City of Brentwood. 2007. Planning Commission Staff Report. December 18, 2007.

15 City of Brentwood. 2008. Project Status Report. February, 2008.

16 Contra Costa County. 2008. Survey of General Plan Amendment Studies in Discovery Bay Area/Byron Area.

17 Contra Costa County. 2008. Survey of General Plan Amendment Studies in Discovery Bay Area/Byron Area Map.

18 Contra Costa County. 2007. Capital Road Improvement and Preservation Program.